MF236 Okehampton
BASELINE ENVIRONMENTAL ASSESSMENT

FINAL REPORT (VERSION 1.0)

July 2017

Report to:
Tassal Limited

Prepared by:
AQUENAL PTY LTD

AQUENAL

Document Control and Distribution

Date	Name	Company	Document Type	Version	Copies
18/7/2017	Matt Barrenger	Tassal	Electronic	1.0	1
18/7/2017	Claudia Russman	EPA	Electronic	1.0	1

Contents

List of Figures

List of Tables

List of Appendices

1 Summary

Okehampton Bay, Lease #236 (MF236), is located in Okehampton Bay in Zone 4 of the *Marine Farming and Development Plan for Great Oyster Bay and Mercury Passage*. The environment of the farm is marine, with some protection from northerly and prevailing westerly winds. The site is subject to oceanic swells from the east. Water depths across the lease area range from approximately 20-28 m depth.

Baseline surveys of the lease area were undertaken in 2000. While the 2000 survey was fit for purpose, the current survey provides an up-to-date measure of baseline conditions that can be used to measure future change. This approach is consistent with recommendations made in the report "*Advice to the Minister for Primary Industries and Water on Salmon Farming Operations Okehampton Bay*" prepared by the Marine Farming Planning Review Panel in February 2017. The survey design and methodologies employed were in accordance baseline environmental survey requirements for MF236 Okehampton Bay, as provided by the Director, Tasmanian Environmental Protection Authority (EPA).

Current flow data was collected by Marine Solutions Pty Ltd. To measure localised current movement, an Acoustic Doppler Current Profiler (ADCP) was deployed inside the lease (55G 580269 5290691) at a depth of approximately 28 m for a period of 6 weeks between 7th November and 19th December 2014. The ADCP was set to measure current velocity and direction throughout the water column every 20 minutes, with the data grouped into three depth bins (surface, middle, bottom waters). Current velocities were considerably higher in surface waters, averaging 30.1 cm s^{-1}, compared to 4.5 cm s^{-1} and 4.7 cm s^{-1} for middle and bottom waters, respectively. Overall, based on the 6 week deployment period, it appears that wind driven surface currents mainly flow in a north/north-easterly direction, with lower velocities of more variable direction measured in mid and bottom waters. Tassal is in the process of undertaking further ADCP deployments to investigate seasonal variation in current strength and velocity in the vicinity of the lease area. A real-time ADCP will be deployed on infrastructure within the lease once developed.

Filming of the seabed was conducted with a Remote Operated Vehicle (ROV), with high quality GoPro footage complementing ROV footage. Filming of the seabed within the lease and at compliance and control sites showed a generally uniform substrate. The dominant substrate type across all sites was light grey sand with shell grit. Burrows and faunal tracks were evident across all survey dives.

For the majority of sites, macroalgal cover on the seabed was very low (<1 % cover). The most common algal species observed was the green alga *Caulerpa scalpelliformis*. Red foliose algae was also occasionally observed attached to dead shells. Small patches of drift algae (predominately red and brown algae) were recorded on most spot dives. Macroalgal cover tended to be higher at sites where New Zealand screw shell density was relatively high, under these circumstances algae was typically attached to these shells.

The most commonly recorded fish during the survey was the sand flathead (*Platycephalus bassensis*), which were observed at most survey sites. Other fish recorded during the survey included butterfly gurnard (*Lepidotrigla* sp.), Degen's leatherjacket (*Thamnaconus degeni*), toothbrush leatherjacket (*Acanthaluteres vittiger*), silverbiddy (*Parequula melbournensis*) and gobies (unidentified species). A number of elasmobranch species were also recorded during the survey including banded stingarees (*Urolophus cruciatus*), sparsely spotted stingarees, (*Urolophus paucimaculatus*) numbfish (*Narcine tasmaniensis*) and sawfish (*Pristiophorus* sp.).

The most commonly observed invertebrates included introduced New Zealand screw shells (*Maoricolpus roseus*) and commercial scallops (*Pecten fumatus*). New Zealand screw shells were observed on all spot dives. The density of screw shells was quite variable. At most sites densities of screw shells were low, however at IF6 and compliance sites 4 and 5 moderate to high densities were present. The underlying cause of this spatial variation in screw shell density remains speculative, since the depth and exposure at these sites was comparable with the remaining sites. Other invertebrates recorded during the ROV survey included flat oysters (*Ostrea angasi*), hermit crabs and swarming crustaceans. The occasional sponge was also observed, these tended to be found amongst dense patches of New Zealand screw shells.

Clumps of mussels and dead mussel shells were observed at some sites. Mussel lines were in place at the time of the survey and these observations were restricted to sites in the immediate vicinity of mussel farming infrastructure. There were no gas bubbles, *Beggiatoa*, or any signs of organic enrichment in the sediments at any site based on the video footage.

Visual assessment showed that sediments were generally very similar across sampling sites. Sediments typically consisted of grey/greyish brown sand, with sparse shell grit observed in most cores. In some cores (e.g. compliance sites 4 and 5), darker colouration and streaks were evident with increasing depth. In cores with darker colouration present, the colour change was generally below 30 mm sediment depth and appeared as a gradient rather than a distinct change. The sandy nature of the sediments indicates that wave and/or swell action influences the seabed sediments and the rate of deposition of finer sediment fractions is low.

Redox measurement revealed well oxygenated sediments at 3 cm depth, averaging 215 mV across all sites. The observed redox values were consistent across sites and are considered indicative of well oxygenated, unimpacted sediments. Sulphide concentrations in sediments was very low at all sites, averaging 7.9 µM. Slightly elevated levels were evident at a restricted number of sites, particularly compliance sites 5 and 7. These slightly higher sulphide levels tended to align with sites that showed darker sediment colouration at depth based on the visual assessment, and are considered to be indicative of naturally occurring compacted sandy sediments rather than a sign of organic enrichment. Overall, there was no strong spatial pattern of sulphide levels between lease, compliance and control sites.

Sediments across the area sampled were typically dominated by sand (0.5-0.25 mm) and fine sand (0.25-0.125 mm) fractions with the majority of sediments being in the 0.25-0.125 mm size class (average 47% v/v across all sites). Overall, the sediments were clean with a relatively low proportion of fine clay and silt fractions (i.e. < 0.063 mm; average 6% v/v across all sites). Patterns of particle size distribution were generally very similar between sites, although control site 10 had a slightly higher level of coarse particle size fractions and control site 11 had a slightly higher level of finer silt/clay fractions.

The organic content of the sediments was low (< 5%) at all sites, as expected in sandy sediments. There was only minor variation between sampling sites, with no spatial strong pattern. Results from heavy metal analysis showed very low heavy metal levels. Accordingly, heavy metal levels were well below the ANZECC Interim Sediment Quality Guideline (ISQG) trigger values. Overall, there was only minor variation between internal farm sites, control and compliance sites for those heavy metals analysed.

Sampling for the threatened screw shell *Gazameda gunnii* within the lease area was undertaken. A single dead shell was found within the lease area from 30 targeted *Gazameda* sp. grab samples and 10 benthic fauna samples. A small number (three dead shells and two live animals) of *G. gunnii* were also recorded from compliance and control sites as part of sediment sampling activities.

Benthic faunal samples were collected from each compliance, control and internal farm dive site. The area possessed very high faunal diversity, with a total of 8184 individuals from 104 families identified across the 43 samples. Faunal communities were dominated by crustaceans, accounting for 60.4% of individuals and 43.3 % of families identified. Polychaetes were also a prominent component of faunal communities, accounting for 26.7% of individuals and 20.2 % of families. Molluscs were a relatively minor component of the fauna in terms of abundance (10.0% of individuals), but they made an important contribution to overall diversity (31.7% of families). Abundance and diversity of other fauna (including anthozoans, echinoderms, nemerteans, sipunculids) was relatively low, accounting for 2.8% of individuals and 4.8% of families.

The most common taxa recorded during the survey was an amphipod from the family Ampeliscidae, which represented 32.4 % of individuals recorded across all samples. Other commonly recorded families included Ampharetidae (polychaete), Phoxocephalidae (amphipod), Sabellidae (polychaete) and Kalliapseudidae (crustacean). A representative from the family Capitellidae, *Notomastus* sp., was recorded in low densities at some survey sites. While some capitellids can be indicators of organic enrichment, *Notomastus* sp. is not regarded as a pollution indicator species.

The introduced New Zealand screw shell *Maoricolpus roseus* was recorded in variable numbers across the survey sites. Overall, 133 individuals were recorded, with the majority occurring at control site 10 (71 individuals across triplicate grabs) and compliance site 4 (18 individuals across triplicate grabs) and site 5 (14 individuals across triplicate grabs). Other introduced species recorded in very low numbers across the survey included the bivalves *Varicorbula gibba* (10 individuals) and *Theora lubrica* (2 individuals).

Multivariate analysis showed generally low variability between most sites, indicative of a relatively consistent faunal community structure across the survey sites. The observed faunal patterns were within the range expected for an unimpacted ecosystem, with diverse communities and low levels of dominance by a single taxa. Based on the benthic faunal patterns present, any future benthic impacts should be readily observable. Reduced faunal diversity and an increase in species dominance patterns would be one of the main indicators of organic enrichment. Such a pattern would be expected to be readily discernible, given the high diversity measured during the baseline survey.

2 Operational Summary

Contractor: AQUENAL PTY LTD
ABN 74 151 011 157
244 Summerleas Road,
Kingston, Tasmania 7050
Phone 03 6229 2334 Fax 03 6229 2335

Client: Tassal Limited
GPO Box 1645
Hobart 7001

Phone: Hobart 03 6244 9099 Huonville 03 6244 8102
Fax: 1300 880 239

Field work: ROV survey: Tassal Pty Ltd
Seabed sampling: Aquenal Pty Ltd

Bathymetry mapping and ADCP analysis:
Marine Solutions Pty Ltd

Dates of fieldwork:
31/5/2017, 1/6/2017, 5/6/2017, 7/6/2017 - Sediment sampling
1/6/2017, 2/6/2017 - ROV survey

Weather	31/5/2017	1/6/2017	2/6/2017	5/6/2017	7/6/2017
Wind:	W 10-15 knots	W 10-15 knots	W 10 knots	Variable <10 knots	NW 10 knots
Sky:	Partly cloudy	Partly cloudy	Clear	Partly cloudy	Clear
Rain:	Nil	Nil	Nil	Nil	Nil
Sea:	0.5-1 m	0.5 m	<0.5 m	<0.5 m	<0.5 m
Current:	Low	Low	Low	Low	Low

Laboratory Analysis:
Heavy metals, organic content: Analytical Services Tasmania (AST)
All other analysis by Aquenal Pty Ltd

Filming for this assessment was carried out by Tassal using a Seabotix LBV150SE Remote Operated Vehicle (ROV). Positioning during the ROV survey was undertaken using a Garmin GPS and Nomad TDS. Seabed and ROV sampling was undertaken by Aquenal using a Craib Corer and Van-veen Grab. Positioning for seabed sampling was undertaken using a Garmin GPS and Omnistar 3000L Differential Global Positioning System. Both GPS systems used provide real-time, differentially corrected DGPS positions accurate to ~2m and were referenced to a State Permanent Mark (SPM) prior to commencement of fieldwork.

3 Map

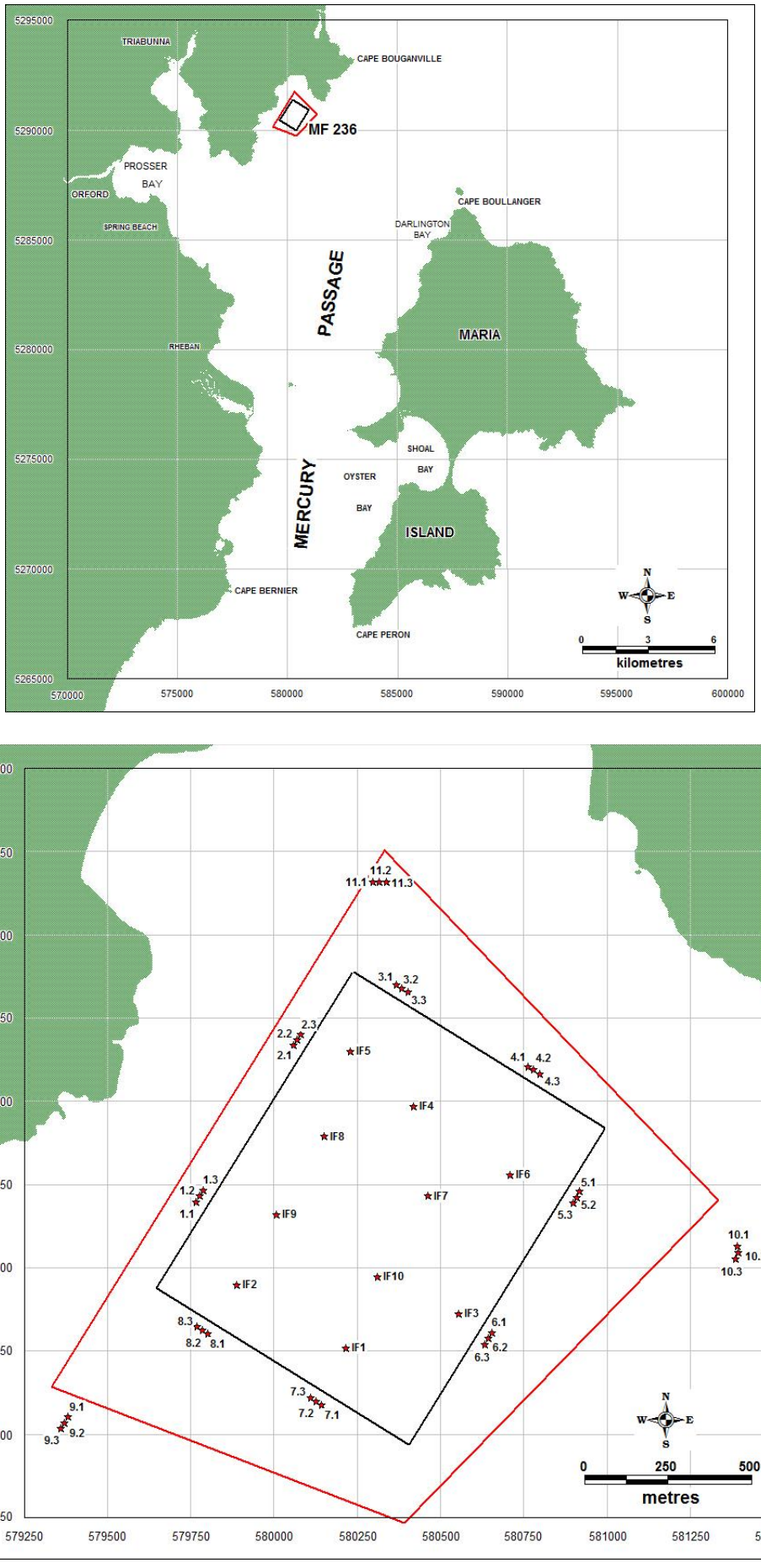


Figure 1 Location and survey maps– MF236, showing the zone (red line) and lease (black line) boundaries. Map includes compliance sites (1.1-1.3, 2.1-2.3, 3.1-3.3, 4.1-4.3, 5.1-5.3, 6.1-6.3, 7.1-7.3, 8.1-8.3) control sites (9.1-9.3, 10.1-10.3, 11.1-11.3) and internal farm dives (IF1-IF10).

4 Current Measurements

Current flow data was collected by Marine Solutions Pty Ltd. In order to measure localised current movement, an Acoustic Doppler Current Profiler (ADCP) was deployed inside the lease (55G 580269 5290691) at a depth of approximately 28 m for a period of 6 weeks between 7th November and 19th December 2014. The ADCP was set to measure current velocity and direction throughout the water column every 20 minutes, with this data grouped into three depth bins (surface < 9.5 m, middle 9.5 – 18.5 m, bottom waters 18.5-27.5 m). The ADCP also collected data on waves and tides within Okehampton Bay during the survey period.

Data from the ADCP deployment was processed and presented as current roses for surface, mid-water and bottom waters (Figures 2, 3 & 4). Current roses summarise water movement direction and velocity over the deployment period. The roses are read as if the current flow moves from the inner circle towards the outer circle of the graph.

Results and interpretation

Current velocities were considerably higher in surface waters, averaging 30.1 cm s^{-1}, compared to 4.5 cm s^{-1} and 4.7 cm s^{-1} for middle and bottom waters, respectively. Flow direction in surface waters was variable, but tended to be characterised by lower velocity currents (0-10 cm s^{-1}) flowing in a north/north easterly direction (Figure 2). A relatively high proportion of stronger currents (i.e. 70-80 cm s^{-1}) were measured flowing in a north/north westerly direction (Figure 2).

Patterns of current direction for mid-water were broadly comparable with surface waters, with flows generally in a north/north easterly direction (Figure 3). Current velocities in mid water were typically 0-10 cm s^{-1}. Similar velocity currents were evident in bottom waters, although there was a tendency for more flow in a westerly direction in the bottom waters (Figure 4).

Overall, based on the 6 week deployment period, it appears that wind driven surface currents mainly flow in a north/north-easterly direction, with lower velocities of more variable direction measured in mid and bottom waters.

Note that Tassal is in the process of undertaking further ADCP deployments to investigate seasonal variation in current strength and velocity in the vicinity of the lease area. A real-time ADCP will also be deployed on infrastructure within the lease once developed. Combined, these data will inform detailed hydrodynamic modelling activities planned for the Okehampton Bay region.

