Benthic Ecological Assessments for Proposed Salmon Farm Sites

PART 1: Benthic Ecological Characterisations

Prepared for Ministry for Primary Industries

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Background and scope of the report

The Ministry for Primary Industries (MPI) engaged NIWA to undertake ecological benthic assessments at eight potential aquaculture farm sites in the Marlborough Sounds as part of the process to assess their suitability for relocation of existing salmon farms. The surveys and analyses at each site are designed to characterise benthic ecological features, to predict the depositional footprint from the farming activity, and to identify benthic features that could be affected by the proposed activity. This report presents Part 1 of the assessment, comprising a description of the benthic ecological characteristics and identification of notable ecological features at all eight sites. Part 2 of the assessment will present modelled deposition footprints for each farm site, produced from hydrodynamic and particle tracking modelling (DEPOMOD) based on likely feed input scenarios and field measurement of currents, to forecast the intensity and extent of the deposition from the proposed farming activity. The results of the DEPOMOD footprint simulations will be overlaid on the ecological features identified in this report, to enable an assessment of the potential effects of farm deposition on notable or significant ecological features at each site.

This report is structured to present the field survey results describing key seabed characteristics at each site including substratum type, habitats, epifaunal and macrofaunal assemblages, and reef communities. At the end of each site characterisation is a section summarising the nature and location of notable ecological features identified.

Methods

Side-scan sonar was used to detect and map 3-dimensional features on the seabed including rocky and biogenic reefs. A remotely operated camera (drop-cam) recorded substratum type, habitat composition and conspicuous epibiota within photoquadrats at ~30 stations that were positioned to achieve broad spatial coverage across each site. An underwater camera mounted on a sled was used to provide a wider field of view in video transects to complement drop-cam photoquadrats. An epibenthic dredge was used to collect macrofauna and flora, and to aid in identifying species seen in drop-cam and video footage. At each farm site, sediment samples were collected using a benthic grab (ponar grab) to quantify soft sediment grain size distribution (sand, mud, gravel) and describe infaunal species assemblages at each of the sites. To characterise prominent rocky reef habitats and communities, divers using SCUBA videoed and noted subtidal reef features to 20 m depth.

Summary of the main findings by site:

Blowhole Point North site (34): The sandy mud substratum beneath the farm site supported an epifaunal community that was sparse and mostly composed of common taxa. Small biogenic clumps of associated organisms mainly comprising ascidians and hydroids were present in a scattered distribution. Brachiopods were found at various locations within the site, and scallops were relatively abundant. Reef patches and kelp communities fringing the shoreline provided habitat for paua and kina, and the varied shoreline habitats and adjacent subtidal zone is blue cod habitat.

Blowhole Point South site (122): Most of the site was positioned over a sandy mud habitat supporting a sparse mixed community of macroalgae and diverse invertebrates. Brachiopods (*Terebratella sanguinea* and *Calloria inconspicua*) were found at positions within and adjacent to the site in dredge and grab samples, but no dense beds were detected. A large reef extending to the southeast of Blowhole Point (and to within ~350 m of the site boundary) provided habitat for a

diversity of macroalgae, and sessile and mobile fauna, and associated reef, demersal and pelagic fish species. This reef, together with smaller patches of bedrock, cobble and sand around the shoreline comprise blue cod habitat inshore of the site.

Waitata Reach North site (125): At this site there were no ecological features of special significance identified beneath the cage area nor in the vicinity of the proposed farm. Habitats and taxa identified at this site can be considered to occur widely in the greater area of Waitata Reach and Pelorus Sound (e.g. Davidson et al 2011, DoC 1995, McKnight and Grange 1991). Furthermore, the site is deep and is subject to strong currents, so depositional material is likely to be dispersed more widely and the magnitude of effects is likely to be reduced. Part way through the study, the proposed farms were reconfigured such that the Waitata Reach South site (118) was discontinued as a potential relocation site. Survey results for that site are presented in this report to provide information relevant to the assessment of the Waitata Reach North site (125) due to the close proximity of the two sites.

Richmond South site (106): There were no particularly notable communities or taxa recorded on the muddy seabed in the immediate vicinity of the site, but scallops were relatively abundant within the site, which may be an issue in relation to commercial and recreational fishing interests. Reef habitat supporting a diverse community was present inshore of the site.

Horseshoe Bay site (124): The cage area and most of the proposed farm site is situated over sandy mud seabed. A zone of shell rubble habitat and associated epibiota considered to be an uncommon ecological feature in the context of the Pelorus Sound region was located approximately 90 m north of the northwest corner of the site. Scallops were relatively abundant beneath the cage area and wider site. There was extensive bedrock reef supporting diverse biotic communities in the vicinity, but not within the proposed farm boundaries.

Tipi Bay site (42): A wide range of habitat types and communities were seen at this site. Throughout most of the site, the substratum was whole shell, shell hash and muddy sands. Zones of low-relief broken rock and bedrock patches supported diverse encrusting biota and biogenic aggregations comprising bryozoans (including *Celleporaria agglutinans*), various sponges, ascidians, hydroids, macroalgae and associated invertebrates including polychaetes. Areas of this habitat type were located between the cage area boundary and the outer site boundary at both ends of the Tipi Bay site. Associated with this habitat was a diverse range of fishes including butterfly perch, tarakihi and blue cod. Also, ecologically important stands of giant kelp (*Macrocystis pyrifera*) were present within the inshore portion of the site. Kina and paua were present within the greater site boundary area. Small areas of seagrass habitat occurred in places inshore of the site boundary.

Motukina site (82): Much of the proposed farm site lies over sand/shell hash habitat inhabited by a sparse to moderately dense epibenthic community. Near the eastern site boundary and the southwestern corner of the cage boundary were areas of broken rock/cobble supporting encrusting communities and large biogenic aggregations comprised of diverse taxa including the reef building bryozoan *Celleporaria agglutinans* and various hydroids, ascidians and sponges. Associated with that habitat were reef fishes including schools of tarakihi and butterfly perch. Hydroid trees (*Solanderia* sp.), were noted within the site boundary. Inshore of the site and extending into the site in places were patches of kelp, including the ecologically important giant kelp (*Macrocystis pyrifera*), and relatively dense algal beds comprising a diverse range of red and green algae. Patches of kina were noted.

Te Weka site (47): Beneath most of the proposed cage area and farm site**,** biota was relatively sparse and brittlestars were the most common conspicuous epifaunal organism, along with small and sparsely distributed biogenic clumps comprised of aggregates of hydroids, sponges, fluffy bryozoans, ascidians, and algae. There were sparsely distributed biogenic clumps and a few isolated tree hydroids (*Solanderia* sp.) within the southwest portion of the site. A macroalgal bed comprised of diverse red seaweeds was also noted at the southwest end of the site in the vicinity of the inshore boundary. Offshore, in the vicinity of the offshore site boundary, were unusual wave-like biogenic mounds comprising semi-consolidated aggregations of whole shell rubble and shell hash bound together by a diverse assemblage of sponges, hydroids, ascidians and bryozoans. Stands of kelp including the giant kelp (*Macrocystis pyrifera*) grew on broken rock, cobble and low relief bedrock habitat along the shoreline adjacent. An extensive bedrock reef lies approximately 100 m to the west of the western site boundary (250 m from the cage area boundary), and a smaller reef area lies approximately 60 m to the east of the eastern site boundary (180 m from the cage area boundary). These reefs supported diverse reef communities. Kina were present, and scallops (in low abundance) were found within the site.

1 Introduction

The Ministry for Primary Industries has engaged NIWA to undertake ecological benthic assessments at eight potential aquaculture farm sites in the Marlborough Sounds as part of the process to assess their suitability for relocation of existing salmon farms. The surveys and analyses at each site are designed to describe benthic ecological features, to predict the depositional footprint from the farming activity, and to identify benthic features that could be affected by the proposed activity. This report presents Part 1 of the assessment, comprising a description of the benthic ecological characteristics at all eight sites, and identification of ecological features that would be considered to have significant ecological, scientific or conservation value in the context of the biogeographic regions of Pelorus Sound, and Tory Channel (see Davidson et al 2011). Fisheries resources identified that are likely to be of particular interest to local Tangata Whenua groups and also commercial and recreational fishing interests are also mentioned.

This report is intended to be supplemented by a subsequent report that will present modelled deposition footprints for each farm site produced from hydrodynamic and particle tracking modelling (DEPOMOD) (Cromey *et al* 2002), based on likely feed input scenarios on each farm, and field measurement of currents (using seabed mounted Acoustic Doppler Current Profilers), to forecast the intensity and extent of the deposition from the proposed farming activity. By combining the results from the benthic ecological characterisations in this report with DEPOMOD simulations, the aim is to predict where the effects of deposition from the farming activity will be in relation to the ecological features identified in this study.

The report is structured to present the field survey results at each site describing key seabed characteristics including substratum type, habitats, epifaunal and macrofaunal assemblages, and reef communities. At the end of each site characterisation is a section summarising the notable ecological features that were present at the site.

Table 1-1: Location and size of the proposed farm sites in the study.

Pelorus Sound	Ref No.	Total area	Latitude °S	Longitude °N
Blowhole North	34	10 ha	40° 55’ 54.43772 S	174° 01’ 01.84054 E
Blowhole South	122	10 ha	40 ° 56’ 26.80217 S	174 ° 00’ 27.19076 E
Waitata Reach North and South	125 118	16 ha	40° 58’ 06.30473 S 40° 58’ 19.82605 S	173° 58’ 34.42026 E 173° 58’ 07.70685 E
Horseshoe Bay	124	11 ha	41° 01’ 26.00837 S	173° 56’ 09.08216 E
Richmond Bay	106	13.75 ha	41° 00’ 50.91566 S	173° 56’ 25.58251 E
Tory Channel				
Tipi Bay	42	9 ha	41° 13’ 34.37781 S	174° 17’ 06.88767 E
Motukina	82	11 ha	41° 14’ 31.19472 S	174° 15’ 38.51199 E
Te Weka Bay	47	12 ha	41° 14’ 52.25166 S	174° 11’ 24.56129 E

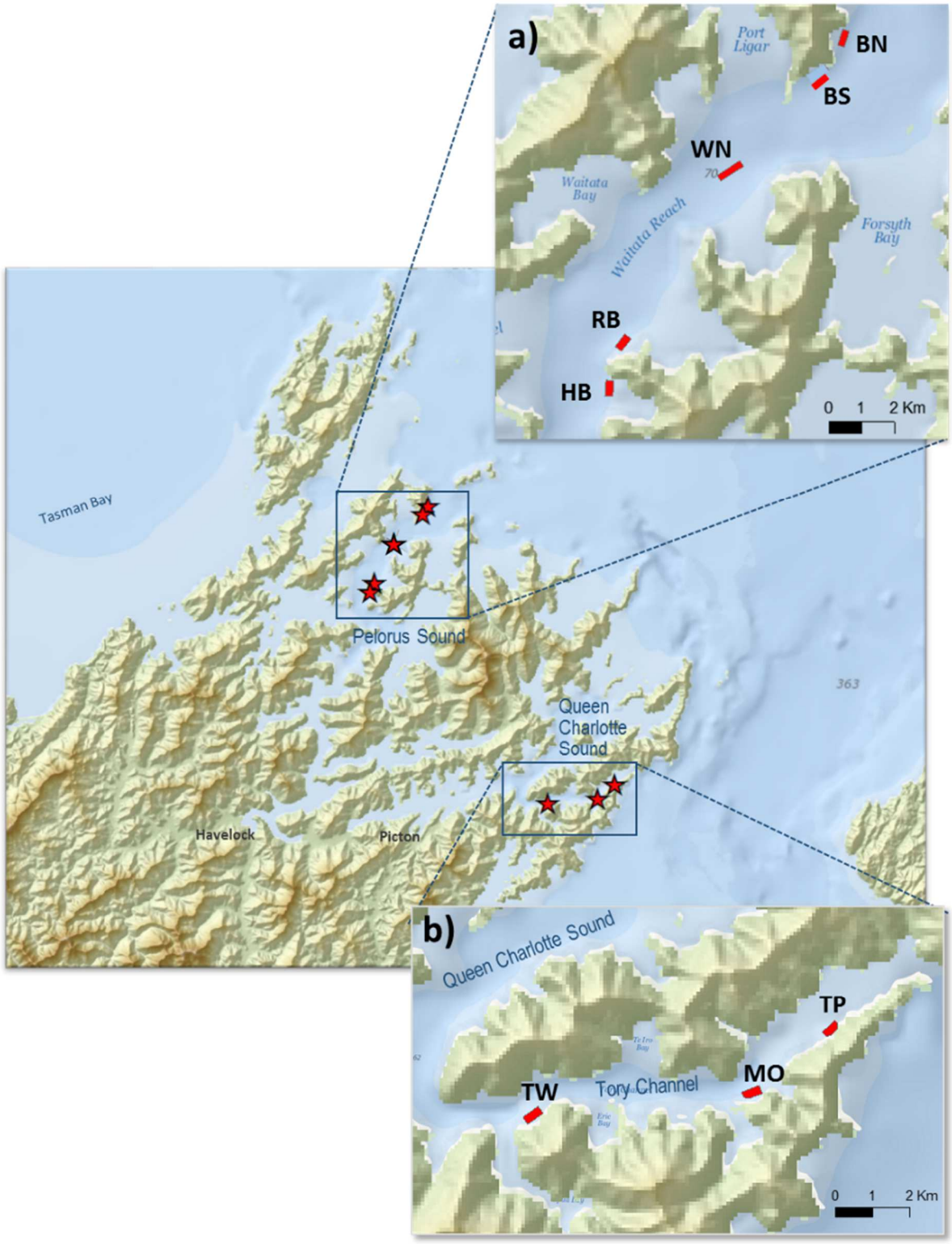

Figure 1-1: Map of proposed farm sites within Marlborough Sounds. a) Farm sites within Pelorus Sound (BN= Blowhole Point North, BS= Blowhole Point South, WN Waitata North, RB= Richmond Bay, HB= Horseshoe Bay); b) Farm sites within Tory Channel (TP = Tipi Bay, MO= Motukina, TW= Te Weka Bay).

2 Methods

2.1 Survey Overview

The objective of the survey was to detect and describe key benthic ecological characteristics in the vicinity of each site, including the area within the farm boundaries and the adjacent embayment. Sampling design was determined using expert judgement and experience, to achieve adequate spatial coverage and sampling intensity to describe the range of key ecological features present at each site, within the constraints of available resources and time. Side-scan sonar was used to detect and map 3-dimensional features on the seabed including rocky and biogenic reefs. To describe prominent rocky reef habitats and communities, divers using SCUBA recorded and noted subtidal reef features between ~5 to 20 m depth. A remotely operated camera (drop-cam) was used to record substratum type, habitat composition and conspicuous epibiota within photoquadrats at 30 stations positioned in a pre-determined grid pattern to achieve broad spatial coverage across each site. An underwater camera mounted on a sled was then used to provide a wider field of view in video transects to complement drop-cam photoquadrats. An epibenthic sled was used to sample macrofauna and flora, and aid in identifying dominant species seen in drop-cam and video footage. At each farm site, sediment samples were collected using a benthic grab (ponar grab) at 6 stations to quantify sediment grain size distribution (sand, mud, gravel) and describe infaunal species assemblages at each of the sites.

Table 2-1: Summary of field sampling at each Proposed Farm site.

Site (#)	Sidescan transects	Video Transects	Drop Cams	Grabs	Epibenthic Sled	SCUBA transects
Pelorus Sound						
Blowhole Pt North (34)	1	4	37	6	5	1
Blowhole Pt South (122)	4	3	52	9	7	2
Waitata North (125) Waitata South (118)	1 1	N/A	27 16	6 6	7 5	N/A
Richmond Bay South (106)	3	3	30	6	5	2
Horseshoe Bay (124)	3	3	30	6	7	2
Tory Channel						
Tipi Bay (42)	4	4	33	8	5	2
Motukina (82)	3	3	38	6	5	2
Te Weka Bay (47)	4	4	37	6	5	2

2.2 Sidescan mapping

Side-scan sonar was used to differentiate and map benthic topography within and adjacent to each site. A high-resolution Tritech CHIRP 675 kHz side-scan, interfaced with GPS recorded the sonar images in real-time in the field. Raw sonographs were processed using Triton Perspective software that provided high-resolution seabed images that were mosaicked, geo-rectified, and imported into mapping software.

At each site, one or more 100 m wide side-scan swaths were made to depict the topography adjacent to the boundaries of each site. Additional swathes were conducted where reefs or other sensitive ecological features were identified near farm sites, to determine their size and location in relation to farm boundaries.

2.3 Habitat and community characterisations

2.3.1 Drop camera and video sleds

Drop cage (drop camera) and sled-mounted (video sled) cameras were used to characterise surface sediment and biological features (Figure 2-1). Video footage and still images were analysed to describe the ecological features recorded.

Drop-camera stills and towed video transects were recorded to depict representative habitats within and adjacent to each site. The optimal number and nature of the video images at each site varied slightly according to the benthic topography and was determined while the field team was on site, but the default guideline was to obtain 30 dropcam photoquadrats positioned in a pre-determined grid pattern, and 2 to 4 video-transects covering the benthos within and adjacent to the site.

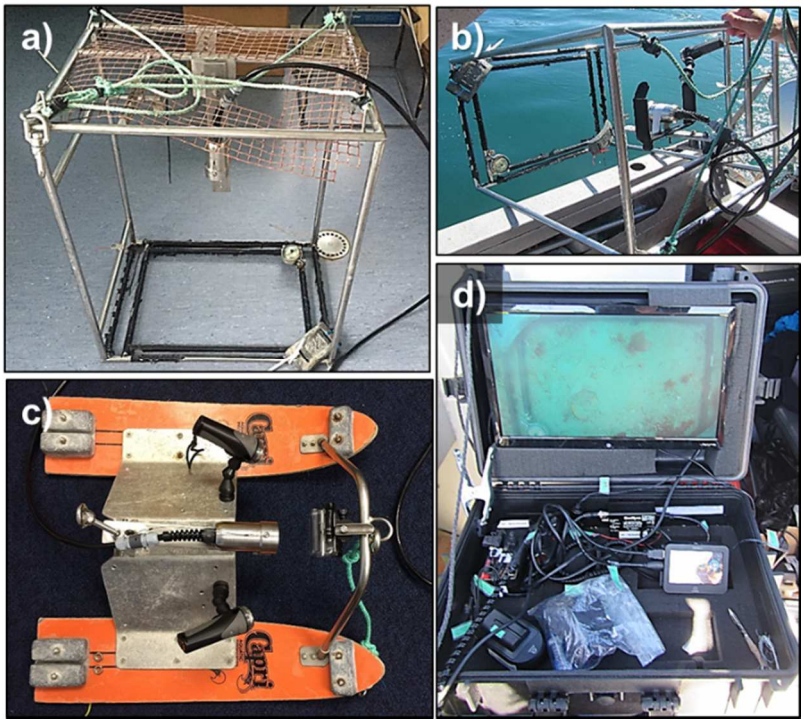

Figure 2-1: NIWA's High-definition underwater video-surveying tools. a-b) Drop-camera system; c) Towed video sled; and d) NIWA's portable high-definition topside recording system.

2.3.2 Sediment and infaunal sampling

A benthic Ponar grab (bite area ca 0.13 m^2, maximum bite depth 22 cm, Figure 2-2a, b) was used to take sediment samples at 6 stations within each proposed farm site to determine sediment grain-size distribution and to describe the infaunal community assemblages within zones of soft sediment habitat. At some positions at sites in Tory Channel the grab failed to obtain a sample due to hard substrate types including large gauge gravel, hard packed gravel, cobble or bedrock.

From each grab sample, a 5 cm diameter core subsample was obtained, from which the top 3 cm of sediment was taken and transported to the laboratory for analysis of sediment grain size. Grain-size distribution was determined by oven drying each sediment sample at 100°C overnight and washing a weighed subsample through stacked 200 µm and 63 µm sieves. The fraction retained on each sieve was then dried and weighed and the weight of material passing the 63 µm sieve obtained by subtraction from the original weight. Dry weights for each fraction are expressed as percentages of the total dry weight.

To sample the infaunal community (small-bodied animals living within the sediment), grab contents were sieved to 0.5 mm, preserved in a solution of 70% ethanol in seawater and transported back to the NIWA lab for taxonomic identification and counting.

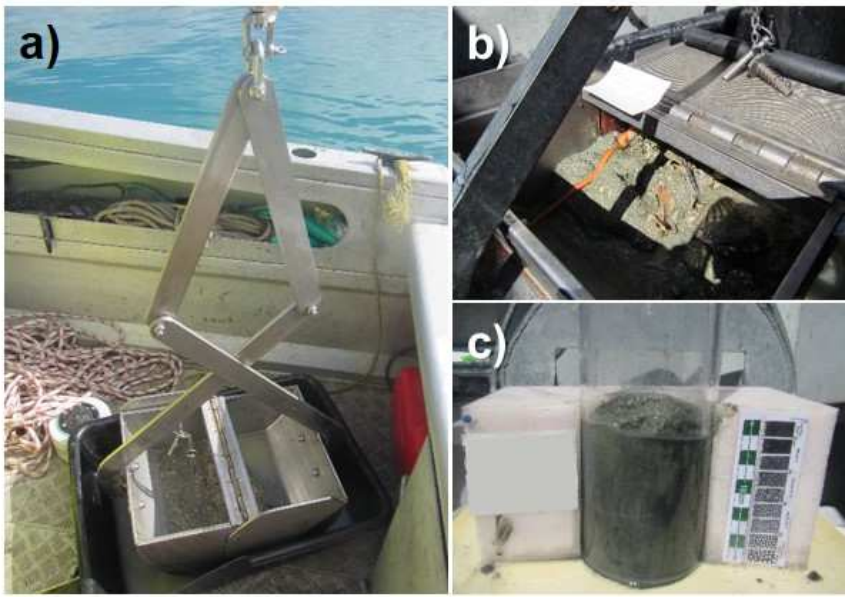

Figure 2-2: Sediment and infaunal grab sampling off the RV Tio. a-b) NIWA's medium-sized Ponar sediment grab, c) 5 cm diam. sediment core being characterized, measured and photographed.

2.3.3 Epibenthic sled sampling

To describe the types of biological specimens present within and adjacent to the proposed farm sites, epibenthos (macro-fauna and -flora living on or at the surface of the seafloor) and surficial infaunal specimens (large bodied surface-dwelling species e.g. bivalves) were characterised from 5 sled tows (~50 m length) sampled within each farm site using NIWA's small epibenthic sled (mouth width 600mm, mesh size 2mm) deployed off the RV Tio (Figure 2-3).

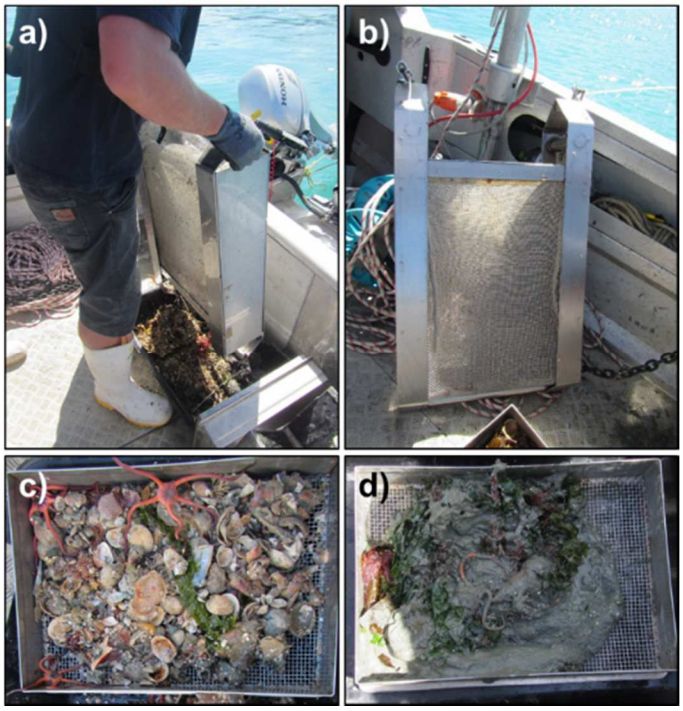

Figure 2-3: Biological specimen sampling using NIWA's small epibenthic sled (a-b), with examples of catch (c-d). c) Shell dominated material and ophiuroids, and d) fine sediment, diatom mat and green algae).

2.3.4 Scuba diver reef assessments

SCUBA divers recorded HD video transects of the reef habitat and communities on reefs adjacent to the proposed sites. The number of dives varied according to the extent of reef habitat adjacent to each site. Divers recorded habitat types, conspicuous epifauna, macroalgae and fish encountered from the shoreline to 20 m depth.

2.3.5 Identification and mapping of notable features

Notable features were defined as ecological features considered to have special ecological, scientific or conservation value in the context of the biogeographic region of the Marlborough Sounds. Assessment of what constitutes a notable ecological feature was based on the local experience of the authors and other NIWA ecologists, available information including work led by Rob Davidson (e.g. Davidson et al 2011), and reports produced by the Department of Conservation (DoC 1995) and by ecologists at Cawthron Institute (e.g. Keeley and Taylor 2011, Clark et al 2011).

Notable ecological features were mapped by reference to recorded sample positions using ArcMap GIS software. Boundaries of the notable features depicted in the maps at the end of each site characterisation are necessarily approximate. This is because ecological features usually do not have abruptly defined boundaries, and also because the benthic sampling was not continuous across the seabed due to logistical constraints of time and resources.

3 Results

Five sites in Pelorus Sound and three sites in Tory channel were surveyed to describe the benthic habitats and communities at each proposed farm location. Fieldwork was conducted by a team of NIWA biologists on the NIWA vessel RV Tio during February, March and April 2016.

3.1 Blowhole Point North (34), Pelorus Sound

3.1.1 Blowhole Point North, general site information, station depths and locations

The proposed site at Blowhole point is located between Blowhole Point and Mataka Point at the entrance to Pelorus Sound. The farm boundaries are positioned over a sloping seabed in depths between 28 and 80 m (Figure 3-1). Survey sample locations are shown in Figure 3-2.

Preliminary data from a seabed mounted ADCP that was deployed at the site during March/April 2016 indicates that the dominant flow is to the southwest and that 17% of profiles exceeded 20 cm s^{-1} and 5% of profiles exceed 34 cm s^{-1}, so the site could be broadly classified as exhibiting moderate to high current speeds. Further hydrodynamic data will be presented in the subsequent report along with the results of the DEPOMOD deposition modelling results.

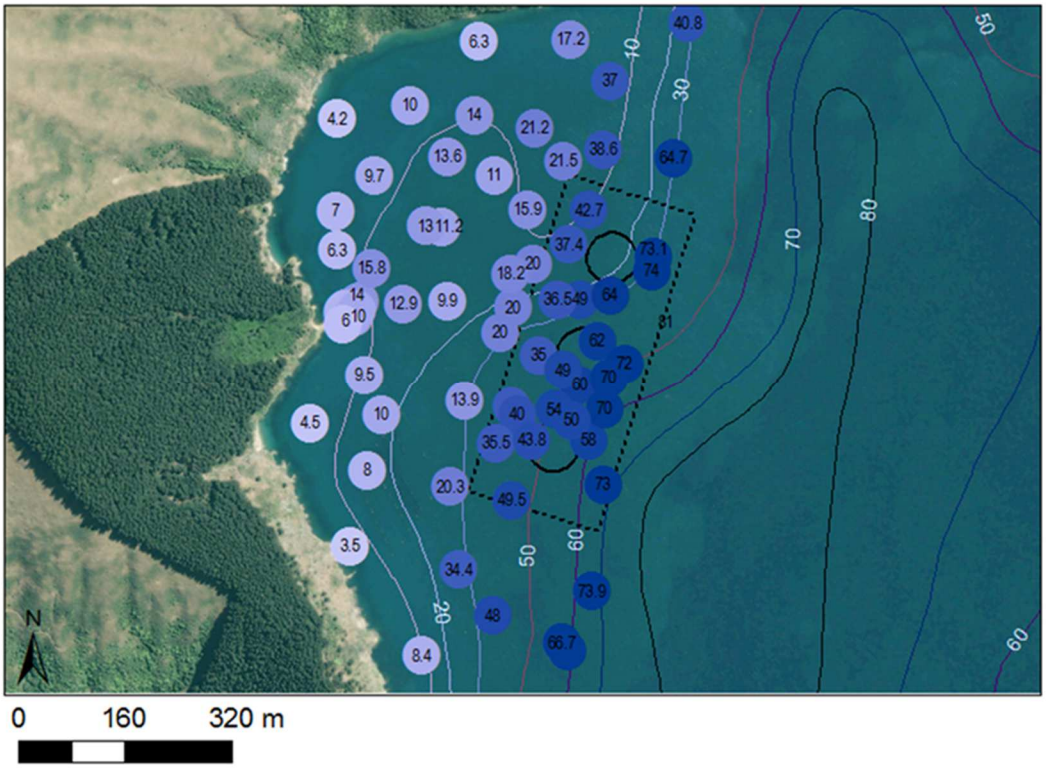

Figure 3-1: Station depths at Blowhole Point North site. Colour depicts depth from shallow (white) to dark blue (deep), central values are depths in metres.

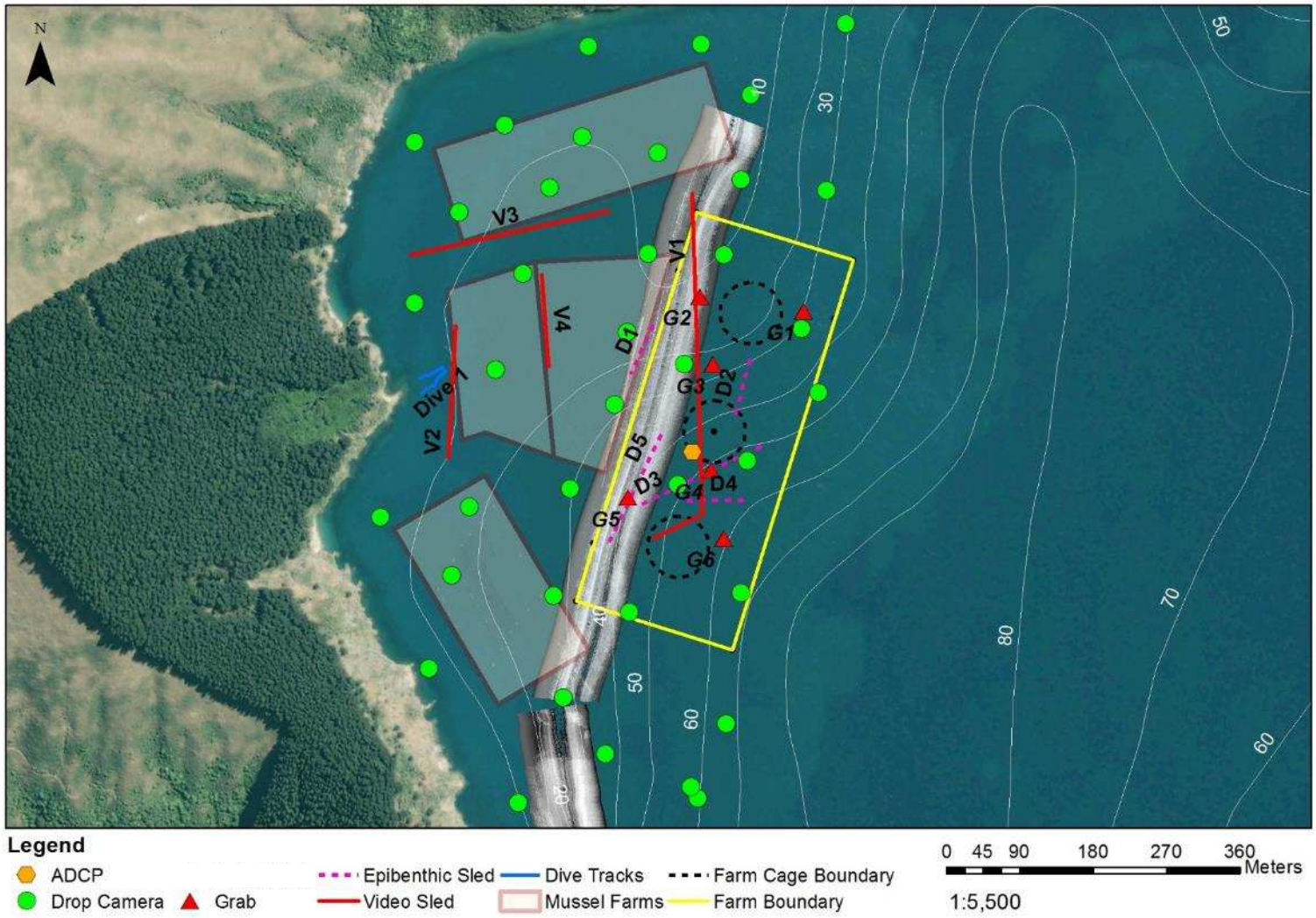

Figure 3-2: Survey sample locations at the Blowhole Point North site, Pelorus Sound. Grey bands are 100 m wide sidescan swaths

3.1.2 Sediment composition at Blowhole Point North

Six grab samples were collected in depths of 35-73 m under the proposed Blowhole North Farm Site (Table B-1, Figure 3-3a). Visual inspection of the cores found sandy muds with some shell and gravel present in the sediment (Table B-1, Figure 3-3b). Grain size analyses for this farm site found sediments were comprised of mud (56.28% ± 3.96 SE) and sand (32.26% ± 2.85 SE) with variable amounts of gravel (11.45% ±3.86 SE). The two deepest offshore stations (i.e. stations G1 and G6 in depths of 73 m and 60 m, respectively) had markedly more gravel than inshore stations (Table B-1, Figure 3-3), reflecting higher amounts of fine shell material in these sediments (e.g. G6, Figure 3-3b).