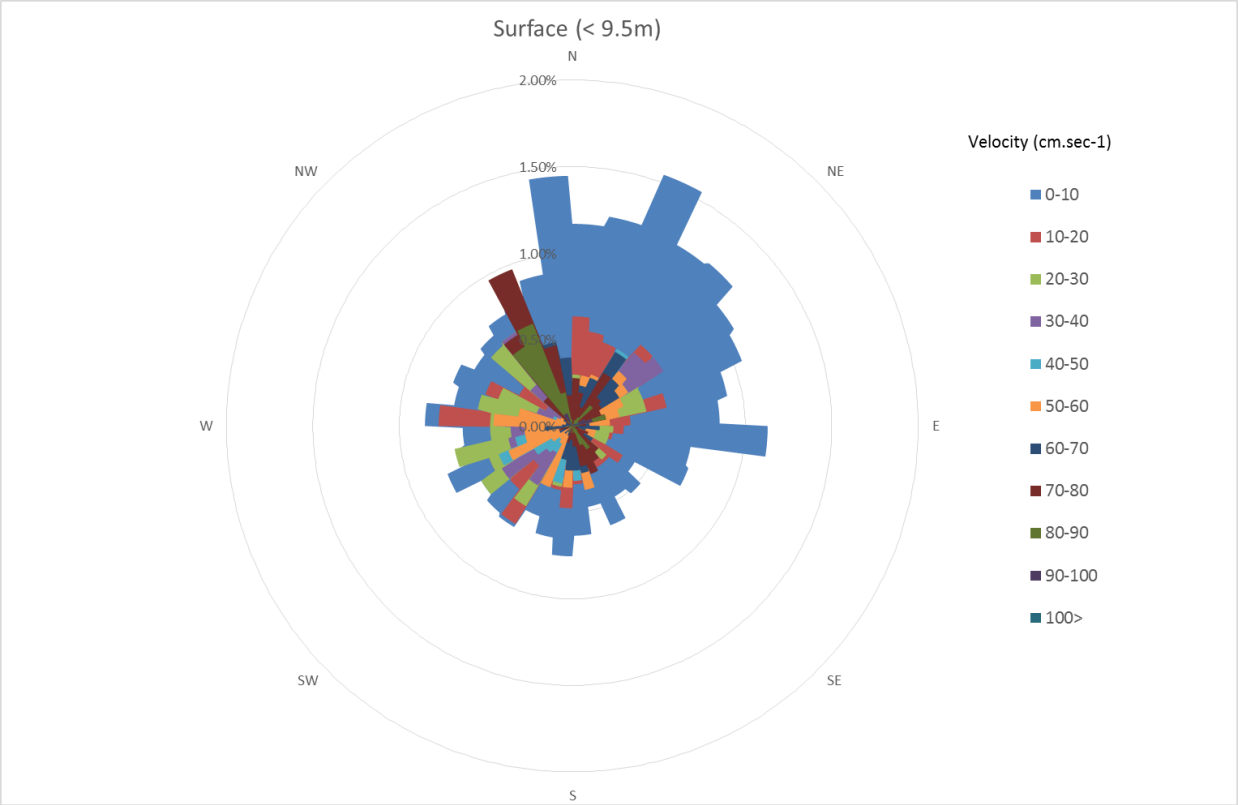


Figure 2 Polar plots of current velocity and direction for surface waters. The plots are read as if the current flow moves from the centre towards the outer circle of the graph.

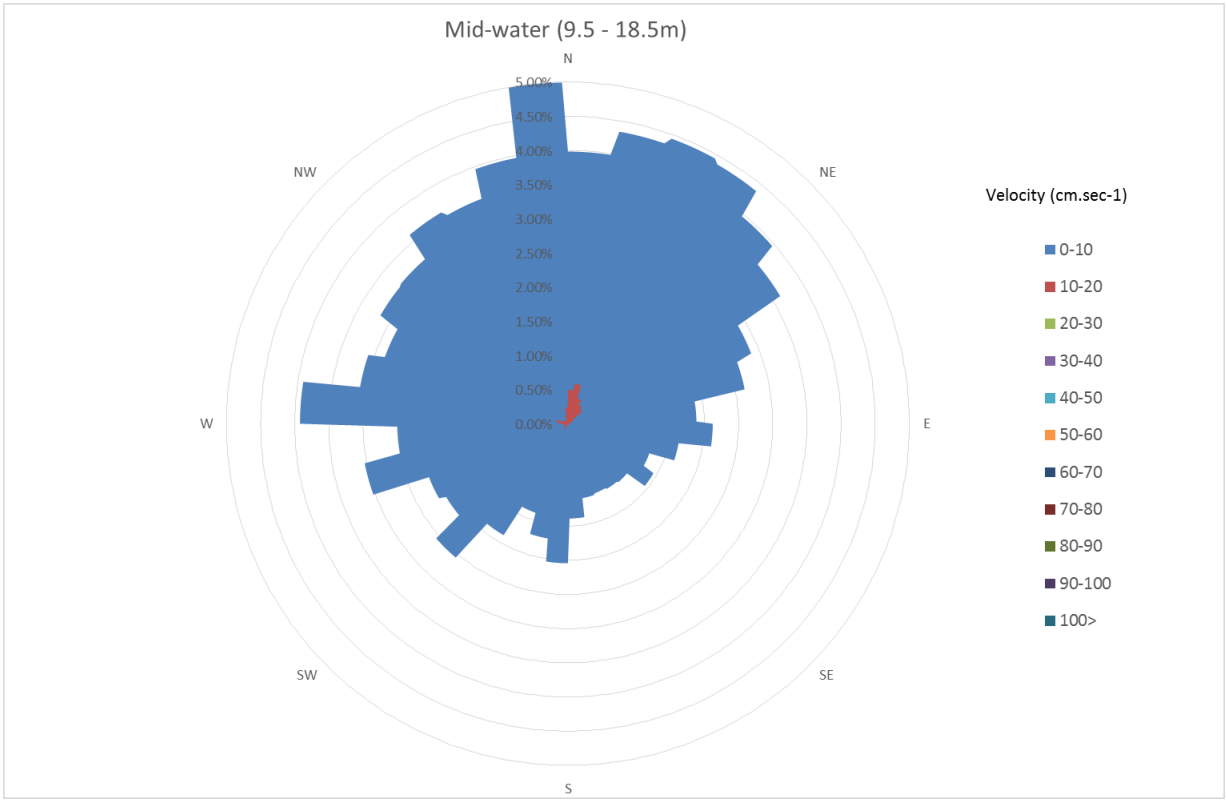


Figure 3 Polar plots of current velocity and direction for mid-water. The plots are read as if the current flow moves from the centre towards the outer circle of the graph.

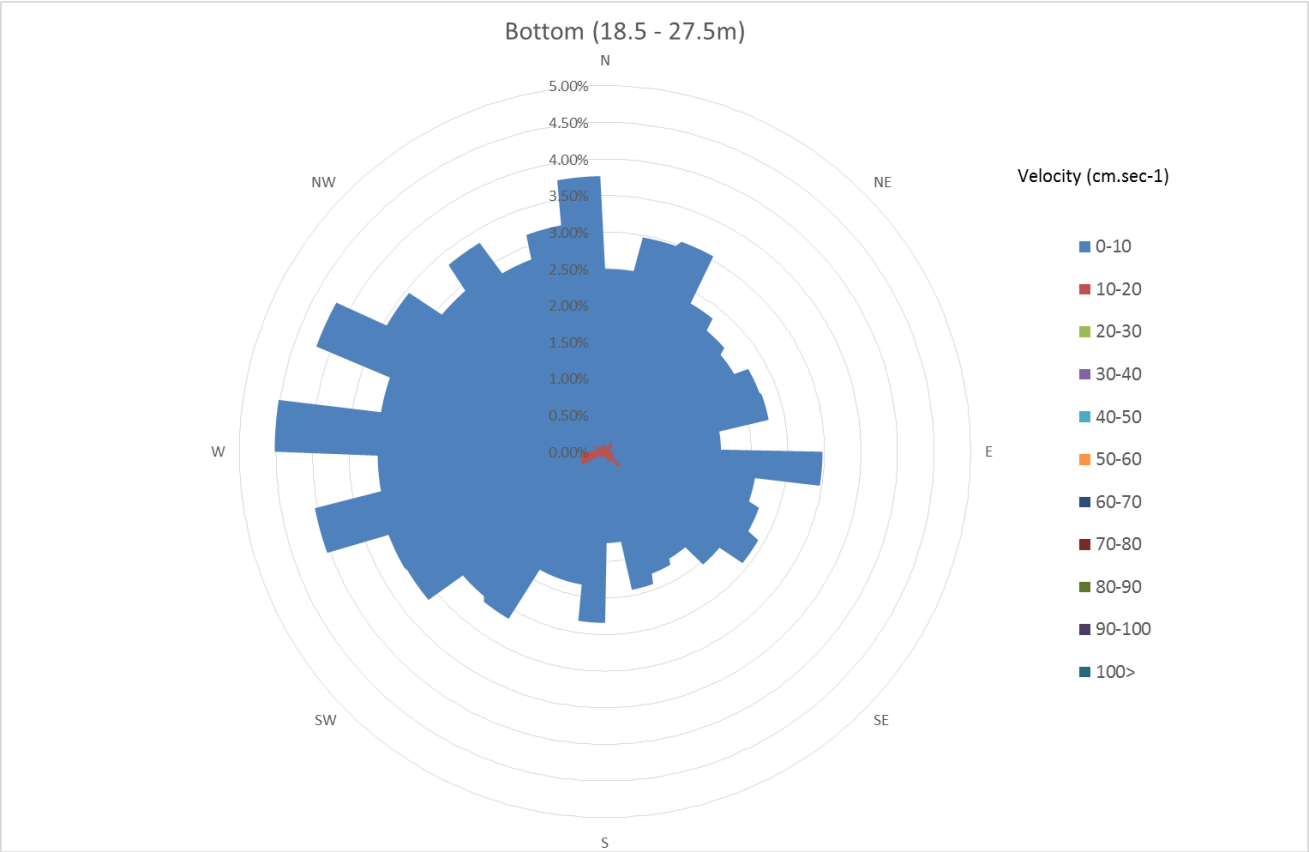


Figure 4 Polar plots of current velocity and direction for bottom water. The plots are read as if the current flow moves from the centre towards the outer circle of the graph.

5 Bathymetric Profile

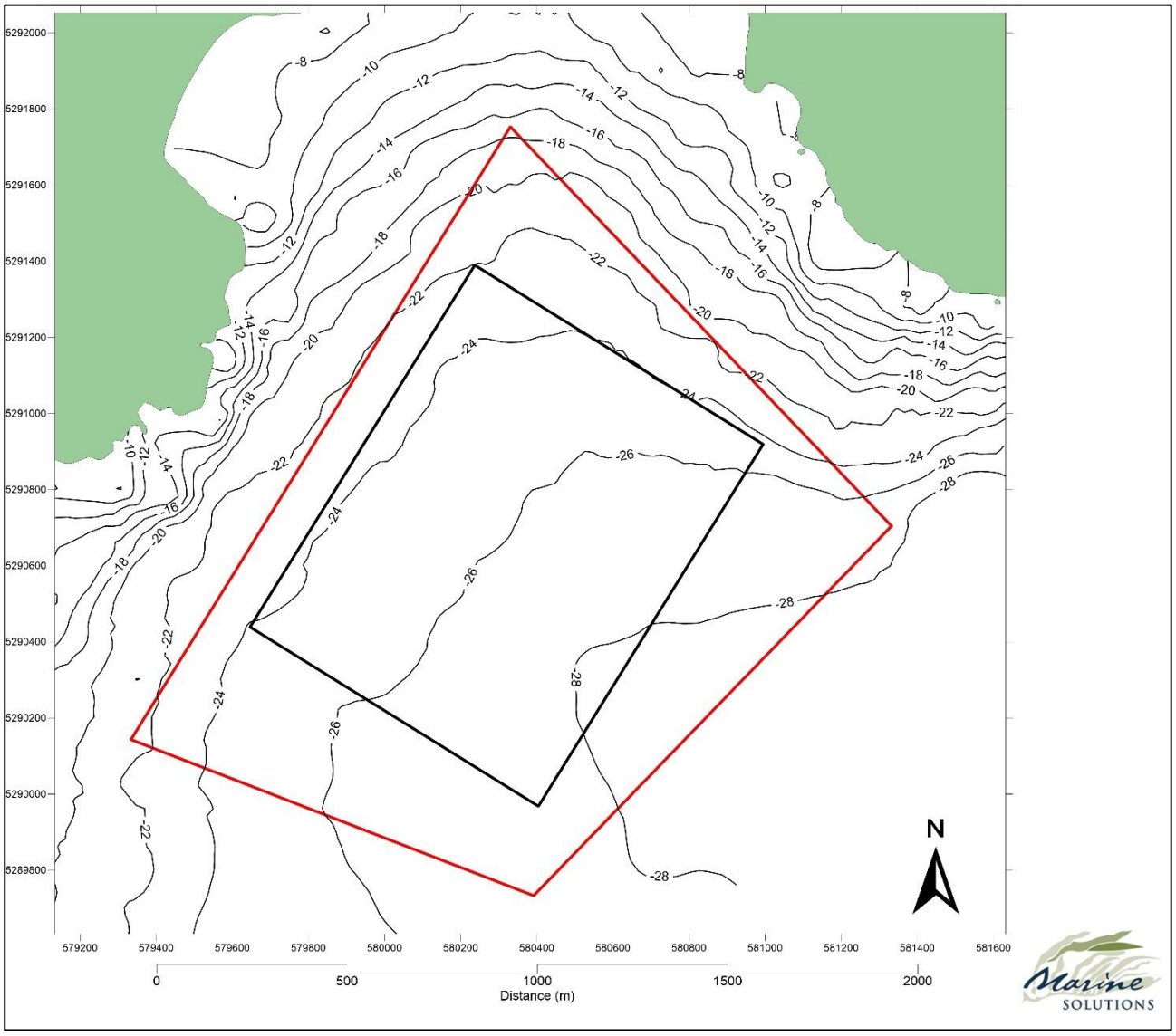


Figure 5 Bathymetric map. Depths contours indicated are relative to chart datum. The zone boundary is shown in red, while the lease boundary is indicated by the black line.

6 Seabed Characteristics and habitat profile

One broad habitat category was identified during the survey area, with sand/shell grit with sparse *Caulerpa scalpelliformis* observed within and adjacent to the lease area (Figure 6). Some variation in habitat type was observed, but this tended to be evident at small spatial scales that could not be reliably depicted in the habitat map. For example, the density of New Zealand screw shells varied considerably between sites within the lease, even those separated by as little as 250 m. For more detailed habitat descriptions, refer to the ROV video footage descriptions (Table 2).

Note that more detailed habitat mapping and assessment of habitats adjacent to the lease area, including nearby rocky reefs, has been undertaken. The results of these surveys will be provided in a supplementary report.

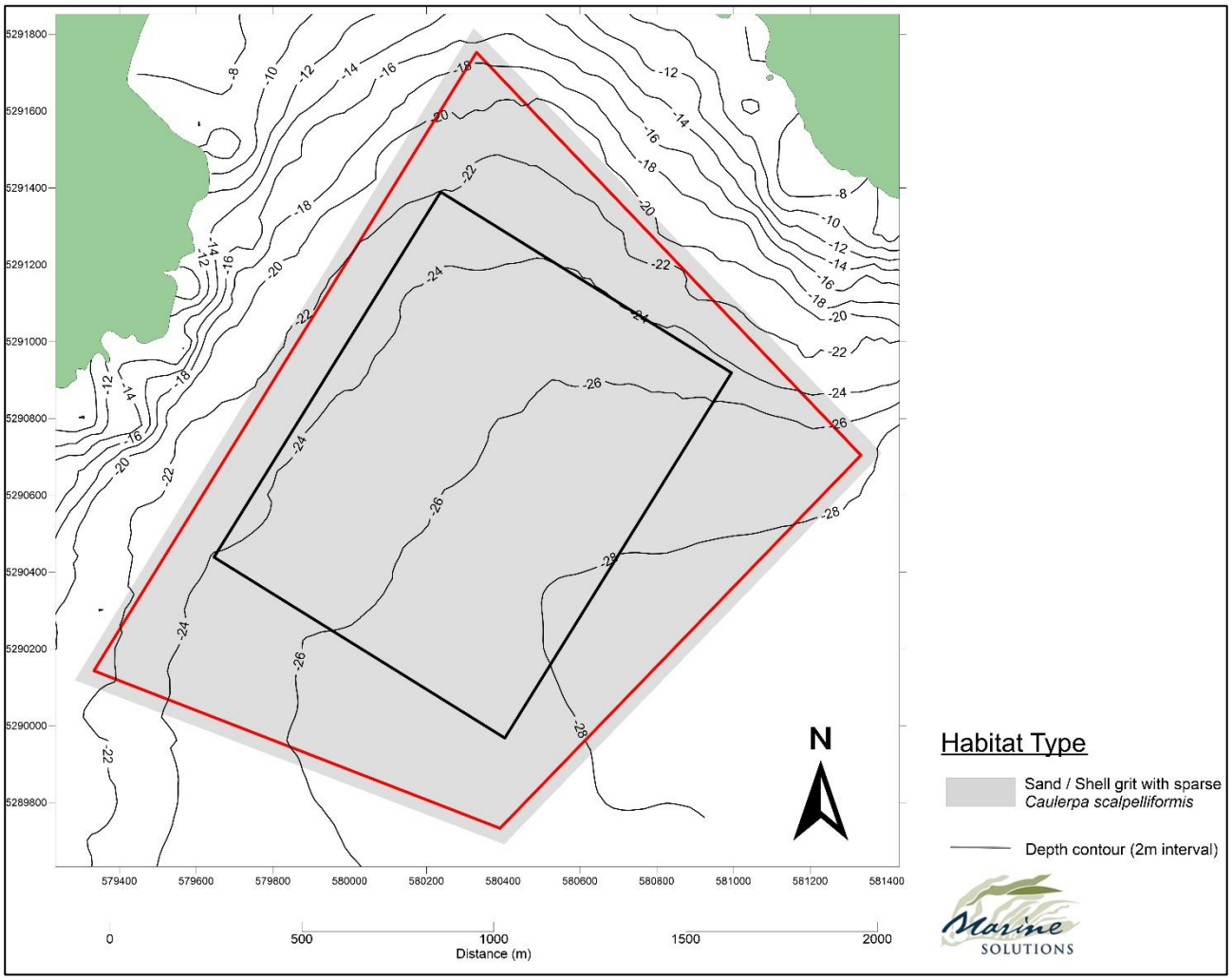


Figure 6 Survey habitat map. The zone boundary is shown in red, while the lease boundary is indicated by the black line.

7 Underwater Video Survey

7.1 Filming summary

The appearance of the seabed in the vicinity of MF236 was recorded by filming spot dives of the sea floor using a Seabotix LBV150SE Remote Operated Vehicle (ROV). The spot dive locations were:

- Compliance sites at 35 m outside the lease boundary (sites 1.1-1.3, 2.1-2.3, 3.1-3.3, 4.1-4.3, 5.1-5.3, 6.1-6.3, 7.1-7.3, 8.1-8.3,).
- Control sites at least 250 m from the lease boundary (sites 9.1-9.3, 10.1-10.3, 11.1-11.3)
- Internal farm dives within the lease area (IF1-IF10).

Survey sites were located at positions specified by the DPIPWE, as illustrated in Figure 1 and listed in Table 1. Descriptions of video footage are provided below in Table 2 below. Representative still images taken from video frame grabs are included in Appendix 5.

7.2 Observations from filming

Table 1 Descriptions of of dives performed.

Site	Dive type	Easting	Northing	Date	Time start	Time end
1.1	35 m compliance	579766	5290703	2/06/2017	1039	1043
1.2	35 m compliance	579783	5290715	2/06/2017	1049	1053
1.3	35 m compliance	579783	5290731	2/06/2017	1059	1103
2.1	35 m compliance	580058	5291165	2/06/2017	1110	1113
2.2	35 m compliance	580070	5291189	2/06/2017	1118	1122
2.3	35 m compliance	580076	5291205	2/06/2017	1128	1132
3.1	35 m compliance	580367	5291346	1/06/2017	1116	1120
3.2	35 m compliance	580385	5291336	1/06/2017	1129	1133
3.3	35 m compliance	580395	5291328	1/06/2017	1142	1146
4.1	35 m compliance	580754	5291110	1/06/2017	1235	1239
4.2	35 m compliance	580782	5291098	1/06/2017	1246	1250
4.3	35 m compliance	580789	5291083	1/06/2017	1302	1306
5.1	35 m compliance	580918	5290729	1/06/2017	1318	1322
5.2	35 m compliance	580905	5290712	1/06/2017	1329	1333
5.3	35 m compliance	580897	5290699	1/06/2017	1339	1343
6.1	35 m compliance	580658	5290307	1/06/2017	1355	1358
6.2	35 m compliance	580643	5290287	1/06/2017	1409	1413
6.3	35 m compliance	580630	5290271	1/06/2017	1419	1423
7.1	35 m compliance	580142	5290088	2/06/2017	916	920
7.2	35 m compliance	580127	5290101	2/06/2017	927	931
7.3	35 m compliance	580109	5290112	2/06/2017	936	940
8.1	35 m compliance	579803	5290297	1/06/2017	949	953
8.2	35 m compliance	579789	5290313	1/06/2017	1001	1005
8.3	35 m compliance	579766	5290323	1/06/2017	1013	1017
9.1	Control	579376	5290053	2/06/2017	844	848
9.2	Control	579367	5290031	2/06/2017	853	857
9.3	Control	579360	5290018	2/06/2017	902	906
10.1	Control	581385	5290558	1/06/2017	1432	1435
10.2	Control	581392	5290543	1/06/2017	1441	1445
10.3	Control	581385	5290523	1/06/2017	1450	1454
11.1	Control	580291	5291659	1/06/2017	1157	1201

Site	Dive type	Easting	Northing	Date	Time start	Time end
11.2	Control	580310	5291655	1/06/2017	1207	1211
11.3	Control	580336	5291659	1/06/2017	1218	1221
IF1	Internal farm dive	580219	5290260	1/06/2017	955	959
IF2	Internal farm dive	579887	5290449	1/06/2017	1020	1024
IF3	Internal farm dive	580554	5290360	1/06/2017	1007	1011
IF4	Internal farm dive	580421	5290984	1/06/2017	1035	1039
IF5	Internal farm dive	580230	5291150	1/06/2017	1057	1101
IF6	Internal farm dive	580710	5290777	1/06/2017	845	849
IF7	Internal farm dive	580462	5290712	1/06/2017	900	904
IF8	Internal farm dive	580159	5290892	1/06/2017	914	918
IF9	Internal farm dive	580004	5290660	1/06/2017	926	930
IF10	Internal farm dive	580310	5290473	1/06/2017	938	942

Interpretation

General comments on the spot dive locations are provided below:

- Filming of the seabed at all compliance, control and internal habitat sites showed them to be generally uniform. The dominant substrate across all sites was light grey sand with shell grit.
- No reef or seagrass habitats were observed within the lease area or adjacent compliance and control sites.
- For the majority of sites, macroalgal cover on the seabed was very low (<1 % cover). The most common algal species observed was the green alga *Caulerpa scalpelliformis*. Red foliose algae was also occasionally observed attached to dead shells. Small patches of drift algae (predominately red and brown algae) were recorded on most spot dives.
- Macroalgal cover was higher at some sites (e.g. IF6, sites 4.1-4.3; 5.1-5.3). At these sites, densities of New Zealand screw shells (*Maoricolpus roseus*) tended to be higher and algae were typically attached to these shells.
- Small patches of drift algae (predominately brown and red algae) were recorded on most spot dives.
- The most commonly recorded fish during the survey was the sand flathead (*Platycephalus bassensis*), which were observed at most sites. Other fish recorded during the survey included butterfly gurnard (*Lepidotrigla* sp.), Degen's leatherjacket (*Thamnaconus degeni*), toothbrush leatherjacket (*Acanthaluteres vittiger*), silverbiddy (*Parequula melbournensis*) and gobies (unidentified species). A number of elasmobranch species were also recorded during the survey including banded stingarees (*Urolophus cruciatus*), sparsely spotted stingarees, (*Urolophus paucimaculatus*) numbfish (*Narcine tasmaniensis*) and sawfish (*Pristiophorus* sp.).
- The most commonly observed invertebrates included New Zealand screw shells (*Maoricolpus roseus*) and commercial scallops (*Pecten fumatus*). New Zealand screw shells were observed on all spot dives. The density of screw shells was quite variable. At most sites densities of screw shells were low, however at IF6 and compliance sites 4 and 5 moderate to high densities were present. The underlying cause of this spatial variation in screw shell density remains speculative, since the depth and exposure at these sites was comparable with the remaining sites.
- Other invertebrates recorded during the ROV survey included flat oysters (*Ostrea angasi*), hermit crabs and swarming crustaceans. Dead bivalve shells and heart urchin tests were also

commonly observed. The occasional sponge was also observed, these tended to be found amongst dense patches of New Zealand screw shells.

- Clumps of mussels and dead mussel shells were observed at some sites. Mussel lines were in place at the time of the survey and these observations were restricted to sites in the immediate vicinity of mussel farming infrastructure (e.g. compliance site 3).
- The cryptogenic fan worm *Myxicola infundibulum* was observed at compliance site 3.1 and control sites 11.1, 11.2, 11.3.
- Small patches of cyanobacterial mat were observed at control site 11.
- There were no gas bubbles, *Beggiatoa*, or any signs of organic enrichment in the sediments at any site based on the video footage.

Table 2 Description of each ROV dive performed at MF236 – seabed characteristics.

Site	Easting	Northing	Date	Time	Depth	Dive type	Visibility	Habitat Description
1.1	579766	5290703	2/06/2017	1039	25.1	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = banded stingarees (*Urolophus cruciatus*), goby, commercial scallops (*Pecten fumatus*), heart urchin test, swarming crustaceans. **Flora:** 5% cover. Low-moderate *Caulerpa scalpelliformis* cover on seabed. Drift red algae.
1.2	579783	5290715	2/06/2017	1049	25.1	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = commercial scallops (*Pecten fumatus*), heart urchin test. **Flora:** 2-5% cover. Low *Caulerpa scalpelliformis* cover on seabed. Drift brown and red algae.
1.3	579783	5290731	2/06/2017	1059	25.2	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = sand flathead (*Platycephalus bassensis*), goby, commercial scallops (*Pecten fumatus*), swarming crustaceans. **Flora:** 5% cover. Low *Caulerpa scalpelliformis* cover on seabed. Drift red algae.
2.1	580058	5291165	2/06/2017	1110	24.8	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = commercial scallops (*Pecten fumatus*), gobies, swarming crustaceans. **Flora:** 5% cover. Low *Caulerpa scalpelliformis* cover on seabed. Drift brown and red algae.
2.2	580070	5291189	2/06/2017	1118	24.6	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = sand flathead (*Platycephalus bassensis*), commercial scallops (*Pecten fumatus*), gobies, hermit crabs, swarming crustaceans. **Flora:** 10% cover. Low *Caulerpa scalpelliformis* cover on seabed. Drift brown and red algae.
2.3	580076	5291205	2/06/2017	1128	24.7	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = sand flathead (*Platycephalus bassensis*), flat oyster (*Ostrea angasi*), commercial scallops (*Pecten fumatus*), swarming crustaceans. **Flora:** 2% cover. Sparse *Caulerpa scalpelliformis* cover on seabed. Drift brown and red algae.

Site	Easting	Northing	Date	Time	Depth	Dive type	Visibility	Habitat Description
3.1	580367	5291346	1/06/2017	1116	24.4	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Occasional dead bivalve shell. Other fauna = sand flathead (*Platycephalus bassensis*), banded stingaree (*Urolophus cruciatus*), numbfish (*Narcine tasmaniensis*), sawfish (*Pristiophorus* sp.), Degen's leatherjacket (*Thamnaconus degeni*), commercial scallops (*Pecten fumatus*), mussel clumps, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed.
3.2	580385	5291336	1/06/2017	1129	24.6	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Other fauna = sand flathead (*Platycephalus bassensis*), commercial scallops (*Pecten fumatus*), mussel clumps, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown and red algae.
3.3	580395	5291328	1/06/2017	1142	24.7	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Other fauna = sand flathead *(Platycephalus bassensis*), toothbrush leatherjacket (*Acanthaluteres vittiger*), commercial scallops (*Pecten fumatus*), dead mussel shells and mussel clumps, *Myxicola infundibulum*, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown algae.
4.1	580754	5291110	1/06/2017	1235	25.4	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in moderate-high densities. Faunal tracks and burrows. Other fauna = Degen's leatherjacket (*Thamnaconus degeni*), toothbrush leatherjacket (*Acanthaluteres vittiger*), silverbiddy *(Parequula melbournensis*), goby, occasional sponge, swarming crustaceans. **Flora:** 10-20% cover. Moderate *Caulerpa scalpelliformis* cover, mainly associated with *Maoricolpus* shells. Sparse algal cover on seabed. Occasional red foliose algae attached to shell debris. Drift brown algae.
4.2	580782	5291098	1/06/2017	1246	25.3	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in moderate-high densities. Faunal tracks and burrows. Other fauna = sand flathead (*Platycephalus bassensis*), Degen's leatherjacket (*Thamnaconus degeni*), bluespotted goatfish, (*Upeneichthys vlamingii*), numbfish (*Narcine tasmaniensis*), goby, commercial scallops (*Pecten fumatus*), occasional sponge, hermit crab, swarming crustaceans. **Flora:** 5-10% cover. Moderate *Caulerpa scalpelliformis* cover, mainly associated with *Maoricolpus* shells. Sparse algal cover on seabed. Drift brown algae.

Site	Easting	Northing	Date	Time	Depth	Dive type	Visibility	Habitat Description
4.3	580789	5291083	1/06/2017	1302	25.6	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in moderate densities. Faunal tracks and burrows. Other fauna = sand flathead (*Platycephalus bassensis*), numbfish (*Narcine tasmaniensis*), gobies, commercial scallops (*Pecten fumatus*), occasional sponge, swarming crustaceans. **Flora:** 5% cover. Moderate *Caulerpa scalpelliformis* cover, mainly associated with *Maoricolpus* shells. Sparse algal cover on seabed. Drift brown algae.
5.1	580918	5290729	1/06/2017	1318	28.7	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in moderate-high densities. Faunal tracks and burrows. Other fauna = flat oyster (*Ostrea angasi*), occasional sponge, swarming crustaceans. **Flora:** 5-10% cover. Red foliose algae amongst *Maoricolpus* shells. Occasional *Caulerpa scalpelliformis* and *C. trifaria*. Sparse algal cover on seabed. Drift brown algae.
5.2	580905	5290712	1/06/2017	1329	28.8	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in moderate-high densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = sand flathead (*Platycephalus bassensis*), bluespotted goatfish, (*Upeneichthys vlamingii),* flat oyster (*Ostrea angasi*), occasional sponge, hermit crabs, swarming crustaceans. **Flora:** 5% cover. Red foliose algae, *Caulerpa scalpelliformis* and *C. trifaria* amongst *Maoricolpus* shells. Sparse algal cover on seabed. Drift brown algae.
5.3	580897	5290699	1/06/2017	1339	29	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in moderate-high densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = banded stingaree (*Urolophus cruciatus*), occasional sponge, swarming crustaceans. **Flora:** 2-5% cover. Red foliose algae, *Caulerpa scalpelliformis* and *C. trifaria* amongst *Maoricolpus* shells. Sparse algal cover on seabed. Drift brown algae.
6.1	580658	5290307	1/06/2017	1355	30.1	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Other fauna = sand flathead *(Platycephalus bassensis*), banded stingaree (*Urolophus cruciatus*), commercial scallops (*Pecten fumatus*), heart urchin tests, swarming crustaceans, drift sponge. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift red algae.
6.2	580643	5290287	1/06/2017	1409	30.3	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = commercial scallops (*Pecten fumatus*), occasional sponge (drift and attached), swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift red algae.

Site	Easting	Northing	Date	Time	Depth	Dive type	Visibility	Habitat Description
6.3	580630	5290271	1/06/2017	1419	30.1	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Other fauna = sand flathead (*Platycephalus bassensis*), commercial scallops (*Pecten fumatus*), flat oyster (*Ostrea angasi*), heart urchin tests, hermit crabs, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown and red algae.
7.1	580142	5290088	2/06/2017	916	28.3	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low-moderate densities. Faunal tracks and burrows. Other fauna = sand flathead (*Platycephalus bassensis*), commercial scallops (*Pecten fumatus*), swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown, green and red algae.
7.2	580127	5290101	2/06/2017	927	28.1	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low-moderate densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = stingaree (*Urolophus* sp.), goby, commercial scallops (*Pecten fumatus*), swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown algae.
7.3	580109	5290112	2/06/2017	936	28	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low-moderate densities. Faunal tracks and burrows. Dead bivalves. Other fauna = sand flathead (*Platycephalus bassensis*), butterfly gurnard (*Lepidotrigla* sp.), commercial scallops (*Pecten fumatus*), swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown and red algae.
8.1	579803	5290297	1/06/2017	949	26.6	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = sand flathead (*Platycephalus bassensis*), numbfish (*Narcine tasmaniensis*), commercial scallops (*Pecten fumatus*), occasional sponge. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown algae.
8.2	579789	5290313	1/06/2017	1001	26.4	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = sand flathead (*Platycephalus bassensis*), commercial scallops (*Pecten fumatus*), heart urchin tests, hermit crab, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown algae.
8.3	579766	5290323	1/06/2017	1013	26.2	35m	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = commercial scallops (*Pecten fumatus*), swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown and red algae.

Site	Easting	Northing	Date	Time	Depth	Dive type	Visibility	Habitat Description
9.1	579376	5290053	2/06/2017	844	23.7	control	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = commercial scallops (*Pecten fumatus*), heart urchin tests, hermit crabs, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown and red algae.
9.2	579367	5290031	2/06/2017	853	23.7	control	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = commercial scallops (*Pecten fumatus*), hermit crab, swarming crustaceans. **Flora:** No attached algae. Drift red algae
9.3	579360	5290018	2/06/2017	902	23.5	control	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = commercial scallops (*Pecten fumatus*), *Gazameda* sp. dead shell, small gastropod, heart urchin test, hermit crab, swarming crustaceans. **Flora:** No attached algae. Drift brown, green and red algae
10.1	581385	5290558	1/06/2017	1432	29.9	control	15 m +	**Seabed:** Light grey sand with coarse shell grit **Fauna:** *Maoricolpus roseus* in moderate densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = banded stingaree (*Urolophus cruciatus*), goby, commercial scallop (*Pecten fumatus*), heart urchin tests, swarming crustaceans. **Flora:** 1% cover. Sparse red algae and very sparse *Caulerpa scalpelliformis* amongst *Maoricolpus* shells. Drift red algae.
10.2	581392	5290543	1/06/2017	1441	30.4	control	15 m +	**Seabed:** Light grey sand with coarse shell grit **Fauna:** *Maoricolpus roseus* in low-high densities (variable densities). Faunal tracks and burrows. Other fauna = commercial scallops (*Pecten fumatus*), occasional sponge, large globular sponge, swarming crustaceans. **Flora:** <1% cover. Sparse red algae and very sparse *Caulerpa trifaria* amongst *Maoricolpus* shells.
10.3	581385	5290523	1/06/2017	1450	30.5	control	15 m +	**Seabed:** Light grey sand with coarse shell grit **Fauna:** *Maoricolpus roseus* in moderate-high densities. Faunal tracks and burrows. Other fauna = commercial scallop (*Pecten fumatus*), occasional sponge, heart urchin test, hermit crab, swarming crustaceans. **Flora:** 1-2% cover. Sparse red algae and very sparse *Caulerpa scalpelliformis* and *C. trifaria* amongst *Maoricolpus* shells. Drift brown algae.

Site	Easting	Northing	Date	Time	Depth	Dive type	Visibility	Habitat Description
11.1	580291	5291659	1/06/2017	1157	20.8	control	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Other fauna = sand flathead *(Platycephalus bassensis*), banded stingaree (*Urolophus cruciatus*), sparsely-spotted stingaree (*Urolophus paucimaculatus*), flat oyster (*Ostrea angasi*), commercial scallops (*Pecten fumatus*), *Myxicola infundibulum*, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift seagrass. Small patches of cyanobacterial mat.
11.2	580310	5291655	1/06/2017	1207	21.4	control	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = sand flathead *(Platycephalus bassensis*), flat oyster (*Ostrea angasi*), *Myxicola infundibulum*, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift seagrass. Small patches of cyanobacterial mat.
11.3	580336	5291659	1/06/2017	1218	21.2	control	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = sparsely-spotted stingaree (*Urolophus paucimaculatus*), flat oyster (*Ostrea angasi*), commercial scallops *(Pecten fumatus*)*, Myxicola infundibulum*, swarming crustaceans. **Flora:** 1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift seagrass. Small patches of cyanobacterial mat.
IF1	580219	5290260	1/06/2017	955	28.2	internal	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Other fauna = flounder (unidentified), flat oyster (*Ostrea angasi*), commercial scallops (*Pecten fumatus*), swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* and *C. trifaria,* mainly growing amongst shell debris*.* Drift brown and red algae.
IF2	579887	5290449	1/06/2017	1020	26.5	internal	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = commercial scallops (*Pecten fumatus*), heart urchin test, swarming crustaceans. **Flora:** 2% cover. Sparse *Caulerpa scalpelliformis.* Drift brown algae.
IF3	580554	5290360	1/06/2017	1007	29.1	internal	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Other fauna = sparsely-spotted stingaree (*Urolophus paucimaculatus*), flat oyster (*Ostrea angasi*), commercial scallops (*Pecten fumatus),* drift sponge, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis.* Drift brown algae.