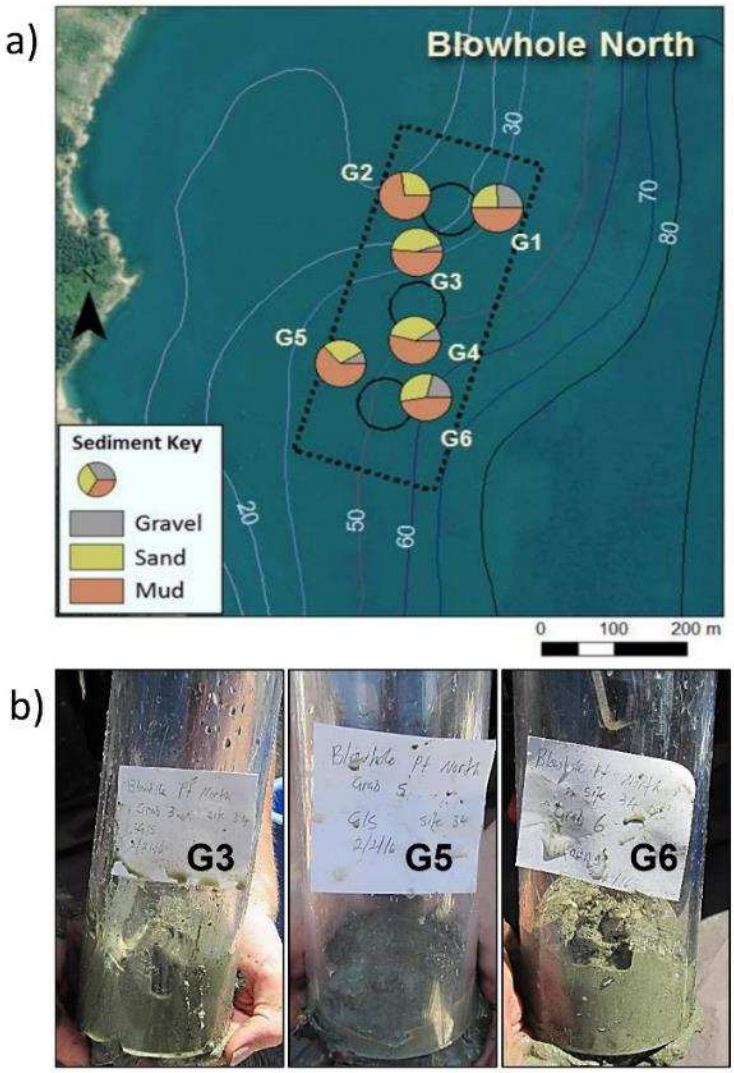

Figure 3-3: Grain size composition (% dry weight) and visual characteristics of sediments collected within the proposed Blowhole North Farm Site. a) Grain size distribution plots. G1 to G6 = station numbers BLN-G1 to BLN-G6; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed cage boundaries, depth contours are in metres; b) Examples of the visual characteristics of sediment cores (e.g. G3, G5 and G6) from this site.

3.1.3 Habitats and Communities at Blowhole Point North

The substratum beneath the proposed site is mainly sandy mud with a varying component of shell gravel (Figure 3-4a, b; Figure 3-5a). The sloping mud seabed beneath the proposed site and much of the surrounding embayment supported a fairly sparse epifaunal community typical of outer Marlborough Sounds deep mud habitat (Figure 3-4a, b). The distribution of habitats and communities encountered at the Blowhole Point North site is summarised from drop camera still images in Figure 3-5. The most commonly seen conspicuous epifaunal species included brittlestars, sea cucumbers, spotty, eleven-arm starfish and opalfish. Scallops (*Pecten novaezelandiae*), were noted as abundant throughout almost the entire length of the site in the video transect V1 at depths between 21 and approximately 45 m (Table 3-1). At depths greater than 30 m, isolated small biogenic clumps composed of aggregations of hydroids, colonial ascidians, and algae were sparsely distributed above the mud substratum (Figure 3-4 c). Diatom films were extensive over the shallow soft sediment habitat inshore of the site and beds of bladed and tufting red macroalgae were present in patches (Figure 3-4 d). Fringing the shoreline were patches of shallow reef and kelp (e.g. *Carpophyllum* spp. and *Cystophora* sp.) communities. The presence in that reef habitat of paua (*Haliotis iris*), kina (*Evechinus chloroticus*) and high density patches of the anemone *Anthothoe albocincta* were notable features Figure 3-4a, c).

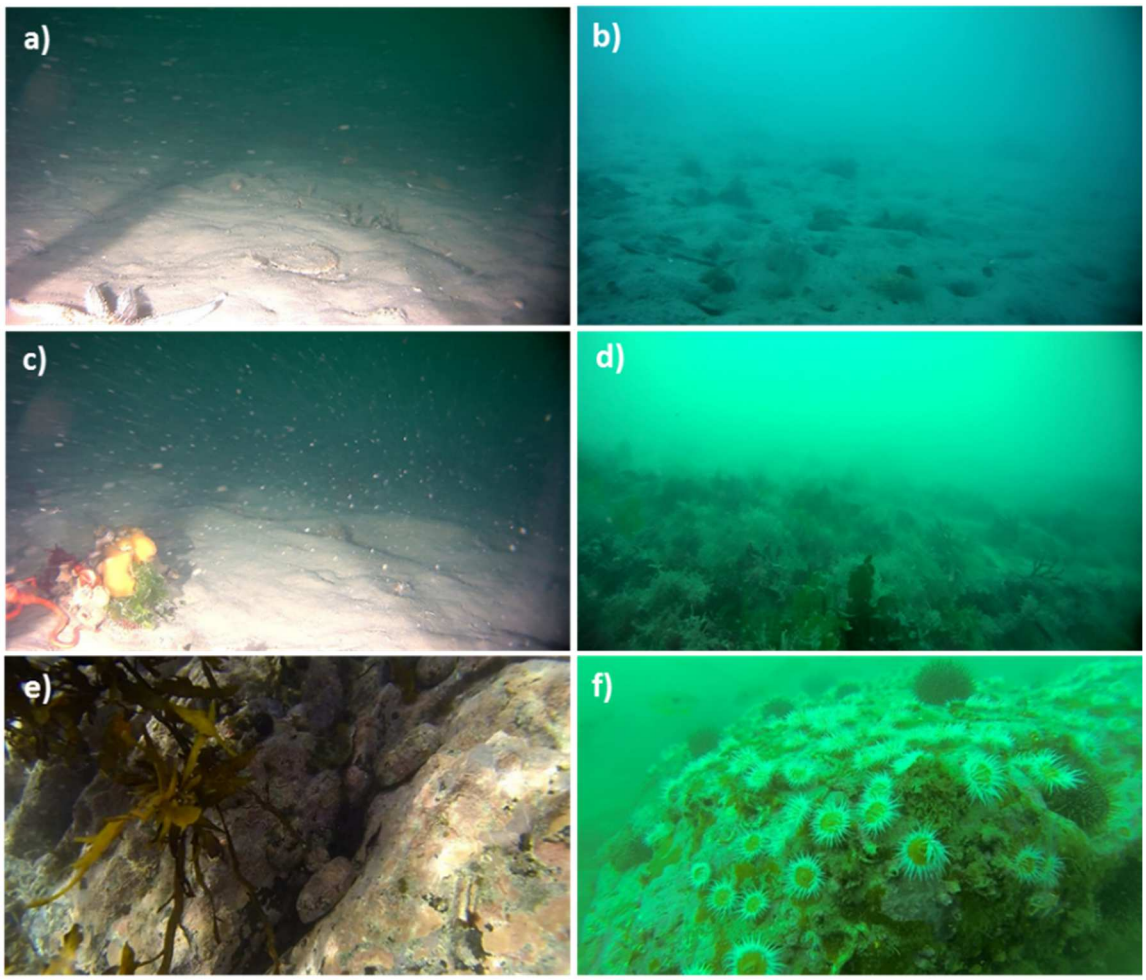

Figure 3-4: Main habitats and communities within the site and surrounding embayment... a) Mud habitat with scallop and starfish in the middle of the site; b) Mud and scattered shell drop from mussel farm adjacent to the inshore boundary of the site; c) Isolated biogenic clump on mud d) Macroalgal bed close to shoreline of the embayment; e) Shoreline reef community with *Carpophyllum maschalocarpum* and paua; f) Shoreline reef habitat with anemones (*Anthothoe albocincta*) and kina (*Evechinus chloroticus*).

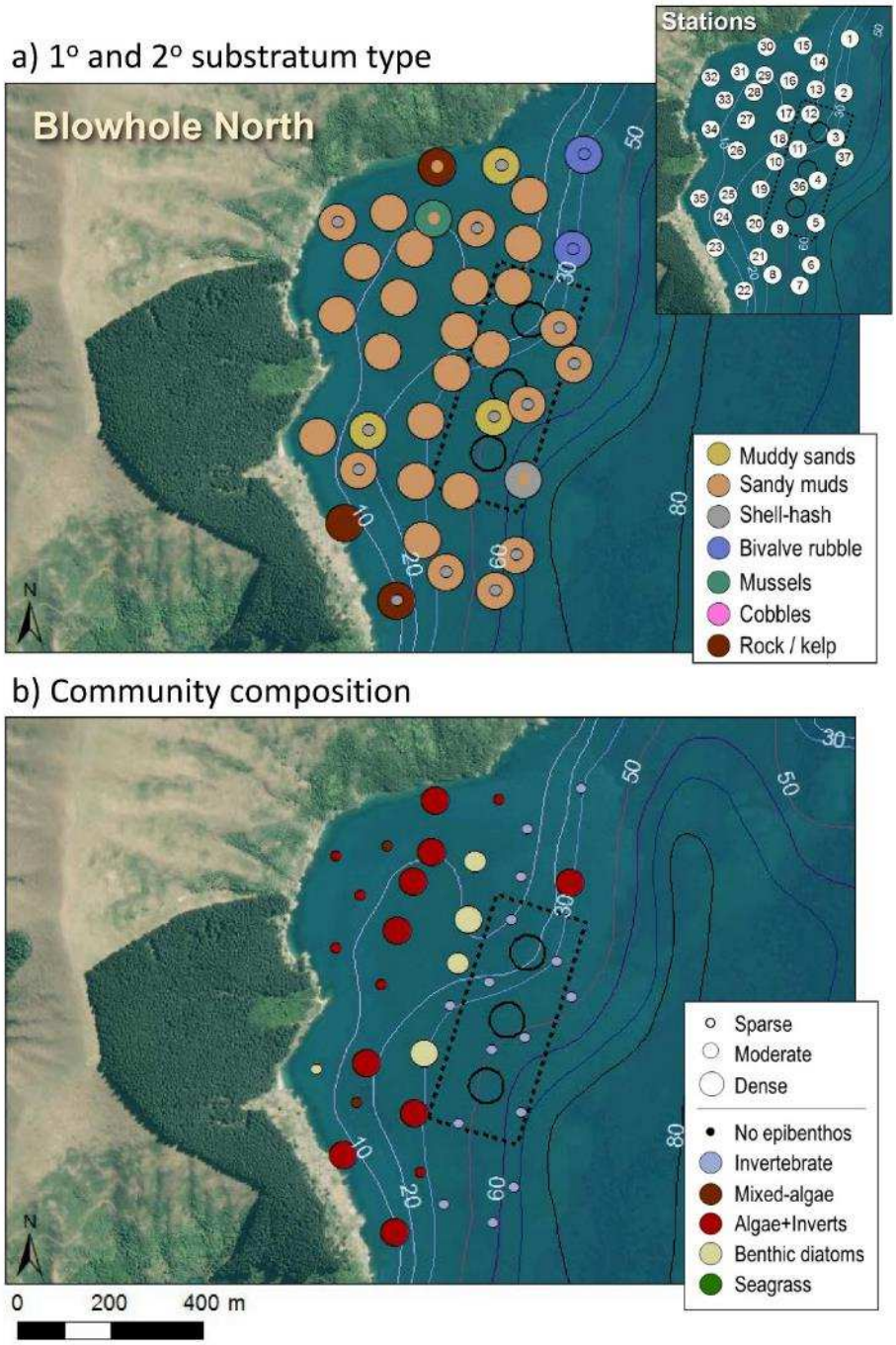

Figure 3-5: Benthic habitat and community composition from drop-camera photo-quadrats within and adjacent to the proposed Blowhole North Farm Site. a) Primary and Secondary substratum type. Large circles = primary substrata (most dominant habitat: ≥50% of cover), inner smaller circles = Secondary substrata (20-50% of quadrat). For example, rock with some sand will have a large dark brown circle with an inner yellow circle, while homogenous sand would be all yellow. b) Community composition. Circle colour denotes community types, while circle size denotes rank abundance (sparse <10% cover; moderate = 10-50% cover, dense = >50% cover). Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed cage boundaries. Depth contours are in metres.

Table 3-1: Ecological features seen in video sled transects at Blowhole Point North.

Video #	Habitat	Depth (m)*	Conspicuous biota
V1	Mud	21 - 30	Scallops (*Pecten novaezelandiae*), ophiuroids (*Ophiopsammus maculata*), hydroids, colonial ascidians (*Cystodytes dellechiajei*), sea cucumber (*Australostichopus* sp.), eleven-arm starfish (*Coscinasterias muricata*)
	Mud, occasional biogenic clumps	30 - 43	Scallops, ophiuroids, hydroids, colonial ascidians (*Cystodytes dellechiajei*), sea cucumber, eleven-arm starfish, kina (*Evechinus chloroticus*), opalfish (*Hemerocoetes monopterygius*)
V2	Sandy mud, shell with red & tuft algae	9.5 - 12	Dog cockle and *Maoricolpus* shells, triplefin (*Forsterygion* sp.), large gastropod
	Sandy mud with diatom biofilm	12 - 14	Ophiuroids, sea cucumber, scallop (*Pecten novaezelandiae*), spotties (*Notolabrus celidotus*), wandering anemone (*Phlyctenactis tuberculosa*), eleven-arm starfish
	Sandy mud with dense patches of algae	14 - 15.8	Triplefins (*Forsterygion* sp.), spotties, wandering anemones (*Phlyctenactis* sp.)
V3	Mud with diatom biofilm and red & tuft algae	11 - 7	Ophiuroids spotties, triplefin (*Forsterygion* sp.), eleven-arm starfish
V4	Sandy mud with diatom biofilm and red tuft algae	9.9 - 10.5	Eleven-arm starfish cushion star (*Patiriella* sp.)
	Sandy mud with shell and red & tuft algae	10.5 - 11.2	Eleven-arm starfish cushion star, ophiuroids, gurnard (*Chelidonichthys kumu*)

*Depths in this summary table are only indicative and not corrected for chart datum

3.1.4 Epifauna collection at Blowhole Point North

A total of 247 epifaunal specimens from 32 different taxa were recorded from five epibenthic sled tows collected within and adjacent to the proposed Blowhole North Farm Site (Table 3-2). Catches were dominated by crustaceans (47.4% of total catch), bivalves (25%), heart urchins (4.9%) and starfish (2%). Dominant and characteristic species included hermit crabs, *Pagurus* sp (73 hermit crabs, 30% of the catch), New Zealand scallops, *Pecten novaezelandiae* (30 scallops, 12.1%), File shell, *Limaria orientalis,* (8.5%) crabs (*Petrolisthes novaezelandiae* and *Ebalia laevis* (7.3% and 6.9% respectively) and Heart urchins, *Echinocardium chordatum* (12 specimens, 4.9%), along with the occasional eleven armed starfish (*Coscinasterias muricata*), brittlestars (*Ophiopsammus maculata*), and red and green macroalgal fragments (Table 3-2, e.g. Figure 3-6a-d).

Notable taxa included scallops, *Pecten noveazelandiae* (n=30 specimens -stations 1 and 5), and rare occurrences of two brachiopod species: *Terebratella sanguinea* (7 specimens - stations 3 and 4) and *Calloria inconspicua* (3 specimens - stations 3 and 4), and the dredge oyster, *Ostrea chilensis* (1 specimens - station 1) (Table 3-2).

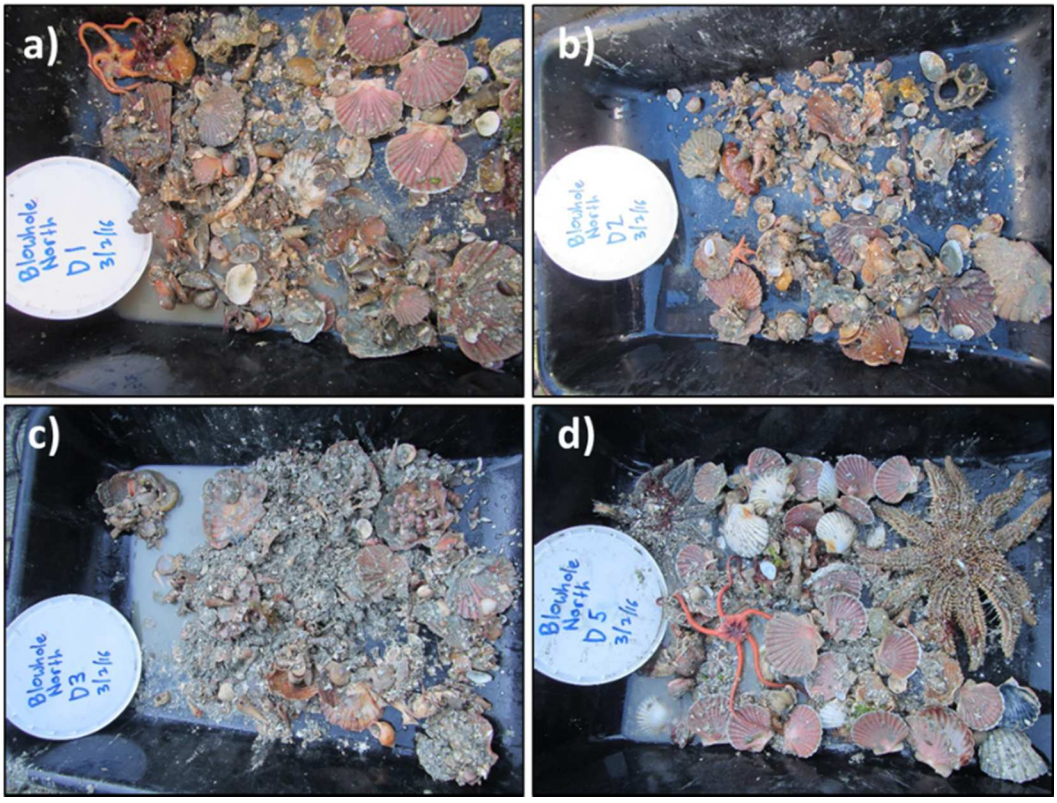

Figure 3-6: Examples of epifauna collected in epibenthic sleds within and adjacent to the proposed Blowhole North Farm Site. Catches included shell debris and characteristic species including, scallops (*Pecten novaezelandiae*), along with the occasional eleven armed starfish (*Coscinasterias muricata*), brittlestars (*Ophiopsammus maculata*), and red and green macroalgal fragments.

Table 3-2: Relative abundance of epifauna collected in epibenthic sleds within and adjacent to the proposed Blowhole North Farm Site. "Tabd"= Total infaunal abundance; Columns 1-5 depict replicate dredges BLN-D1 to BLN-D5; "✓"=(1-4 specimens), "C" = common (5-9 specimens), "A"= abundant (>10 specimens). Tabd >= 5 are in blue text.

Taxa group	Common name	Taxa/Species	Blowhole North					
			Tabd	1	2	3	4	5
Anthozoa	Anemone clump	*Anemone* clump	1			✓		
Ascidiacea	Saddle sea squirt	*Cnemidocarpa bicornuta*	9	C	✓			✓
	Colonial sea squirt	*Cystodytes* sp.	4	✓	✓	✓		✓
	Solitary sea squirt	*Molgula* sp	1					✓
Asteroidea	Reef starfish	*Stichaster australis*	3		✓	✓	✓	
	Eleven armed starfish	*Coscinasterias muricata*	2					✓
Bivalvia	NZ scallop	*Pecten novaezelandiae*	30	C				A
	File shell	*Limaria orientalis*	21	C	✓	C	✓	C
	NZ fan shell	*Talochlamys zelandiae*	7			✓	C	
	Strawberry cockle	*Pratulum pulchellum*	2				✓	✓
	Dredge oyster	*Ostrea chilensis*	1	✓				
Brachiopoda	Red-ribbed brachiopod	*Terebratella sanguinea*	7			✓	C	
	Small brachiopod	*Calloria inconspicua*	3			✓	✓	
Chordata	Graham's gudgeon	*Grahamichthys* sp	4					✓
	Common triplefin	*Forsterygion lapillum*	1		✓			
Crustacea	Hermit crab	*Pagurus* sp	73	A	✓	A	A	C
	Red half-crab	*Petrolisthes novaezelandiae*	18			A	C	
	Crab	*Ebalia laevis*	17				✓	A
	Shrimp	Shrimp	5				C	
	Rough rock crab	*Nectocarcinus integrifrons*	2				✓	✓
	Squat lobster	*Munidopsis serricornis*	1			✓		
	Decorator crab	*Notomithrax* sp	1	✓				
Echiniodea	Heart urchin	*Echinocardium cordatum*	12					A
Gastropoda	Screw shell	*Maoricolpus roseus*	10			C	C	
	Olive shell	*Amalda mucronata*	3			✓	✓	
	Knobbed whelk	*Austrofusus glans*	1					✓
Holothuroidea	Common sea cucumber	*Australostichopus mollis*	1		✓			
Hydrozoa	Hydroid	Hydroid	1		✓			
Ophiuroidea	Brittle star	*Ophiopsammus maculata*	2	✓				✓
	Brittle star	*Ophionereis fasciata*	1					✓
Porifera	Sponge	Sponge	2		✓			✓
Rhodophyta	Red macroalgae	Macroalgae red	1	✓				

3.1.5 Infauna at Blowhole Point North

Blowhole North supported the highest number of infaunal taxa of all sites sampled. A total of 573 infauna from 78 different taxa were recorded from the 6 replicate grab samples collected at this site (Table D-1; Figure 3-7a-b). The total numbers of infauna, however, were highly variable between sampling stations (mean site abundance of 96.50 ± 27.31 SE, range 52-221 individuals p/grab), but supported relatively high taxa richness (27.17± 3.23 SE, range 20-38 species p/grab). High variability in abundance between stations was driven for the most part by high localized numbers of small shrimp-like Tanaids at station G3 (74 individuals, comprising 34% of the G3 catch, and 12.8% of the total site catch), relative to low Tanaid numbers in other stations. The remaining infauna at all stations, were characterized by a mix of polychaete worms (22.6% of total catch: Chaetopteridae [5.2%], Maldanidae [2.8%], Glyceridae [n=2.6%], Lumbrineridae [2.2%] worms), amphipods (17.7%), bivalves (10.2%: mostly *Corbula zelandica* [1.9%] and *Gonimyrtea concinna* [1.2%]), and isopods (5.4%) (Table D-1, Figure 3-7b).

Notable taxa collected in the grabs included a single scallop, *Pecten noveazelandiae* (1 specimen - station G5), Red-ribbed brachiopod, *Terebratella sanguinea* (3 specimens - station G6), the small brachiopod, *Calloria inconspicua* (1 specimen - station G4) and an erect bryozoan (1 specimen - station G3) (Table D-1).

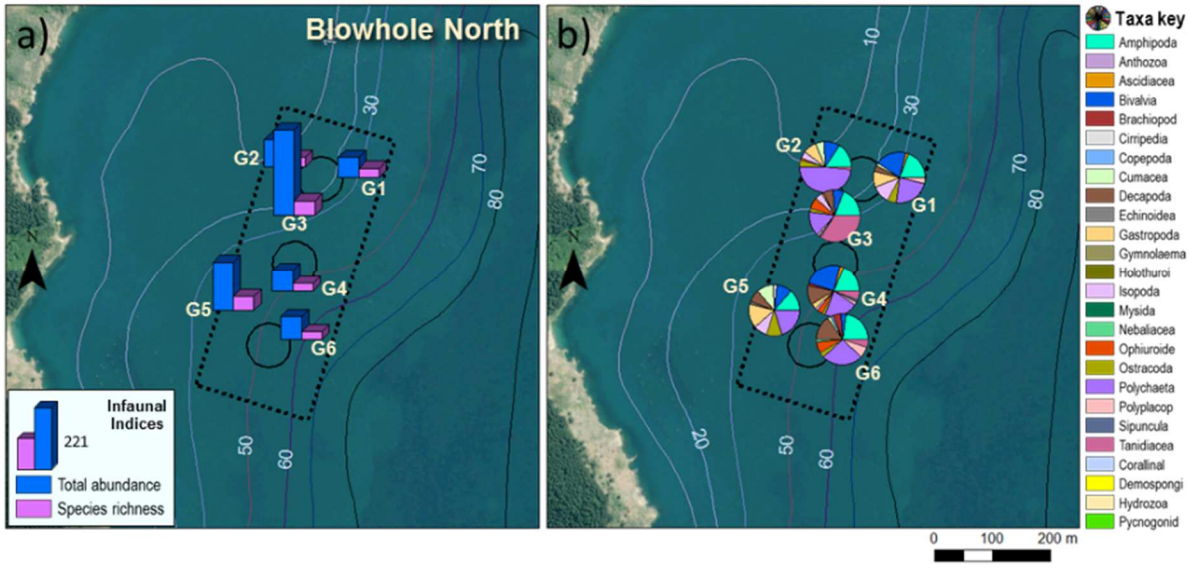

Figure 3-7: Infaunal summary indices and taxonomic composition from grab sampling stations within the proposed Blowhole North Farm Site. a) Infaunal total abundance and species richness, b) pie charts showing the taxonomic composition of each sample. G1 to G6 = station numbers BLN-G1 to BLN-G6; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed cage boundaries.

3.1.6 Reef Dive at Blowhole Point North

Large bedrock reef habitats were present extending from the main headlands to the north and south of the site, but they were more than 250 m and 300 m distant from the site boundaries respectively, so were not investigated in detail in this survey. A single dive was conducted on a small shoreline reef in order to characterise the inshore reef habitat. A summary of ecological features adapted from divers notes and dive video footage is presented in Table 3-3. At this site the inshore habitat was rocky reef supporting macroalgae stands (*Carpophyllum* and *Ecklonia*), and associated fauna including paua, and common reef fish. With increasing depth, the algal cover reduced and the rocky reef was dominated by kina barrens with a range of other mobile fauna, sponges and a diverse range of fish. Further offshore, the substrate changed to sand. Here, scallops were frequently seen, as well as blue cod.

Table 3-3: Features noted in the reef dive inshore of the site at Blowhole Pt North.

Habitat	Depth (m)	Conspicuous biota	Fish
Reef, kelp	3-6	kina *(Evechinus chloroticus)*, paua (*Haliotis iris*), anemone (*Anthothoe albocincta*), encrusting ascidian/sponges, *Ancorina alata, Carpophyllum*, *Anomia* sp., Cooks turban (*Cookia sulcata*), catseyes (*Turbo smaragdus*), 11 arm starfish (*Coscinasterias muricata)*	Schooling triplefins, spotties (*Notolabrus celidotus*), blue moki (*Latridopsis ciliaris*)
Bedrock	6 - 9	Kina *(Evechinus chloroticus)*, *Ancorina alata,* sea cucumber (*Australostichopus mollis*), gastropods cooks turban, catseyes (*Turbo smaragdus*), anemones, ascidians	Blue moki (*Latridopsis ciliaris*), spotties (*Notolabrus celidotus*), scarlet wrasse (*Pseudolabrus miles*), stingray (*Dasyatis thetydis*), triplefins (*Forsterygion* sp), blue cod (*Parapercis colias*), sweep (*Scorpis lineolatu*), red cod (*Pseudophycis bachus*)
Rocks/sand	9 - 10	Anemone, kina, horse mussel (*Atrina zelandica*), hermit crab, sea cucumber, solitary ascidian, brittlestars (*Ophiopsammus maculata*), Grey sponge *Ancorina alata,* encrusting ascidians/sponge, scallop (*Pecten novaezelandia*), Cooks turban	Spotties, blue cod, triplefins, scarlet wrasse, tarakihi (*Nemadactylus macropterus*), sweep (*Scorpis lineolatu*), trevally (*Pseudocaranyx georgianus*), jack mackerel (*Trachrurus novaezelandiae*)
Sand/shell, red & tufting algae	10 -15	Scallops, brittlestars, 11 armed starfish, sea cucumber, fan worms, wandering anemone (*Phlyctenactis tuberculosa*)	Blue cod (*Parapercis colias*), triplefins, spotties (*Notolabrus celidotus*)

3.1.7 Notable features: Blowhole Point North

The sandy mud substratum beneath the farm site supported an epifaunal community that was sparse and mostly composed of taxa commonly seen in the Marlborough Sounds. Biogenic clumps of associated organisms mostly comprising ascidians and hydroids were present in a sparse distribution. These types of associations are considered to have ecological value in supporting benthic biodiversity in the region (Davidson *et al* 2011), however the biogenic clumps found on the mud habitat within the site boundaries were relatively small and were sparsely distributed.

The infaunal community at this site was composed mostly of taxa that are common and widespread within the outer Marlborough Sounds region (e.g. McKnight and Grange 1991), but some taxa sampled in the grabs and sleds were notable: Ten specimens of the red-ribbed brachiopod, *Terebratella sanguinea* and 4 specimens of the small brachiopod (*Calloria inconspicua)* were found in dredge and grab samples from within the site.

The reef patches and kelp communities fringing the shoreline (A in Figure 3-8) provided habitat for a range of invertebrate taxa including paua and kina – species considered valuable commercially, and also as kaimoana. The varied shoreline habitats and adjacent subtidal zone is blue cod habitat. Scallops, a valued resource to recreational and commercial fisheries, were commonly seen in the video sled transects within and inshore of the boundaries of the site and were sampled in both grab and dredge samples. This indicates that scallops are likely to be abundant within the site and surrounding embayment.

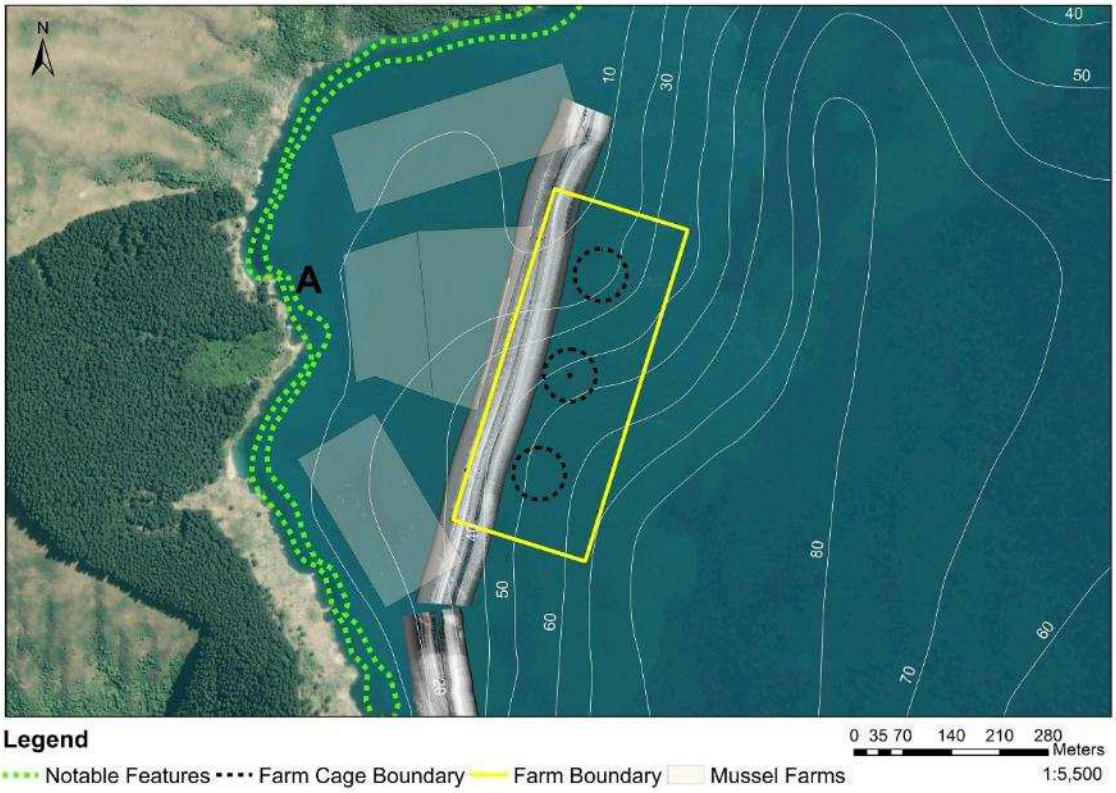

Figure 3-8: Notable ecological features at Blowhole Point North. A) Patch reefs and kelp inshore of site. Boundaries of notable ecological features are approximate.