Site	Easting	Northing	Date	Time	Depth	Dive type	Visibility	Habitat Description
IF4	580421	5290984	1/06/2017	1035	27	internal	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Dead bivalve shells. Other fauna = banded stingaree (*Urolophus cruciatus*), commercial scallops (*Pecten fumatus*), drift sponge, hermit crab, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis.* Drift brown and red algae.
IF5	580230	5291150	1/06/2017	1057	25.9	internal	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Occasional dead bivalve shell. Other fauna = sand flathead (*Platycephalus bassensis*), stingaree (*Urolophus* sp.), numbfish (*Narcine tasmaniensis*), commercial scallops (*Pecten fumatus*), heart urchin test, dead mussel shells and mussel clumps on seafloor, hermit crab, swarming crustaceans. **Flora:** 1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown algae.
IF6	580710	5290777	1/06/2017	845	27.9	internal	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in moderate densities. Faunal tracks and burrows. Other fauna = sand flathead (*Platycephalus bassensis*), silverbiddy (*Parequula melbournensis*), flat oyster (*Ostrea angasi*), occasional sponge, swarming crustaceans. **Flora:** 10-20% cover. *Caulerpa scalpelliformis, C. trifaria* and red foliose algae, mainly attached to shell debris.
IF7	580462	5290712	1/06/2017	900	27.8	internal	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Occasional dead bivalve shell. Other fauna = stingaree (*Urolophus* sp.), hermit crab, drift sponge, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown algae.
IF8	580159	5290892	1/06/2017	914	26.4	internal	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Occasional dead bivalve shell. Other fauna = sand flathead (*Platycephalus bassensis*), banded stingarees (*Urolophus cruciatus*), numbfish (*Narcine tasmaniensis*), Degen's leatherjacket (*Thamnaconus degeni*), commercial scallops (*Pecten fumatus*), dead mussel shells and mussel clumps on seafloor, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown algae.
IF9	580004	5290660	1/06/2017	926	26.3	internal	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in very low densities. Faunal tracks and burrows. Other fauna = sand flathead (*Platycephalus bassensis*), flat oyster (*Ostrea angasi*), commercial scallops (*Pecten fumatus*), mussel clumps on seafloor, heart urchin tests, eleven-armed seastar (*Coscinasterias muricata*), swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown algae.

Site	Easting	Northing	Date	Time	Depth	Dive type	Visibility	Habitat Description
IF10	580310	5290473	1/06/2017	938	28.1	internal	15 m +	**Seabed:** Light grey sand with shell grit **Fauna:** *Maoricolpus roseus* in moderate densities. Faunal tracks and burrows. Other fauna = sand flathead (*Platycephalus bassensis*), stingaree (*Urolophus* sp.), commercial scallops (*Pecten fumatus*), heart urchin tests, drift sponge, swarming crustaceans. **Flora:** <1% cover. Very sparse *Caulerpa scalpelliformis* on seabed. Drift brown algae.

***Note that depths are recorded from the ROV unit and are indicative. For accurate bathymetry measured to chart datum refer to Figure 5.**

8 Sediment Chemistry

8.1 Visual Assessment

Methods

A Craib corer was used to collect 50 mm diameter sediment cores in transparent Perspex tubes. These were handled carefully and retained in a vertical orientation to minimise disturbance of the sediment surface until they were described and redox and sulphide readings taken. The cores were described in terms of length, colour (using a Munsell soil chart), plant and animal life, gas vesicles, and smell. Odour from hydrogen sulphide gas, if present, was noted after the water was removed from the core barrels.

Results and interpretation

Visual assessment showed that sediments were generally very similar across sampling sites. Sediments typically consisted of grey/greyish brown sand, with sparse shell grit observed in most cores. In some cores (e.g. compliance sites 4 and 5) darker colouration and streaks were evident with increasing depth. In cores with darker colouration present, the colour change was generally below 30 mm sediment depth and appeared as a gradient rather than a distinct change.

Animals or evidence of their presence (i.e. animal burrows) were observed in many sediment cores. No odour or gas bubbles were noted in any core sample.

The sandy nature of the sediments indicates that wave and/or swell action influences the seabed sediments and the rate of deposition of finer sediment fractions is low. The darker sediment colouration evident at some sites is indicative of low oxygen levels in the sediment. These observations are not considered evidence of organic enrichment, such a pattern is not unusual in circumstances where sandy, well compacted sediments are present.

Descriptions of the sediment cores are tabulated in Table 3. Images of core samples are provided in Appendix 6.

Table 3 Visual description of sediment cores at MF236.

Site	Length (mm)	Colour 1 (Munsell score)	Sediment 1	Depth 1 (mm)	Colour 2 (Munsell score)	Sediment 2	Depth 2 (mm)	Plants	Animals	Gas	Smell
1.1	140	10YR/5/1 Grey	Sand with sparse shell grit	140				Nil	Burrows, amphipod on sediment surface	Nil	Nil
1.2	160	10YR/5/1 Grey	Sand with sparse shell grit	160				Drift *Caulerpa*	Burrows	Nil	Nil
1.3	150	10YR/5/1 Grey	Sand with sparse shell grit	150				Nil	Burrows	Nil	Nil
2.1	120	10YR/5/1 Grey	Sand with sparse shell grit	120				Nil	Burrows	Nil	Nil
2.2	140	10YR/5/1 Grey	Sand with sparse shell grit	80	10YR/4/1 Dark grey	Sand	140	Nil	Burrows	Nil	Nil
2.3	150	10YR/5/1 Grey	Sand with sparse shell grit	150				Nil	Burrows	Nil	Nil
3.1	180	10YR/5/1 Grey	Sand with sparse shell grit	80	10YR/4/1 Dark grey	Sand with sparse shell grit	180	Nil	Nil	Nil	Nil
3.2	130	10YR/5/1 Grey	Sand with sparse shell grit	60	10YR/4/1 Dark grey	Sand with sparse shell grit	130	Nil	Nil	Nil	Nil
3.3	130	10YR/5/1 Grey	Sand with sparse shell grit	70	10YR/4/1 Dark grey	Sand with sparse shell grit	130	Nil	Nil	Nil	Nil
4.1	160	10YR/5/1 Grey	Sand with sparse shell grit	160				*Caulerpa* on sediment surface	Nil	Nil	Nil
4.2	140	10YR/5/2 Greyish brown	Sand with sparse shell grit	50	10YR/3/1 Very dark grey with darker streaks	Sand with sparse shell grit	140	Nil	Burrows	Nil	Nil
4.3	120	10YR/5/2 Greyish brown	Sand with sparse shell grit	30	10YR/3/1 Very dark grey with darker streaks	Sand with sparse shell grit	120	Nil	Nil	Nil	Nil
5.1	170	10YR/5/2 Greyish brown	Sand with sparse shell grit	30	10YR/4/1 Dark grey with darker streaks	Sand with sparse shell grit	170	Nil	Polychaete at 40 mm	Nil	Nil
5.2	160	10YR/5/2 Greyish brown	Sand with sparse shell grit	20	10YR/4/1 Dark grey with darker streaks	Sand with sparse shell grit	160	Nil	Polychaete at 40 mm, burrows	Nil	Nil

Site	Length (mm)	Colour 1 (Munsell score)	Sediment 1	Depth 1 (mm)	Colour 2 (Munsell score)	Sediment 2	Depth 2 (mm)	Plants	Animals	Gas	Smell
5.3	180	10YR/5/2 Greyish brown	Sand with sparse shell grit	30	10YR/4/1 Dark grey with darker streaks	Sand with sparse shell grit	180	Nil	Polychaete on sediment surface	Nil	Nil
6.1	160	10YR/5/2 Greyish brown	Sand with sparse shell grit	160				Nil	Nil	Nil	Nil
6.2	190	10YR/5/2 Greyish brown	Sand with sparse shell grit	190				Nil	Nil	Nil	Nil
6.3	170	10YR/5/2 Greyish brown	Sand with sparse shell grit	170				Nil	Nil	Nil	Nil
7.1	120	10YR/5/2 Greyish brown	Sand with sparse shell grit	40	10YR/4/1 Dark grey	Sand with sparse shell grit	120	Nil	Ghost shrimp at 20 mm, burrows	Nil	Nil
7.2	170	10YR/5/2 Greyish brown	Sand with sparse shell grit	30	10YR/4/1 Dark grey	Sand with sparse shell grit	170	Nil	Nil	Nil	Nil
7.3	150	10YR/5/2 Greyish brown	Sand with sparse shell grit	30	10YR/4/1 Dark grey with darker streaks	Sand with sparse shell grit	150	Nil	Nil	Nil	Nil
8.1	130	10YR/5/2 Greyish brown	Sand with sparse shell grit	130				Nil	Burrows	Nil	Nil
8.2	120	10YR/5/2 Greyish brown	Sand with sparse shell grit	120				Nil	Nil	Nil	Nil
8.3	140	10YR/5/2 Greyish brown	Sand with shell grit	140				Nil	Polychaete at 30 mm, burrows	Nil	Nil
9.1	130	10YR/5/1 Grey	Sand with sparse shell grit	60	10YR/4/1 Dark grey	Sand with sparse shell grit	130	Nil	Nil	Nil	Nil
9.2	150	10YR/5/1 Grey	Sand with sparse shell grit	80	10YR/4/1 Dark grey	Sand with sparse shell grit	150	Nil	Burrows	Nil	Nil
9.3	170	10YR/5/1 Grey	Sand with sparse shell grit	90	10YR/4/1 Dark grey	Sand with sparse shell grit	170	Nil	Nil	Nil	Nil
10	190	10YR/5/2 Greyish brown, faint dark streaks at 100 mm	Sand with sparse shell grit	190				Nil	*Gazameda gunnii* on sediment surface	Nil	Nil

Site	Length (mm)	Colour 1 (Munsell score)	Sediment 1	Depth 1 (mm)	Colour 2 (Munsell score)	Sediment 2	Depth 2 (mm)	Plants	Animals	Gas	Smell
10	110	10YR/5/2 Greyish brown, faint dark streaks at bottom of core	Sand with sparse shell grit	110				Nil	Burrows	Nil	Nil
10	100	10YR/5/2 Greyish brown, faint dark streaks at bottom of core	Sand with sparse shell grit	100				Nil	Burrows	Nil	Nil
11	130	10YR/5/1 Grey	Sand with sparse shell grit	60	10YR/4/1 Dark grey	Sand with sparse shell grit	130	Nil	Gastropod on sediment surface	Nil	Nil
11	180	10YR/5/1 Grey	Sand with sparse shell grit	90	10YR/4/1 Dark grey	Sand with sparse shell grit	180	Nil	Nil	Nil	Nil
11	140	10YR/5/1 Grey	Sand with sparse shell grit	70	10YR/4/1 Dark grey	Sand with sparse shell grit	140	Nil	Nil	Nil	Nil
IF1	140	10YR/5/2 Greyish brown	Sand with sparse shell grit	90	10YR/4/1 Dark grey	Sand with sparse shell grit	140	Nil	Nil	Nil	Nil
IF2	170	10YR/5/2 Greyish brown	Sand with sparse shell grit	90	10YR/4/1 Dark grey	Sand with sparse shell grit	170	Nil	Burrows	Nil	Nil
IF3	140	10YR/5/2 Greyish brown	Sand with sparse shell grit	140				Nil	Burrows	Nil	Nil
IF4	160	10YR/5/2 Greyish brown, faint dark streak at bottom of core	Sand with sparse shell grit	160				Nil	Nil	Nil	Nil
IF5	180	10YR/5/1 Grey	Sand with sparse shell grit	60	10YR/4/1 Dark grey	Sand with sparse shell grit	180	Nil	Ghost shrimp at 40 mm	Nil	Nil
IF6	160	10YR/5/1 Grey	Sand with sparse shell grit	160				Nil	Nil	Nil	Nil
IF7	150	10YR/5/1 Grey	Sand with sparse shell grit	150				Nil	Polychaete on sediment surface	Nil	Nil
IF8	160	10YR/5/1 Grey	Sand with sparse shell grit	160				Nil	Polychaete at 50 mm, burrows	Nil	Nil

Site	Length (mm)	Colour 1 (Munsell score)	Sediment 1	Depth 1 (mm)	Colour 2 (Munsell score)	Sediment 2	Depth 2 (mm)	Plants	Animals	Gas	Smell
IF9	170	10YR/5/1 Grey	Sand with sparse shell grit	170				Nil	Ghost shrimp at 100 mm, burrows	Nil	Nil
IF10	130	10YR/5/2 Greyish brown	Sand with sparse shell grit	130				Nil	Burrows	Nil	Nil

8.2 Redox Potential

Methods

Redox potential was measured in millivolts at 30 mm below the sediment surface using a WTW pH 320 meter with a Mettler Toledo Ag/AgCl combination pH/Redox probe. Calibration and functionality of the meter were checked before each test using a Redox Buffer Solution (248 mV at 10 °C). Measurements were made within 3 hours of the samples being collected. Corrected Redox potential values were calculated by adding the standard potential of the reference cell to the measured redox potential and are reported in millivolts.

In all cases the lowest reading observed was recorded as the Redox value. In low permeability, muddy sediments, the recorded value is determined when the reading is stable or dropping at less than 1 mV per second. In permeable, sandy sediments the lowest reading is often observed while the probe is being worked to the measurement depth. As soon as the probe stops moving in sandy sediments with low Redox values, the readings normally start to increase when water is drawn down by the probe diluting the interstitial fluids.

Results and interpretation

Sediment redox values at 30 mm sediment depth averaged 216 mV and were well above 100 mV at each site (Figure 7). The observed high redox values at all lease, compliance and control sites are indicative of well oxygenated sediments (Macleod and Forbes 2004). Raw data is presented in Appendix 2.

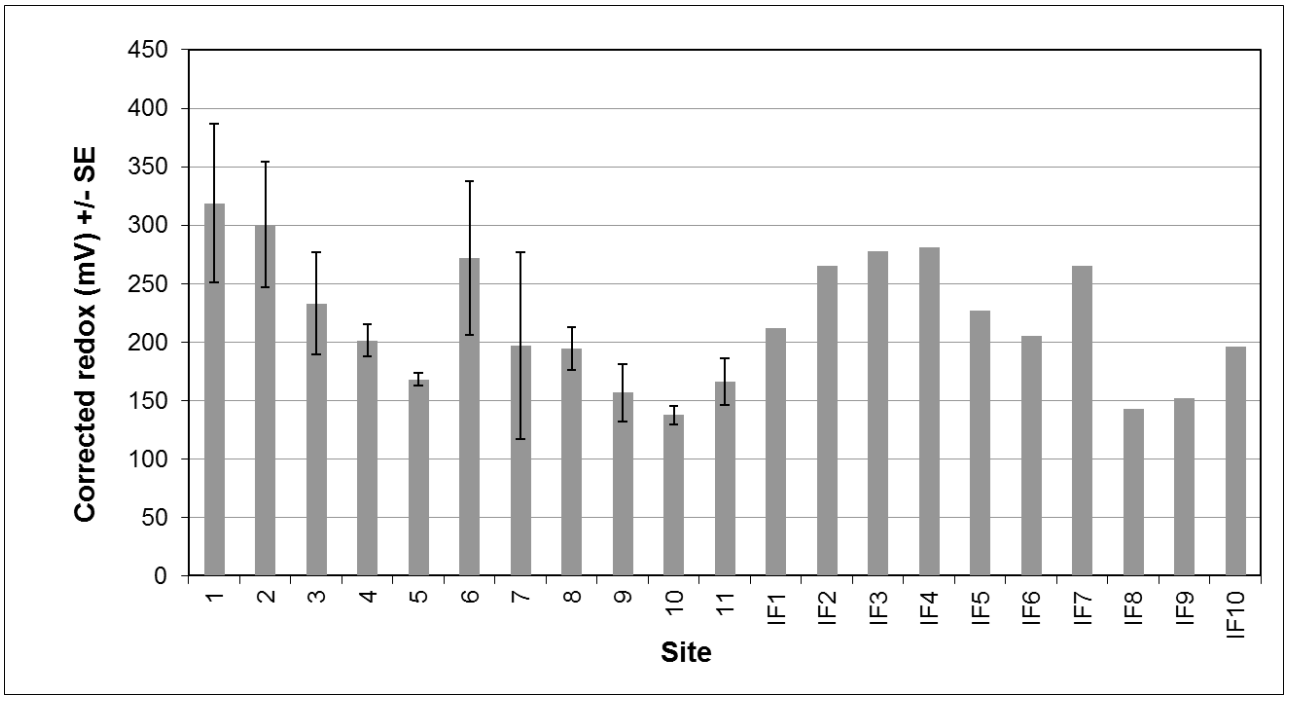


Figure 7 Redox potential at 30 mm depth in sediment cores at each site. For sites 1-11, bars represent mean corrected redox values (± SE error) across three replicate cores at each site. For internal farm dives (IF1-IF10), bars represent redox measurement for a single core.

8.3 Sulphide Analysis

Methods

Sediment sulphide was measured in accordance with the prescribed DPIPWE protocols (Macleod and Forbes 2004). Measurements were made using a TPS uniPROBE Sulphide ISE and a WTW pH 320 meter. Using a modified syringe, 2 mL of sediment was removed at 30 mm depth from the core and mixed with 2 mL of reagent (sulphide anti-oxidant buffer, SAOB) in a small beaker. The sediment/SAOB mixture was carefully stirred with the probe for 15-20 seconds, until the reading stabilised. The accuracy and functionality of the meter and probe was assessed prior to analysis commencing, using standards of known concentration. A calibration curve was produced using three standards of known concentration.

Results and interpretation

Sulphide concentration in sediments was typically very low across the survey sites, averaging 7.9 µM across all sediment cores (Figure 8). Slightly elevated levels were evident at a restricted number of sites, particularly compliance sites 5 and 7. While relatively high compared to the other sites, sulphide levels were below levels expected for organically enriched sediments (i.e. < 100 µM; Macleod and Forbes 2004). Sites with slightly higher sulphide levels tended to align with sites that showed darker sediment colouration at depth based on the visual assessment, and are considered to be indicative of naturally occurring compacted sandy sediments rather than a sign of organic enrichment (refer to section 8.1 above). Overall, there was no strong spatial pattern of sulphide levels between lease, compliance and control sites.

Raw data is presented in Appendix 3.

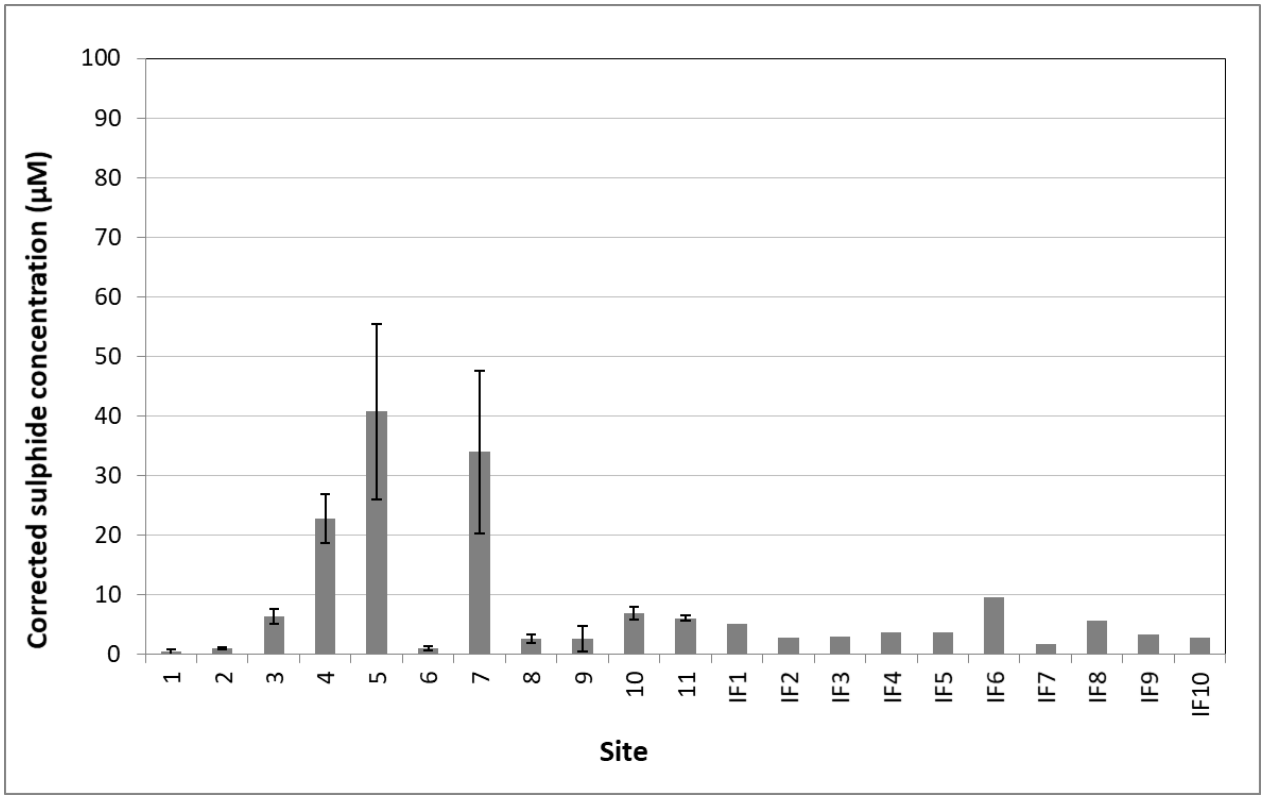


Figure 8 Sulphide concentrations in sediment core samples. For sites 1-11, bars represent mean sulphide values (± SE error) across three replicate cores at each site. For internal farm dives (IF1-IF10), bars represent sulphide levels for a single core.

8.4 Particle Size Analysis

Methods

The top 100 mm of each sediment core was homogenised and then 68-72 ml of sediment was sub-sampled for particle size determination.

Results and interpretation

Sediments across the area sampled were typically dominated by sand (0.5-0.25 mm) and fine sand (0.25-0.125 mm) fractions with the majority of sediments being in the 0.25-0.125 mm size class (average 47 % v/v across all sites). Overall, the sediments were clean with a relatively low proportion of fine clay and silt fractions (i.e. < 0.063 mm; average 6% v/v across all sites). Patterns of particle size distribution were generally very similar between sites, although control site 10 had a slightly higher level of coarse particle size fractions and control site 11 had a slightly higher level of finer silt/clay fractions.

Patterns of particle size distribution were indicative of a sedimentary environment with moderate agitation of seabed sediments and associated low abundance of fine silt and clay fractions. These patterns are considered typical of sediments in relatively deep (i.e. >20 m) and exposed locations. The similarity in particle size distribution between most sites implies similar depositional environments.

The reason for the variation in particle size distribution evident at control sites 10 and 11 is likely to be explained by differences in wave exposure. Control site 10 is located approximately 500 m east of the lease and is likely to be subject to slightly higher water movement and a different depositional environment compared to the other sites. In contrast, the slightly higher levels of fine silt/clay sediment fractions evident at control site 11 is likely due to the site being located to the north of the lease boundary in a more sheltered part of Okehampton Bay.

Particle size results are presented in Figure 9, while raw data is included in Appendix 4.

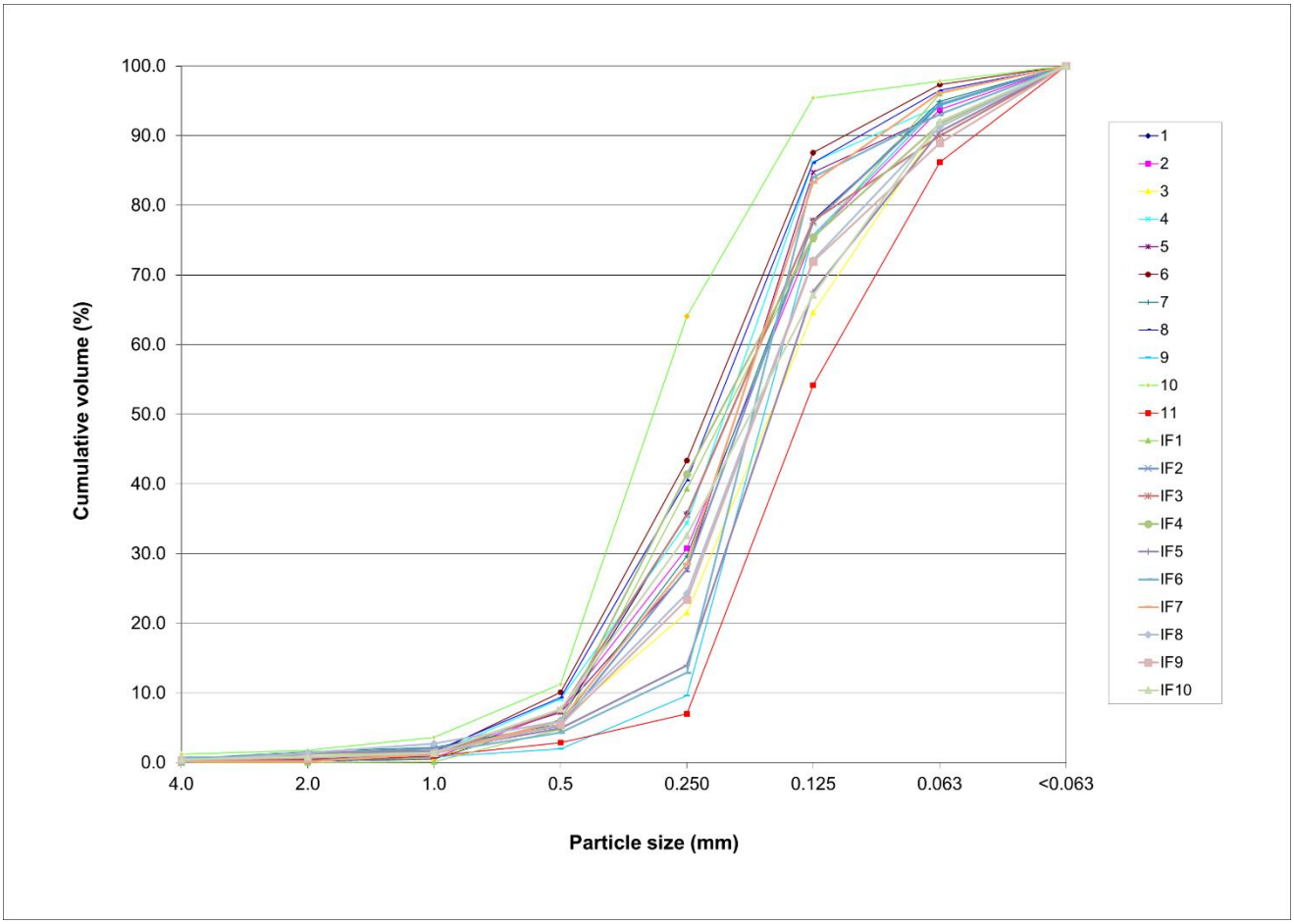


Figure 9 Particle size analyses of the top 100 mm of sediment. Plots represent mean percentage cumulative volume for size fractions for sites 1-11 across three replicate cores at each site. For internal farm dives (IF1-IF10) lines represent particle size analysis from a single core.

8.5 Organic Carbon

Methods

A single undisturbed sediment core sample taken using a perspex core with an internal diameter of at least 50 mm at each sample site specified in the survey for the purposes of organic content analysis. The top 3 cm of each was oven dried at 60 °C prior to analysis of total organic carbon. Total organic carbon was measured by loss on ignition (450 °C in a muffle furnace for 4 hours) by AST.

Results and interpretation

Results from the organic content analysis are presented in Figure 10. The organic content was low, ranging from 1.3% to 3.4%, with an average of 2.2% across all sites. The observed low organic content levels were consistent with those expected for sandy sediments.

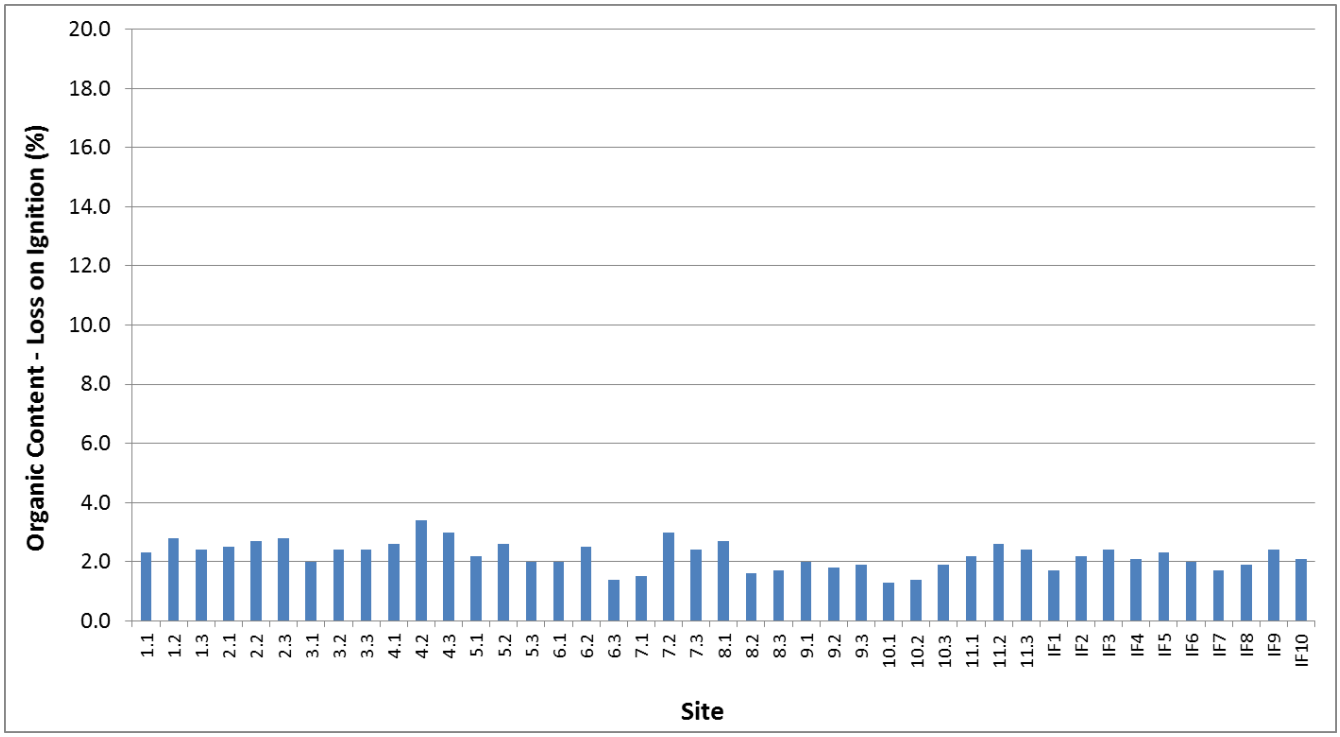


Figure 10 Organic content in sediment core samples at each site.

8.6 Heavy Metal Analysis

Methods

Sediment cores of 50 mm diameter were collected and the top 30 mm of each core was transferred to a clean jar for metal analysis. Heavy metals analysed in sediment samples included: arsenic, cadmium, cobalt, chromium, copper, manganese, nickel, lead and zinc. The analyses were conducted by AST using the test methods specified in the following Australian Standards:

2301-Soil: Metals in Soil, Sediment and Dust by ICPAES

Results and interpretation

Results from the heavy metal analysis are presented in Table 4. Heavy metal levels were very low across all sites. Accordingly, none of the ANZECC Interim Sediment Quality Guideline (ISQG) trigger value were exceeded for any of the analytes measured.

Overall, there was only minor variation between internal farm sites, control and compliance sites for those heavy metals analysed.

Table 4 Results of heavy metal analysis of sediment samples and the ANZECC 2000 trigger values.

Site	Metal (mg/kg DMB)								
	As	Cd	Co	Cr	Cu	Mn	Ni	Pb	Zn
1.1	6	<0.5	2	16	4	39	4	3	14
1.2	7	<0.5	2	14	4	35	4	3	13
1.3	7	<0.5	2	14	4	37	3	2	13
2.1	6	<0.5	2	13	5	36	4	3	13
2.2	7	<0.5	2	13	5	36	4	3	13
2.3	6	<0.5	2	14	6	36	4	3	14
3.1	5	<0.5	2	12	5	27	4	2	11
3.2	5	<0.5	2	12	5	27	4	2	10
3.3	5	<0.5	2	11	5	27	4	2	10
4.1	8	<0.5	2	12	4	32	3	2	11
4.2	8	<0.5	2	13	4	32	3	3	12
4.3	7	<0.5	2	12	4	31	3	2	11
5.1	8	<0.5	1	12	3	25	3	2	10
5.2	8	<0.5	1	12	3	23	3	2	10
5.3	8	<0.5	1	12	3	25	3	2	10
6.1	6	<0.5	2	18	4	39	4	3	15
6.2	9	<0.5	1	16	2	25	3	2	13
6.3	6	<0.5	2	18	4	37	4	3	16
7.1	5	<0.5	1	14	2	26	3	2	11
7.2	6	<0.5	2	16	3	27	4	2	13
7.3	6	<0.5	2	16	3	33	4	3	14
8.1	7	<0.5	2	16	3	29	3	2	12
8.2	7	<0.5	1	14	2	22	3	2	10
8.3	9	<0.5	1	12	1	18	2	2	8
9.1	5	<0.5	3	15	6	63	5	2	16
9.2	5	<0.5	2	16	5	61	5	2	15
9.3	5	<0.5	3	15	5	64	5	2	15
10.1	8	<0.5	<1	8	1	17	2	1	6
10.2	8	<0.5	<1	9	1	15	2	2	7
10.3	11	<0.5	<1	10	1	17	2	2	7
11.1	5	<0.5	2	14	6	36	4	2	11
11.2	5	<0.5	2	15	7	35	5	2	13
11.3	5	<0.5	2	14	7	35	5	2	13
IF1	8	<0.5	1	14	2	22	2	2	9
IF2	6	<0.5	1	14	2	23	3	2	10
IF3	6	<0.5	2	17	4	35	4	3	14
IF4	5	<0.5	1	11	3	24	3	2	9
IF5	5	<0.5	2	12	4	28	4	2	11
IF6	6	<0.5	1	12	3	25	3	3	10
IF7	8	<0.5	1	10	2	15	2	2	7
IF8	5	<0.5	2	12	4	28	3	2	11
IF9	5	<0.5	2	13	3	28	3	2	11
IF10	7	<0.5	2	16	3	30	4	3	12
ANZECC 2000 ISQG-Low (trigger value)	20	2		80	65		21	50	200
ANZECC 2000 ISQG-High (trigger value)	70	10		370	270		52	220	410

9 Threatened Species

Gunn's screw shell (Gazameda gunnii)

A targeted survey was undertaken for the native screw shell species *Gazameda gunnii,* listed as vulnerable under the Tasmanian *Threatened Species Protection Act 1995*. In accordance with Schedule EPA requirements, 15 samples were initially taken across the lease area using a Van Veen grab. Samples were sieved in the field through a 4 mm sieve before inspection by a taxonomic expert (Mr J. Lane). A dead *G. gunnii* shell was detected from the initial 15 samples, so a further 15 samples were taken across the lease area.

Results

From the 30 targeted samples taken within the lease area, a single juvenile dead shell (20 mm in length) was detected at site G8 (Figure 10). During other benthic sampling activities undertaken during the baseline survey, the presence of *G. gunnii* was also noted and it was detected from benthic samples and sediment cores. These additional observations were at compliance and control sites (see Table 5 below). No further *G. gunnii* observations were made from within the lease area.