3.2 Blowhole Point South (122), Pelorus Sound

3.2.1 Blowhole Point South, general site information, station depths and locations

The proposed site at Blowhole Point South covers an area of 10 Ha located between Blowhole Point and West Entry Point at the entrance to Pelorus Sound. The farm boundaries are positioned over a sloping seabed in depths between 33 and 65 m (Figure 3-9). Survey sample stations are shown in Figure 3-10.

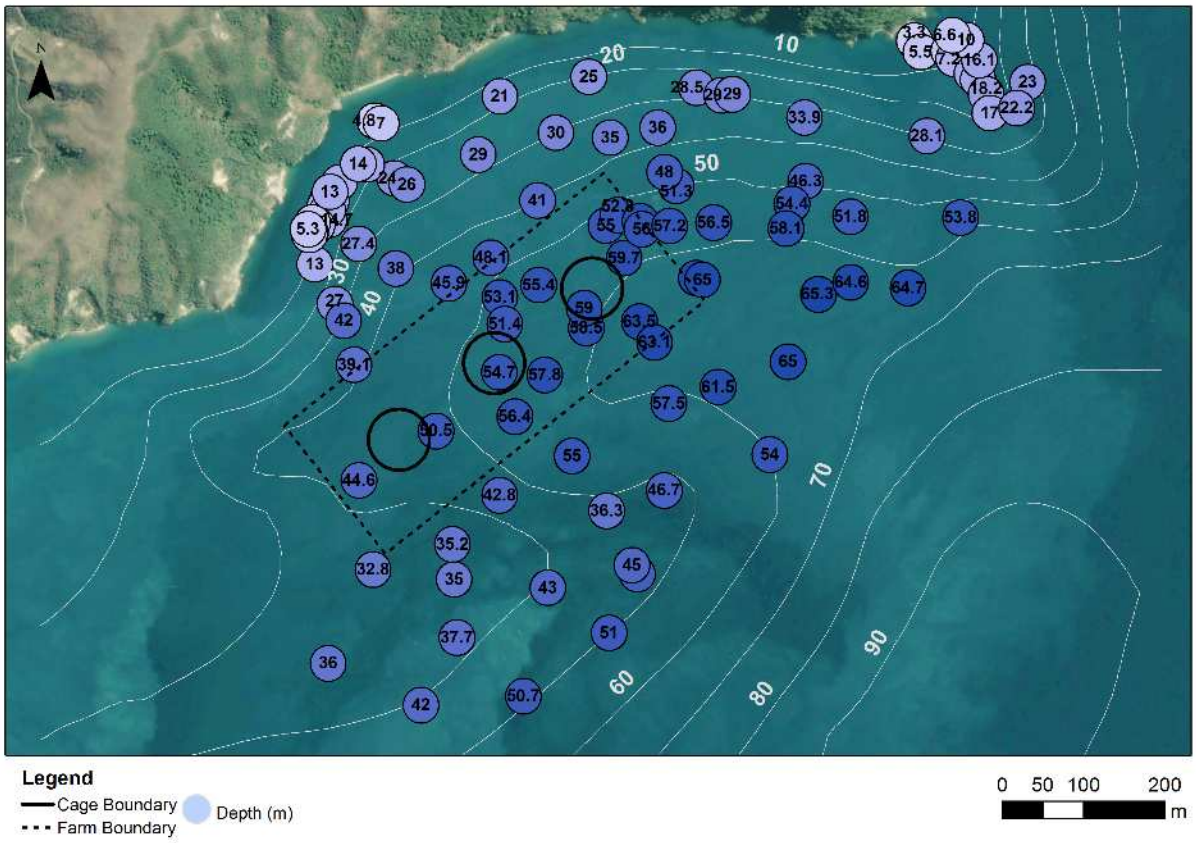

Figure 3-9: Station depths at Blowhole Point South. Colour depicts depth from shallow (white) to dark blue (deep), central values are depths in metres.

ADCP measurements at this site showed slightly stronger currents than the Blowhole Point North site, with 20% of profiles exceeding 20 cm s^{-1}, and the fastest 5% exceed approximately 38 cm s^{-1}. The strongest and most common flows were to the NE/ENE, with some slower average flows to the west.

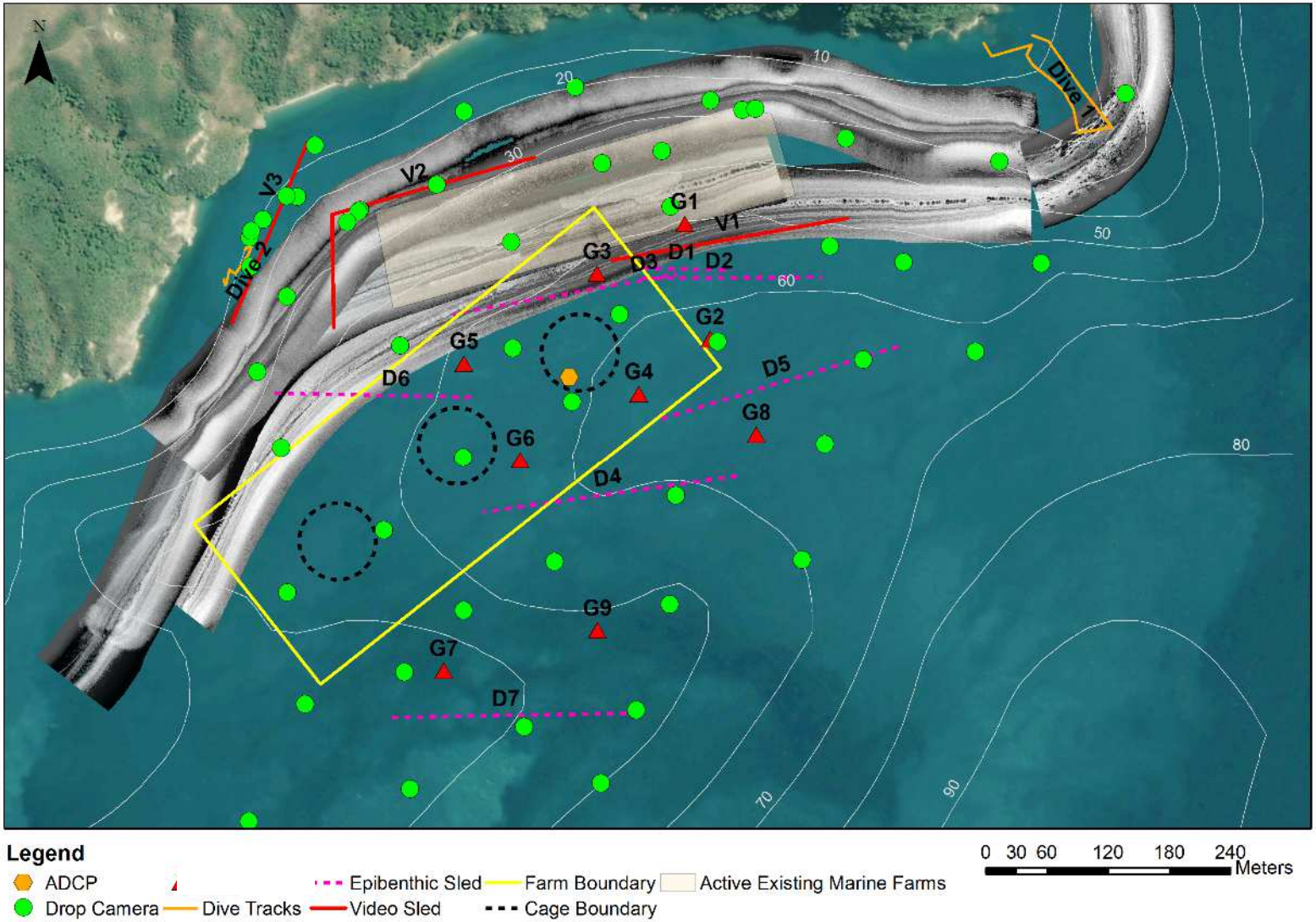

Figure 3-10: Survey sample locations at the Blowhole Point South site. Grey bands are 100 m wide sidescan swaths

3.2.2 Sediment composition at Blowhole Point South

Nine grab samples were collected in depths of 51 to 65 m in the vicinity of the proposed Blowhole South Farm Site (Table B-1, Figure 3-11a). Visual inspection of the cores found sandy muds with varying amounts of fine and coarse shell material visible in the sediment (Table B-1, Figure 3-11b). Like Blowhole North, grain size analyses for Blowhole South found sediments comprised of similar proportions of mud (52,39% ± 3.35 SE) and sand (31.05% ± 1.78 SE), but gravel was present at all stations (16.54% ±3.65 SE) (Table B-1, Figure 3-11).

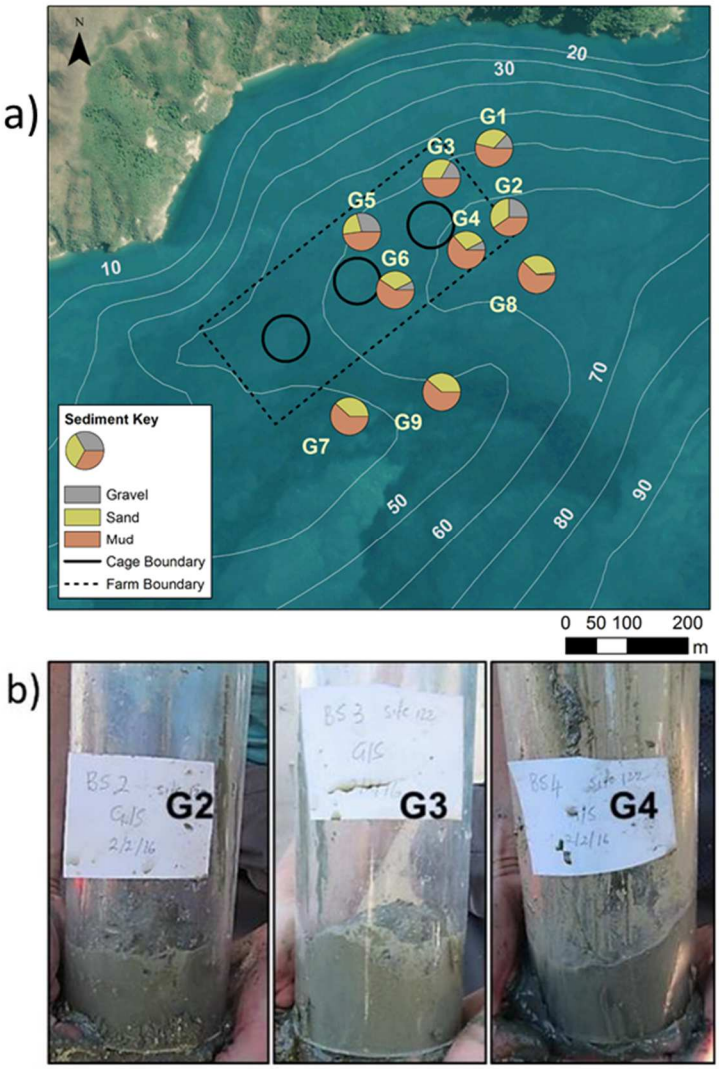

Figure 3-11: Grain size composition (% dry weight) and visual characteristics of sediments collected within the proposed Blowhole South Farm Site. a) Grain size distribution plots. G1 to G9 = station numbers BLS-G1 to BLS-G9; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed cage boundaries; b) Examples of the visual characteristics of sediment cores (e.g. G2, G3 and G4) from this site.

3.2.3 Habitats and Communities at Blowhole Point South

Most of the site lies over a sand/mud habitat (Figure 3-12a, b; Figure 3-13a) supporting a rather sparse mixed community of macroalgae and diverse invertebrates (Figure 3-13b). Infaunal and epifaunal diversity at this site was relatively high. The most common conspicuous epifaunal invertebrates were brittlestars (*Ophiopsammus maculata*) and hermit crabs (*Pagurus* spp.). At the northwest corner of the site the influence of an existing mussel farm was evident due to mussels (Figure 3-12c) and other biota dropping from the mussel farm structures, resulting in increased abundance of green lipped mussels, eleven arm starfish and cushion stars (V2 in Table 3-4). Brachiopods, and fan shells (*Talochlamys* sp.) were also present in that zone. Brachiopods were found in several samples widely dispersed at the site. The substratum inshore of the site was variable, with a range of different community types, including muddy sand with patches of shell hash (Figure 3-12d), and kelp communities on small patch reefs. Scallops were also noted as common inshore of the farm site.

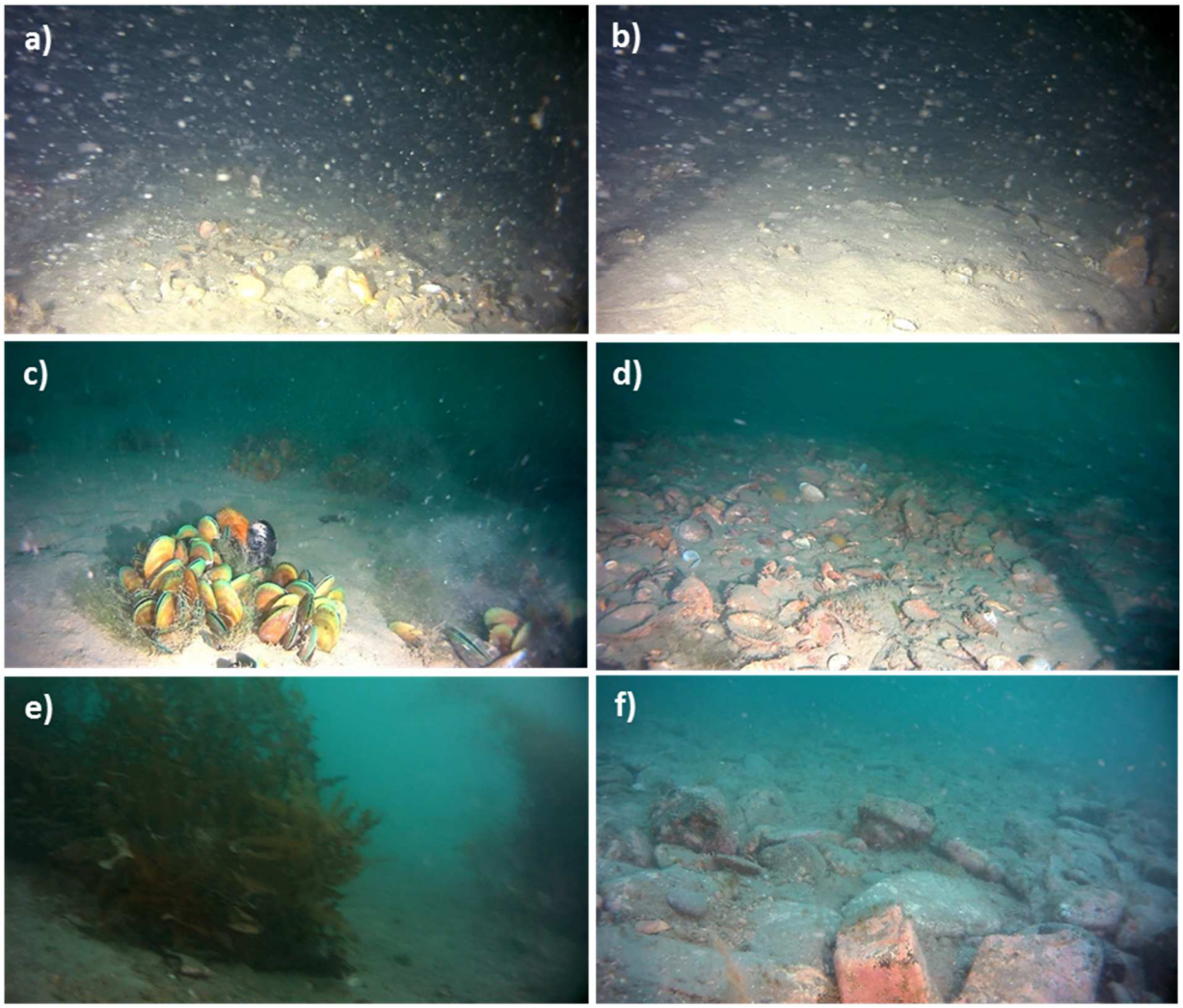

Figure 3-12: Habitat types at the Blowhole South site and surrounding embayment. a) Mud and shell rubble habitat within the site boundaries; b) Sandy mud habitat within the proposed site; c) mussel drop from existing farm at the northwest corner of the site; d) Sandy mud and shell rubble habitat inshore of SW end of the site; e) kelp (*Carpophyllum maschalocarpum*) and sand near the shoreline; f) Inshore cobble habitat

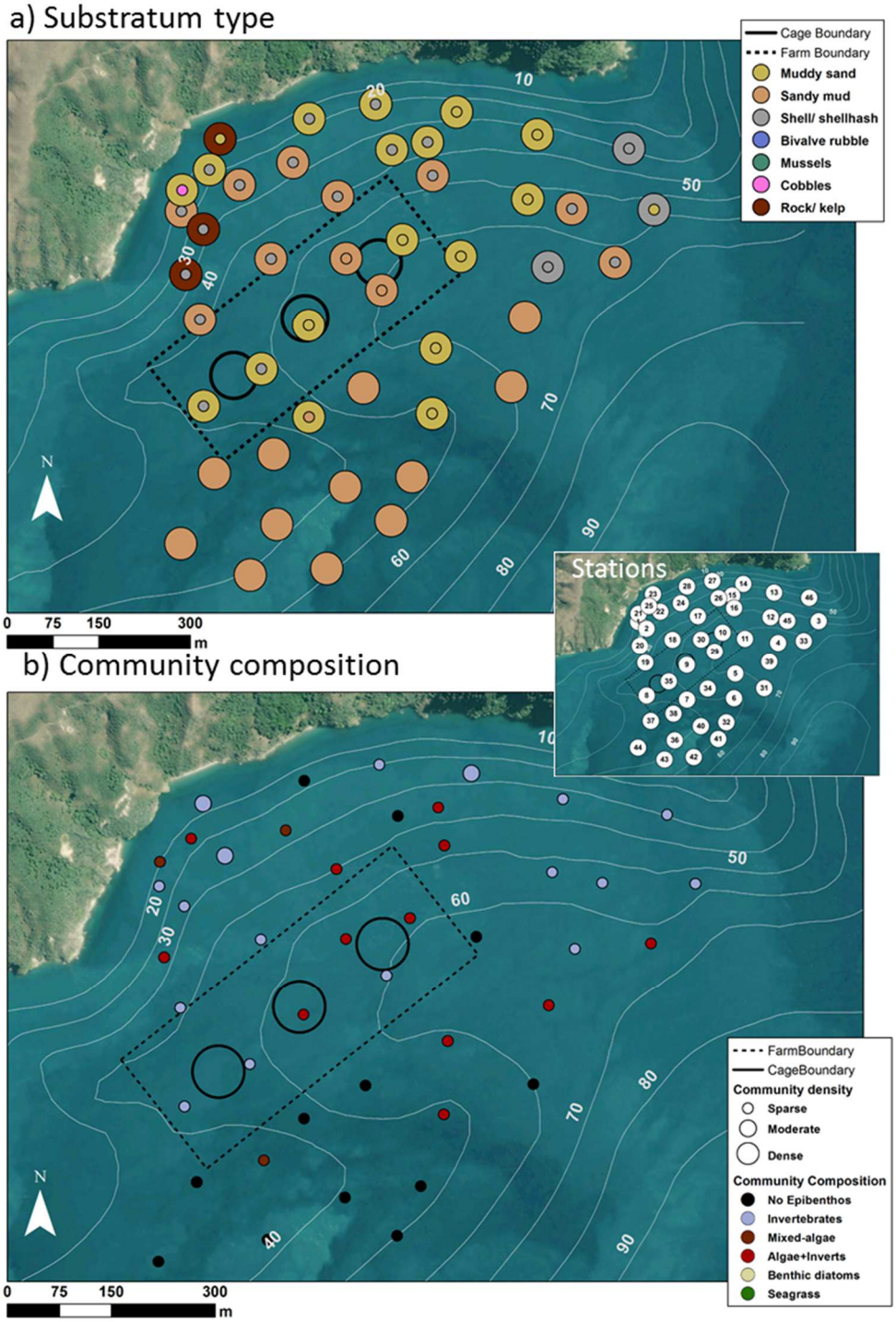

Figure 3-13: Benthic habitat and community composition from drop-camera photo-quadrats within and adjacent to the proposed Blowhole South Farm Site. a) Primary and Secondary substratum type. Large circles = primary substrata (most dominant habitat: ≥50% of cover), inner smaller circles = Secondary substrata (20-50% of quadrat). For example, rock with some sand will have a large dark brown circle with an inner yellow circle, while homogenous sand would be all yellow. b) Community composition. Circle colour denotes community types, while circle size denote rank abundance (sparse <10% cover; moderate = 10-50% cover, dense = >50% cover). Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries. Depth contours are in metres.

Table 3-4: Ecological features seen in video sled transects at Blowhole Point South.

Video #	Habitat	Depth (m)*	Conspicuous biota
V1	Mud with shell rubble	46 - 50	Ophiuroids (*Ophiopsammus maculata*), hermit crabs (*Pagurus* sp.), colonial ascidians (e.g. *Cystodytes dellechiajei*), hydroids, sea cucumber (*Australostichopus* sp.), eleven-arm starfish (*Coscinasterias muricata*), cushion star (*Patiriella* sp.)
	Mud with shell rubble	50 - 53	Green mussels (*Perna canaliculus*), solitary ascidians, brachiopod, fan shell (*Talochlamys zelandiae*), ophiuroids (*Ophiopsammus maculata*), hermit crabs (*Pagurus* sp.), sea cucumber (*Australostichopus* sp.), cushion star (*Patiriella* sp.)
V2	Mud with clumps green mussels	30 - 25	Green mussels (*Perna canaliculus*), ophiuroids (*Ophiopsammus maculata*), colonial ascidians (*Cystodytes dellechiajei*), cushion star (*Patiriella* sp.), eleven-arm starfish (*Coscinasterias muricata*), scallop (*Pecten novaezelandiae*), sea cucumber (*Australostichopus* sp.)
	Mud with shell rubble	25 - 34	Fan worm, colonial ascidians (*Cystodytes dellechiajei*), ophiuroids (*Ophiopsammus maculata*), sea cucumber (*Australostichopus* sp.), sponge, hydroids, solitary ascidians, cushion star (*Patiriella* sp.), eleven-arm starfish (*Coscinasterias muricata*)
V3	Cobble and sand	5 - 9	Sea cucumber (*Australostichopus* sp.), kina (*Evechinus chloroticus*), cushion star (*Patiriella* sp.), Fan worms, ophiuroids (*Ophiopsammus maculata*), horse mussel (*Atrina zelandica*), eleven-arm starfish (*Coscinasterias muricata*)
	Reef patches	6	Kelp (*Carpohyllum* sp.)
	Sandy-mud with some shell	9 - 10	Scallops (*Pecten novaezelandiae*), ophiuroids (*Ophiopsammus maculata*), Fan worms, hermit crabs (*Pagurus* sp.), horse mussel (*Atrina zelandica*), colonial ascidians (*Cystodytes dellechiajei*)
	Sandy mud with dense hermit crabs	10 - 12	Hermit crabs (*Pagurus* sp.), scallops (*Pecten novaezelandiae*), sea cucumber (*Australostichopus* sp.), cushion star (*Patiriella* sp.), ophiuroids (*Ophiopsammus maculata*), horse mussel (*Atrina zelandica*), kina (*Evechinus chloroticus*)
	Sandy-mud with rock/reef and shell rubble	12 - 13	Sea cucumber (*Australostichopus* sp.), colonial ascidians (*Cystodytes dellechiajei*), kina (*Evechinus chloroticus*), hydoirds, sponge (yellow), ophiuroids (*Ophiopsammus maculata*), anemone (*Anthothoe albocincta*)

*Depths in this summary table are only indicative and not corrected for chart datum

3.2.4 Epifaunal collection at Blowhole Point South

A total of 155 epifaunal specimens from 42 different taxa were recorded from seven epibenthic sled tows within and adjacent to the proposed Blowhole South Farm Site (Table 3-5). Catches were dominated by crustaceans (47.2%) and bivalves (23.4%), with some starfish (5.6%). Dominant and characteristic species included Red half-crabs, *Petrolisthes novaezelandiae* (27.7%), File shells, *Limaria orientalis* (22.6%), Hermit crabs, *Pagurus* sp (17.4%), Cushion stars, *Patiriella regularis* (3.9%), Squat lobsters, *Munidopsis serricornis* (3.2%) and Fan shells, *Talochlamys zelandiae* (1.9%), and the Red-ribbed brachiopod, *Terebratella sanguinea* (1.9%), as well as the occasional brittle star, *Ophiopsammus maculata* (Table 3-5, Figure 3-14). Some catches (e.g. stations 2, 3 and 5) also included lots of shell debris, although this was highly variable between stations (e.g. Figure 3-14a-d).

Notable taxa included rare occurrences of two brachiopod species: *Terebratella sanguinea* (5 specimens - stations 2, 3, 5 and 6) and *Calloria inconspicua* (6 specimens - stations 2, 3 and 6), and Erect Bryozoa (4 specimens - stations 2, 4 and 5) (Table 3-5).

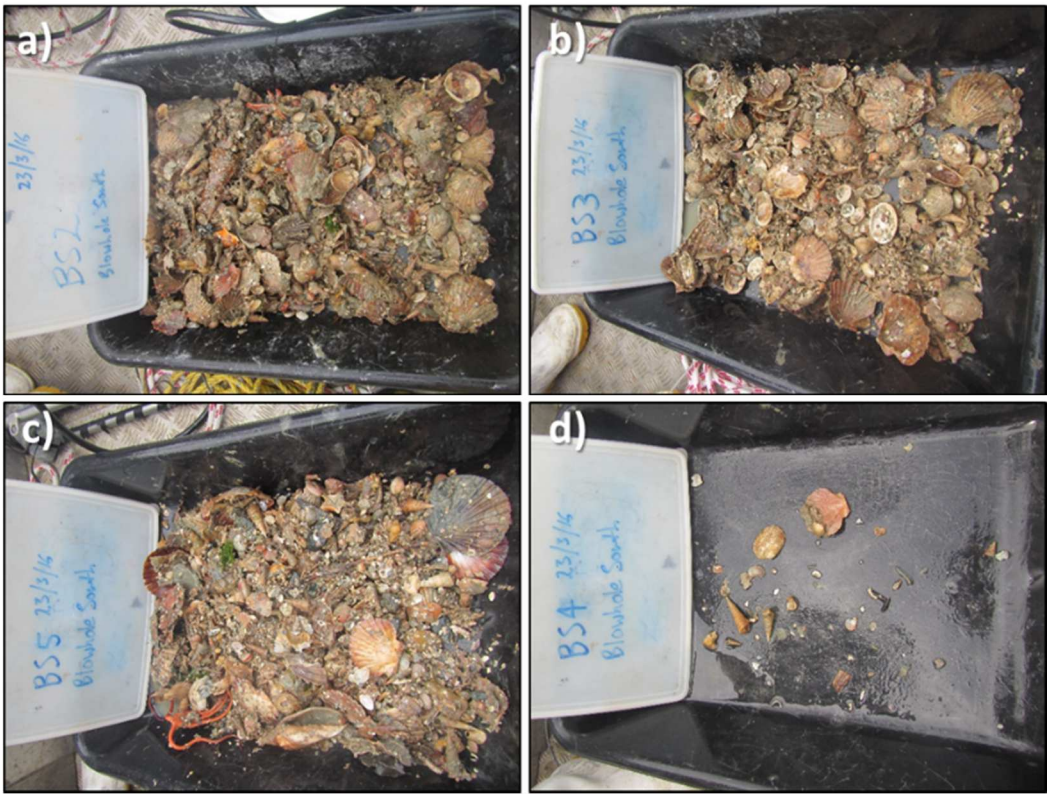

Figure 3-14: Examples of epifauna collected in epibenthic sleds within and adjacent to the proposed Blowhole South Farm Site. Catches included lots of shell debris, although this was highly variable between sample sites, with characteristic species including: file shells (*Limaria orientalis*), hermit crabs (*Pagurus* sp.) and an occasional brittle star (*Ophiopsammus maculata*).

Table 3-5: Relative abundance of epifauna collected in epibenthic sleds within and adjacent to the proposed Blowhole South Farm Site, Pelorus Sound. "Tabd"= Total infaunal abundance; Columns 1-7 depict replicate dredges BLN-D1 to BLN-D7; "✓"= present (1-4 specimens), "C" = common (5-9 specimens), "A"=abundant (>10 specimens). Tabd >= 5 are in blue text.

Taxa group	Common name	Taxa/Species	Blowhole South							
			Tabd	1	2	3	4	5	6	7
Anthozoa	Cup coral	*Monomyces rubrum*	1					✓		
Ascidiacea	Colonial sea squirt	*Cystodytes dellechiajei*	3		✓			✓	✓	
	Saddle sea squirt	*Cnemidocarpa bicornuta*	3		✓			✓	✓	
	Compass sea squirt	*Asterocarpa humilis*	1		✓					
	Saddle sea squirt	*Cnemidocarpa nisiotis*	1		✓					
	Ascidian	*Agnezia glaciata*	1					✓		
Asteroidea	Cushion star	*Patiriella* sp.	6		✓			✓	✓	
	Eleven armed starfish	*Coscinasterias muricata*	2		✓					
	Reef starfish	*Stichaster australis*	3		✓			✓	✓	
Bivalvia	File shell	*Limaria orientalis*	35		A	A	✓	✓	✓	
	NZ fan shell	*Talochlamys zelandiae*	5		✓	✓		✓	✓	
	Strawberry cockle	*Pratulum pulchellum*	2		✓	✓				
	Corbula clam	*Corbula zelandica*	1					✓		
	New zealand scallop	*Pecten novaezelandiae*	1						✓	
	Bivalve	*Neilo australis*	1							✓
	Razor mussel	*Solemya parkinsoni*	1		✓					
Brachiopoda	Red-ribbed brachiopod	*Terebratella sanguinea*	7		✓	✓		✓	✓	✓
	Small brachiopod	*Calloria inconspicua*	4		✓	✓			✓	✓
Bryozoa	Bryozoa	Bryozoan	2				✓	✓		
	Branching bryozoan	Bryozoa branching	2		✓				✓	✓
	Bryozoa	*Caberia* sp	1		✓					
Chordata	Sea horse	*Hippocampus* sp	1					✓		
Crustacea	Red half-crab	*Petrolisthes novaezelandiae*	43		A	A		✓		
	Hermit crab	*Pagurus* sp	27		A	A	✓	✓	✓	✓
	Squat lobster	Galatheoidea	5		C					
	Decorator crab	*Notomithrax* sp	3			✓		✓	✓	
	Crab	*Ebalia laevis*	1							✓
	Spider crab	*Halicarcinus* sp	1					✓		
	Barnacle	Barnacle	3			✓	✓	✓		
Echiniodea	Heart urchin	*Echinocardium cordatum*	6					✓		✓
Gastropoda	Lined whelk	*Buccinulum* sp	1			✓				
	Olive shell	*Amalda mucronata*	1			✓				
	Purple cockle	*Purpurocardia purpurata*	1						✓	
Holothuroidea	Sea cucumber	*Australostichopus mollis*	7		✓				✓	
Hydrozoa	Hydroid	Hydroid	3		✓				✓	
	Hydroid	Tree hydroid	4						✓	✓
Polyplacophora	Chiton	*Notoplax* sp	1		✓					
Ophiuroidea	Brittle star	*Ophiopsammus maculata*	2					✓	✓	

Taxa group	Common name	Taxa/Species	Blowhole South							
			Tabd	1	2	3	4	5	6	7
	Brittle star	Ophiuroid spp	2		✓				✓	
Porifera	Sponge	Sponge	41				✓			
Rhodophyta	Red macroalgae	Macroalgae red	1					✓		

3.2.5 Infauna at Blowhole Point South

A total of 495 infaunal specimens from 71 different taxa were recorded from 9 replicate grab samples collected in the vicinity of the proposed Blowhole South Farm Site (Table D-2). Grab stations at this farm site had relatively even numbers of total infauna (mean abundance of 50.5 ± 7.03 SE) and species richness (20 species ± 2.4 SE) (Figure 3-15a). However, infaunal composition varied between stations – due to the presence of Tanaid shrimps, Small brachiopods (*Calloria inconspicua*) and Red half-crabs (*Petrolisthes novaezelandiae*) at station G2 (in 64.7 m, near the SE outer farm boundary) and higher numbers of bivalves (species mix, numerically dominated by *Gonimyrtea concinna* and the Strawberry cockle, *Pratulum pulchellum*) at inshore stations G1 (51.3 m) and G3 (55 m), and to a lesser extent offshore at station G4 (63.5 m). Overall, the most dominant taxa for this site were polychaetes (23% of total catch, including Lumbrineridae [4.3%], Eunicidae [3.3%], Capitellidae [2%] worms), amphipods (22% of total catch), cumaceans (10% of catch), bivalves (13% - *Gonimyrtea concinna* [4%] and the Strawberry cockle*, Pratulum pulchellum* [2%]), the brittlestar, *Amphiura* sp. (5%) and localized occurrence of brachiopods (3.3%) (Table D-2, Figure 3-15b)

Notable taxa collected in the grabs included isolated occurrences of two species of brachiopods: the Small brachiopod, *Calloria inconspicua* (8 specimens - station G2) and the Red-ribbed brachiopod, *Terebratella sanguinea* (2 specimens - station G3) (Table D-2).