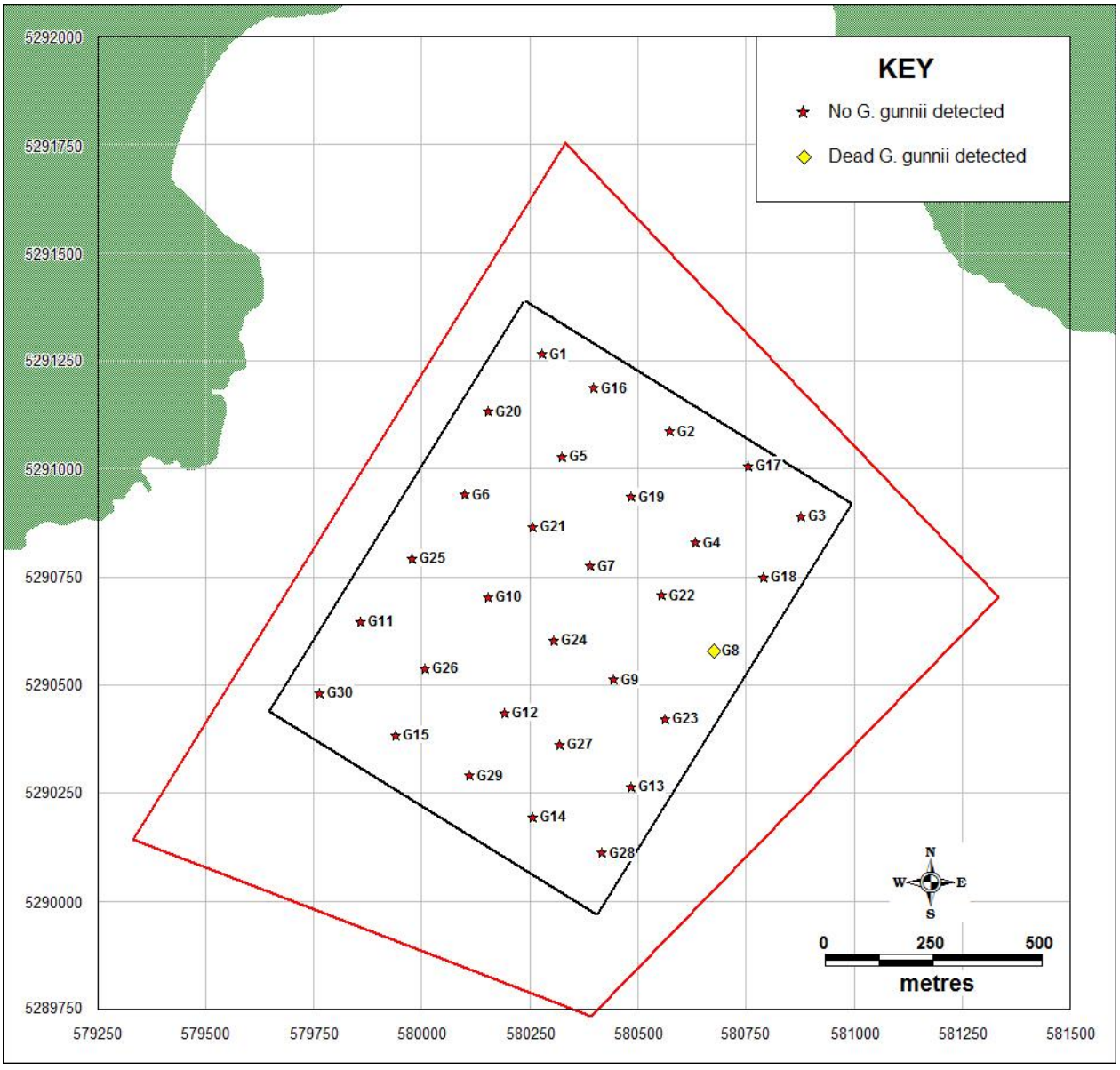


Figure 11 Results of targeted *Gazameda gunnii* sampling

Table 5 Summary of *Gazameda gunnii* observations

Site	Method	*Gazameda gunnii* details
G8 (inside lease)	Targeted *Gazameda* survey	1 x dead shell
Compliance site 1.2	Benthic fauna grab	1 x live animal
Compliance site 4.2	Benthic fauna grab	2 x dead shells
Control site 9.3	Benthic fauna grab	1 x dead shell
Control site 10.1	Sediment core	1 x live animal

The risk to *Gazameda gunnii* populations from the proposed development is considered to be negligible. Potential impacts to *G. gunnii* individuals inhabiting the proposed zone relate to installation of mooring infrastructure and organic enrichment of the benthos inside the lease area. However, such interactions are considered very unlikely due to the extremely low density of *G. gunnii* in the area. Furthermore, recent studies investigating the distribution of benthic molluscs have also found the species is more wide-spread than previously determined (Grove and Little 2014). Dredge surveys conducted across south east Tasmania concluded that *G. gunnii* 'was by no means rare being recorded from almost half of all samples, generally as live individuals (Grove & Little, 2014).'

Overall, based on the extremely low densities in the zone area and widespread distribution of *G. gunnii*, the development poses a negligible threat to *G. gunnii* populations. The results of the current survey were supplied to DPIPWE's Policy and Conservation Advice Branch (PCAB), Conservation Assessment Section. Based on the findings of the survey, PCAB advised that a Threatened Species Permit was not required for the proposed development

10 Biological Analysis

Methods

Macroinvertebrates were collected using a Van Veen grab which sampled a 0.07 m^2 area of seabed. A single grab sample was collected at each of the compliance and control sites, with a total of 43 grabs collected. Grab samples were sieved in the field using 1 mm mesh sieve bags, with animal and sediment material retained in the mesh bags placed in 5% buffered formalin.

Results and interpretation

Abundance and patterns of family richness are summarised in Table 6 below (see Appendix 7 for raw data). The area possessed very high faunal diversity, with a total of 8184 individuals from 104 families identified across the 43 samples. Faunal communities were dominated by crustaceans, accounting for 60.4% of individuals and 43.3 % of families identified. Polychaetes were also a prominent component of faunal communities, accounting for 26.7% of individuals and 20.2 % of families. Molluscs were a relatively minor component of the fauna in terms of abundance (10.0% of individuals), but they made an important contribution to overall diversity (31.7% of families). Abundance and diversity of other fauna (including anthozoans, echinoderms, nemerteans, sipunculids) was relatively low, accounting for 2.8% of individuals and 4.8% of families.

The most common taxa recorded during the survey was an amphipod from the family Ampeliscidae, which represented 32.4 % of individuals recorded across all samples. Other commonly recorded families included Ampharetidae (polychaete), Phoxocephalidae (amphipod), Sabellidae (polychaete) and Kalliapseudidae (crustacean). A representative from the family Capitellidae, *Notomastus* sp., was recorded in low densities at some survey sites. While some capitellids can be indicators of organic enrichment, *Notomastus* sp. is not regarded as a pollution indicator species.

The introduced New Zealand screw shell *Maoricolpus roseus* was recorded in variable numbers across the survey sites. Overall, 133 individuals were recorded, with the majority occurring at control site 10 (71 individuals across triplicate grabs) and compliance site 4 (18 individuals across triplicate grabs) and site 5 (14 individuals across triplicate grabs). Other introduced species recorded in very low numbers across the survey included the bivalves *Varicorbula gibba* (10 individuals) and *Theora lubrica* (2 individuals).

The MDS analysis showed generally low variability between most sites (Figure 12). The majority of sites clustered tightly together and at the 40% similarity level (based on cluster analysis), all sites clustered within the same grouping. These patterns are indicative of relatively consistent faunal community structure across the survey sites. While most sites formed a tight grouping in the MDS analyses, some variation in community structure was evident between internal lease, compliance and control sites. In particular, sites 4, 5, 10 and IF6 separated out from the main grouping of sites. Abundance of fauna at these sites, mainly crustaceans and polychaetes, tended to be lower compared to the remaining sites. When the ROV footage was considered, these sites also tended to be those where the New Zealand screw shell was most prominent. While speculative, it is likely that differences in faunal community structure have been influenced by variation in the density of New Zealand screw shells. As noted in section 7.2 above, there was no clear environmental factor attributable to the observed patchy variation in New Zealand screw shell density across the survey area.

Dominance patterns as described by K-dominance plots are shown in Figure 13. Single taxa dominance patterns were low-moderate across all control and compliance sites, ranging from 13.8 – 55.2 %, with an overall average of 30.8%. These values fall within ranges expected for unimpacted ecosystems, with relatively diverse communities and low levels of dominance by a single family (see Figure 13).

Based on the benthic faunal patterns present, any future benthic impacts outside the lease area should be readily observable. Reduced faunal diversity and an increase in species dominance patterns would be one of the main indicators of organic enrichment. Such a pattern would be expected to be readily discernible, given the high diversity measured during the baseline survey.

Table 6 Summary of benthic faunal analysis. The category 'other' included anthozoans, echinoderms, nemerteans and sipunculids. Values represent results from pooled triplicate samples for compliance and control sites and single samples for internal farm sites.

Site	Abundance (No's per sample)				Family diversity (No. families per sample)			
	Crustaceans	Molluscs	Polychaetes	Other	Crustaceans	Molluscs	Polychaetes	Other
1	537	50	236	25	22	10	10	4
2	514	44	676	21	24	6	14	5
3	384	42	74	18	23	8	12	2
4	118	49	50	7	23	12	11	5
5	120	38	37	3	21	7	11	3
6	382	80	185	14	21	7	11	4
7	451	67	95	18	22	7	11	5
8	269	61	87	14	17	11	10	3
9	396	61	164	28	19	9	11	3
10	119	100	20	2	22	13	8	2
11	507	24	187	39	18	8	11	5
IF1	58	9	20	2	10	5	9	2
IF2	110	16	55	7	13	3	10	3
IF3	72	28	36	6	16	3	9	2
IF4	184	27	45	1	17	4	9	1
IF5	126	3	27	4	12	2	7	1
IF6	38	11	12	3	14	5	9	1
IF7	214	20	21	3	16	4	7	2
IF8	149	27	60	11	19	6	9	3
IF9	117	30	75	5	16	5	6	4
IF10	80	28	29	2	14	4	9	2
Total	**4945**	**815**	**2191**	**233**	45	33	21	5
%	**60.4**	**10.0**	**26.7**	**2.8**	**43.3**	**31.7**	**20.2**	**4.8**

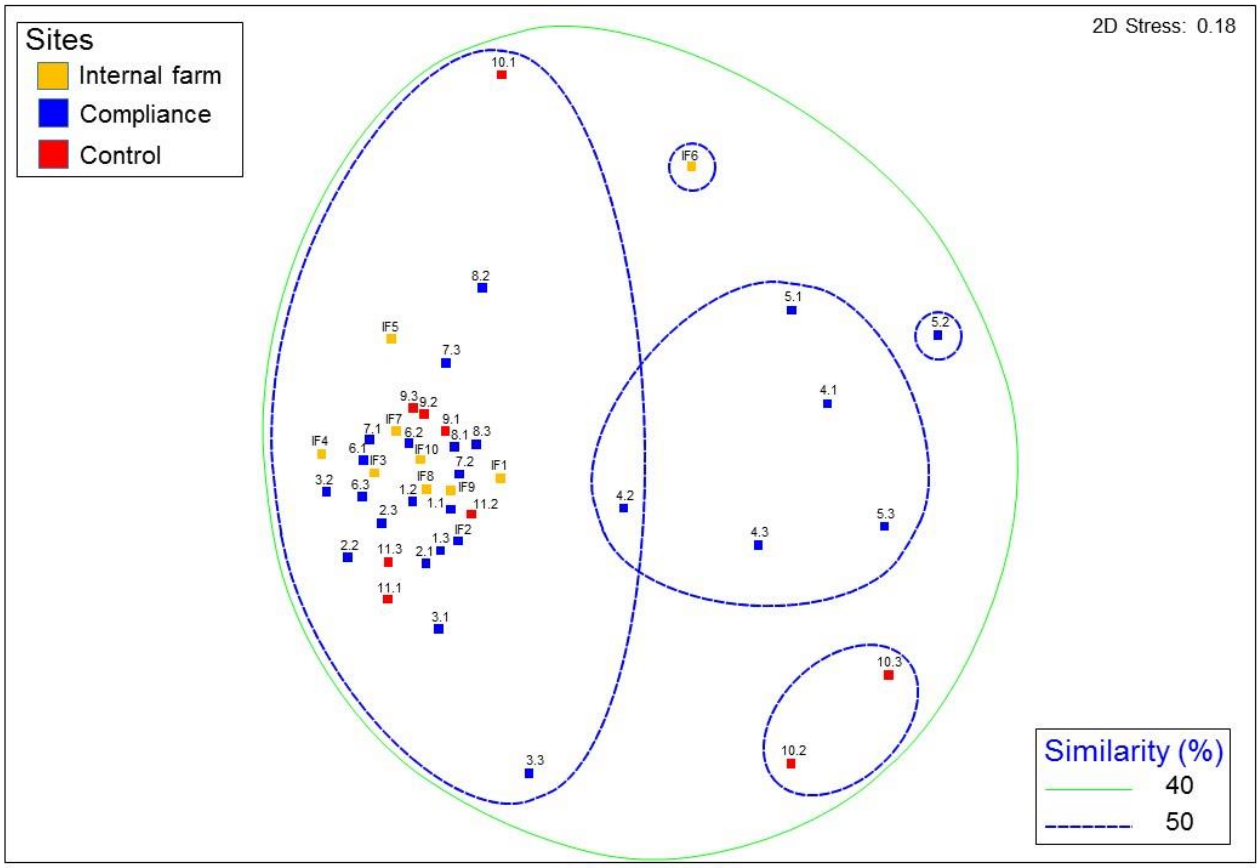


Figure 12 Results of MDS analysis using benthic faunal data collected from internal farm (n=1), compliance (n=3) and control (n=3) sites for MF236. Ellipses indicate community similarity (%), based on cluster analysis.

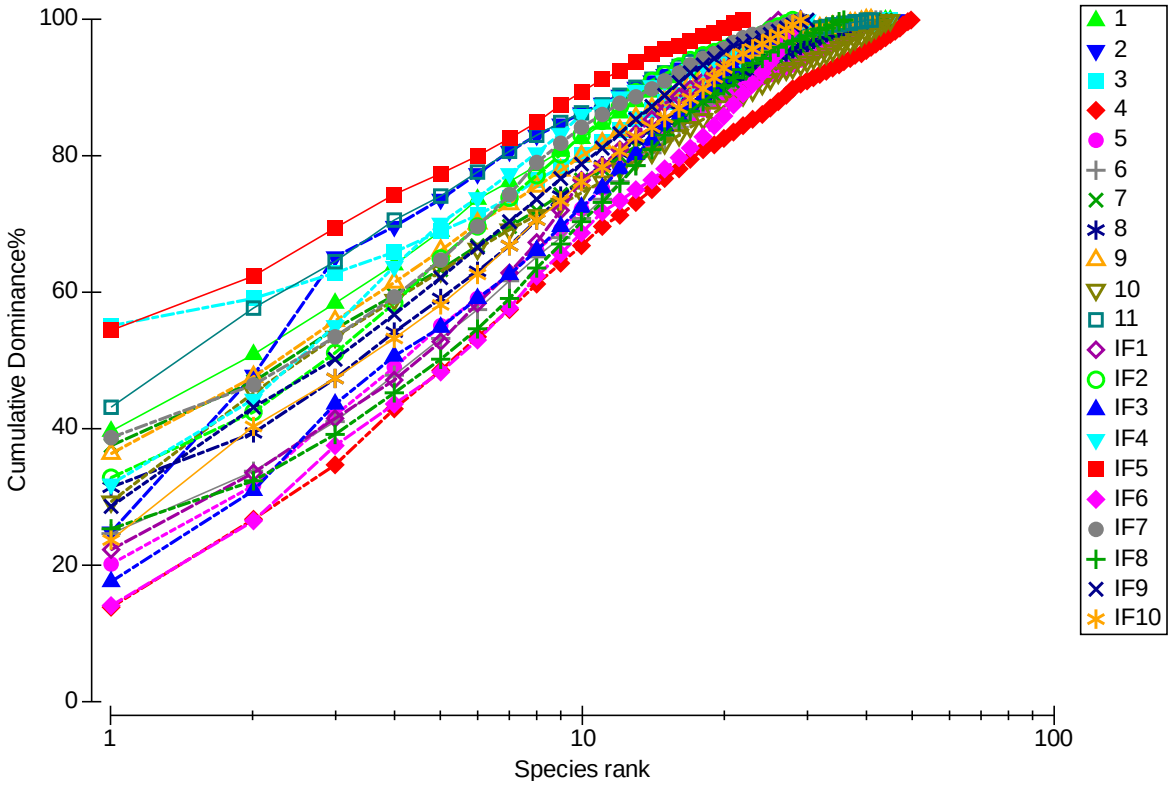


Figure 13 Benthic faunal analysis of seabed samples – MF236. K – dominance curves. Analysis based on pooled triplicate data for compliance and control sites and single samples for internal farm sites.

References

Macleod, C.K. and Forbes, S. (2004) Guide to the assessment of sediment condition at marine finfish farms in Tasmania. Tasmanian Aquaculture and Fisheries Institute – University of Tasmania, Hobart, Australia, 65 pp.

Grove S. and R. de Little (2014). Extensions for marine molluscs from dredging surveys off the Tasman and Forestier Peninsulas, south-east Tasmania. Kanunnah 7: 141-167.

Appendix 1 Survey coordinates for seabed sampling provided by EPA, based on the Mapping Grid of Australia Zone 55 (Datum GDA94).

Site name	Easting	Northing
1.1	579765	5290696
1.2	579778	5290716
1.3	579787	5290733
2.1	580060	5291168
2.2	580068	5291184
2.3	580079	5291202
3.1	580365	5291350
3.2	580385	5291340
3.3	580401	5291329
4.1	580765	5291104
4.2	580780	5291095
4.3	580795	5291084
5.1	580918	5290727
5.2	580906	5290711
5.3	580898	5290694
6.1	580653	5290305
6.2	580643	5290287
6.3	580633	5290269
7.1	580146	5290090
7.2	580128	5290098
7.3	580110	5290111
8.1	579800	5290302
8.2	579786	5290312
8.3	579769	5290325
9.1	579380	5290052
9.2	579371	5290038
9.3	579361	5290020
10.1	581391	5290567
10.2	581391	5290544
10.3	581385	5290527
11.1	580295	5291660
11.2	580318	5291658
11.3	580336	5291658
IF1	580215	5290259
IF2	579888	5290450
IF3	580553	5290362
IF4	580418	5290986
IF5	580229	5291148
If6	580710	5290779
IF7	580461	5290714
IF8	580150	5290896
IF9	580008	5290659
IF10	580312	5290473
SPM 9308	575595	5292744

Appendix 2 – Raw data – redox analysis (3 cm core depth)

Site	Uncorrected Redox (mV)	Corrected Redox (mV)
1.1	87	343
1.2	115	371
1.3	-14	242
2.1	53	309
2.2	-13	243
2.3	93	349
3.1	-65	191
3.2	22	278
3.3	-26	230
4.1	-54	202
4.2	-41	215
4.3	-69	187
5.1	-94	162
5.2	-85	171
5.3	-85	171
6.1	90	346
6.2	-35	221
6.3	-7	249
7.1	24	280
7.2	-66	190
7.3	-135	121
8.1	-44	212
8.2	-81	175
8.3	-60	196
9.1	-72	184
9.2	-107	149
9.3	-119	137
10.1	-110	146
10.2	-126	130
10.3	-119	137
11.1	-75	181
11.2	-82	174
11.3	-113	143
IF1	-44	212
IF2	9	265
IF3	22	278
IF4	25	281
IF5	-29	227
IF6	-51	205
IF7	9	265
IF8	-113	143
IF9	-104	152
IF10	-60	196

Appendix 3 – Raw data – sulphide analysis

Site	Sulphide (uM)
1.1	0.062853
1.2	1.268959
1.3	0.075007
2.1	1.268959
2.2	1.063349
2.3	0.746677
3.1	5.219402
3.2	5.219402
3.3	8.870247
4.1	16.467835
4.2	21.468119
4.3	30.572947
5.1	12.632201
5.2	62.004600
5.3	47.562693
6.1	0.891054
6.2	1.654265
6.3	0.683513
7.1	6.804218
7.2	47.562693
7.3	47.562693
8.1	3.665029
8.2	1.268959
8.3	3.071184
9.1	0.815677
9.2	0.337023
9.3	6.804218
10.1	6.804218
10.2	5.219402
10.3	8.870247
11.1	6.804218
11.2	6.228628
11.3	5.219402
IF1	5.219402
IF2	2.811383
IF3	3.071184
IF4	3.665029
IF5	3.665029
IF6	9.689950
IF7	1.807136
IF8	5.701729
IF9	3.354993
IF10	2.811383

Appendix 4 – Raw data – particle size analysis

Sample No	Vi	V4	V2	V1	V0.5	V0.25	V0.125	V0.063	Volume of water
	ml	ml	ml	ml	ml	ml	ml	ml	ml
1.1	73	25	25.1	25.3	30.3	58.2	82.3	93.7	25
1.2	68	25	25	25.2	28	44.4	75.4	88.7	25
1.3	72	25.1	25.3	25.6	29.9	49	83.3	93.5	25
2.1	66	25	25.2	25.4	30.9	48.2	80.1	88.4	25
2.2	72	25.3	25.3	25.7	31.3	51.8	78.1	91.5	25
2.3	70	25.2	25.2	25.3	28.2	39	73.3	90	25
3.1	68	25	25.1	25.3	32.5	44.4	70.7	92.7	25
3.2	68	25.2	25.4	26	28	35.2	69.2	85.5	25
3.3	77	25	25	25.1	27.3	41.2	72.5	91.5	25
4.1	70	25	25.2	25.8	30.9	48.5	85.2	91.2	25
4.2	70	25.2	25.5	26.3	33	50.5	85.8	91.5	25
4.3	70	25	25.2	25.5	30.3	48.2	85	90.3	25
5.1	70	25	25.1	25.8	29.6	46.3	87.5	92.3	25
5.2	73	25	25.1	26.1	30	44.4	86.4	93	25
5.3	73	25.1	25.8	26.4	31	44	84	90.8	25
6.1	68	25.5	25.7	26	27.8	51.1	86.2	91.8	25
6.2	72	25.1	25.2	26.1	34	49	86.5	94.8	25
6.3	72	25.1	25.2	25.8	34.9	67	87.9	94.7	25
7.1	71	26	27.8	28	31.5	55.1	84.1	95.2	25
7.2	72	25.1	25.2	25.7	27.2	42	79	90.2	25
7.3	71	25.1	25.4	25.9	28.1	41.3	77.6	92.7	25
8.1	70	25.7	25.8	26.1	29	43.4	82.9	89.2	25
8.2	68	25.1	25.4	25.6	28	42.2	80.3	92	25
8.3	67	25.1	25.4	26.7	37	71.9	88.2	91.5	25
9.1	72	25.1	25.1	25.4	26	31	81	93.8	25
9.2	70	25.1	25.2	25.3	26.1	32.5	76.8	91.4	25
9.3	72	25	25.1	26	27.2	32	79.2	91.8	25
10.1	68	25.1	25.6	27.1	32.8	64.4	89	90.8	25
10.2	69	26.5	27	28.1	29.9	76.8	92.6	93.8	25
10.3	69	25.9	26	27.3	35.5	65.8	89.9	91.9	25
11.1	72	25	25	26	27.6	30.8	65	87.2	25
11.2	72	25	25	25.1	26.2	28.4	59	87	25
11.3	72	25.4	25.4	26	27.4	31	68	87	25
FD1	71	30	30	30.1	33.4	57.9	83.3	98.2	30
FD2	64	25	25.8	26.3	28.4	42.8	74.6	85.5	25
FD3	72	25.2	25.2	25.9	30.4	50.6	81	89.8	25
FD4	70	25.2	25.9	26	29.2	54	77.8	89.2	25
FD5	71	25.3	26	26.2	28.5	34.9	73	89.3	25
FD6	69	25.5	25.5	26	28	33.9	83	89.2	25
FD7	70	25.1	25.1	25.9	29.2	45	83.3	92.3	25
FD8	70	25.2	26	26.9	29.2	42	75.5	88.9	25
FD9	73	25.3	25.5	26	29	42.1	77.5	89.9	25
FD10	69	25.3	25.6	26	30.3	47.5	71.3	88.5	25

Appendix 5 – Frame grabs from ROV survey

Photos in this appendix are representative.

1.1

1.2

1.3

2.1

2.2

2.3

3.1

3.2

Photos in this appendix are representative.

3.3

4.1

4.2

4.3

5.1

5.2

5.3

6.1

Photos in this appendix are representative.

6.2

6.3

7.1

7.2

7.3

8.1

8.2

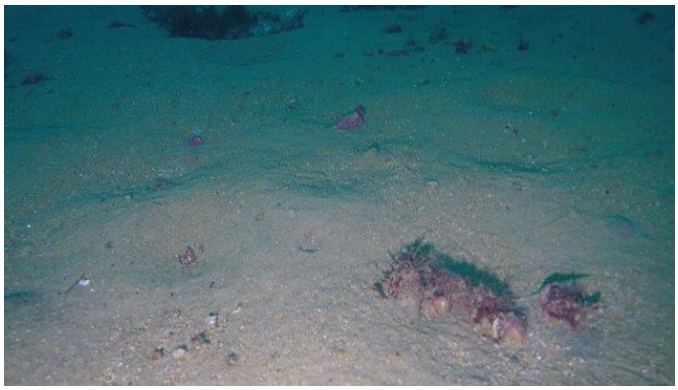
8.3

Photos in this appendix are representative.

9.1

9.2

9.3



10.1

10.2

10.3

11.1

11.2

Photos in this appendix are representative.

11.3

IF1

IF2

IF3

IF4

IF5

IF6

IF7

Photos in this appendix are representative.

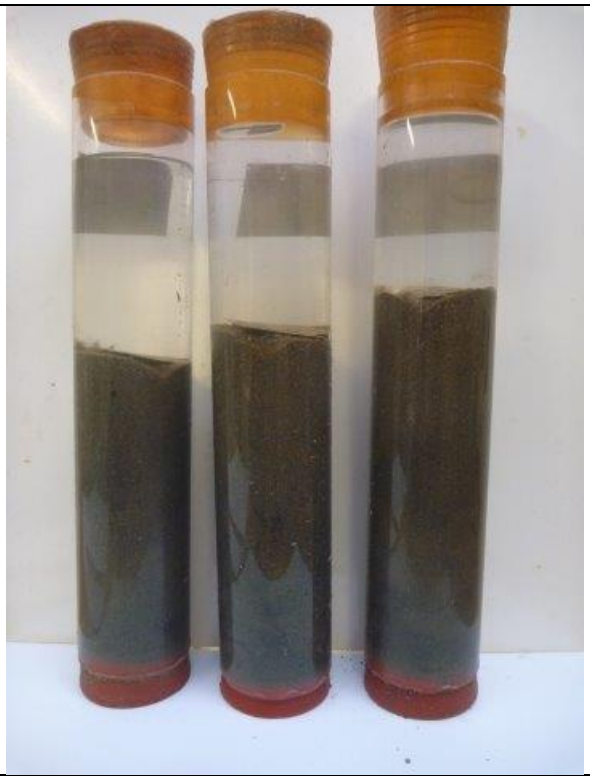
IF8

IF9

IF10

Appendix 6 – Images of core samples

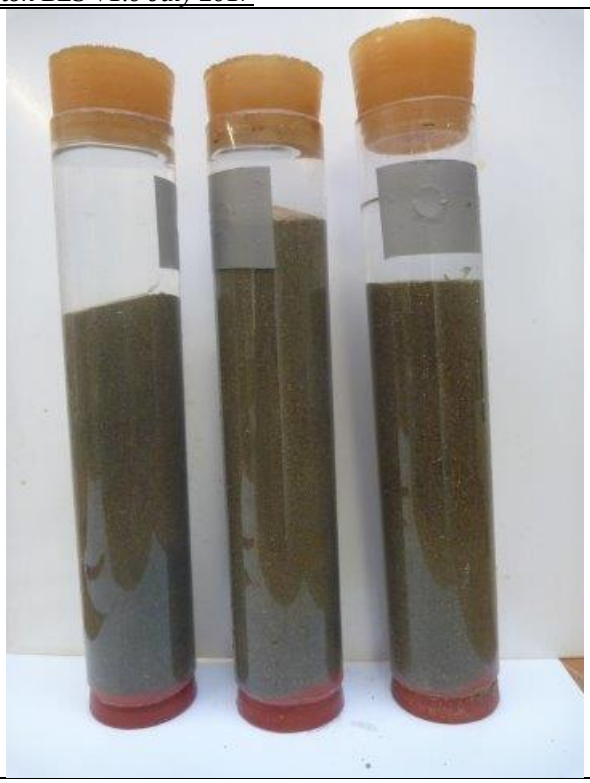
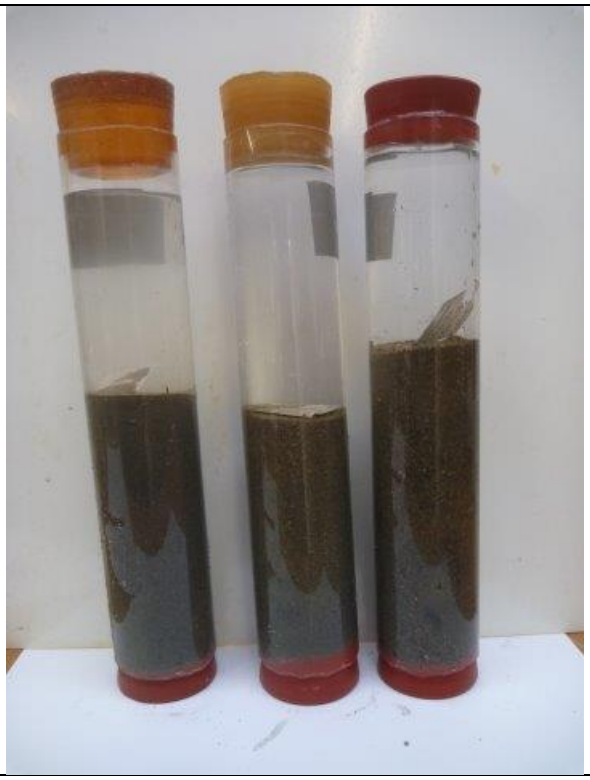
1.1-1.3

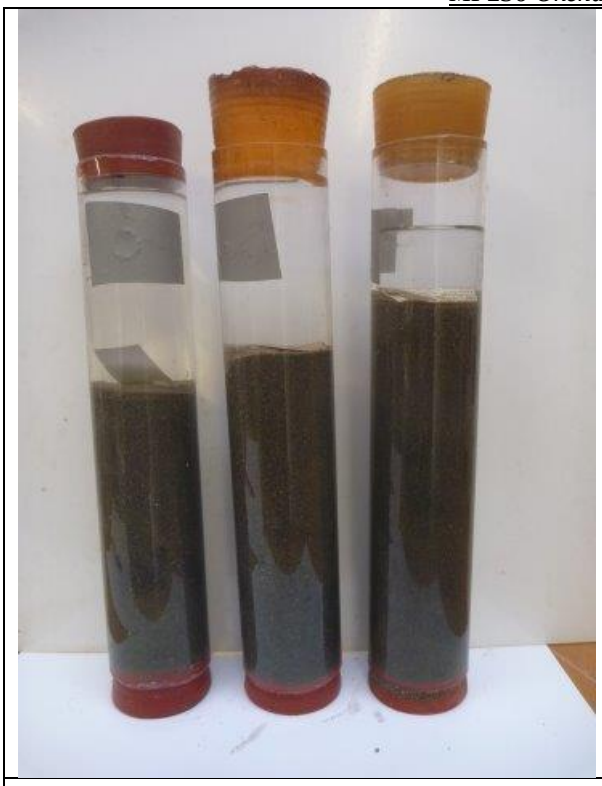


2.1-2.3

3.1-3.3

4.1-4.3

	
5.1-5.3	6.1-6.3
	
7.1-7.3	8.1-8.3



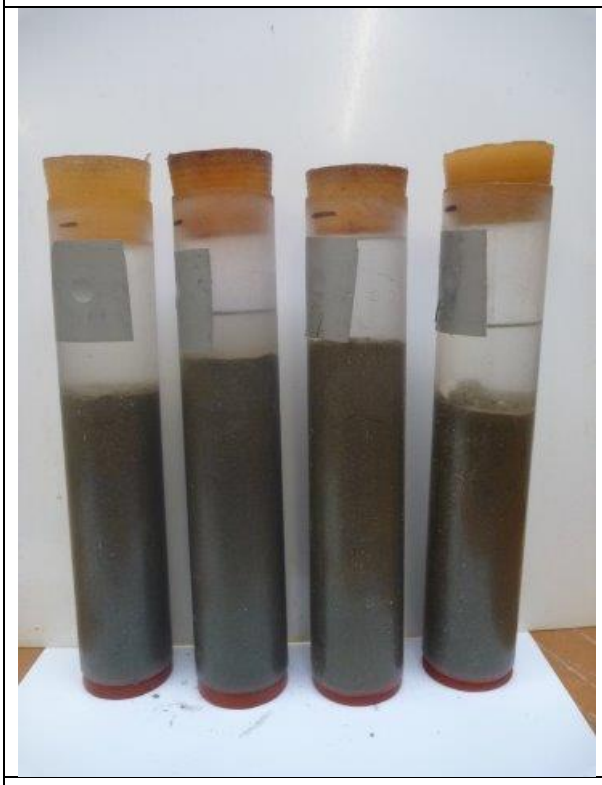
9.1-9.3

10.1-10.3

11.1-11.3

IF1-IF3

IF4-IF6



IF7-IF10

Appendix 7 – Results of benthic fauna analysis – raw data, sites 1-5.

Group	Family	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3
Anthozoa	Edwardsiidae	3	5	2	2		2						1	1		
Crustacean - amphipod	Ampeliscidae	116	125	96	77	94	143	92	103	91	7	8	14	14	3	3
Crustacean - amphipod	Amphilochidae															
Crustacean - amphipod	Ampithoidae															
Crustacean - amphipod	Anthuridae															
Crustacean - amphipod	Aoridae			1									2			1
Crustacean - amphipod	Corophiidae										1		1			
Crustacean - amphipod	Dexaminidae				1								2			
Crustacean - amphipod	Ischyroceridae						2	1								
Crustacean - amphipod	Lyssianassidae			1			2	1		1						
Crustacean - amphipod	Melitidae	3	2		1	1	5					1		1		
Crustacean - amphipod	Oedocerotidae	1	1			1	1		1					1		
Crustacean - amphipod	Photidae	11	2	6	7	9	12		4	1						
Crustacean - amphipod	Phoxocephalidae	19	14	16	14	16	12	6	11	3	7	12	12	30	4	6
Crustacean - amphipod	Synopiidae							1	1							
Crustacean - amphipod	Tethygeneidae				1	1							1	1		
Crustacean - amphipod	Urohaustoridae													1		
Crustacean - crab	Goneplacidae									1						
Crustacean - crab	Hymenosomatidae			5	1	5					1		1			
Crustacean - crab	Leucosidae	1			1	1	1									
Crustacean - crab	Majidae									2						
Crustacean - crab	Pilumnidae		1	5	1	4	2	2	2	2			1	1		2
Crustacean - crab	Portunidae													1		
Crustacean - cumacean	Bodotriidae	8	6	1	3	1	2	4	1	3	6	4	3	20	1	2
Crustacean - cumacean	Diastylidae	6	4	4		2	3	8	3	4						
Crustacean - cumacean	Nannastacidae					1	1							1		
Crustacean - ghost shrimp	Callianassidae								1							
Crustacean - hermit crab	Paguridae										3		4	1	1	4
Crustacean - isopod	Cirolanidae	3	1	1		3	2	5	3	1		1				

Group	Family	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3
Crustacean - isopod	Gnathiidae															
Crustacean - isopod	Paranthuridae	1	2	1	2	7	6	2	2				1		1	
Crustacean - isopod	Serolidae				1				1							
Crustacean - isopod	Sphaeromatidae												1			
Crustacean - nebalid	Nebaliidae		1				1		1							
Crustacean - ostracod	Cypridinidae				1		1			4		1	1	1		1
Crustacean - ostracod	Philomedidae	1							1		2			5	1	
Crustacean - shrimp	Palaemonidae		1										2		1	
Crustacean - shrimp	Pandalidae										1					
Crustacean - shrimp	Processidae			1												
Crustacean - shrimp	Mysidae		1	1			1		1							
Crustacean - squat lobster	Galatheidae									2	1		2	1		
Crustacean - tanaid	Apseudidae	1		2	1	3		1		1	1				1	
Crustacean - tanaid	Kalliapseudidae	23	15	26	15	17	24	7	1	1	2	2	7	4	2	
Crustacean - tanaid	Leptocheliidae												2			
Crustacean - tanaid	Nototanaidae													3		
Crustacean - tanaid	Whiteleggiidae															
Echinoiderm - brittle star	Amphiuraae			1	1						1			1		
Echinoiderm - heart urchin	Loveniidae	3		3	2		1	5	3	5		1	1			
Mollusc - bivalve	Cardiidae	1	1		3	3	5	8	2		1	1	1			
Mollusc - bivalve	Corbulidae – *Corbula gibba*				3			1								
Mollusc - bivalve	Galeomatidae			1			2				3		3	4	2	1
Mollusc - bivalve	Hiatellidae															
Mollusc - bivalve	Limidae										1					
Mollusc - bivalve	Myochamidae			1												
Mollusc - bivalve	Mytilidae									13						
Mollusc - bivalve	Nuculanidae	1									3	1		2	2	2
Mollusc - bivalve	Ostreidae															
Mollusc - bivalve	Semelidae - *Theora lubrica*															
Mollusc - bivalve	Solemyidae									1						