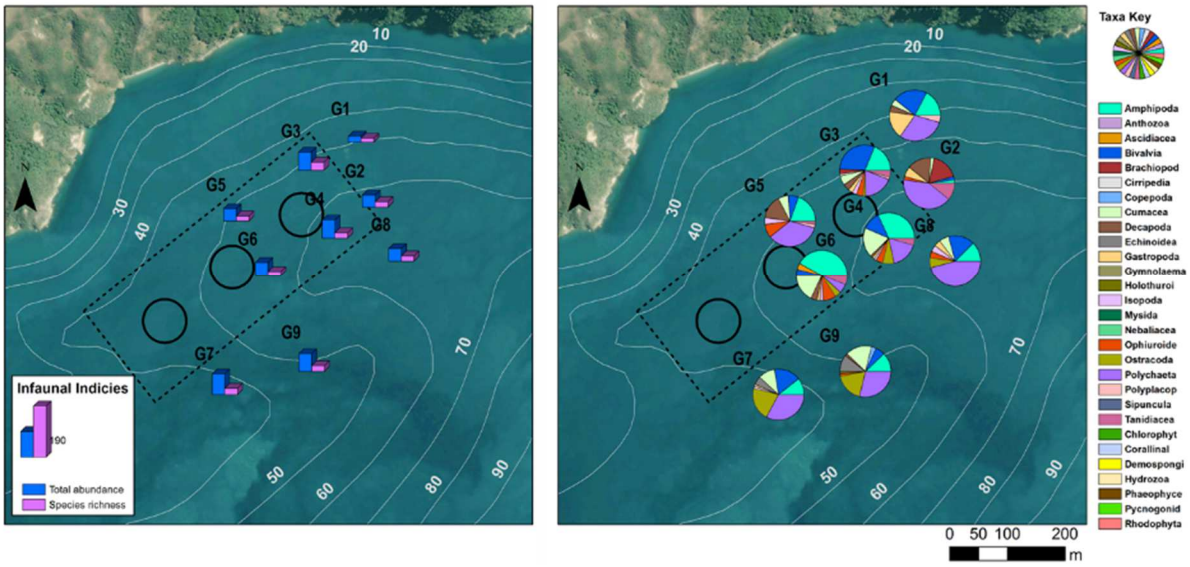

Figure 3-15: Infaunal summary indices and taxonomic grab sampling stations within the proposed Blowhole North Farm Site. a) Infaunal total abundance and species richness, b) pie charts showing the taxonomic composition of each sample. G1 to G9 = station numbers BLS-G1 to BLS-G9; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries.

3.2.6 Reef dives at Blowhole Point South

A large reef extends for at least 200 m to the southeast of Blowhole Point into the channel, to approximately 60 m depth and it is approximately 230 m distant from the NE corner of the site. The reef provides habitat for a high diversity of macroalgae, and sessile and mobile fauna, and associated reef, demersal and pelagic fish species (Dive 1 in Table 3-6). A smaller inshore reef was also surveyed by divers (Dive 2 in Table 3-6). Taxa noted on this reef were all common and widespread taxa in the outer Marlborough Sounds region.

Table 3-6: Features noted in the reef dives at Blowhole Pt South (Dives 1 and 2)

DIVE 1 Blowhole Pt Reef			
Habitat	**Depth (m)**	**Conspicuous/notable biota**	**Fish**
Bedrock	3	Coralline paint, tufting green algae Kina, Anemones (*Anthothoe albocincta*), *Turbo*	Blue Cod
Bedrock, Sand Kelp stands	4.4	*Carpophyllum maschalocarpum* Grey ascidian, *Ancorina*, Triplefin, kina, *Anomia*, Coralline paint	
Bedrock and sand terraces, Kelp	5	Paua, Coralline algae, *Ecklonia radiata*	Banded wrasse, blue cod, red moki,
Bedrock and sand patches	10	Coralline paint	Kahawai (*Arripis trutta*), Kingfish (*Seriola lalandi*), Blue Cod
Bedrock (High relief) sand terraces	13 - 17	*Galeolaria*, Ancorina, *Anthothoe albocincta* (abundant), Yellow Sponge Brittlestars (*Ophiopsammus maculata)*, feather hydroids	Wrasse, Red Moki, Tarakihi
Bedrock (High relief) and sand and shell gravel terrace	19 -23	Cup coral *(Monomyces rubrum)*, anemones, 11 arm starfish, Brittlestars, hydroids	Sweep (*Scopus lineolate*), Butterfly perch (*Caesioperca lepidoptera*)
DIVE 2 Small Inshore Reef			
muddy Sand	12.9	Scallops (sparse), few hermit crabs (*Pagurus* sp.)	
muddy Sand	14.8	Diatom film	Kahawai (*Arripis trutta*), blue cod, spotties (*Notolabrus celidotus*)
gravel/cobble	10	Kina, common sea cucumber, Brittlestars	blue cod, kahawai, spotties
reef/ bedrock patches	9.8	Anemones, kina, *Australostichopus mollis*, Sponge	
reef/ bedrock patches	8	Anemones, kina, *Australostichopus mollis*, Sponge, *Anomia*, Kelp (*Carpophyllum* spp.)	
reef/ bedrock patches	7.8	Cushion stars , brittlestars	banded wrasse
reef wall	7.7	*Coscinasterias*, *Undaria*, *Ancorina alata*	triplefins, moki

3.2.7 Notable ecological features: Blowhole Point South

Biota at this site was diverse and moderately abundant. Brachiopods (*Terebratella sanguinea* and *Calloria inconspicua*) were found in several samples at positions within and adjacent to the site in dredge and grab samples. The presence of 8 individuals of *Calloria inconspicua* in a single grab sample (G2) and 4 more individuals of that species in a single epibenthic sled sample (D6) indicates that they are relatively common in the vicinity of this site.

The large reef extending to the southeast of Blowhole Point (Figure 3-16) is a significant feature that provides habitat for a diversity of macroalgae, sessile and mobile fauna, and associated reef, demersal and pelagic fishes. Notable taxa seen either on, or associated with the reef included paua, kina and a range of fish including moki, blue cod, butterfly perch, kahawai and kingfish. This reef and smaller patches of bedrock, cobble and sand comprise blue cod habitat present around the entire shoreline of the site.

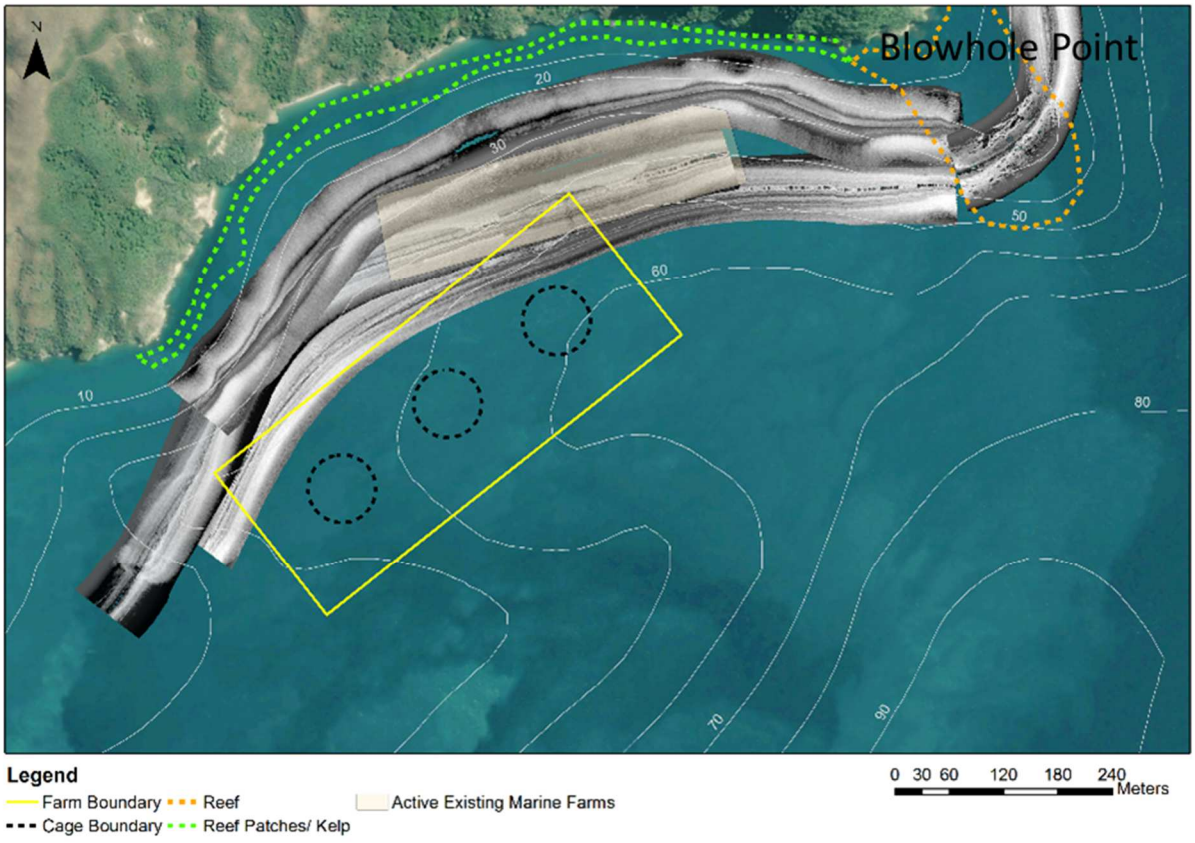

Figure 3-16: Location of notable ecological features at Blowhole Point South. Large reef at top right and bedrock, cobble, sand areas inshore of the site. Boundaries of notable ecological features are approximate.

3.3 Waitata Reach Mid-Channel - North (125) and South (118), Pelorus Sound

3.3.1 Waitata Reach general site information, station depths and locations

Initially two sites were proposed for mid Waitata Reach (Waitata North site 125 and Waitata South site 118), but this was amended to a single extended site at Waitata North (125). This is a deep site located in the centre of Waitata Reach between Burnt Point and Post Office Point. It is situated over an almost flat, sandy mud substratum where depths range from 61 to 64 m (Figure 3-17). Sample stations are shown in Figure 3.18. The depth of the water column at this site precluded dive transects and video sled transects. To compensate for this, extra drop camera stations and benthic dredge tows were conducted at the northern block (125).

Preliminary data from the ADCP deployment at the Waitata North site indicated that current flows there are tidally-dominated and aligned with the axis of the channel, with flows in a NE/SW orientation. Current speeds were high at this site, with 52% of the measured profiles exceeding 20 cm s^{-1}, 8% of profiles exceeding 40 cm s^{-1}, and the top 2% exceeding 50 cm s^{-1}. Throughout the data collection period, on average the upper water column was dominated by a NNE flow, whereas the lower part of the water column was more in the SW direction.

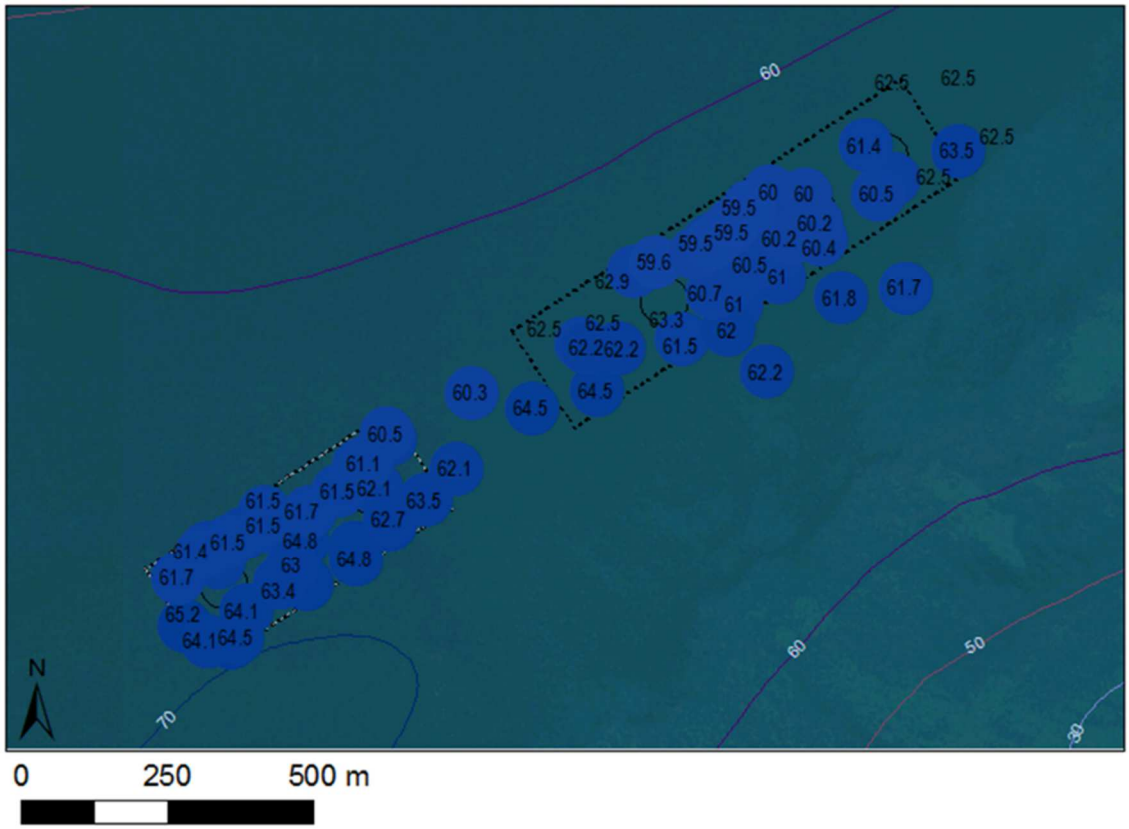

Figure 3-17: Station depths for Waitata Reach North and South. Colour depicts depth from shallow (white) to dark blue (deep), central values are depths in metres.

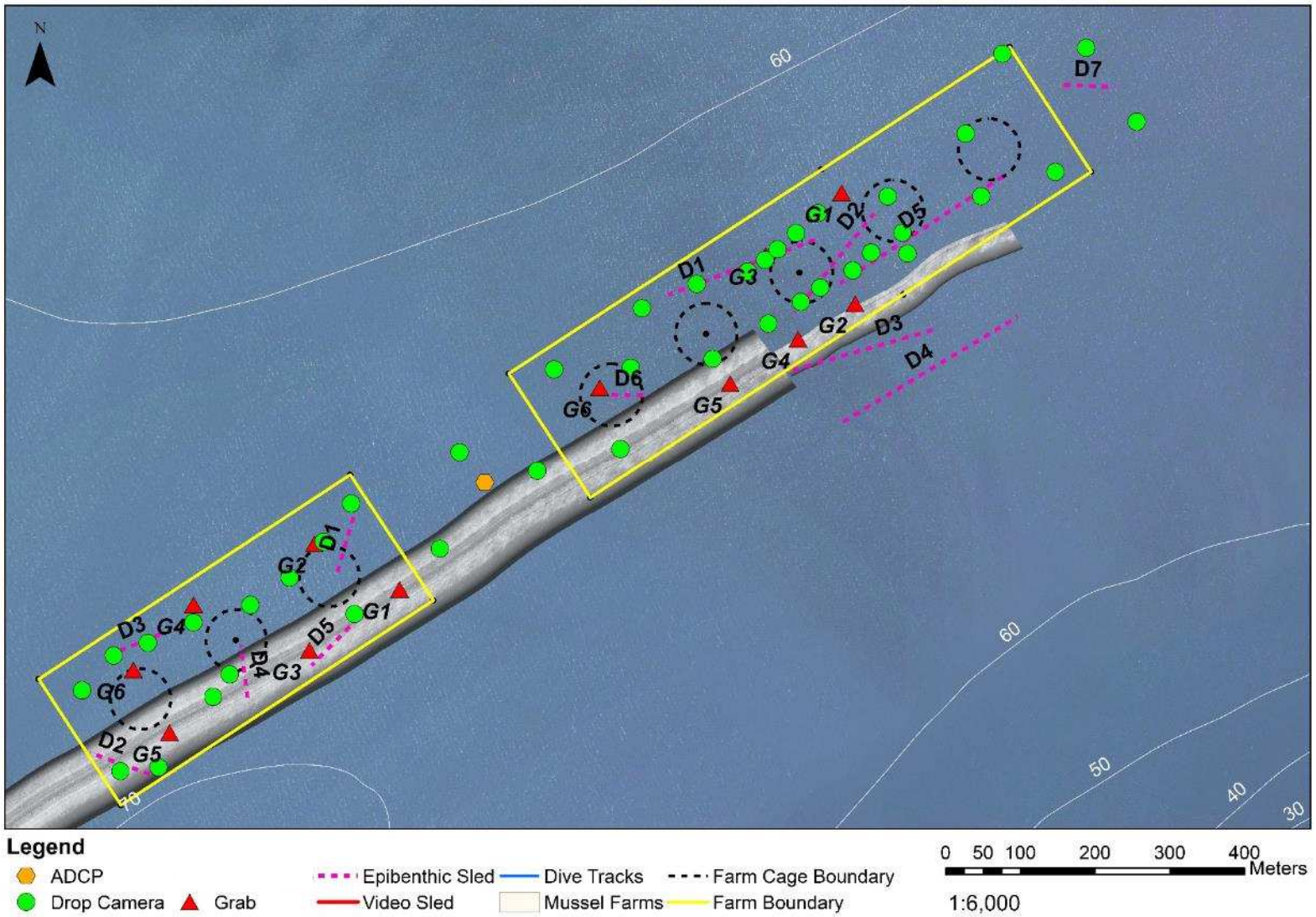

Figure 3-18: Survey sample locations at the Waitata North (125) and Waitata South (118) sites. Grey band is 100 m wide side-scan swath.

3.3.2 Sediment composition at Waitata North

Six grab samples were collected in depths of 60-61 m under the proposed Waitata North Farm Site, with another six grab samples collected in depths of 61-64 m in the initially proposed South site (Table B-1, Figure 3-19a). Visual inspection of the cores found muddy sediments that were grey-brown in colour in both the north and south sites (Table B-1, Figure 3-19b). Grain size analyses for this farm site, found sediments comprised a slightly higher percentage of mud (65.48% ± 1.72 SE), with sand (33.46% ± 1.43 SE), but very little gravel (1.06% ± 0.51 SE). Sediments at Waitata South also comprised a relatively high proportion of mud (60.49% ± 2.01 SE) with slightly more sand (36.92% ± 1.06 SE), but again low amounts of gravel (2.57% ±1.06 SE). A faint sulphide smell was also detected in the sediments at N2 [=WAN-G2], N5 [=WAN-G5] and S6 [=WAS-G6] stations, with mild enrichment noted at site S5 [=WAS-G5] (Table B-1,), indicating that sediments may be poorly oxygenated at those stations.

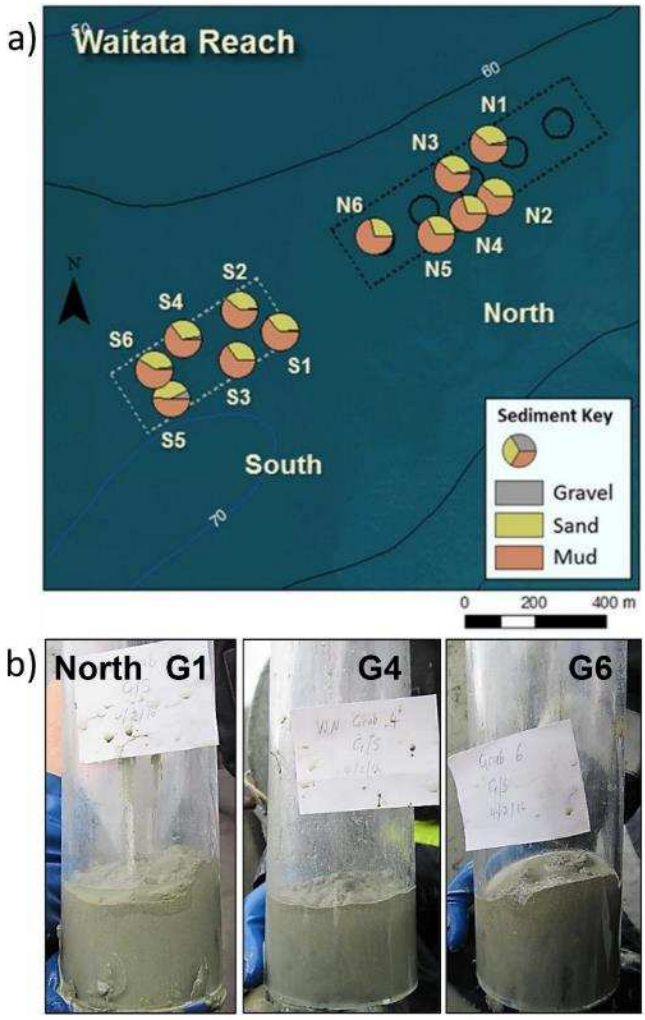

Figure 3-19: Grain size composition (% dry weight) and visual characteristics of sediments collected within the proposed Waitata Reach Farm Site. a) Grain size distribution plots; N1 to N6 = station numbers for Waitata North (WAN-G1 to WAN-G6), S1 to S6 = station numbers for Waitata South (WAS-G1 to WAS-G6); Light-grey dashed-lines indicate the initial farm site south, black dashed-line indicates the revised farm site (north only), solid-lines indicate the revised Cage boundaries. b-c) Examples of the visual characteristics of sediment cores from sites at b) Waitata North (e.g. N1, N4, and N6) .

3.3.3 Habitats and Communities at Waitata Reach North

The habitat throughout this deep site was sandy mud (Figure 3-20, Figure 3-21), and the community at that depth was almost exclusively faunal, with no macroalgae recorded from the grab, dredge or drop cam samples. The invertebrate community was sparse throughout the entire site except for an area of moderate densities near the centre of the northern block (125) (Figure 3-21). The species assemblage sampled in the epibenthic sled tows comprised taxa that are known to be widespread and common in the Marlborough Sounds deep mud habitat (e.g. McKnight and Grange 1991). Fan shells were the most common taxon seen in drop cam images. Two scallops were recorded within epibenthic sled tow samples from within the southern site (118), but no scallops were sampled from within the north site (125). Two brachiopods were noted in epibenthic sled tows from within the north site and one from dredge tow samples in the south site. Two long-stemmed hydroids were present in samples from the south site, but none were sampled from the north site.

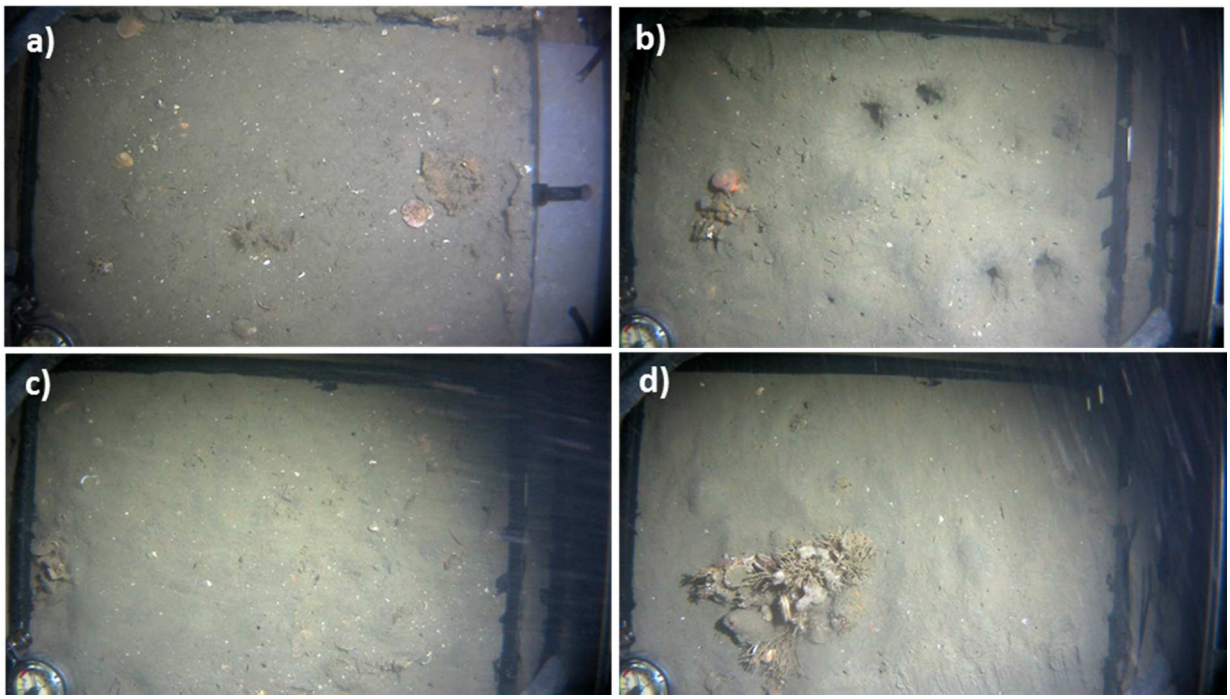

Figure 3-20: Examples of Drop camera photos from within Waitata North Site (125). a) Mud with fan shell; b) Mud with fan shell and infauna holes; c) Mud; d)Mud with small biogenic clump of bryozoans and solitary and colonial ascidians.

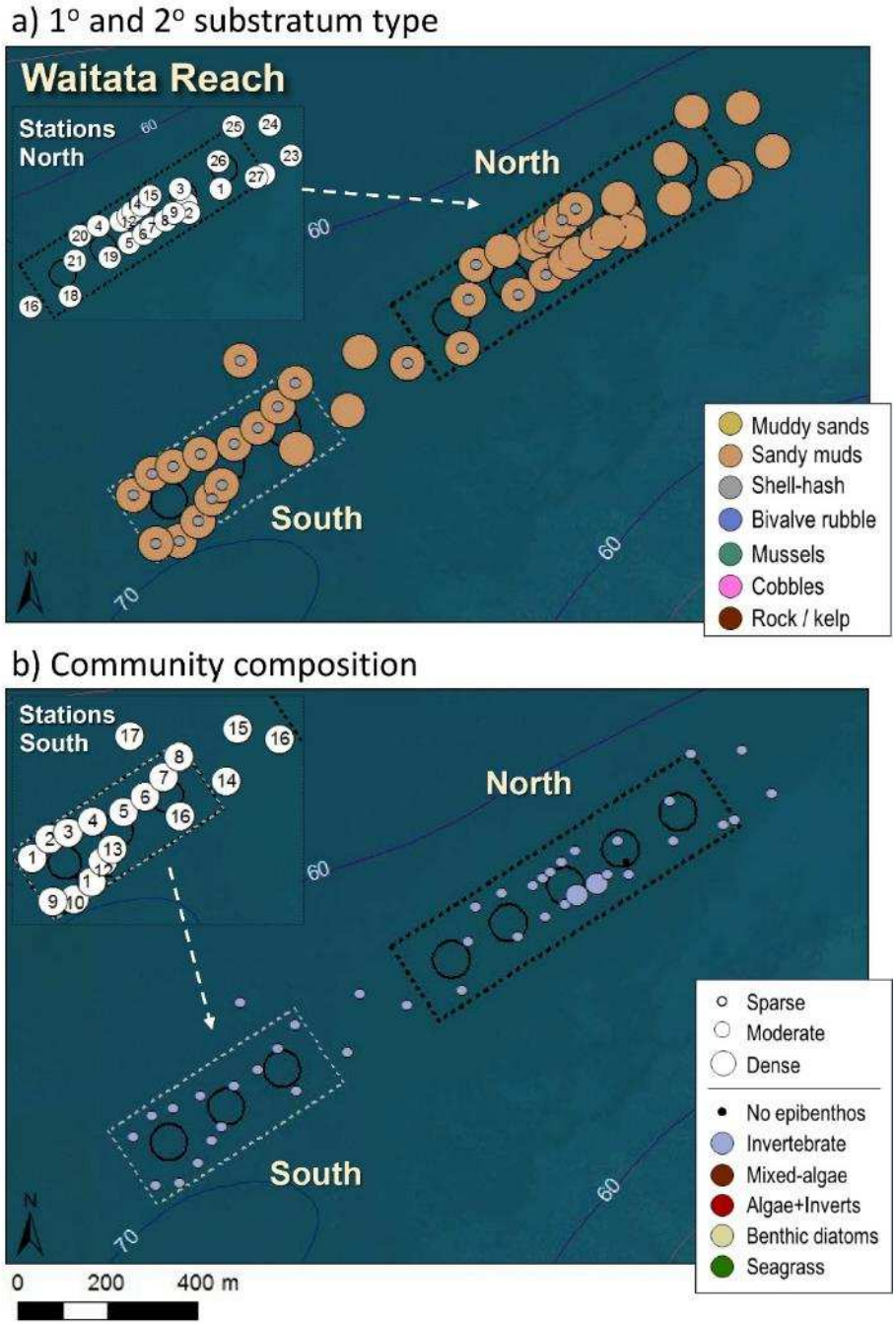

Figure 3-21: Benthic habitat and community composition from drop-camera photo-quadrats within and adjacent to the proposed Waitata Farm Site. a) Primary and Secondary substratum type for Waitata North and Waitata South drop-camera stations. Large circles = primary substrata (most dominant habitat: ≥50% of cover), inner smaller circles = Secondary substrata (20-50% of quadrat). For example, rock with some sand will have a large dark brown circle with an inner yellow circle, while homogenous sand would be all yellow. b) Community composition. Circle colour denotes community types, while circle size denotes rank abundance (sparse <10% cover; moderate = 10-50% cover, dense = >50% cover). Light-grey dashed-lines indicate the initial farm site south, black dashed-line indicates the revised farm site (north only), solid-lines indicate the revised Cage boundaries. Depth contours are in metres.

3.3.4 Epifaunal collection at Waitata Reach North

A total of 127 epifauna from 23 different taxa was recorded from five epibenthic sled tows collected within and adjacent to the proposed Waitata Reach North Farm Site (Table 3-7). Similar catches were recorded from the five epibenthic sled tows collected at Waitata Reach South where 146 epifauna from 26 species were collected (Table 3-5), with a total of 37 different taxa/species collected from the combined Waitata Reach region. Catches at Waitata North were dominated by crustaceans (46% of North-catch), bivalves (30.6%) gastropods (2.4%) and brittlestars (3.7%). Dominant and characteristic species at Waitata North included Hermit crabs, *Pagurus* sp. (17.3%), Crabs, *Ebalia laevis* (13.7%), the epiphytic NZ fan shells, *Talochlamys zelandiae* (11.8%), Heart urchins, *Echinocardium cordatum* (11.8%), Strawberry cockles, *Pratulum pulchellum* (9.5%), File shells, *Limaria orientalis* (6.2%), Decorator crab, *Notomithrax* sp. (6.2%) and Red half-crabs, *Petrolisthes novaezelandiae* (4.7%) (Table 3-7, Figure 3-22). Although composition of catches were similar between Waitata Reach North and South, stations in the south supported higher numbers of bivalves (mostly Strawberry cockles, *P. pulchellum* and file shells, *L. orientalis*) and the Red half-crabs, *P. novaezelandiae*, while stations in the north supported higher numbers of hermit crabs and *E. laevis* (Table 3-7).