Group	Family	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3
Mollusc - bivalve	Tellinidae															
Mollusc - bivalve	Thraciidae															
Mollusc - bivalve	Veneridae	11	5	6	7	3	5	4	4	2	5	2	2		2	
Mollusc - gastropod	Anabathridae														1	
Mollusc - gastropod	Calyptraeidae															
Mollusc - gastropod	Columbellidae									1						
Mollusc - gastropod	Epitonidae														1	
Mollusc - gastropod	Fasciolariidae										1					
Mollusc - gastropod	Gadilidae	1														
Mollusc - gastropod	Haminoeidae															
Mollusc - gastropod	Hipponicidae															
Mollusc - gastropod	Mangeliidae				1											
Mollusc - gastropod	Marginellidae											1				
Mollusc - gastropod	Mitridae										3					
Mollusc - gastropod	Nassariidae		3	5	2	10		1	3			1			4	3
Mollusc - gastropod	Naticidae															
Mollusc - gastropod	Olivellidae	1										1				
Mollusc - gastropod	Philinidae															
Mollusc - gastropod	Pyramidellidae										1					
Mollusc - gastropod	Retusidae							2								
Mollusc - gastropod	Turritellidae – *Gazameda gunnii*		1													
Mollusc - gastropod	Turritellidae - *Maoricolpus roseus*	11		1							8	3	7	4	2	8
Nemertean	Nemertea (Phylum)	2	1	5	4	3	5	1	1	3	1	1				1
Polychaete - ampharetid	Ampharetidae	33	34	27	87	113	86	4	15	1	4	1	1			1
Polychaete - capitellid	Capitellidae - *Notomastus* sp.												1			1
Polychaete - cirratulid	Cirratulidae									3					1	1
Polychaete - dorvellid	Dorvilleidae		1										1			
Polychaete - eunicid	Eunicidae	11	11	17	13	5	28				2	2				
Polychaete - flabelligerid	Flabelligeridae					1		1	1						2	
Polychaete - lumbrinerid	Lumbrineridae	2	2	1	3	8	6	1	5	1		1	3			

Group	Family	1.1	1.2	1.3	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2	4.3	5.1	5.2	5.3
Polychaete - maldanid	Maldanidae				1	1			1							
Polychaete - nephtyid	Nephthyidae	5	6	9	6	11	6	1		2	2	1	5	5	2	1
Polychaete - nereid	Nerididae									3						
Polychaete - ophelid	Opheliidae					1										
Polychaete - orbiniid	Orbinidae	2	6	8	13	25	12	2	3	11	3	11	4	6	1	5
Polychaete - paraonid	Paraonidae		1			4										
Polychaete - pectinariid	Pectinariidae							2		1				1		
Polychaete - polynoid	Polynoidae									1	1					
Polychaete - sabellid	Sabellidae	7	21	13	106	77	36								1	
Polychaete - scalibregmatid	Scalibregmatidae					2										
Polychaete - sigalionid	Sigalionidae															
Polychaete - spionid	Spionidae		1	2	2	3		1		1		1	1	1		3
Polychaete - syllid	Syllidae						1				1			2		
Polychaete - terebellid	Terrebellidae	9	1	6	7	8	4	5	5	3	1	2	1	2		1
Sipunculid - peanut worm	Phascolosomatidae						1						1			

Appendix 7 – Results of benthic fauna analysis – raw data, sites 6-11

Group	Family	6.1	6.2	6.3	7.1	7.2	7.3	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	10.3	11.1	11.2	11.3
Anthozoa	Edwardsiidae				2		1				3	6	9				3	3	4
Crustacean - amphipod	Ampeliscidae	27	52	85	137	61	39	66	18	52	78	77	81	18		2	129	107	91
Crustacean - amphipod	Amphilochidae																		1
Crustacean - amphipod	Ampithoidae					2													
Crustacean - amphipod	Anthuridae																		1
Crustacean - amphipod	Aoridae	7	2	6	2								1						
Crustacean - amphipod	Corophiidae														1				
Crustacean - amphipod	Dexaminidae		1												2			1	2
Crustacean - amphipod	Ischyroceridae														2				
Crustacean - amphipod	Lyssianassidae	1		3															
Crustacean - amphipod	Melitidae	1	11	6	2	10	2	1	1		1		2		1				2
Crustacean - amphipod	Oedocerotidae	1	7	4	4	3	2	1	1	1	2	1	2	2	1			3	1
Crustacean - amphipod	Photidae				4	8	10	7	6	3		9		1	2	1	3	5	
Crustacean - amphipod	Phoxocephalidae	8	27	12	20	23	17	15	10	9	17	14	21	19	9	10	13	18	15
Crustacean - amphipod	Synopiidae	1		1															
Crustacean - amphipod	Tethygeneidae																		
Crustacean - amphipod	Urohaustoridae				2	1	1							2					
Crustacean - crab	Goneplacidae																		
Crustacean - crab	Hymenosomatidae	1		1				1					1		1				
Crustacean - crab	Leucosidae	1	1	1				1		1	2		1						
Crustacean - crab	Majidae																		
Crustacean - crab	Pilumnidae	4	4	4	4	2		1	1	1	1						2	4	2
Crustacean - crab	Portunidae																		
Crustacean - cumacean	Bodotriidae	5	3	9	4	3	4	3	7	5	3	3	7	9	3	1		1	1
Crustacean - cumacean	Diastylidae	1	2	3		3	2		4	4	4	1	3	1	3	1	2	8	5
Crustacean - cumacean	Nannastacidae											2							
Crustacean - ghost shrimp	Callianassidae				1														
Crustacean - hermit crab	Paguridae														4	4			
Crustacean - isopod	Cirolanidae		2	2	2	1				2						1	6	4	

Group	Family	6.1	6.2	6.3	7.1	7.2	7.3	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	10.3	11.1	11.2	11.3
Crustacean - isopod	Gnathiidae													1					
Crustacean - isopod	Paranthuridae	3	1	5	3	5		1		1	7	3	7	1			23	11	18
Crustacean - isopod	Serolidae																		
Crustacean - isopod	Sphaeromatidae					1									1				
Crustacean - nebalid	Nebaliidae		1	3	2	1	2	2		3	8	1	4					1	
Crustacean - ostracod	Cypridinidae		1	1	6	4	1	1	1		1			2	1			1	
Crustacean - ostracod	Philomedidae	9	2		7		8	7	6	3	2	1		7				1	1
Crustacean - shrimp	Palaemonidae														1				
Crustacean - shrimp	Pandalidae																		
Crustacean - shrimp	Processidae		1	1															
Crustacean - shrimp	Mysidae				2						1	1				1			
Crustacean - squat lobster	Galatheidae														2	1			
Crustacean - tanaid	Apseudidae																		
Crustacean - tanaid	Kalliapseudidae	4	7	17	11	15	5	13	2	6	1	5	20				9	6	9
Crustacean - tanaid	Leptocheliidae																		
Crustacean - tanaid	Nototanaidae																		
Crustacean - tanaid	Whiteleggiidae	7	7	5	1		1	1											
Echinoiderm - brittle star	Amphiuraae	1				1	1	3		1							1		
Echinoiderm - heart urchin	Loveniidae	1				1	2	1	3	1			3			1	6	8	3
Mollusc - bivalve	Cardiidae	1	5		4	3		3			2	4			1		1		4
Mollusc - bivalve	Corbulidae – *Corbula gibba*																3		2
Mollusc - bivalve	Galeomatidae		1		2	2						1						1	
Mollusc - bivalve	Hiatellidae														1				
Mollusc - bivalve	Limidae																		
Mollusc - bivalve	Myochamidae									1									
Mollusc - bivalve	Mytilidae																		
Mollusc - bivalve	Nuculanidae							1		4	1				8	2			
Mollusc - bivalve	Ostreidae														2				
Mollusc - bivalve	Semelidae - *Theora lubrica*																1		

Group	Family	6.1	6.2	6.3	7.1	7.2	7.3	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	10.3	11.1	11.2	11.3
Mollusc - bivalve	Solemyidae																		
Mollusc - bivalve	Tellinidae				1														
Mollusc - bivalve	Thraciidae								2		1		2						
Mollusc - bivalve	Veneridae	23	23	14	21	20	7	20	4	10	8	9	13	1	2		1	3	3
Mollusc - gastropod	Anabathridae		1	1															
Mollusc - gastropod	Calyptraeidae														1				
Mollusc - gastropod	Columbellidae														4				
Mollusc - gastropod	Epitonidae											1							
Mollusc - gastropod	Fasciolariidae																		
Mollusc - gastropod	Gadilidae								1	1		1							
Mollusc - gastropod	Haminoeidae		1							1							1		
Mollusc - gastropod	Hipponicidae							1											
Mollusc - gastropod	Mangeliidae														1				
Mollusc - gastropod	Marginellidae						1												
Mollusc - gastropod	Mitridae													1					
Mollusc - gastropod	Nassariidae	1	5	3		1	2	1	4	2	7	7	2	1	2			3	
Mollusc - gastropod	Naticidae							1		1				1					
Mollusc - gastropod	Olivellidae																		
Mollusc - gastropod	Philinidae																		
Mollusc - gastropod	Pyramidellidae													1					
Mollusc - gastropod	Retusidae	1																	
Mollusc - gastropod	Turritellidae – *Gazameda gunnii*																		
Mollusc - gastropod	Turritellidae - *Maoricolpus roseus*					1	2	1		2			2		38	33		1	
Nemertean	Nemertea (Phylum)	4	3	4	8	1		2		3	3	4			1		3	3	3
Polychaete - ampharetid	Ampharetidae	7	14	24	3	9	6	22	2	6	12	9	16	1	1		33	21	56
Polychaete - capitellid	Capitellidae - *Notomastus* sp.																	1	
Polychaete - cirratulid	Cirratulidae			1	2														
Polychaete - dorvellid	Dorvilleidae								1										

Group	Family	6.1	6.2	6.3	7.1	7.2	7.3	8.1	8.2	8.3	9.1	9.2	9.3	10.1	10.2	10.3	11.1	11.2	11.3
Polychaete - eunicid	Eunicidae	1	2	4	2	1	1	13	2	2	2	4	5				1		
Polychaete - flabelligerid	Flabelligeridae					1													
Polychaete - lumbrinerid	Lumbrineridae	3		4	2	1		1									2	1	
Polychaete - maldanid	Maldanidae										1	1	1				2	2	
Polychaete - nephtyid	Nephthyidae		2	2	3	3			1	1	2	3	2	1	2	1	2	3	5
Polychaete - nereid	Nerididae														2				
Polychaete - ophelid	Opheliidae	1		1									1						
Polychaete - orbiniid	Orbinidae	8	15	13	1	6	3	6	1	1	6	2	4		1	3	9	6	11
Polychaete - paraonid	Paraonidae																		
Polychaete - pectinariid	Pectinariidae							2							1				
Polychaete - polynoid	Polynoidae																		
Polychaete - sabellid	Sabellidae	12	2	14	6	13	5	3		7	28	38	8		1	1			1
Polychaete - scalibregmatid	Scalibregmatidae																		
Polychaete - sigalionid	Sigalionidae										1								1
Polychaete - spionid	Spionidae	3	12	8	1	5		4		2	1	4	4	1	1	1	3		1
Polychaete - syllid	Syllidae	1	6	12	10	2	1					1							
Polychaete - terebellid	Terrebellidae	2	5	6	5	1	2	7		3	1	2	5		1	1	7	8	11
Sipunculid - peanut worm	Phascolosomatidae	1			1													1	1

Appendix 7 – Results of benthic fauna analysis – raw data, internal farm dives IF1-IF10

Group	Family	IF-1	IF-2	IF-3	IF-4	IF-5	IF-6	IF-7	IF-8	IF-9	IF-10
Anthozoa	Edwardsiidae		4	2	1				2	1	
Crustacean - amphipod	Ampeliscidae	20	62	25	82	87	8	100	63	65	33
Crustacean - amphipod	Amphilochidae					1	1				
Crustacean - amphipod	Ampithoidae										
Crustacean - amphipod	Anthuridae					1	1				
Crustacean - amphipod	Aoridae			3	2		1	2	1	1	
Crustacean - amphipod	Corophiidae						1				
Crustacean - amphipod	Dexaminidae			2							
Crustacean - amphipod	Ischyroceridae							2			
Crustacean - amphipod	Lyssianassidae		1	2	2				1		
Crustacean - amphipod	Melitidae		1		8			12	12	5	2
Crustacean - amphipod	Oedocerotidae		2	4	3	4		3		1	
Crustacean - amphipod	Photidae	5	4		9			15	9	3	2
Crustacean - amphipod	Phoxocephalidae	7	18	10	16	11	9	13	17	16	10
Crustacean - amphipod	Synopiidae		1				1				
Crustacean - amphipod	Tethygeneidae										
Crustacean - amphipod	Urohaustoridae					1		1			
Crustacean - crab	Goneplacidae										
Crustacean - crab	Hymenosomatidae								1		
Crustacean - crab	Leucosidae									3	
Crustacean - crab	Majidae										
Crustacean - crab	Pilumnidae	2	1	1	2			3	1	4	3
Crustacean - crab	Portunidae										
Crustacean - cumacean	Bodotriidae	4	3	5	7	5	7	12	7	4	6
Crustacean - cumacean	Diastylidae		2	4	4	2	1	3	2	2	3
Crustacean - cumacean	Nannastacidae						1				
Crustacean - ghost shrimp	Callianassidae	1									
Crustacean - hermit crab	Paguridae								1		
Crustacean - isopod	Cirolanidae	1		3	2			2	1	4	4

Group	Family	IF-1	IF-2	IF-3	IF-4	IF-5	IF-6	IF-7	IF-8	IF-9	IF-10
Crustacean - isopod	Gnathiidae										
Crustacean - isopod	Paranthuridae	4	1	2		1	1	1	3		4
Crustacean - isopod	Serolidae										
Crustacean - isopod	Sphaeromatidae										
Crustacean - nebalid	Nebaliidae			1	2	1		18	5		2
Crustacean - ostracod	Cypridinidae						2		6	1	1
Crustacean - ostracod	Philomedidae	4		2	10	4		7	7	2	2
Crustacean - shrimp	Palaemonidae						1				
Crustacean - shrimp	Pandalidae										
Crustacean - shrimp	Processidae				1						
Crustacean - shrimp	Mysidae			2	2						
Crustacean - squat lobster	Galatheidae										
Crustacean - tanaid	Apseudidae								1	1	
Crustacean - tanaid	Kalliapseudidae	10	14	6	32	8	3	20	11	5	7
Crustacean - tanaid	Leptocheliidae										
Crustacean - tanaid	Nototanaidae										
Crustacean - tanaid	Whiteleggiidae										1
Echinoiderm - brittle star	Amphiuraae		1						1	1	1
Echinoiderm - heart urchin	Loveniidae	1				4		1	8	2	1
Mollusc - bivalve	Cardiidae	2		6	2		1	3	3	12	
Mollusc - bivalve	Corbulidae – *Corbula gibba*		1								
Mollusc - bivalve	Galeomatidae	1				1					
Mollusc - bivalve	Hiatellidae										
Mollusc - bivalve	Limidae										
Mollusc - bivalve	Myochamidae										
Mollusc - bivalve	Mytilidae								3		
Mollusc - bivalve	Nuculanidae						3	1			
Mollusc - bivalve	Ostreidae										
Mollusc - bivalve	Semelidae - *Theora lubrica*						1				
Mollusc - bivalve	Solemyidae										

Group	Family	IF-1	IF-2	IF-3	IF-4	IF-5	IF-6	IF-7	IF-8	IF-9	IF-10
Mollusc - bivalve	Tellinidae										
Mollusc - bivalve	Thraciidae										
Mollusc - bivalve	Veneridae	4	6	19	22	2	4	14	15	9	23
Mollusc - gastropod	Anabathridae										
Mollusc - gastropod	Calyptraeidae										
Mollusc - gastropod	Columbellidae										
Mollusc - gastropod	Epitonidae									1	
Mollusc - gastropod	Fasciolariidae									1	
Mollusc - gastropod	Gadilidae										
Mollusc - gastropod	Haminoeidae										
Mollusc - gastropod	Hipponicidae										1
Mollusc - gastropod	Mangeliidae										
Mollusc - gastropod	Marginellidae										1
Mollusc - gastropod	Mitridae								2		
Mollusc - gastropod	Nassariidae	1		3	2		2	2	3	7	3
Mollusc - gastropod	Naticidae										
Mollusc - gastropod	Olivellidae										
Mollusc - gastropod	Philinidae				1				1		
Mollusc - gastropod	Pyramidellidae										
Mollusc - gastropod	Retusidae	1									
Mollusc - gastropod	Turritellidae – *Gazameda gunnii*										
Mollusc - gastropod	Turritellidae - *Maoricolpus roseus*		9								
Nemertean	Nemertea (Phylum)	1	2	4			3	2		1	
Polychaete - ampharetid	Ampharetidae	5	16	18	28	13	1	4	17	33	8
Polychaete - capitellid	Capitellidae - *Notomastus* sp.		1		1		1				
Polychaete - cirratulid	Cirratulidae										
Polychaete - dorvellid	Dorvilleidae						1				
Polychaete - eunicid	Eunicidae	1	6	1	1	2			11	15	2
Polychaete - flabelligerid	Flabelligeridae										
Polychaete - lumbrinerid	Lumbrineridae	1		5	2	1			2		1

Group	Family	IF-1	IF-2	IF-3	IF-4	IF-5	IF-6	IF-7	IF-8	IF-9	IF-10
Polychaete - maldanid	Maldanidae				1		1	1			
Polychaete - nephtyid	Nephthyidae	5	5				3		3	5	2
Polychaete - nereid	Neididae		1								
Polychaete - ophelid	Opheliidae			1							
Polychaete - orbiniid	Orbinidae	2	8	5	2	3		3	11	10	5
Polychaete - paraonid	Paraonidae										2
Polychaete - pectinariid	Pectinariidae		1			1	1				
Polychaete - polynoid	Polynoidae						1				
Polychaete - sabellid	Sabellidae	2	12	1	2			6	5		6
Polychaete - scalibregmatid	Scalibregmatidae				1						
Polychaete - sigalionid	Sigalionidae										
Polychaete - spionid	Spionidae	2		1		3	2	5	4	7	
Polychaete - syllid	Syllidae	1	1	2			1	1	1		1
Polychaete - terebellid	Terrebellidae	1	4	2	7	4		1	6	5	2
Sipunculid - peanut worm	Phascolosomatidae										