Notable taxa within the proposed Waitata Reach North Farm Site were brachiopods (2 specimens - stations N3 and N5) (Table 3-7).

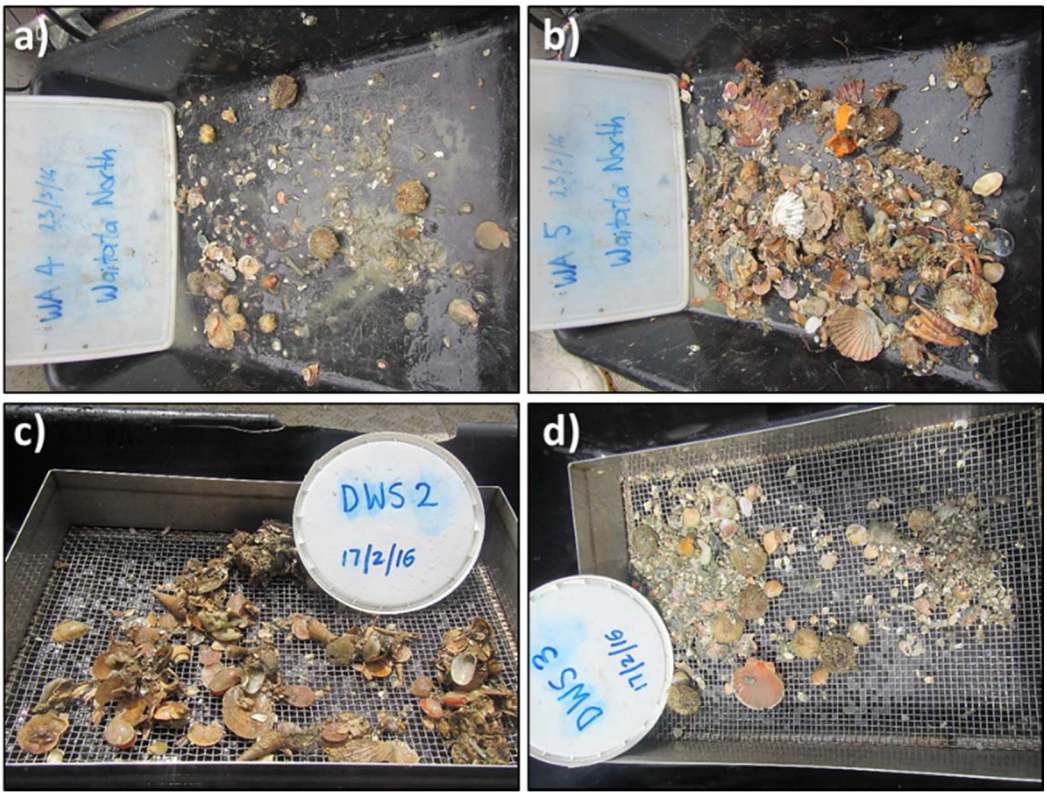

Figure 3-22: Examples of epifauna collected in epibenthic sleds within and adjacent to the proposed Waitata Reach Farm Site. a-b) Waitata Reach North, c-d) Waitata Reach south. Catches included some shell debris with characteristic species including: the file shell (*Limaria orientalis*), heart urchin (*Echinocardium cordatum*), scallops (*Pecten novaezelandiae*), hermit crabs (Pagurus sp.) and the NZ fan shell (*Talochlamys zelandiae*).

Table 3-7: Relative abundance of epifauna collected in epibenthic sleds within and adjacent to the proposed Waitata Reach Farm Site, Pelorus Sound. "N-Tabd"and "S-Tabd" = Total infaunal abundance for all northern and southern sites, respectively; Columns N1 to N6 = station numbers for Waitata North (WAN-G1 to WAN-G6), S1 to S6 = station numbers for Waitata South (WAS-G1 to WAS-G6); "✓"= present (1-4 specimens, "C" = common (5-9 specimens), "A"=abundant (>10 specimens). Tabd >= 5 are in blue text.

Taxa group	Common name	Taxa/Species	Waitata North						Waitata South				
			N-Tabd	N1	N2	N3	N4	N5	S-Tabd	S1	S2	S3	S4	S5
Ascidiacea	Colonial sea squirt	*Cystodytes dellachiajei*							2		✓			✓
Ascidiacea	Saddle sea squirt	*Cnemidocarpa bicornuta*	2			✓		✓	1					✓
	Carpet sea squirt	*Didemnum* sp	1					✓						
	Colonial sea squirt	*Leptoclinides novaezelandiae*	1					✓						
Bivalvia	NZ fan shell	*Talochlamys zelandiae*	15	✓		A	✓	✓	16	✓		✓	C	C
	Strawberry cockle	*Pratulum pulchellum*	12		✓		✓	C	32	✓		C	✓	A
	File shell	*Limaria orientalis*	8			✓		C	15		C		C	✓
	Corbula clam	*Corbula zelandica*	2			✓	✓							
	Sunset shell	*Gari lineolata*							3	✓		✓	✓	
	NZ scallop	*Pecten novaezelandiae*							2	✓		✓		
	Dredge oyster	*Ostrea chilensis*	1			✓								
	Bivalve	*Dosina mactracea*							1				✓	
	Impact mussel	*Musculus impactus*							1					✓
Brachiopoda	Brachiopod	*Calloria inconspicua*	2			✓		✓						
	Red-ribbed brachiopod	*Terebratella sanguinea*	0						1				✓	
Bryozoa	Branching bryozoan	Bryozoa branching	3			✓								
Chordata	Triplefin	*Forsterygion* sp.	1					✓						
Crustacea	Red swimming crab	*Nematocarcinus* sp							3			✓		
	Hermit crab	*Pagurus* sp	22		✓	A		A	1				✓	
	Crab	*Ebalia laevis*	17		✓	✓	C	C	4	✓		✓		
	Decorator crab	*Notomithrax* sp	8			✓	✓	✓	3	✓			✓	
	Red half-crab	*Petrolisthes novaezelandiae*	6	✓	✓	✓	✓	✓	20	✓	✓		C	A
	Rough rock crab	*Nectocarcinus integrifrons*	3		✓			✓						

Taxa group	Common name	Taxa/Species	Waitata North						Waitata South				
			N-Tabd	N1	N2	N3	N4	N5	S-Tabd	S1	S2	S3	S4	S5
	Spider crab	*Halicarcinus* sp	1			✓								
Echiniodea	Heart urchin	*Echinocardium cordatum*	15			✓	A	✓	14	✓		C	✓	✓
Gastropoda	Olive shell	*Amalda mucronata*							2				✓	✓
	Knobbed whelk	*Austrofusus glans*	2					✓						
	Screw shell	*Maoricolpus roseus*	1					✓	4	✓	✓			✓
	Slipper limpet	*Sigapatella* sp							1		✓			
	Whelk	Whelk							1					✓
Holothuroidea	Sea cucumber	Holothurian							2			✓		
Hydrozoa	Hydroid	Hydroid	1					✓						
	Hydroid sp. 1	*Nemertesia* sp..							2	✓			✓	
Ophiuroidea	Brittle star	Ophiuroid							8				✓	C
	Brittle star	Ophiuroid sp1 (small pink)							2	✓				
Polychaeta	Sea mouse	Aphroditiidae							3					✓
Porifera	Sponge	Sponge	1	✓										

3.3.5 Infauna at Waitata North

A total of 403 infauna from 52 different taxa was recorded from 6 replicate grab samples collected within the proposed Waitata Reach North farm site (Table D-3; Figure 3-23a-b). Infaunal numbers were moderately low at most stations (mean site abundance of 67.17 ± 16.38 SE), with markedly more infauna collected from station N6 (Figure 3-23a-b). However, this was driven by slightly higher catches of the same taxa as found at other stations within this site. In contrast, the number of taxa collected were relatively consistent between stations (19.83 species ± 3.24 SE). Infaunal assemblages at Waitata North were characterized by a mix of amphipods (30.3% of total catch), polychaete worms (27%: from a suite of families, including Glyceridae, Lumbrineridae, Cossuridae, Cirratulidae, Spionidae, Maldanidae, Flabelligeridae), cumaceans (15.4%) and bivalves (12.2%: e.g. *Ennucula str*angei and *Linucula hartvigiana*), along with low numbers of Heart urchins (*Echinocardium cordatum*) and the occasional Sea cucumber *(Pentadactyla longidentis* and *Heterothyone alba*) (Table D-3; Figure 3-23b). Waitata Reach South supported similar infaunal abundances (mean site abundance of 77.83 ± 14.74 SE), species richness (23.5 species ± 3.0 SE), and species composition (Table D-4, Figure 3-23a-b) to those found at Waitata Reach North. No notable taxa were recorded from either Waitata Reach North or South (Table D-3 and Table D-4).

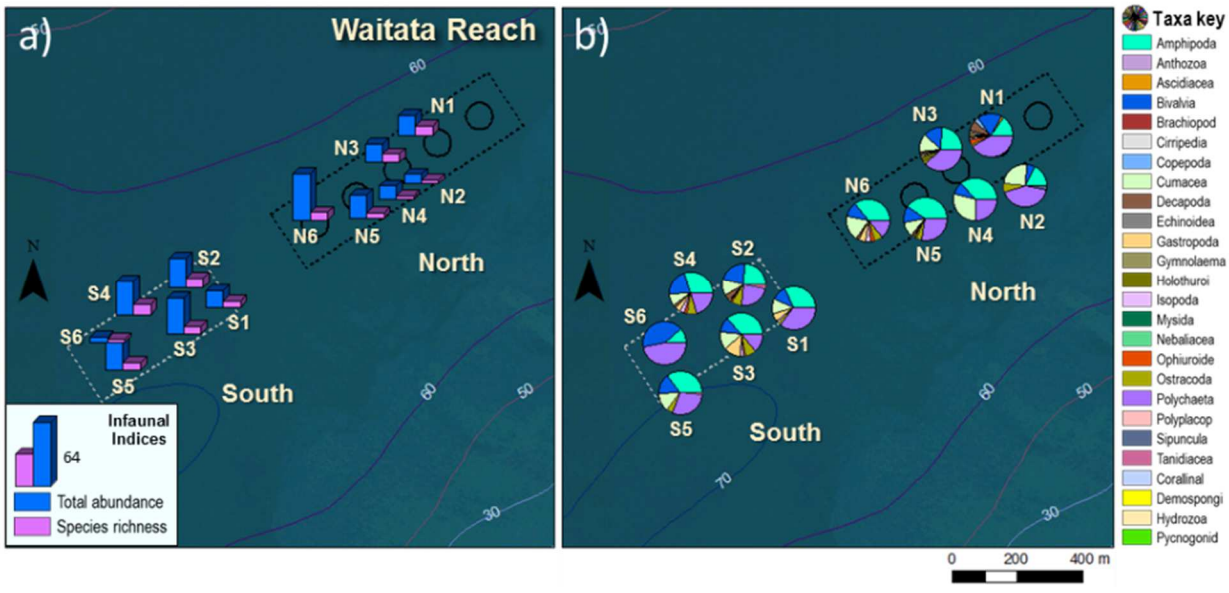

Figure 3-23: Infaunal summary indices and taxonomic grab sampling stations within the proposed Waitata Reach Farm Site. a) Infaunal total abundance and species richness, b) pie charts showing the taxonomic composition of each sample. N1 to N6 = station numbers for Waitata North (WAN-G1 to WAN-G6), S1 to S6 = station numbers for Waitata South (WAS-G1 to WAS-G6); Black dashed-line indicates the revised farm site north, brown dashed-line indicates the earlier farm site south, solid-lines indicate the revised Cage boundaries.

3.3.6 Notable ecological features: Waitata North

There were no features of special ecological importance identified from the survey at this site. The benthic habitat at the site was sandy mud in deep water, and the macrobenthos comprised a sparse to moderately dense faunal community of taxa that are widespread and common within the Marlborough Sounds region (e.g. McKnight & Grange 1991). Brachiopods (*Terebratella sanguinea*) were noted from dredge tow samples in the north farm block (site 125), but these were single isolated individuals, indicating that their distribution was sparse rather than occurring in a dense bed. Two scallops were recorded from within the south site (118), but none were sampled from the north site (125). No notable species were recorded from grab samples.

3.4 Richmond Bay South (106), Pelorus Sound

3.4.1 Richmond South, general site information, station depths and locations

The proposed 13.75 Ha site is located south of Richmond Bay on the east side of Waitata Reach, between The Reef and Te Kaiangapipi. The farm boundaries are positioned over a sloping seabed in depths between 30 and 56 m (Figure 3-24). Sampling locations are shown in Figure 3-25.

Figure 3-24: Drop Camera station depths at Richmond Bay South. Colour depicts depth from shallow (white) to dark blue (deep), central values are depths in metres.

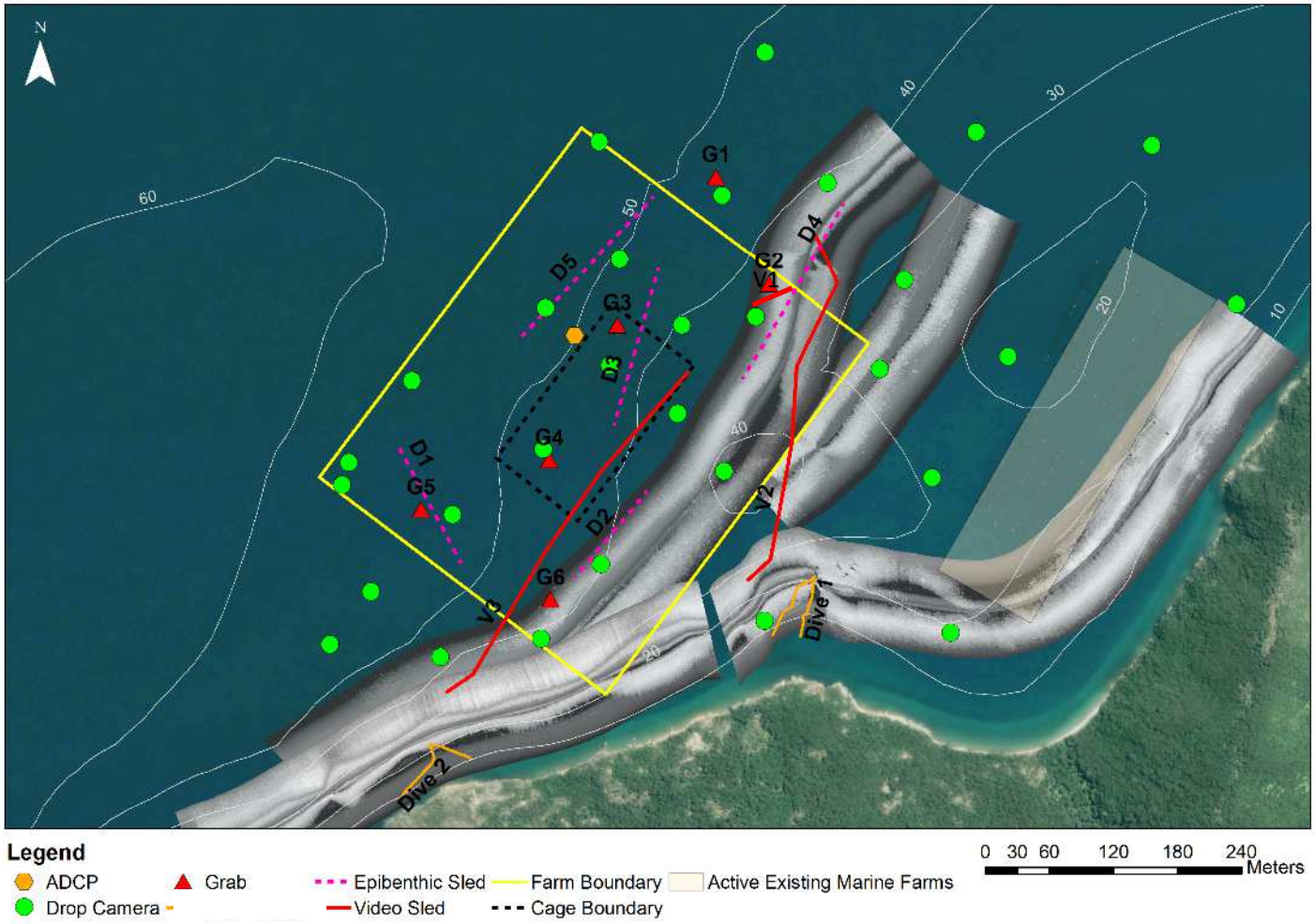

Figure 3-25: Survey sample locations at the Richmond South site. Grey bands are 100 m wide sidescan swaths.

3.4.2 Sediment composition Richmond South

Six grab samples were collected in depths of 37-53 m under the proposed Richmond Bay Farm Site (Table B-1, Figure 3-26a). Visual inspection of the cores found muddy sediment grey-brown in colour that were clean (i.e. devoid of gravel or shell material) (Table B-1, Figure 3-26b). Grain size analyses for this farm site, found sediments were comprised mostly of mud (88.33% ± 1.85 SE) with some sand (11.25% ± 1.75 SE) and negligible amounts of gravel (0.43% ± 0.16 SE).

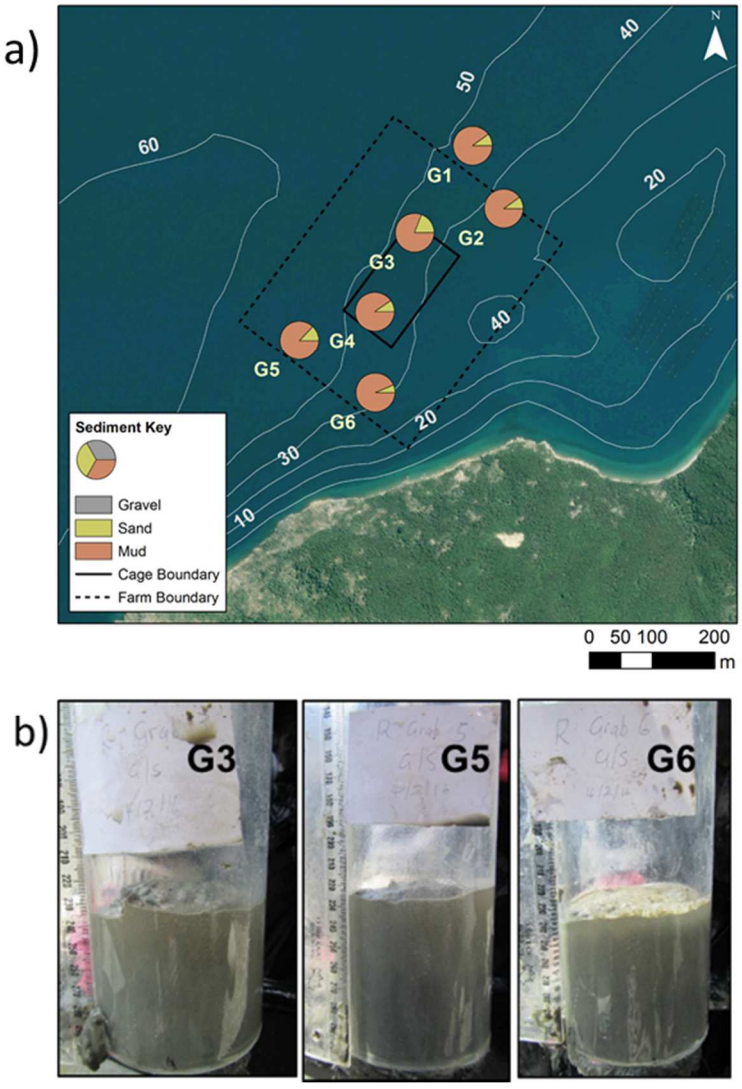

Figure 3-26: Grain size composition (% dry weight) and visual characteristics of sediments collected within the proposed Richmond Bay Farm Site. a) Grain size distribution plots. G1 to G6 = station numbers RIC-G1 to RIC-G6; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries; b-d) Examples of the visual characteristics of sediment cores (e.g. G3, G5 and G6) from this site.

3.4.3 Habitats and Communities at Richmond South

The habitat throughout was homogenous mud with small polychaete worm tubes and uniformly distributed mounds and hollows (Figure 3-27a,b and Figure 3-28a,b). Scallops were commonly seen in all video transects at depths between 50m and ~30m (Figure 3-27c, Table 3-9) and were noted as present in dredge samples (section 3.4.4). Feather hydroids and opalfish were also commonly seen throughout video footage and were sampled in epibenthic sled tows. Small isolated biogenic clumps composed of hydroids, sponges, ascidians, bivalves (e.g. *Talochlamys* sp.) and red and green macroalgae occurred in a scattered distribution at depths less than ~40 m, and became larger and more common at shallower depths inshore of the farm site (Figure 3-27d). The abundance of mobile epifauna including brittlestars, eleven arm starfish and several species of gastropods increased as the seabed profile shallowed to 25m.

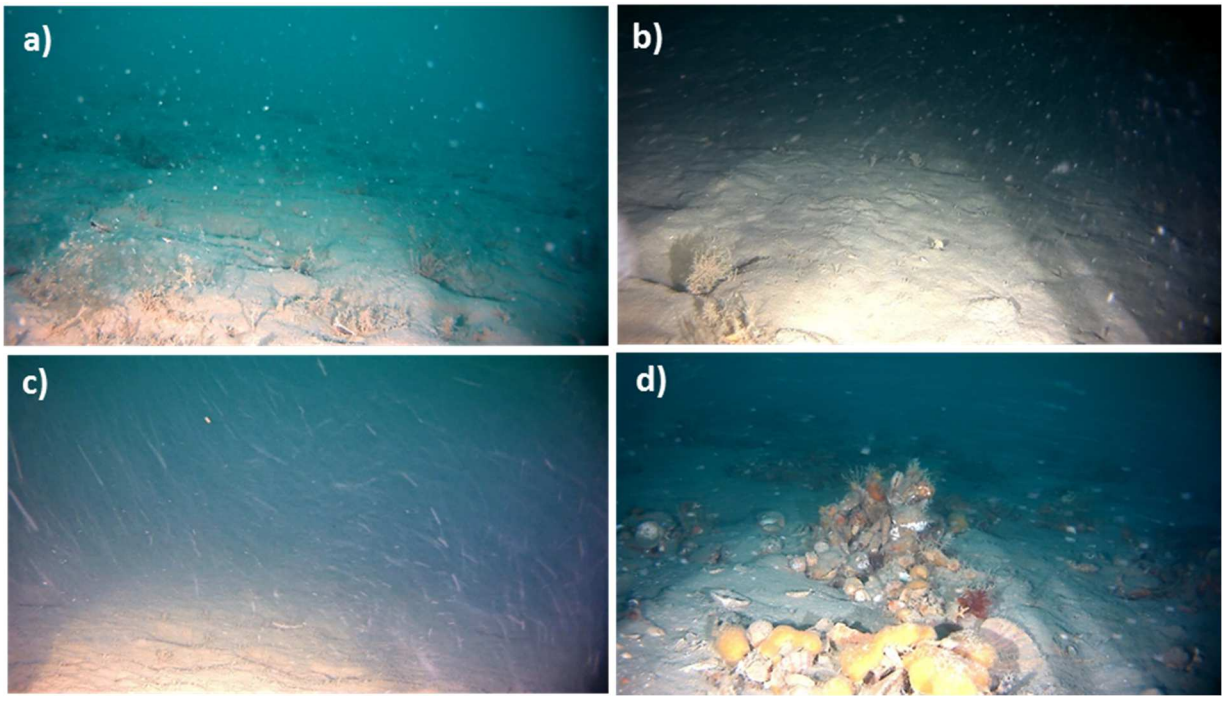

Figure 3-27: Habitat at the Richmond South site. a) Mud habitat with hydroids and small mounds and hollows; b) Mud habitat with very sparse biota; c) Mud habitat with scallop; d) Biogenic clump inshore of the site.

Large reefs extended out from 'The Reef' headland north of the site at the mouth of Richmond Bay, and south of the site from Te Kaiangapipi headland at the mouth of Horseshoe Bay. These large reefs were both more than 500 m away from the proposed farm boundaries, and were considered to be outside the influence of significant depositional effects from the proposed farm activity, so were not investigated during this survey.

Inshore of the site the shoreline comprised alternating cobble, sandy beach and reef habitat. SCUBA dives were conducted to investigate bedrock reefs extending a short way from the shoreline well inshore of the farm site, and these were found to support reef communities typical of the outer Marlborough Sounds (see section 3.4.6).

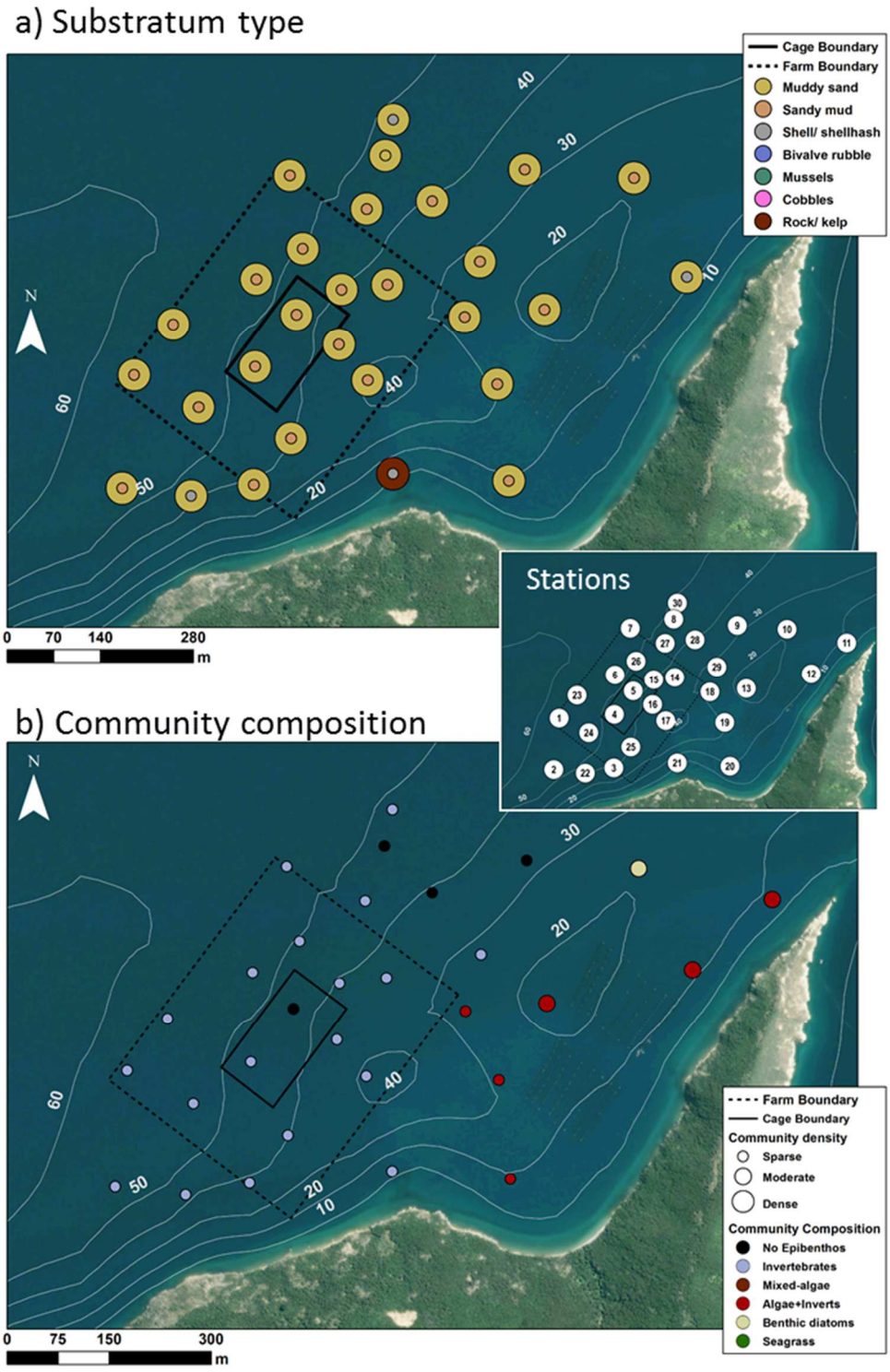

Figure 3-28: Benthic habitat and community composition from drop-camera photo-quadrats within and adjacent to the proposed Richmond Bay Farm Site. a) Primary and Secondary substratum type. Large circles = primary substrata (most dominant habitat: ≥50% of cover), inner smaller circles = Secondary substrata (20-50% of quadrat). For example, rock with some sand will have a large dark brown circle with an inner yellow circle, while homogenous sand would be all yellow. b) Community composition. Circle colour denotes community types, while circle size denote rank abundance (sparse <10% cover; moderate = 10-50% cover, dense = >50% cover). Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries. Depth contours are in metres.

Table 3-8: Ecological features seen in video sled transects, Richmond South.

Video #	Habitat	Depth (m)*	Conspicuous biota
V1	Mud	50	Hydroids (sparse), polychaete worms, scallops (*Pecten novaezelandiae*)
V2	Mud	50	Hydroids (sparse), tube polychaetes, scallops
	Mud	45	Hydroids (sparse), tube polychaetes, scallops
	Mud	35	Biogenic clumps comprised of hydroids, sponges, macroalgae
	Mud Shell debris/rubble	25	Larger biogenic clumps. Hydroids, sponges, red macroalgae, bivalves (e.g. *Talochlamys*), scallops (, colonial ascidians (*Cystodytes dellechiajei*), gastropods, macroalgae
V3	Mud	40 - 36	Tubeworms, scallops (common), polychaete tubes, low turfing red algae, opal fish (*Hemerocoetes monopterygius*). red algae, tubeworms and hydrozoans, sea cucumber (*Australostichopus* sp.), Brittle star (*Ophiopsammus maculata*), scaly gurnard (*Lepidotrigla brachyoptera*)

*Depths in this summary table are only indicative and not corrected for chart datum

3.4.4 Epifaunal collection at Richmond South

The Richmond South Farm Site was relatively depauperate of epifauna, with only of 70 epifauna specimens from 21 different taxa recorded in the five epibenthic sled tows collected within and adjacent to the proposed Richmond Bay Farm Site (Table 3-9). Catches were dominated by echinoderms (38.6% of total catch), crustaceans (25.7%) and bivalves (15.7%). Dominant and characteristic species included heart urchins, *Echinocardium chordatum* (38.6% of total catches), Hermit crabs, *Pagurus* sp (10%, most from station 5), Red half-crabs, *Petrolisthes novaezelandiae* (10%), as well as the occasional bivalve (e.g. *Pecten novaezelandiae*, *Pratulum pulchellum, Limaria orientalis*) and gastropod snail (e.g. *Strutholaria vermis*) (Table 3-9, Figure 3-29). Catches contained very little shell debris (e.g. Figure 3-29a-d).

Notable taxa included occurrences of scallops, *Pecten noveazelandiae* (3 specimens - stations 1, 2 and 3), rare occurrences of the Dredge oyster, *Ostrea chilensis* (1 specimen - station 3), the tube-building fanworm, *Galeolaria* sp. (1 specimen - station 1), Red-ribbed brachiopod, *Terebratella sanguinea* (1 specimen - station 5,), and an Erect Bryozoan (1 specimens - station 5) (Table 3-9).

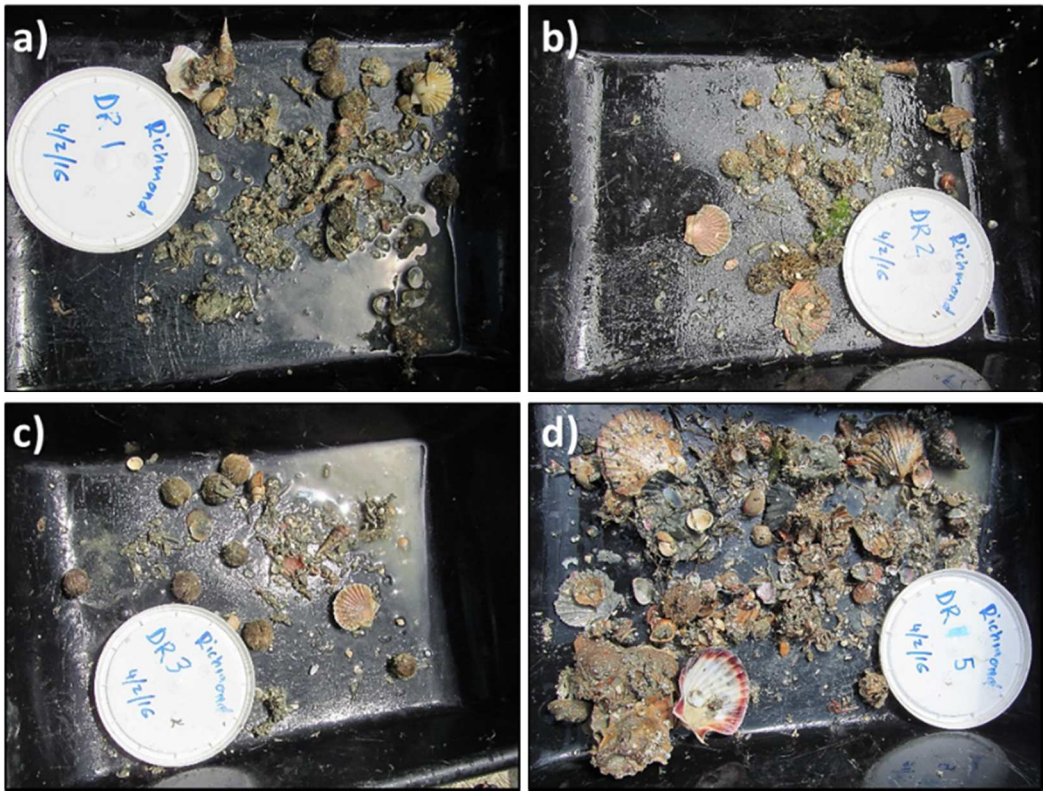

Figure 3-29: Examples of epifaunal collected in epibenthic sleds within and adjacent to the proposed Richmond Bay Farm Site. Characteristic species include: the heart urchins (*Echinocardium cordatum*), hermit crabs (*Pagurus* sp.) and the occasional scallop (*Pecten novaezelandiae*) and file shell (*Limaria orientalis*).

Table 3-9: Relative abundance of epifauna collected in epibenthic sleds within and adjacent to the proposed Richmond Bay Farm Site, Pelorus Sound. "Tabd"= Total infaunal abundance; Columns 1-5 depict replicate dredges RIC-D1 to RIC-D5; "✓"= present (1-4 specimens), "C" = common (5-9 specimens), "A"=abundant (>10 specimens). Tabd >= 5 are in blue text.

Taxa group	Common name	Taxa/Species	Richmond Bay				
			Tabd	1	2	3	4	5
Ascidiacea	Saddle sea squirt	*Cnemidocarpa nisiotis*	2					✓
Bivalvia	NZ scallop	*Pecten novaezelandiae*	3	✓	✓	✓		
	Strawberry cockle	*Pratulum pulchellum*	3			✓		
	File shell	*Limaria orientalis*	2					✓
	NZ fan shell	*Talochlamys zelandiae*	2	✓		✓		
	Dredge oyster	*Ostrea chilensis*	1			✓		
Brachiopoda	Red-ribbed brachiopod	*Terebratella sanguinea*	1					✓
Bryozoa	Bryozoa	Bryozoan	1					✓
Crustacea	Hermit crab	*Pagurus* sp	7			✓		C
	Red half-crab	*Petrolisthes novaezelandiae*	7	✓	✓			✓
	Decorator crab	*Notomithrax* sp	2			✓		✓
	Crab	*Ebalia laevis*	1			✓		
	Spider crab	*Halicarcinus* sp	1				✓	
Echinoidermata	Heart urchin	*Echinocardium cordatum*	27	C	✓	C	C	✓
Gastropoda	Snail	*Strutholaria vermis*	3		✓			
	Olive shell	*Amalda novaezelandiae*	2			✓	✓	
	Nudibranch	Nudibranch	1		✓			
	Olive shell	*Amalda mucronata*	1		✓			
Hydrozoa	Hydroid	Hydroid	2			✓		✓
Polychaeta	Tube-building fanworms	*Galeolaria* sp	1	✓				

3.4.5 Infauna at the Richmond South

A total of 239 infauna from 47 different taxa was recorded from 6 replicate grab samples collected within the proposed Richmond Bay Farm Site (Table D-5a-b). This farm site supported the lowest mean abundance of infauna (mean abundance of 39.83 ± 10.34 SE, range 23-74 individuals) compared to the other proposed farms described in this report, and low numbers of infaunal species (15.5 species ± 2.51 SE, range 10-25 species per grab (Figure 3-30a). Infaunal assemblage composition at the Richmond site was characterized by a mix of polychaete worms (29.7% of total catch: from a suite of families, including Glyceridae, Maldanidae, Capitellidae, Dorvillidae, Lumbrineridae, Spionidae), amphipods (22.6%), cumaceans (15.9%) and bivalves (13%: e.g. *Ennucula strangei* and *Melliteryx parva*) and ostracods (6.3%), and a few Heart urchins (*Echinocardium cordatum*) at station G3 (Table D-5, Figure 3-30b). Notable taxa collected in the grabs at this site included one scallop, *Pecten novaezelandiae* (1 specimen - station G4) (Table D-5).

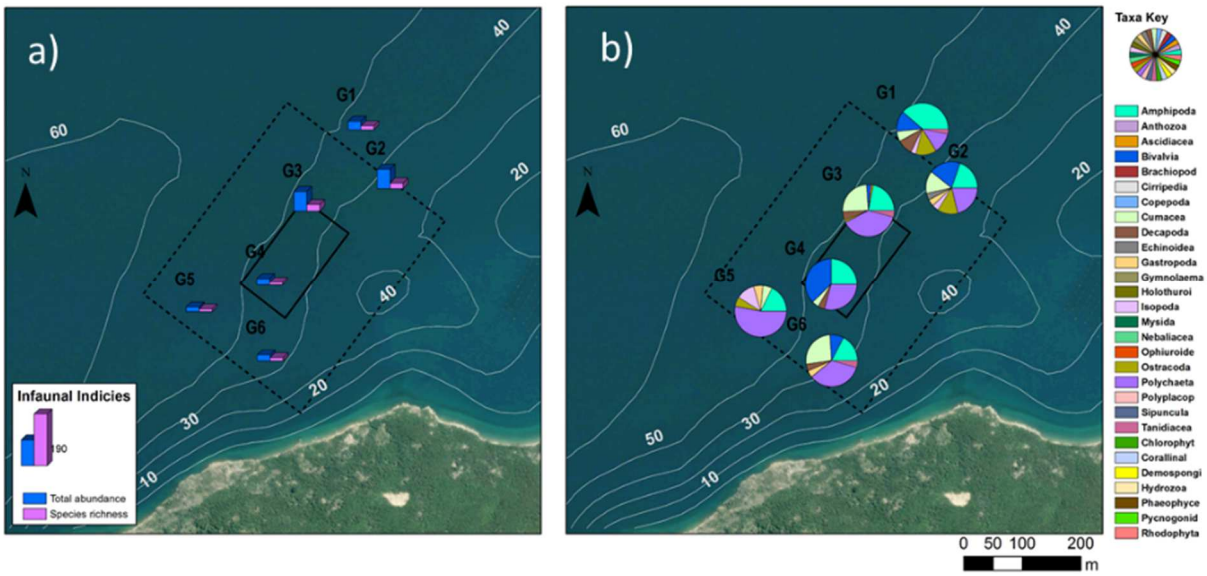

Figure 3-30: Infaunal summary indices and taxonomic grab sampling stations within the proposed Richmond Farm Site. a) Infaunal total abundance and species richness, b) pie charts showing the taxonomic composition of each sample. G1 to G6 = station numbers RIC-G1 to RIC-G6; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries.

3.4.6 Reef dives at the Richmond South

Inshore patch reef and cobble habitat was investigated in Dive 1 (Table 3-10) where rocky patches were interspersed with areas of cobble with sand, both substrates supporting macroalgal stands (*Carpophyllum* and *Caulerpa*). Algal cover decreased with increasing depth and sponges became the dominant biota. The areas of rocky reef supported a more diverse assemblage of encrusting and mobile fauna including kina, and *Galeolaria* tubeworms. On the patches of sand substrate, kina and a burrowing tube anemone (*Cerianthus*) were noted. Fish species seen on this dive included blue cod, tarakihi and goatfish, with large schools of spotties present throughout.

The habitat found in the dive conducted to the south (Dive 2 in Table 3-10) was similar to that in Dive 1, with occasional rocky reef patches interspersed with areas of cobble, both substratum types supporting macroalgae stands (*Carpophyllum*). Again, algal cover decreased with increasing depth and a diverse range of sponges became the dominant biota. Kina and blue cod were common throughout the area, along with a variety of other fauna including individuals and small patches of *Galeolaria* tubeworms.

Table 3-10: Features noted in the reef dives at Richmond South (Dives 1 and 2).

Habitat	Depth (m)*	Conspicuous biota	Fish
DIVE 1 Mid reef dive			
Cobble, algae (carpophyllum, Caulerpa)	2-4	Kina *(Evechinus chloroticus)*, 11 arm starfish (*Coscinasterias muricata)*, anemones, window oyster (*Anomia* sp.)	Spotties (*Notolabrus celidotus*), juvenile blue cod (*Parapercis colias*), banded wrasse (*Notolabrus fucicola*), triplefins
Rock, algae (carpophyllum)	4-6	Gastropods, Catseyes (*Turbo smaragdus*), window oyster, solitary ascidians (*Cnemidocarpa bicornuata*), slaty sponge *Ancorina alata,* anemone (*Ancothoe albocincta*), sea cucumber (*Australostichopus mollis*), 11 arm starfish, Brittlestars (*Ophiopsammus maculata*), cushion star	Spotties
Cobble sand, algae (carpophyllum)	6	Kina *(Evechinus chloroticus)*, Cerianthid anemone, nudibranch	Spotties, triplefins, blue cod
Rock, patches algae (carpophyllum), sponges	8-20	*Galeolaria* , Ophiuroids, kina *(Evechinus chloroticus)*, sea cucumber, sponges (*Ancorina alata,* orange fan, encrusting), Circular saw shell *(Astreaea heliotropium) Galeolaria hystrix*, , hydroid, anemone, 11 arm starfish	Spotties, Goatfish (*Upeneichthys lineatus*), butterfly perch (*Caesioperca lepidoptera*), tarakihi (*Nemadactylus macropterus*), blue cod, common roughy (*Paratrachichthys trailli*)
DIVE 2 Southern reef dive			
Rock, cobble, kelp (carpophyllum)	2-6	Kina, tube worms, sea cucumber, catseyes (*Turbo smaragdus*), sponge (yellow), anemone	Spotties, triplefins, blue cod
Rock, cobble slope with patch kelp	7-17	Kina, 11 arm starfish, tube worms, *Botrylloides*, sponges (finger, *Ancorina alata*), colonial ascidian (yellow), *Coscinasterias muricata*,	Spotties (*Notolabrus celidotus*), triplefins, blue cod (*Parapercis colias*)
Rocks, sand, sponges	18-20	Brittlestars, kina, cushion stars, *Ancorina alata,* tube worms, *11 arm starfish*	Spotties , triplefins, blue cod

3.4.7 Notable ecological features: Richmond South

The habitat on the seabed directly beneath the site was homogeneous mud inhabited by a sparsely distributed epibiota. Sampled epibiota and infauna were mostly taxa known to be common and/or widespread in the region.

Scallops were frequently seen in all video sled transects and were present in some dredge samples, indicating that scallops were relatively abundant within the site and adjacent habitat. Small isolated biogenic clumps composed of hydroids, sponges, ascidians, bivalves and red and green macroalgae were seen in a scattered distribution at depths less than ~40 m, and became larger and more common at shallower depths inshore of the farm site (Figure 3-27d). The abundance of mobile

epifauna including brittlestars, eleven arm starfish and several species of gastropods also increased as the seabed profile shallowed toward the shoreline.

Large reefs extended out from The Reef headland north of the site at the mouth of Richmond Bay, and south of the site from Te Kaiangapipi headland at the mouth Horseshoe Bay. These large reefs were both more than 500 m away from the proposed farm boundaries, and were considered to be outside the likely zone of potential effects of deposition from the proposed farm activity, so were not investigated during this survey.

Inshore of the site the shoreline comprised alternating cobble, sandy beach and reef habitat (Figure 3-31). SCUBA dives were conducted to investigate bedrock reefs extending a short way from the shoreline well inshore of the farm site, and these supported communities comprising taxa typical of Marlborough Sounds reef habitat including a diverse range of macroalgae, sessile and mobile invertebrates, and fishes. All of this inshore area was characteristic of blue cod habitat.

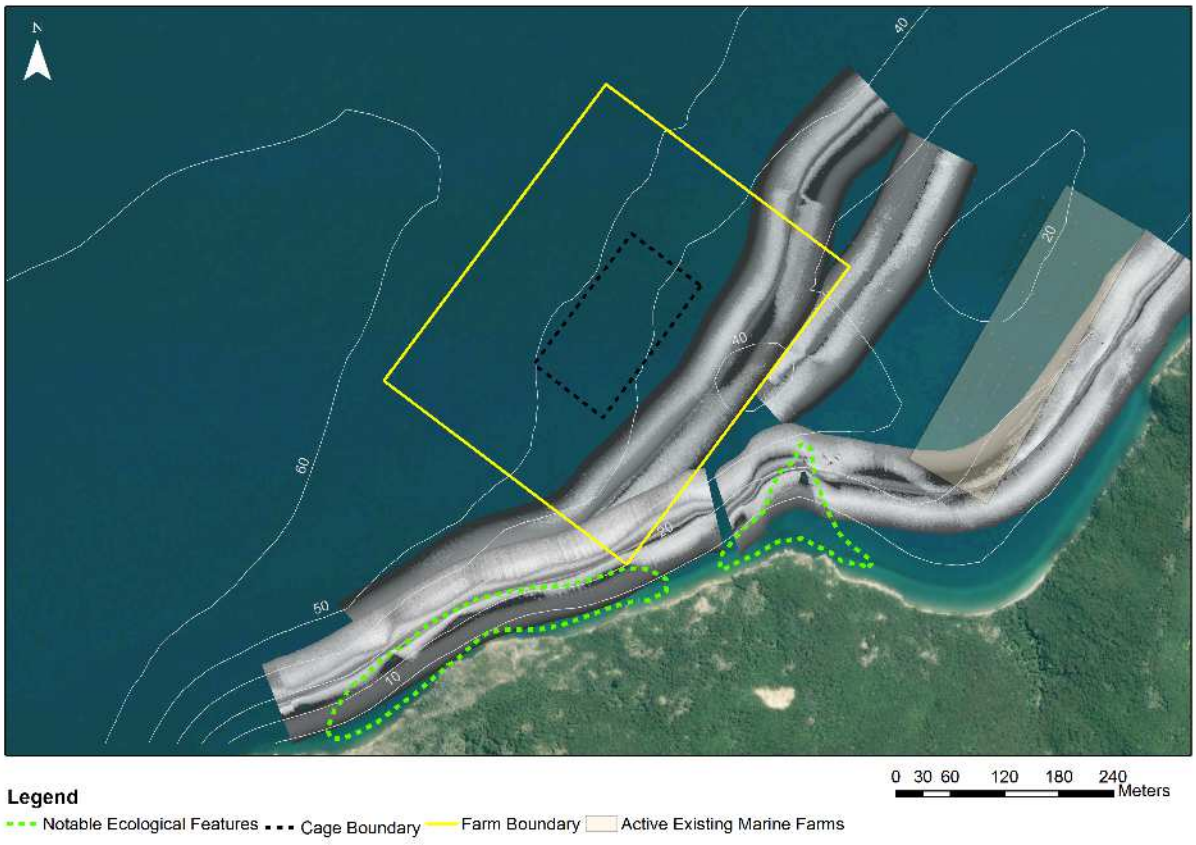

Figure 3-31: Location of notable ecological features at the Richmond South site. A) and B) are areas of rocky reef and cobble habitat. Boundaries of notable ecological features are approximate.

3.5 Horseshoe Bay (124), Pelorus Sound

3.5.1 Horseshoe Bay, general site information, station depths and locations

The proposed 11 Ha site is located on the north side of Horseshoe Bay near Te Kaiangapipi headland. The farm boundaries are positioned over a sloping seabed in depths between 18 and 45 m (Figure 3-32). Sampling locations are shown in Figure 3-32.

Current data provided by the Cawthron Institute from a previous current deployment indicate that the prevalent flow at the Horseshoe Bay site is out of the bay to the northwest, and current speeds were characterised as moderate to high.

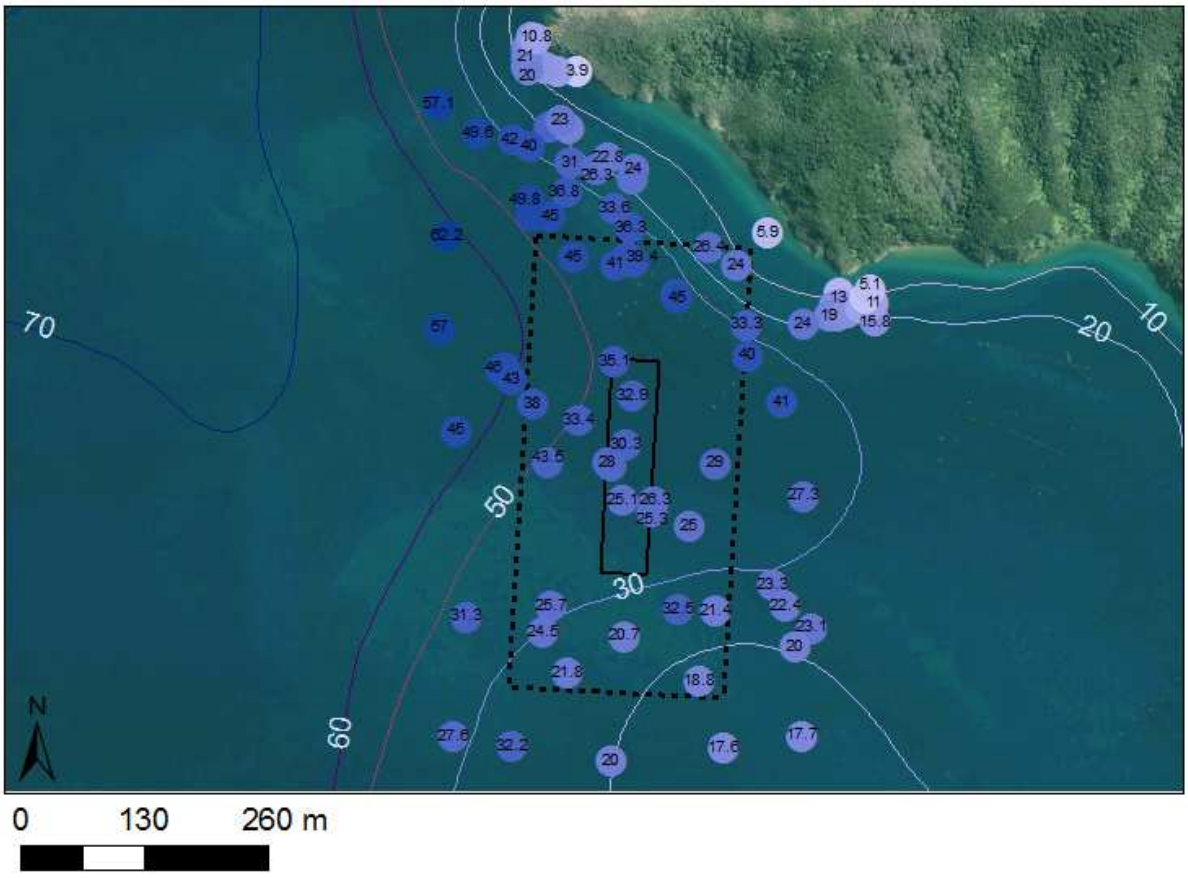

Figure 3-32: Station depths for Horseshoe Bay. Colour depicts depth from shallow (white) to dark blue (deep), central values are depths in metres.

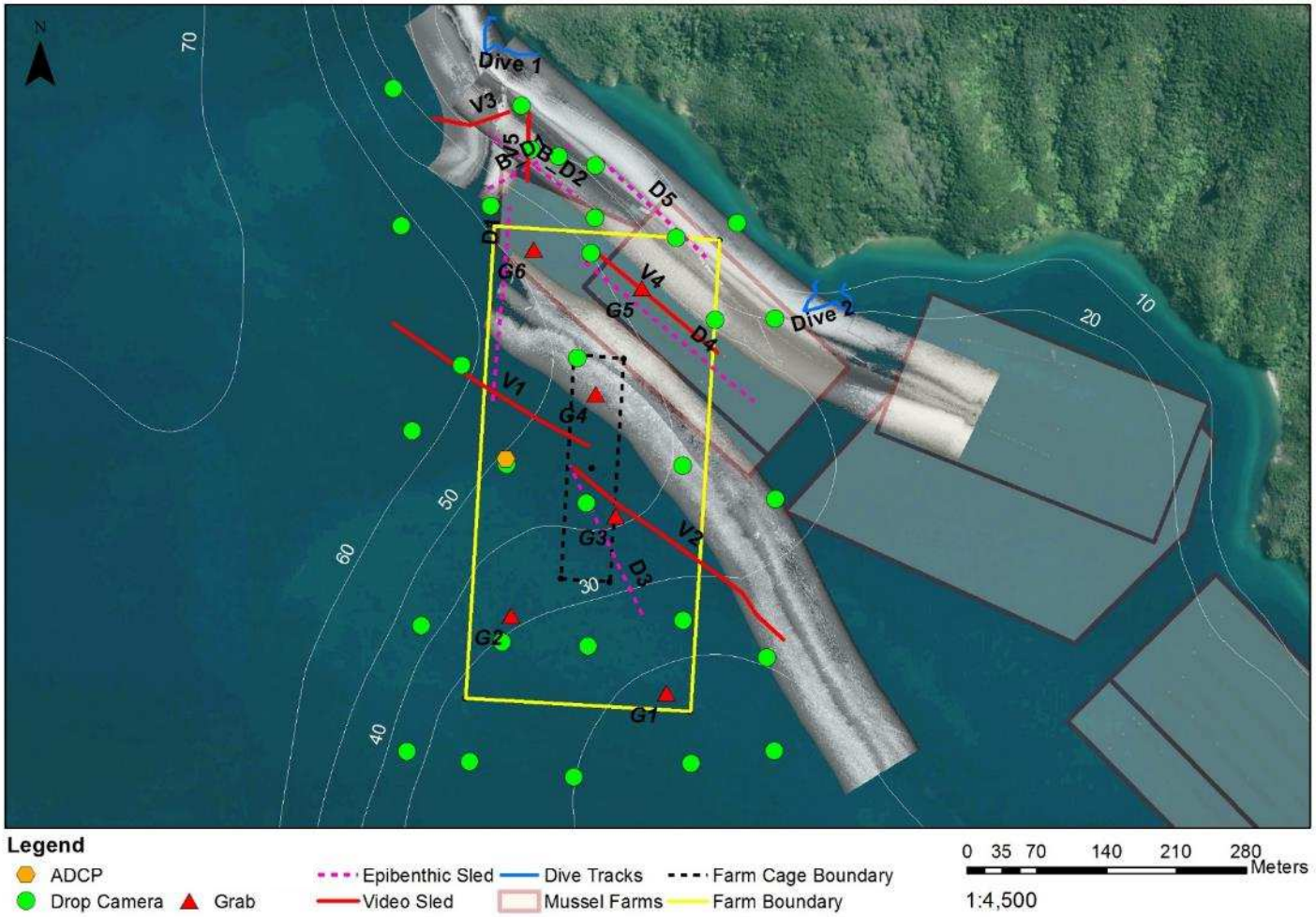

Figure 3-33: Survey sample locations at the Horseshoe Bay site. Grey bands are 100 m wide side-scan swaths.

3.5.2 Sediment Composition at the Horseshoe Bay

Six grab samples were collected in depths of 18-45 m under the proposed Horseshoe Bay Farm Site (Table B-1, Figure 3-34a). Visual inspection of the cores found sandy muds with shell material recorded in the sediment (Figure 3-34b). Like Richmond Bay, grain size analyses for this farm site found sediments comprised mostly mud (84.87% ± 2.79 SE) with some sand (12.45% ± 3.0 SE) and low amounts of gravel (2.68% ± 2.21 SE). Five of the six sites, however, had very little gravel (range 0.02- 1.2%), with one northern site (HOR-G5 in) sampled in mud where mussels were present, contained a markedly higher amount of shell gravel (13.75%) and was responsible for driving the higher site average (Figure 3-34a).

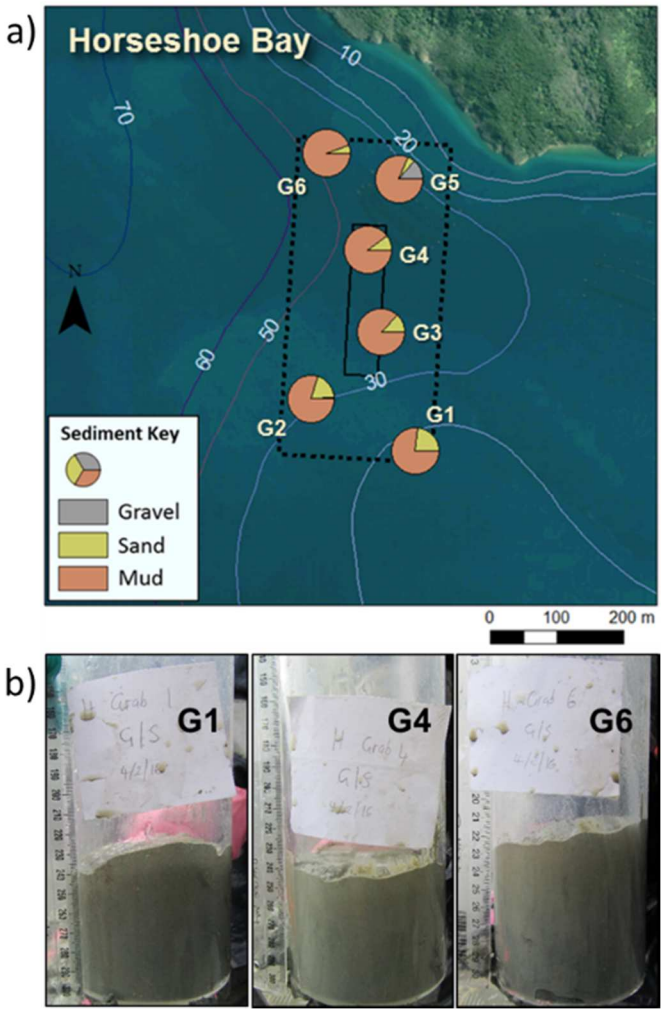

Figure 3-34: Grain size composition (% dry weight) and visual characteristics of sediments collected within the proposed Horseshoe Bay Farm Site. a) Grain size distribution plots. G1 to G6 = station numbers HOR-G1 to HOR-G6; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries. b) Examples of the visual characteristics of sediment cores (e.g. G1, G4 and G6) from this site

3.5.3 Habitats and Communities at the Horseshoe Bay

The proposed farm site is situated largely over sandy mud seabed (Figure 3-35a, b, e, f; Figure 3-36a). In the northeast corner of the site the substratum has a considerable amount of shell gravel as a result of shell-drop from the existing mussel farm which overlaps the site (Figure 3-36d). Benthic biota was sparsely distributed within the site except for the northeast corner where the mussel shell material provides substrata that supports a more diverse and abundant assemblage (Figure 3-36b). The greater diversity of biota there is probably due to the influence of hard substratum in the form of shell-drop from the mussel farm, and also the proximity to the steeply shallowing shoreline and adjacent reef and cobble habitat located approximately 40 m from the site boundary that supports a diverse assemblage of biota (section 3.5.6, Dive 2). Scallops (*Pecten novaezelandiae*) were frequently seen in video transects within the site boundaries (Figure 3-35b) and were also collected in the epifaunal dredge tows conducted through the site (Figure 3-37 c, e, f).

The subtidal slope deepens rapidly to the west and north of the site. There is bedrock reef habitat extending from the northern headland to within approximately 90 m of the NW corner of the proposed farm site. Near the base of the reef at 30 m there is considerable shell rubble habitat supporting a diverse community of biota including brachiopods (Figure 3-35c). Our video sled footage located this feature approximately 70 to 100 m NNW of the site at a depth of 30 to 35 m (Table 3-11).

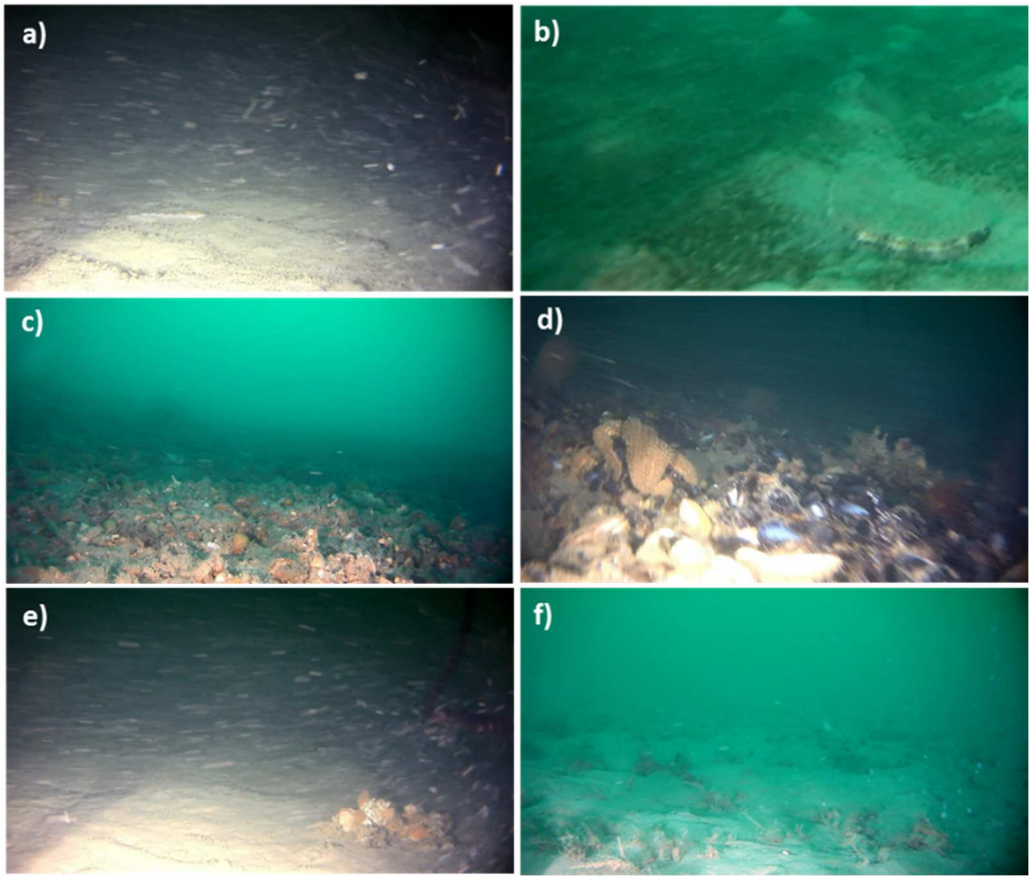

Figure 3-35: Habitats at the Horseshoe Bay site and surrounds. a) Mud habitat, polychaete tubes, opalfish within the proposed site; b) mud with diatom mat and scallop in the south of the site; c) Shell rubble and associated invertebrate community at 30 m depth near base of the reef to the north of the site; d) Shell drop and starfish within the site beneath existing mussel farm lines; e) Mud habitat with isolated biogenic clump including brachiopods; f) Mud, hydroids and scattered small biogenic clumps within the site at ~28 m depth.

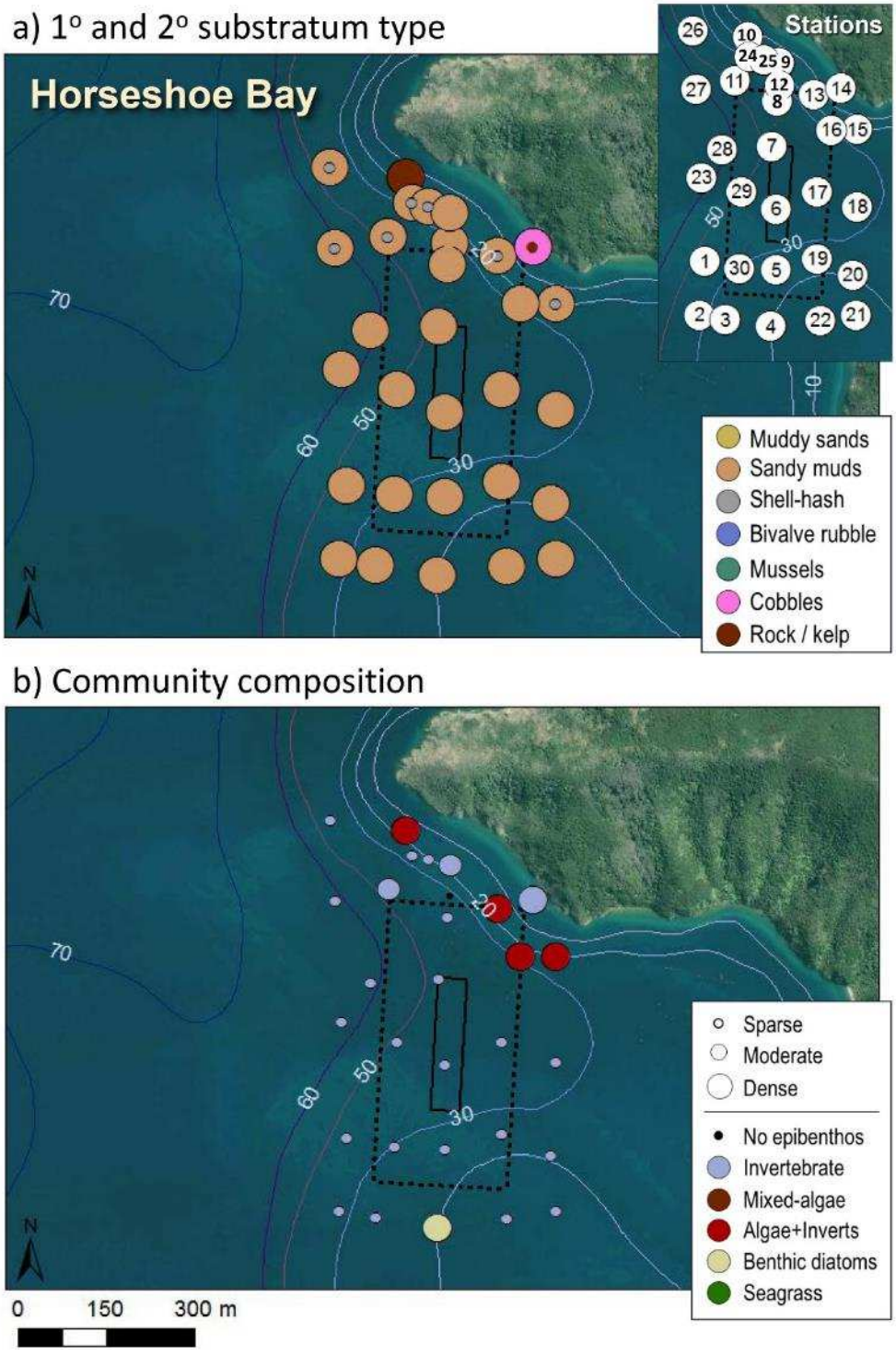

Figure 3-36: Benthic habitat and community composition from drop-camera photo-quadrats within and adjacent to the proposed Horseshoe Bay Farm Site. a) Primary and Secondary substratum type. Large circles = primary substrata (most dominant habitat: ≥50% of cover), inner smaller circles = Secondary substrata (20-50% of quadrat). For example, rock with some sand will have a large dark brown circle with an inner yellow circle, while homogenous sand would be all yellow. b) Community composition. Circle colour denotes community types, while circle size denote rank abundance (sparse <10% cover; moderate = 10-50% cover, dense = >50% cover). Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries. Depth contours are in metres.

Table 3-11: Ecological features seen in video sled transects, Horseshoe Bay.

Video #	Habitat	Depth (m)*	Conspicuous biota
V1	Mud	57	Polychaetes
	Mud	45	Polychaetes, opalfish
	Mud	32	Polychaetes, sparse biogenic clumps including brachiopods and bryozoans
V2	Mud	28	Sparse biota. polychaetes, occasional biogenic clumps hydroids, sponges, ascidian
	Mud	26	Scallops (*Pecten novaezelandiae*) (common), benthic diatoms, hermit crabs (*Pagurus* spp.) polychaetes, hydroids, scallops, dense diatom biofilm
	Mud	23	dense diatom biofilm, scallops (common)
V3	Biogenic habitat, Whole Shell Rubble, , Sand lenses	30	Brachiopods, Bivalves, Hydroids, Horse mussels, Colonial ascidians (*Cystodytes dellechajei*), ophiuroids (*Ophiopsammus maculata*), horse mussels (*Atrina zelandica*)
	Biogenic habitat, Shell Rubble, Shell hash, lenses of sand	32	Brachiopods, bivalves, hydroids, didemnid, ascidians
	Shell Rubble, Whole shell, Shell hash	40	hydroids and colonial ascidians encrusting shell
	Shell Rubble, Whole shell, Shell hash	45	hydroids, bivalves, dogfish (*Squalus acanthias*), blue moki, (*Latridopsis ciliaris*) spotties
V4	Mud Mussel shell drop	40	Blue mussels (*Mytilus edulis*), *Undaria* in mud. Some hydroids
	Mud Mussel shell drop	40	Blue mussels (*Mytilus edulis*), green mussels (*Perna canaliculus*), eleven arm starfish
	Mud	43	Very sparse biota – just mud.
V5	Sand, shell hash, whole shell	40	Muddy shell substratum with brachiopods colonial ascidian (*Cystodytes dellechiajei*), solitary ascidian (*Molgula* sp.) and hydroids, brittlestars (*Ophiopsammus maculata*), cushion star (*Patiriella* sp.)
	Whole shell debris and shell hash.	30	Brachiopods, hydroids, colonial ascidian (*Cystodytes dellechajei*), horse mussel (*Atrina zelandica*)

3.5.4 Epifaunal collection at Horseshoe Bay

A total of 155 epifauna from 35 different taxa was in the seven epibenthic sled tows collected within and adjacent to the proposed Horseshoe Bay Farm Site (Table 3-12). Sampling at this Farm site included two additional epibenthic sled tows across an area that might be a potential brachiopod area inshore north of the farm site. Most catches were dominated by bivalves (57.7% of total catch) and crustaceans (29.2%), but this was driven by a single large collection of Blue mussels, *Mytilus edulis* (100 specimens) from station 4. Other sites (excluding Station D4) were dominated by crustaceans (27.3%) and other species of bivalves (16.6%). Dominant and characteristic species at other sites included Blue mussels, *Mytilus edulis* (100 specimens, all from station 4), Hermit crabs, *Pagurus* sp (18.4%), File shells, *Limaria orie*ntalis (11.1%) and Decorator crabs, *Notomithrax* sp (6.2%) (Table 3-12, Figure 3-37). Other occasional taxa collected included the NZ green-lipped mussels (*Perna canaliculus*), starfish (*Coscinasterias muricata*), file shells (*Limaria orientalis*), scallops (*Pecten novaezelandiae*), and the occasional heart urchin (*Echinocardium cordatum*) and dog cockle (*Tucetona laticostata*) (Table 3-12, Figure 3-37a-d). Catches contained variable amounts of shell debris, with sites 4, 5 and BR2 containing the highest volume of shell debris from blue mussel shells (stations 4 and 5; Figure 3-37b,d) or green-lipped mussel shells (station BR2 Figure 3-37a).

Notable taxa included high localised numbers of Blue mussel, *Mytilus edulis* (100 specimens - station D4); common occurrences of NZ green-lipped mussel, *Perna canaliculus* (13 specimens - stations 4, and Br2 and Scallops, *Pecten novaezelandiae* (11 specimens - stations 1, 2, 3 and Br2); and rare occurrences of the Red-ribbed brachiopod, *Terebratella sanguinea* (3 specimens - station 2) and Wakame (invasive kelp), *Undaria pinnatifida* (1 specimen - station 4) (Table 3-12).

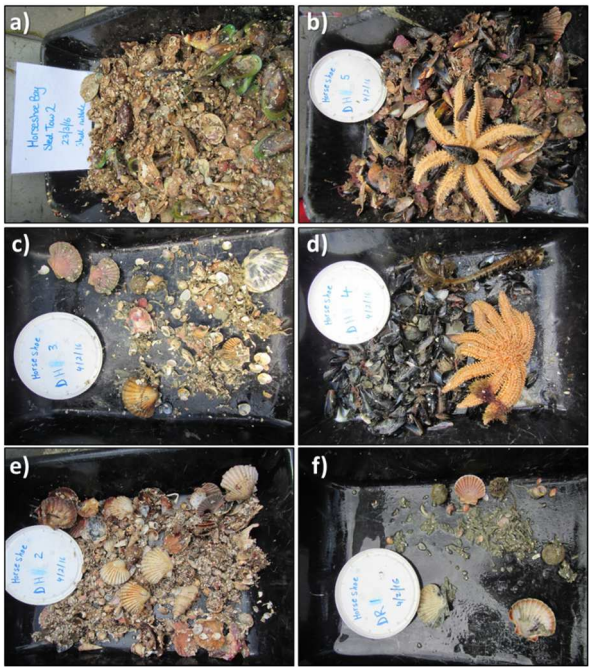

Figure 3-37: Examples of epifaunal collected in epibenthic sleds within and adjacent to the proposed Horseshoe Bay Farm Site. a) Station BR2, b-f) Station 5, 3, 4, 2 and 1 respectively. Characteristic species at this site includes: clumps of both Mediterranean mussels (*Mytilus edulis*) and NZ green-lipped mussels (*Perna canaliculus*) – actively being predated upon by starfish [e.g. seen here are the eleven armed starfish (*Coscinasterias muricata*)], file shell (*Limaria orientalis*), hermit and decorator crabs ((*Pagurus* sp. and *Notomithrax* sp., respectively), scallops (*Pecten novaezelandiae*), and the occassional heart urchins (*Echinocardium cordatum*).

Table 3-12: Relative abundance of epifauna collected in epibenthic sleds within and adjacent to the proposed Horseshoe Bay Farm Site, Pelorus Sound. "Tabd"= Total epifaunal abundance; Columns 1-5 depict replicate dredges HOR-D1 to HOR-D5, BR1-2 = HOR-BR1 and HOR-BR2 [2x additional dredge samples collected in the potential brachiopod area north of the farm site]; "✓"= present (1-4 specimens, "C" = common (5-9 specimens), "A"=abundant (>10 specimens). Tabd >= 5 are in blue text.

Taxa group	Common name	Taxa/Species	Horseshoe Bay							
			Tabd	1	2	3	4	5	Br1	Br2
Ascidiacea	Colonial sea squirt	*Cystodytes dellechiajei*	2						✓	✓
	Saddle sea squirt	*Cnemidocarpa bicornuta*	1					✓		
	Saddle sea squirt	*Cnemidocarpa nisiotis*	1					✓		
Asteroidea	Eleven armed starfish	*Coscinasterias muricata*	3				✓	✓		
	Cushion star	*Patiriella regularis*	2					✓		✓
	NZ cushion star	*Stegnaster inflatus*	1						✓	
Bivalvia	Blue mussel	*Mytilus edulis*	100				A			
	File shell	*Limaria orientalis*	34		A	✓	✓	✓	✓	A
	NZ green-lipped mussel	*Perna canaliculus*	13				✓	✓		A
	NZ scallop	*Pecten novaezelandiae*	11	✓	C	✓				✓
		Notocallista multistriata	6	✓		✓				
		Dosina mactracea	2					✓		✓
	NZ fan shell	*Talochlamys zelandiae*	4		✓				✓	
	Nut shell	*Ennucula strangei*	2	✓						
		Neilo australis	1	✓						
	Purple cockle	*Purpurocardia purpurata*	1							✓
	Dog cockle	Tucetona laticostata	1							✓
	Strawberry cockle	*Pratulum pulchellum*	1	✓						
Brachiopoda	Red-ribbed brachiopod	*Terebratella sanguinea*	3		✓			✓		
Chordata	Sea horse	*Hippocampus* sp	1		✓					
Crustacea	Hermit crab	*Pagurus* sp	56		A	✓		A	✓	A
	Decorator crab	*Notomithrax* sp	19		✓	✓	A	C		✓
	Red half-crab	*Petrolisthes novaezelandiae*	11		✓			✓	✓	C
	Hairy-handed crab	*Hemigrapsus crenulatus*	1							✓
	Rough rock crab	*Nectocarcinus integrifrons*	1							✓
	Barnacle	Barnacle	1							✓
Echiniodea	Heart urchin	*Echinocardium cordatum*	5	✓		✓				
Gastropoda	Olive shell	*Amalda mucronata*	4		✓	✓				
	Snail	*Strutholaria vermis*	3	✓						
Holothuroidea	Common sea cucumber	*Australostichopus mollis*	6					✓		C
Hydrozoa	Hydroid	Hydroid	1		✓					
Ophiuroidea	Brittle star	*Ophionereis fasciata*	1				✓			
	Brittle star	*Ophiopsammus maculata*	1							✓
Phaeophyceae	Wakame (invasive kelp)	*Undaria pinnatifida*	1				✓			
Porifera	Sponge	Sponge	2					✓		✓
Rhodophyta	Red macroalgae	Filamentous red algae	1					✓		
	Red macroalgae	Macroalgae red	1							✓

3.5.5 Infauna at Horseshoe Bay

A total of 345 infauna from 48 different taxa was recorded from 6 replicate grab samples collected within the proposed Horseshoe Bay Farm Site (Table D-6). The Horseshoe farm site supported moderately low infaunal abundance (mean site abundance of 57.5 ± 16.89 SE, range of 24-128 individuals) and low numbers of infaunal species (15.3 species ± 2.04 SE, range 10-23 species per grab), (Figure 3-38a). Infaunal assemblage composition at this site was characterized by a mix of polychaete worms (34.5% of total catch: from a suite of families, including Chaetopteridae [15.4%], Dorvillidae [3.5%], Maldanidae [3.2%], Spionidae [2.3%], Glyceridae [2%]), amphipods (29.9%), bivalves (11%: e.g. *Ennucula strangei* [3.2%] and the File shell, *Limaria orientalis* [1.4%]), cumaceans and ostracods (both 3.8%) (Figure 3-38b), along with a few brittlestars (*Amphiura* sp.), low numbers of Heart urchins (*Echinocardium cordatum*) and the occasional Sea cucumber *(Pentadactyla longidentis*) (Table D-6). Notable taxa collected in the grabs at this site, included Blue mussels, *Mytilus edulis* (5 specimens, station 5 – NE boundary of the farm) and a scallop, *Pecten novaezelandiae* (1 specimen - station G1), (Table D-6).

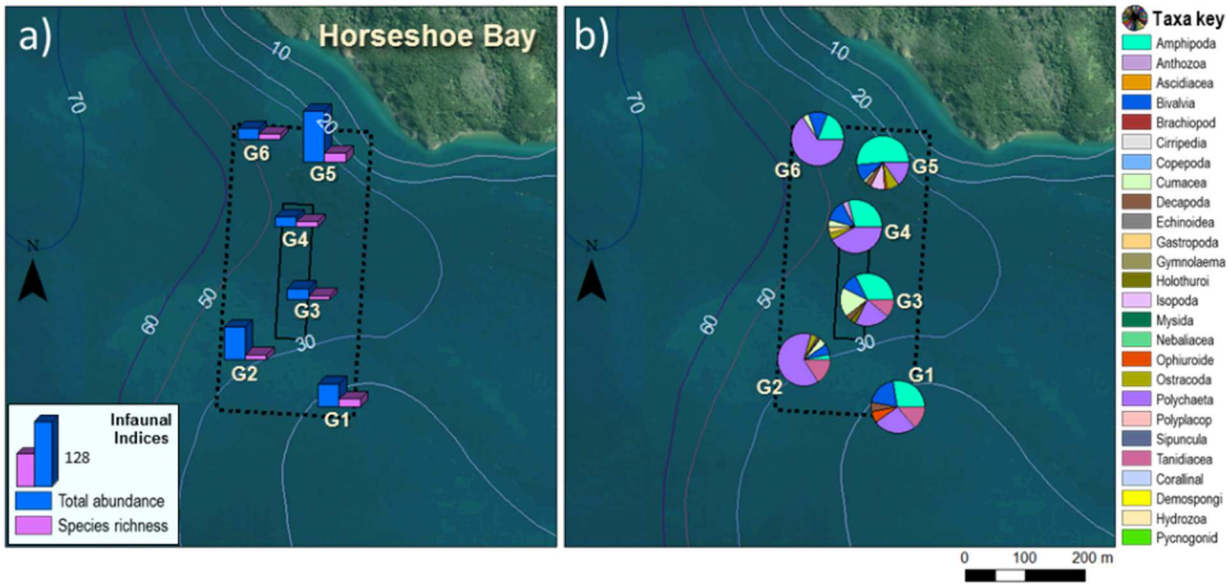

Figure 3-38: Infaunal summary indices and taxonomic grab sampling stations within the proposed Horseshoe Bay Farm Site. a) Infaunal total abundance and species richness, b) pie charts showing the taxonomic composition of each sample. G1 to G6 = station numbers HOR-G1 to HOR-G6; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries.

3.5.6 Reefs dives at Horseshoe Bay

In Dive 1 (Table 3-13) at Te Kaiangapipi, divers found bedrock reef supporting macroalgae stands (*Carpophyllum*) and a diverse assemblage of sponges, *Galeolaria* tubeworms (small clumps or individuals rather than large mounds), kina and other typical reef fauna (Table 3-13). With increasing depth the algal cover decreased to patchy and the density of sponges increased. Blue cod were common throughout the area. A large variety of fish were present including tarakihi, butterfly perch, and a school of kingfish. Crayfish were found in a rocky cave at the deepest section of the dive.

The inshore rocky reef (Dive 2 in Table 3-13) supported kelp stands of *Carpophyllum* sp. and *Cystophora* sp. and a diverse assemblage of fauna including sponges, *Galeolaria* tubeworms, kina and fish including blue cod, snapper and tarakihi. With increasing depth the habitat changed to sand and shell rubble habitat supporting scallops, horse mussels, schools of spotties plus sweep and blue moki.

Table 3-13: Features noted in the reef dives at Horseshoe Bay (Dives 1 and 2).

Habitat	Depth (m)*	Conspicuous biota	Fish
DIVE 1 Headland reef			
Rock/boulders, macroalgae (*Carpophylum*)	2-10	Sponge (orange, *Ancorina alata*), kina *(Evechinus chloroticus)*, Eleven arm starfish (*Coscinasterias muricata),* Brittlestars (*Ophiopsammus maculata*), solitary ascidian (*Cnemidocarpa bicornuata*)	Spotties (*Notolabrus celidotus*), triplefins, blue cod, red cod
Rock, sponges	10-15	Galeolaria, kina sponges, Ophiuroids, sponges (orange fan, finger, *Ancorina alata,* yellow encrusting), sea cucumber (*Australostichopus mollis*), Eleven arm starfish	Spotties (*Notolabrus celidotus*), leather jacket, triplefins, blue cod (*Parapercis colias*), kingfish
Rock/cobble slope, sponge, patches algae	15-20	sponges (orange fan, finger, *Ancorina alata,* yellow encrusting), anemones (white stripe), *Coscinasterias muricata*, Ophiuroids, sea cucumber (*Australostichopus mollis*), cushion star, solitary and colonial ascidians (*Cnemidocarpa bnicornuata)* and yellow compound ascidian	Spotties (*Notolabrus celidotus*), butterfly perch (*Caesioperca lepidoptera*), crayfish, common roughy, blue cod (*Parapercis colias*), tarakihi (*Nemadactylus macropterus*)
DIVE 2 Inshore Middle Reef			
Rock, boulder, cobble with macroalgae (*Carpophyllum* sp.)	2-8	*Anomia* sp., Patiriella, *Galeolaria*, Ophiuroids, sponges (orange fan, *Ancorina alata*), kina (*Evechinus chloroticus*)	triplefins, blue cod (*Parapercis colias*), snapper, red cod, spotties (*Notolabrus celidotus*),
Boulder, cobble slop	8-15	Tubeworms (*Galeolaria hystrix*), Hydroid, wandering anemones, kina *(Evechinus chloroticus)*, sponges (*Ancorina alata,* orange fan), sea cucumber (*Australostichopus mollis*), solitary ascidian (*Cnemidocarpa*)	Kahawai (*Arripis trutta*), sweep (*Scorpis lineolatu*), sea perch, tarakihi (*Nemadactylus macropterus*), blue moki (*Latridopsis ciliaris*), spotties (*Notolabrus celidotus*), blue cod (*Parapercis colias*), banded wrasse
Sand, shell rubble	16-20	Scallop (*Pecten novaezelandia*)s, juvenile horse mussels, Brittlestars (*Ophiopsammus maculata*), sea cucumber (*Australostichopus mollis*), fan shell (*Chlamys* sp.)	Sweep (*Scorpis lineolatu*), spotties (*Notolabrus celidotus*),blue moki, triplefins, conger eel (*conger verrauxi*)

3.5.7 Notable ecological features: Horseshoe Bay

Within the proposed farm site boundaries the substratum is mostly sandy mud and there were no habitats or communities of particular ecological or conservation value. However, scallops were frequently seen in video transects within the site boundaries and were also collected in epifaunal dredge tows conducted within the site.

There is extensive reef habitat extending south from Te Kaiangapipi headland that is a habitat for adiverse reef community (Table 3-13, Dive 1) Near the base of the reef approximately 90 m to the northwest of the northwest corner of the site boundary there is considerable shell rubble habitat and there, brachiopods and other invertebrate biota were noted in our video sled footage (video sled transect V3 in Table 3-11). Such a distinct zone of biogenic habitat and the associated invertebrate community is considered to be an unusual ecological feature in the context of the Marlborough Sounds region (authors per obs.).

There is an area of cobble and rock habitat approximately 40 m inshore of the northwest corner of the farm and this habitat supports a diverse community of macroalgae, epifauna and fish.

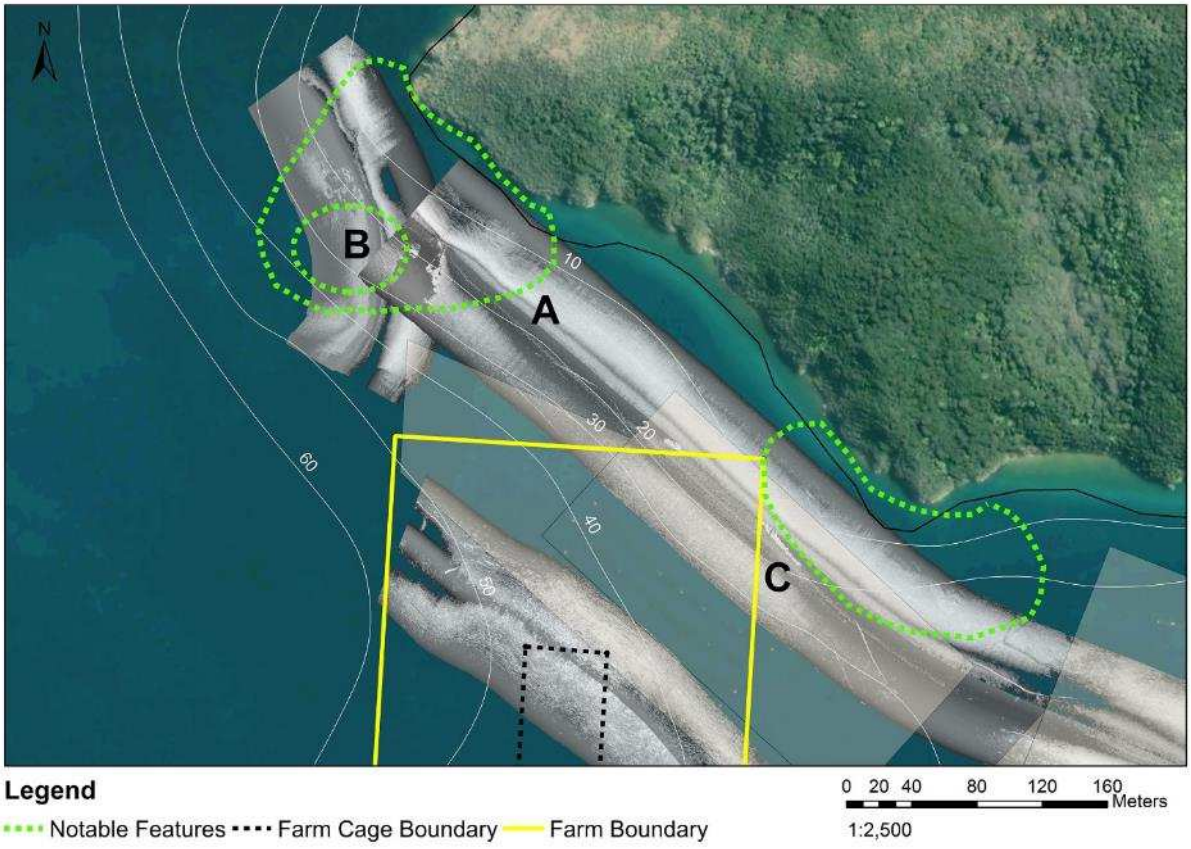

Figure 3-39: Location of notable ecological features the Horseshoe Bay site. A) Extensive reef area at Te Kaiangapipi headland; B) Zone of biogenic shell rubble and associated invertebrates; C) Reef and cobble area. Boundaries of notable ecological features are approximate.

3.6 Tipi Bay (42), Tory Channel

3.6.1 Tipi Bay, general site information, station depths and locations

The proposed 9 Ha site is located on the eastern side of Tory Channel 3 km from the Tory Channel entrance. The farm boundaries are positioned over a sloping seabed in depths between 3 and 30 m (Figure 3-40). Survey sample locations are shown in Figure 3-41. A seabed mounted Acoustic Doppler Current profiler is recording the current profiles at this site at the time of preparing this report so the data on currents at the site is not reported here (but will be presented in a subsequent report for Part 2 of this assessment).

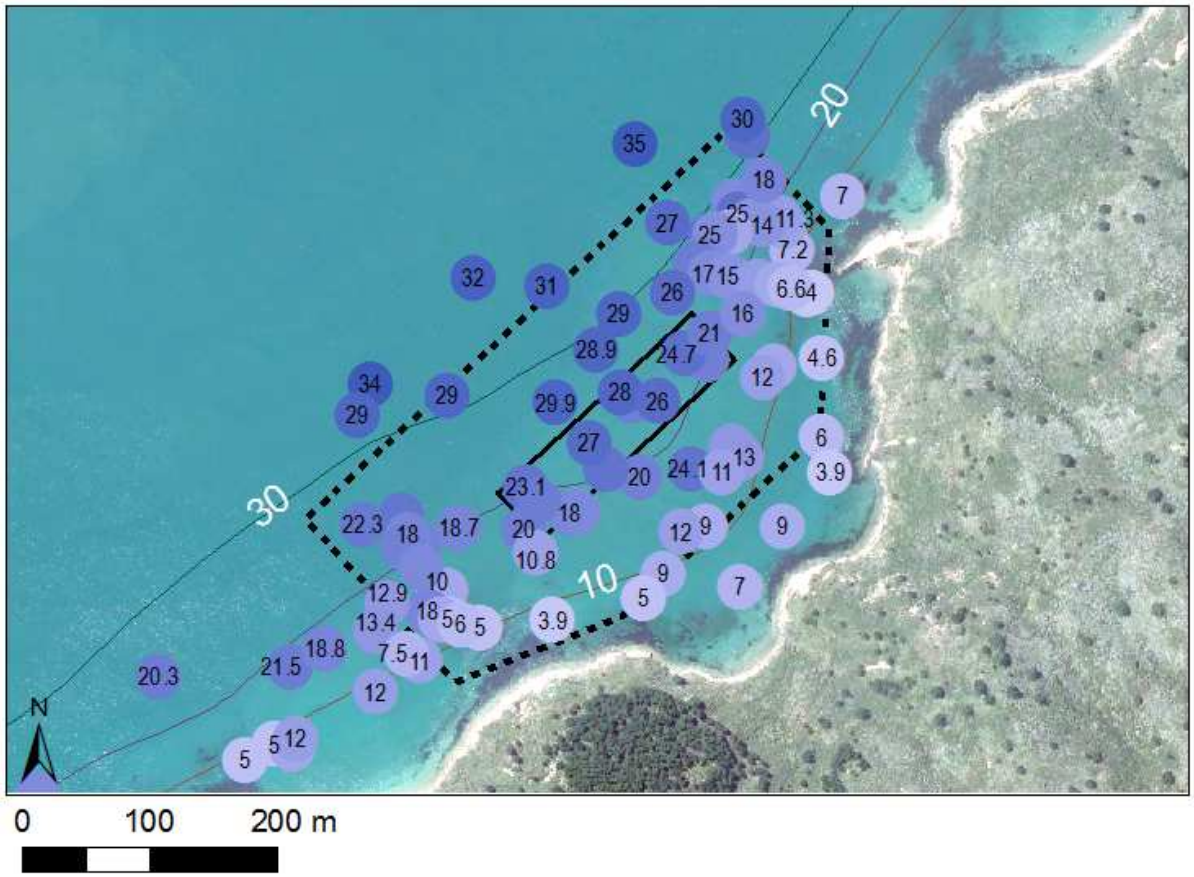

Figure 3-40: Station depths at Tipi Bay, Tory Channel. Colour depicts depth from shallow (white) to dark blue (deep), central values are depths in metres.

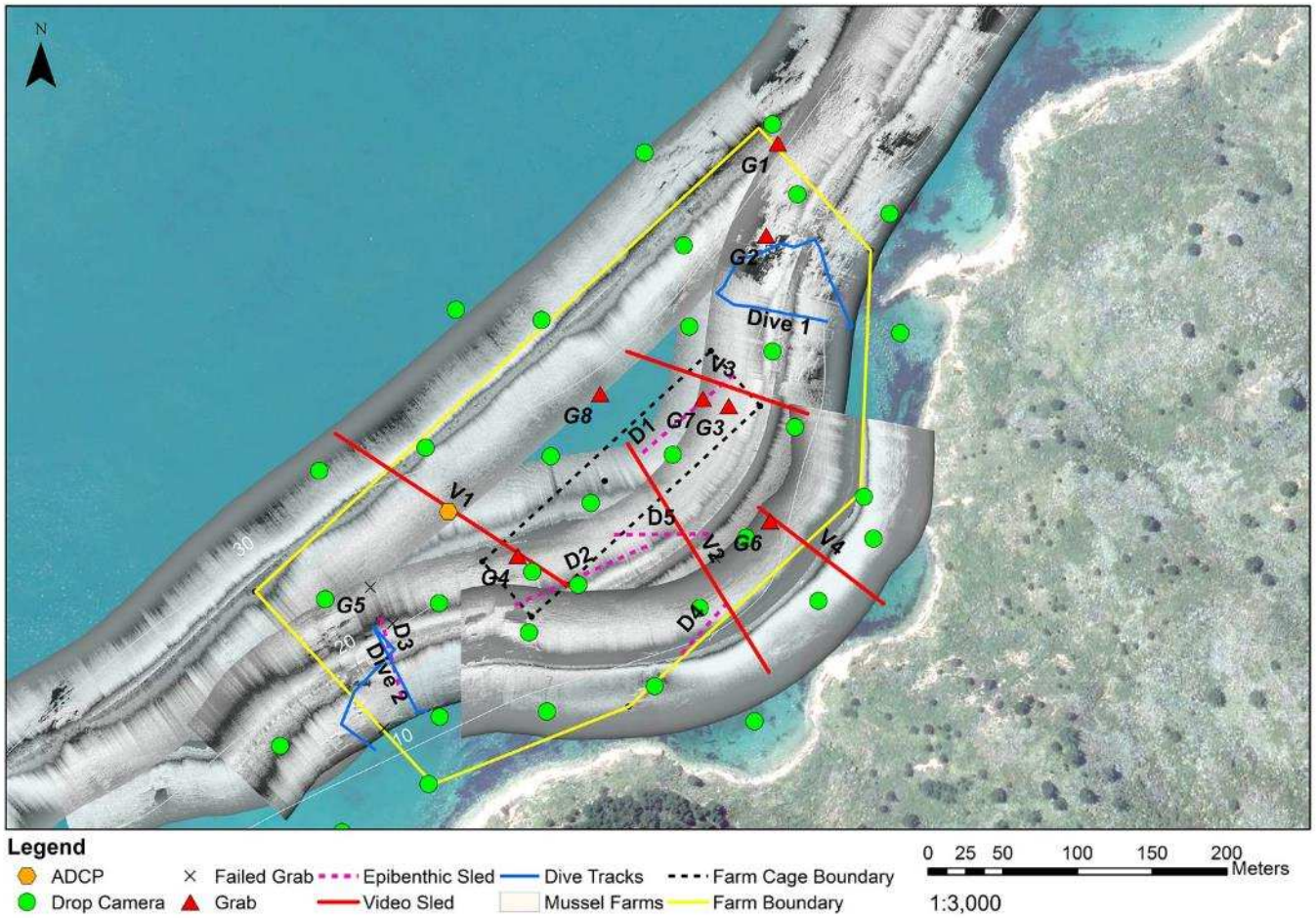

Figure 3-41: Survey sample locations at the Tipi Bay site. Grey bands are 100 m wide side-scan swaths

3.6.2 Sediment composition at Tipi Bay

Six grab samples were collected in depths of 13-29 m under the proposed Tipi Bay Farm Site (Table B-1, Figure 3-42a). However, additional grab stations failed to return any sample due to large-gauge and rather hard-packed shell hash gravel at the offshore locations (n=9 attempts from 4 additional stations - depicted as crossed in Figure 3-42a). The reason for the failed grab at the location inshore near to G6 is unclear and may have been due to the grab simply triggering prematurely ('grab misfire'). The remaining 6 grab stations returned an adequate sediment sample (Table B-1, Figure 3-42b). Visual inspection of the six successful cores found that sediment composition varied among sites, with clean muddy-sands from one inshore site (G6 - 13 m water depth), and muddy sands with a variety of gravel, shell, rock and dead bryozoan material in the deeper stations further offshore (depths > 20 m - G2, G3, G4, G7 and G8) (Figure 3-42a,b). Grain size analyses for this farm site, found sediment composition varied offshore, with most stations comprised of sand (48.02% ± 5.05 SE, range 29.8-62.83%) and mud (mean 27.30% ± 5.8 SE, range 12.12-49.91%). Gravel composition ranged from 0.02 to 58% (mean 24.68% ± 7.98 SE). Inshore stations comprised higher proportions of mud, while offshore stations comprised higher proportions of gravel (Table B-1).

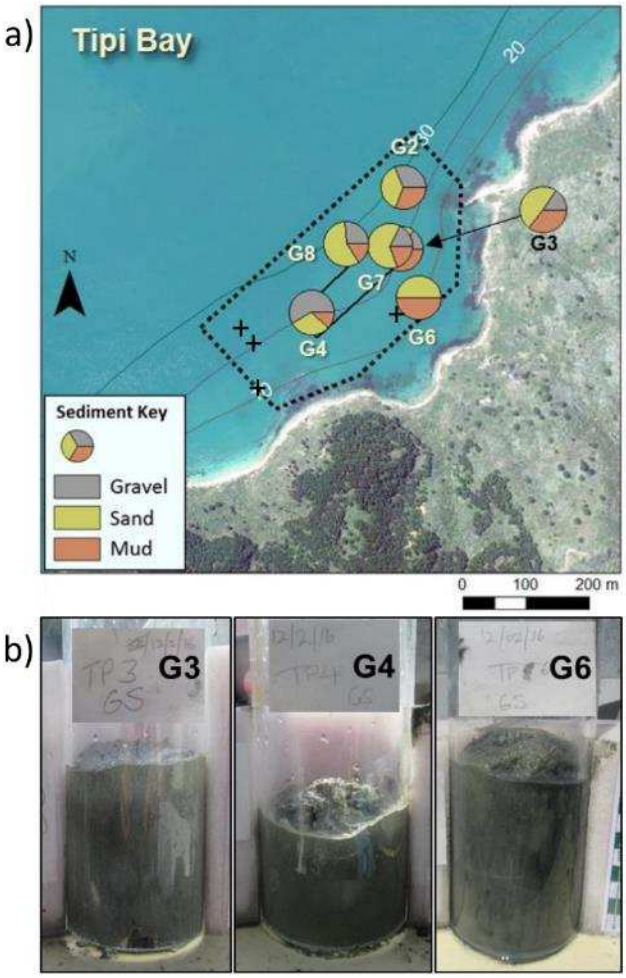

Figure 3-42: Grain size composition (% dry weight) and visual characteristics of sediments collected within the proposed Tipi Bay Farm Site. a) Grain size distribution plots. G2 to G8 = station numbers TIP-G2 to TIP-G8; **+** indicates the location of failed grabs due to hard ground; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries. Insert piechart is provide for the partially obscured G3 grab station, with arrow indicating the location of the sample. b) Examples of the visual characteristics of sediment cores (e.g. G3, G4 and G6) from this site.

3.6.3 Habitats and Communities at Tipi Bay

A wide range of habitat types and communities were seen at this site. In the vicinity of the offshore boundary in approximately 28 to 30 m depth, and throughout most of the offshore third of the site, the substratum was whole shell, shell hash and muddy sands (Figure 3-43; Figure 3-44) that supported mainly ophiuroids and bryozoans (both branching and fluffy) (Figure 3-43a; Table 3-14). The seabed under the cage area consisted of muddy sand with shell hash that supported sparsely distributed ophiuroids and fluffy bryozoans (Figure 3-43b; Table 3-14). Further inshore, the sandy mud component of the sediment increased and the shell hash content decreased. Inshore of the central portion of the cage area between approximately 5 and 15 m depth there was a conspicuous diatom biofilm overlaying the soft muddy sand substratum and epibiota was scarce (Figure 3-43c), except for scattered macroalgae, ophiuroids and a few kina (Figure 3-43d).

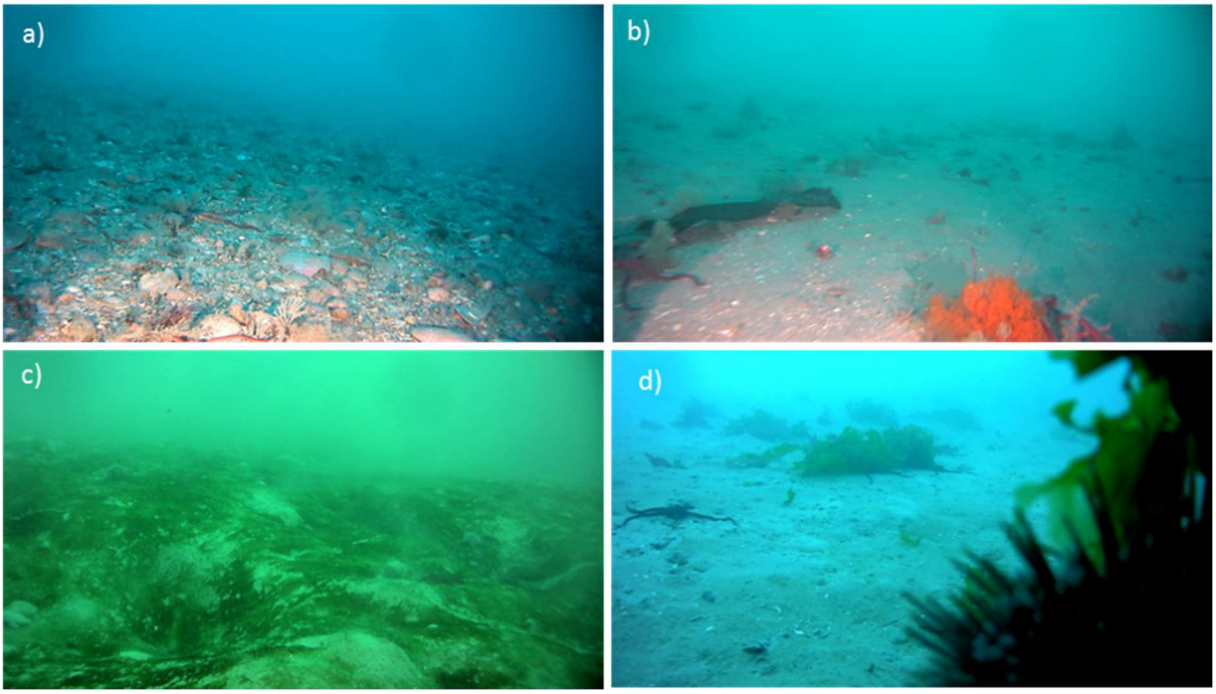

Figure 3-43: Most widespread habitats found within the proposed site. a) Shell hash habitat at offshore boundary of the site (~30m depth). b) Within cages boundary. c) Soft muddy sand inshore at 13 m depth. d) Inshore sandy habitat.

A rocky reef extends into the northeast end of the site to within 30-40 m of the cage area. The reef provided habitat for a diverse assemblage of macroalgae, molluscs, hydroids, ascidians, and bryozoans and associated fishes, including large schools of butterfly perch (Figure 3-45 a, b Table 3-17). In the vicinity of the southwest end of the cage area, broken rock patches support macroalgae and reef epifauna, including sponges, hydroids, bryozoans and ascidians (Figure 3-45 c). Inshore, patches of broken rock and low-relief reef fringed most of the shoreline adjacent to the inshore boundary of the site providing contiguous rocky-reef habitat for blue cod.

Beds of seagrass (Figure 3-45 d) were noted in the small embayment, 10 to 20 m inshore of the northeast corner of the site boundary and also in the next small embayment to the south.

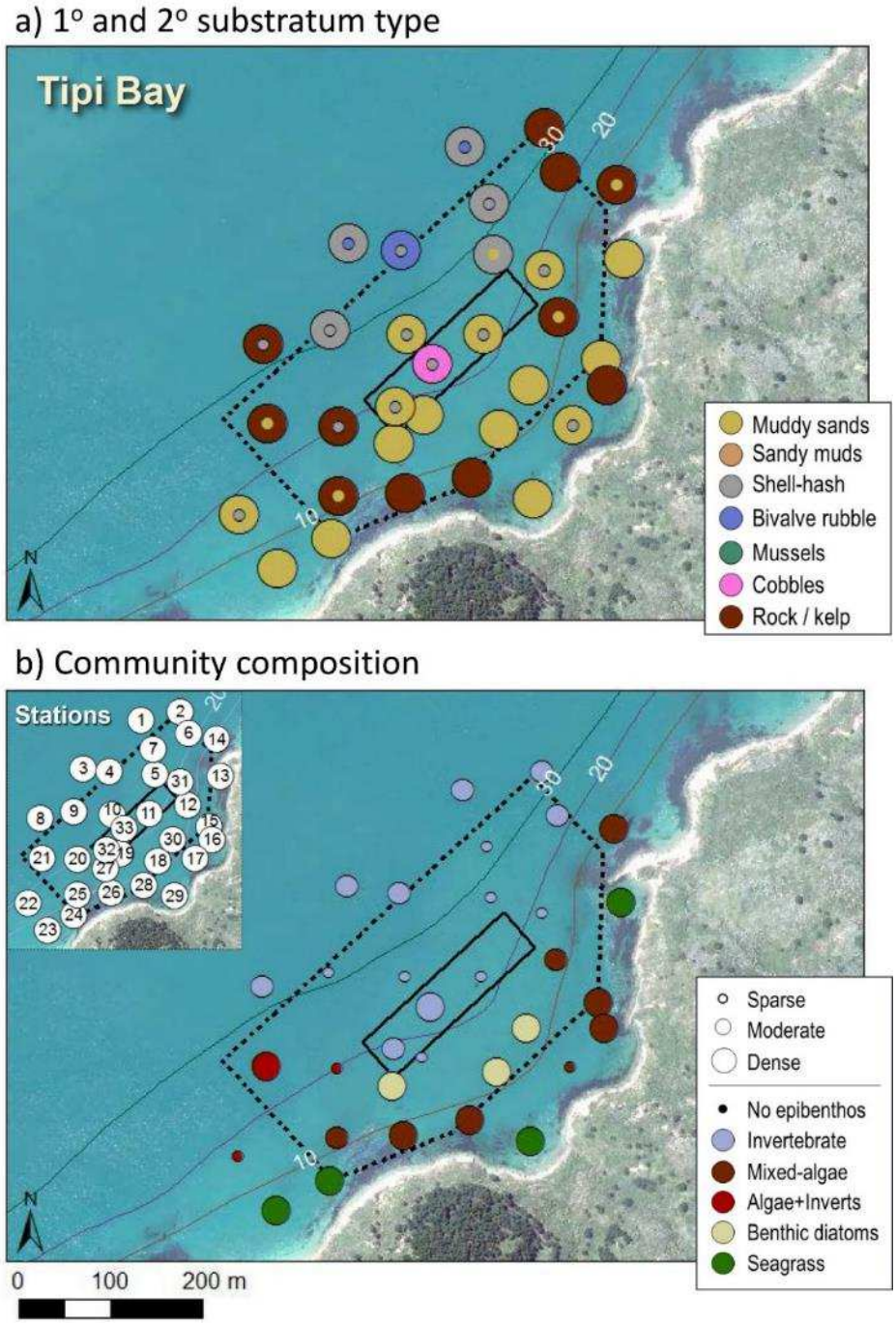

Figure 3-44: Benthic habitat and community composition from drop-camera photo-quadrats within and adjacent to the proposed Tipi Bay Farm Site. a) Primary and Secondary substratum type. Large circles = primary substrata (most dominant habitat: ≥50% of cover), inner smaller circles = Secondary substrata (20-50% of quadrat). For example, rock with some sand will have a large dark brown circle with an inner yellow circle, while homogenous sand would be all yellow. b) Community composition. Circle colour denotes community types, while circle size denotes rank abundance (sparse <10% cover; moderate = 10-50% cover, dense = >50% cover). Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries. Depth contours are in metres.

Table 3-14: Ecological features seen in video sled transects at Tipi Bay.

Video #	Habitat	Depth (m)*	Conspicuous biota
V1	Whole shell, shell hash, sandy mud	30	Scattered bryozoans branching and fluffy, brittlestars (*Ophiopsammus maculata*)
	Whole shell, shell hash, sandy mud	24	Fluffy bryozoans frequent, scattered biogenic clumps
	Muddy sand, shell hash, rock outcrops with biogenic aggregations	22	Diverse biota of sponges, ascidians, hydroids bryozoans and macroalgae, sea cucumbers (*Australostichopus* sp.), ophiuroids
	Muddy sand, scattered cobble	17	Green and red macroalgae
V2	Muddy sand, shell hash	28	Fluffy bryozoans, ophiuroids, (moderate densities)
	Muddy sand, very sparse biota	22	Fluffy bryozoans, ophiuroids (sparse)
	Muddy sand, infaunal burrows, biofilm	10	Thick benthic diatom biofilm
V3	Whole shell, shell hash, sand	29	ophiuroids (sparse)
	sand,shell hash,	22	fluffy bryozoans
	Muddy sand	12	benthic diatom biofilm, scattered macroalgae, blue cod (*Parapercis colias)*
V4	Muddy sand	13	Thick benthic diatom biofilm
	Muddy sand		Macroalgae, ophiuroids, kina (*Evechinus chloroticus*)

*Depths in this summary table are approximate and not corrected for chart datum

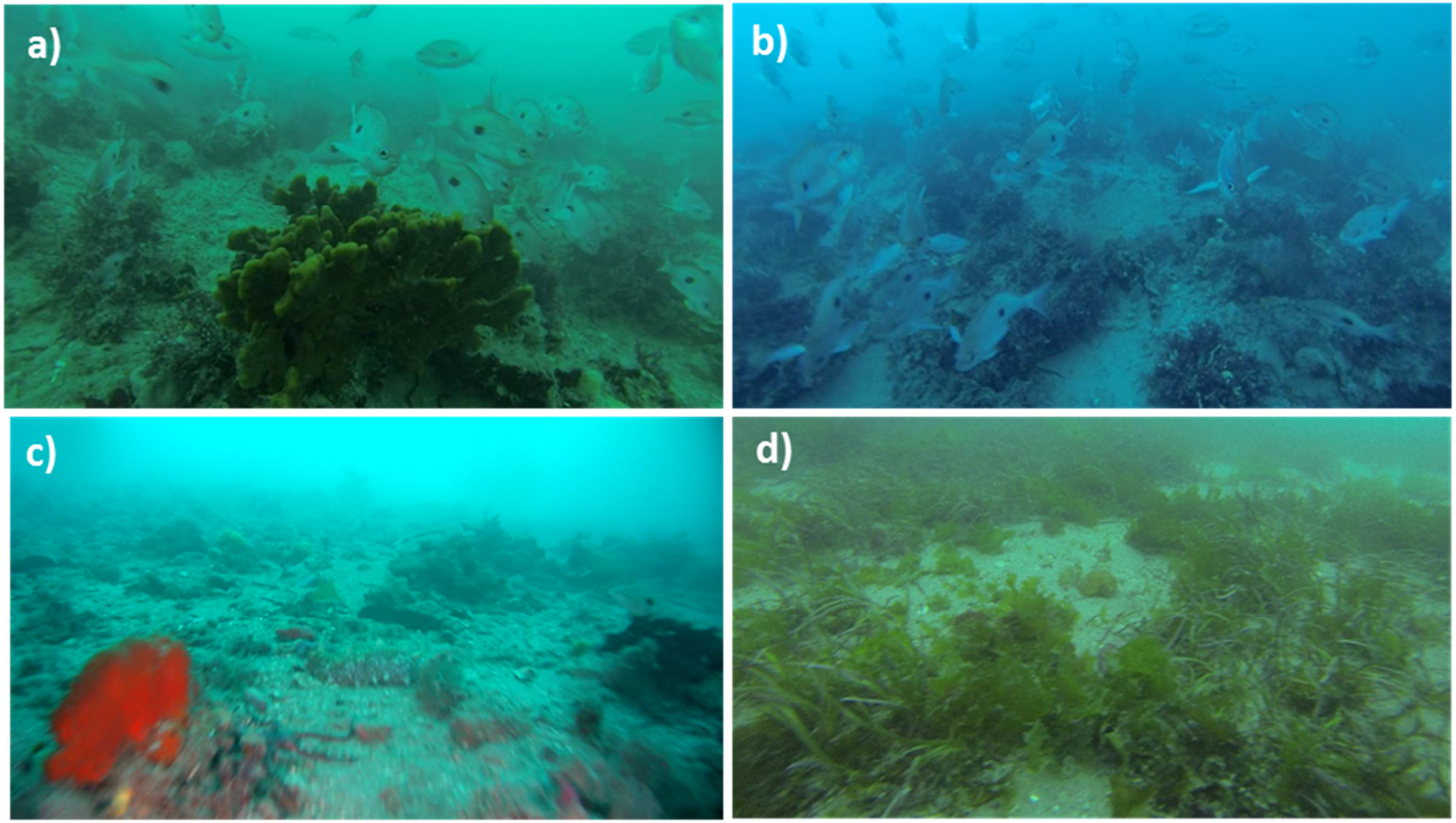

Figure 3-45: Reef, broken rock and seagrass habitat. a) Reef with sponge (*Crella incrustans*) and butterfly perch in the northeast end of the site, b) Reef and butterfly perch in the northeast end of the site, c) broken rock habitat in the vicinity of the southwestern end of the cage area, d) seagrass (*Zostera muelleri*) inshore of the site, northeast end.

3.6.4 Epifaunal collections at Tipi Bay

A diverse array of soft and hard bottom species were collected from this site, with a total of 92 epifaunal specimens from 34 different taxa recorded from five epibenthic sled tows collected within and adjacent to the proposed Tipi Bay Farm Site (Table 3-15). The most common taxa collected at this farm site were Hermit crabs, *Pagurus* sp. (25.3%), Brittlestars, *Ophiopsammus maculata* (12.1%) and the Red-ribbed brachiopod, *Terebratella sanguinea* (6.6% / 6 specimens). Other characteristic taxa included cushion and reef starfish (*Patiriella regularis* and *Stichaster australis*), Circular saw gastropod (*Astraea heliotropium*), sea urchins (*Evechinus chloroticus*) and green, brown and red macroalgae (e.g. *Ulva lactuca, Codium fragile, Ecklonia radiata*, *Colpomenia* sp., red filamentous and foliose algae) (Table 3-15, Figure 3-46). Epibenthic catches (as well as grab samples) collected considerable shell, rubble and cobble debris as well as biogenic and bryozoan encrusted clumps (Figure 3-46a-d) and *Ecklonia* stipes on consolidated material.

Notable taxa included occasional or rare occurrences of the red-ribbed brachiopod, *Terebratella sanguinea* (6 specimen - stations 1 and 3), Kina, *Evechinus chloroticus* (2 specimens - station 2), Paddle weed (kelp), *Ecklonia radiata* (2 specimen - stations 2 and 3); Wakame (invasive kelp), *Undaria pinnatifida* (2 specimen - stations 2 and 3) and Erect Bryozoa (1 specimen - station 1) and Encrusting Bryozoa (1 specimen - station 4). Encrusting bryozoan clumps were also collected at grab stations (TIP-G2).

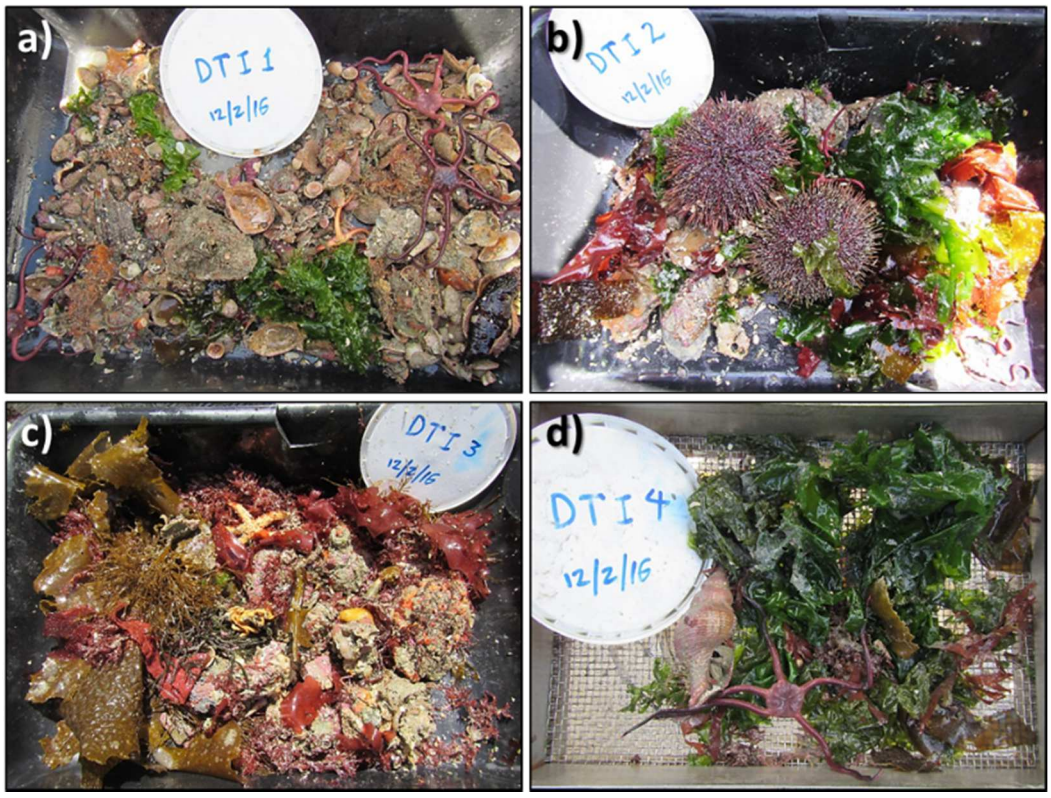

Figure 3-46: Examples of epifaunal collected in epibenthic sleds within and adjacent to the proposed Tipi Bay Farm Site. Characteristic species at this site includes: hermit crabs (*Pagurus* sp.), brittlestars (*Ophiopsammus maculata*), sea urchins (*Evechinus chloroticus*), starfish (e.g. Cushion stars and Reef starfish), Red-ribbed brachiopod (*Terebratella sanguinea*), and red, brown and green macroalgae (including *Ecklonia radiata, Undaria pinnatifida, Colpomenia* sp. and *Ulva lactuca*).

Table 3-15: Relative abundance of epifauna collected in epibenthic sleds within and adjacent to the proposed Tipi Bay Farm Site, Tory Channel. "Tabd"= Total infaunal abundance; Columns 1-5 depict replicate dredges TIP-D1 to TIP-D5, "✓"= present (1-4 specimens), "C" = common (5-9 specimens), "A"=abundant (>10 specimens). Tabd >= 5 are in blue text.

Taxa group	Common name	Taxa/Species	Tipi Bay					
			Tabd	1	2	3	4	5
Ascidiacea	Saddle sea squirt	*Cnemidocarpa bicornuta*	2		✓			
	Sea squirt	Ascidian unknown	1			✓		
Asteroidea	Cushion star	*Patiriella regularis*	4	✓	✓			
	Reef starfish	*Stichaster australis*	1			✓		
Bivalvia	Strawberry cockle	*Pratulum pulchellum*	3					✓
	Purple cockle	*Purpurocardia purpurata*	2	✓				
	NZ fan shell	*Talochlamys zelandiae*	2	✓				
Brachiopoda	Red-ribbed brachiopod	*Terebratella sanguinea*	6	C		✓		
Bryozoa	Encrusting Bryozoa	Encrusting bryozoa	2	✓			✓	
	Erect Bryozoa	Erect bryozoa	1	✓				
	Fluffy Bryozoa	Fluffy bryozoa (orange)	4	✓				
	Fluffy Bryozoa	Fluffy bryozoa (green)	2	✓				
Chlorophyta	Sea lettuce	*Ulva lactuca*	4	✓	✓		✓	✓
	Green macroalgae	Macroalgae green	1		✓			
	Stag seaweed	*Codium fragile*	1			✓		
Chordata	Triplefin	*Forsterygion* sp	2				✓	
Crustacea	Hermit crab	*Pagurus* sp	23	✓	A		✓	
	Spider crab	*Halicarcinus* sp	2	✓	✓			
	Squat lobster	Galatheoidea	1			✓		
	Decorator crab	*Notomithrax* sp	1			✓		
Echiniodea	Kina	*Evechinus chloroticus*	2		✓			
	Heart urchin	*Echinocardium cordatum*	1					✓
Gastropoda	Circular saw shell	*Astraea heliotropium*	4	✓	✓	✓		
Holothuroidea	Sea cucumber	*Australostichopus mollis*	1	✓				
Hydrozoa	Hydroid	Hydroid	1	✓				
Mollusca/Polyplacophora	Chiton	Chiton	2		✓			
Ophiuroidea	Brittle star	*Ophiopsammus maculata*	11	C	✓		✓	✓
	Brittle star	*Ophionereis fasciata*	2	✓		✓		
Phaeophyceae	Paddle weed (kelp)	*Ecklonia radiata*	2		✓	✓		
	Wakame (invasive kelp)	*Undaria pinnatifida*	2		✓	✓		
	Bubble weed	*Colpomenia* sp	1			✓		
	Branching brown	Xiphophora						
Polychaeta	Sea mouse	Aphroditidae	1			✓		
Porifera	Sponge	*Mycale hentcheli*	1		✓			
	Yellow sponge	Sponge (yellow)	1		✓			
Rhodophyta	Red macroalgae	Filamentous red algae	1			✓		
	Foliose red macroalgae	Macroalgae foliose red	1					✓
	Red macroalgae	Macroalgae red	1	✓				

3.6.5 Infauna at Tipi Bay

A total of 508 infauna from 69 different taxa was recorded from 6 replicate grab samples collected within the proposed Tipi Bay Farm Site (Table D-7; Figure 3-47a-b). This farm site supported relatively high, but variable numbers of total infauna (mean abundance of 84.67 ± 27.69 SE, range 12-194 individuals per grab) and variable numbers of infaunal taxa (19.3 species ± 5.42 SE, range 3-43 taxa per grab) Figure 3-47b. This variability in infaunal catches, likely reflected the variability in habitat and sediment types within this farm site (*see* Tipi Bay: Sediment composition 3.6.2). Infaunal assemblage composition at this site was dominated by a mix of amphipods (43.3% of total catch) and polychaete worms (13.2% e.g. Chaetopteridae, Capitellidae, Sabellidae, Glyceridae, Opheliidae), with a suite of bivalves (11% e.g. *Corbula zelandica, Pratulum pulchellum, Gonimyrtea concinna*), Tanaid shrimps (6.1%), isopods (7.9%), ascidians (4.3%), ostracods (2.7%), and gastropods (e.g. *Maoricolpus roseus* [1.8%]) (Table D-7; Figure 3-47a-b). Notable taxa collected in the grabs included the brachiopod, *Calloria inconspicua* (2 specimens - station G2) and the reef-building Bryozoa, *Celleporaria agglutinans*, (2 specimen - stations G2 and G7) (Table D-7).

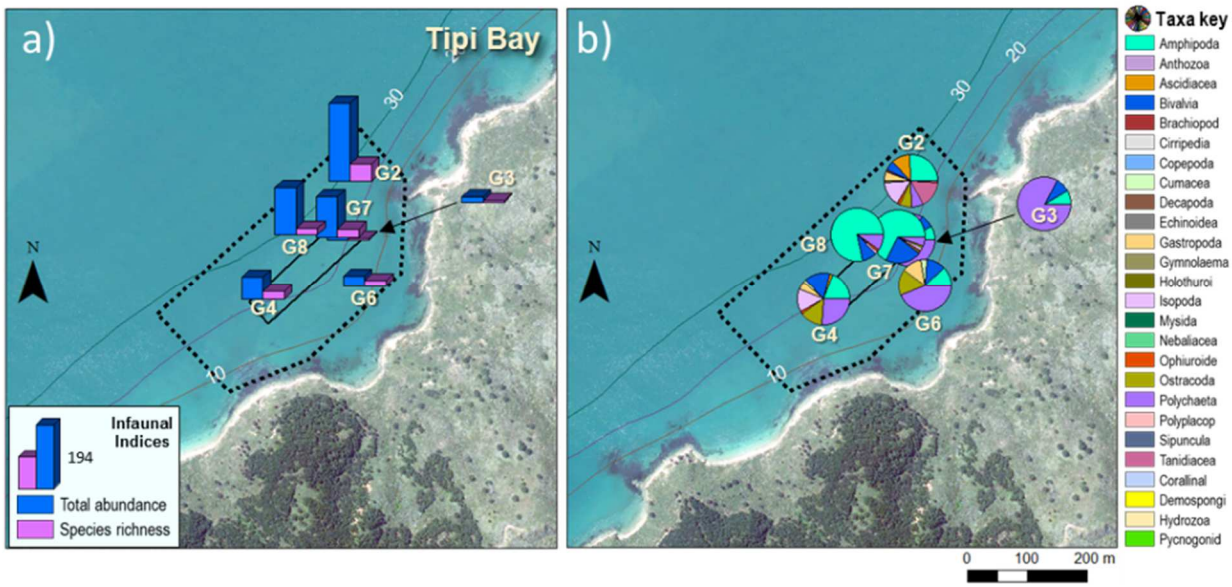

Figure 3-47: Infaunal summary indices and taxonomic grab sampling stations within the proposed Tipi Bay Farm Site in Tory Channel, Queen Charlotte Sound.. a) Infaunal total abundance and species richness, b) pie charts showing the taxonomic composition of each sample. G2 to G8 = station numbers TIP-G2 to TIP-G8 [NB grab samples at stations G1 and G5 failed due to hard ground]; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries. Insert histogram and piechart are provide for the partially obscured G3 grab station, with arrow indicating the location of the sample.

3.6.6 Reef Dives at the Tipi Bay

Dives were conducted on reef and broken rock habitat from the shore to 20 m depth at the east and west ends of the site. Extensive reef and broken rock habitat was encountered at the site and the reef community was very diverse (Table 3-16). The reef provided habitat for macroalgae, molluscs, hydroids, ascidians, and bryozoans and associated fishes, including large schools of butterfly perch and terakihi (Figure 3-45 a, b Table 3-17). In the vicinity of the southwest end of the cage area, broken rock patches support macroalgae and reef epifauna, including sponges, hydroids, bryozoans and ascidians (Figure 3-45 c). Notable conspicuous taxa encountered in the dives included crayfish, kina, burrowing anemone (*Cerianthus* sp.) and paua.

Table 3-16: Features noted in the reef dives at Tipi Bay (Dives 1 and 2).

Habitat	Depth (m)*	Epibiota	Fish
Dive 1 East Dive			
Sand, seagrass (*Zostera muelleri)*	3 - 5	Brittlestars (*Ophiopsammus maculata*)	Blue moki (*Latridopsis ciliaris*), triplefins, spotties (*Notolabrus celidotus*), butterfly perch
Patch reef (bedrock/sand), kelp	5 - 15	Brittlestars, kina, *Ancorina alata,* sea cucumber, knobbed whelk, paua, solitary ascidians*, Patiriella*, colonial ascidian	Butterfish (*Odax pullus),* banded wrasse, tarakihi (*Nemadactylus macropterus*), blue moki butterfly perch spotties, blue cod
Reef (rock, cobble sand), red algae beds	16 - 18	Brittlestars, white stripe anemone, kina *(Evechinus chloroticus)*, sponges (*Ancorina alata,* encrusting, fan)	School of butterfly perch (*Caesioperca lepidoptera*)
Reef (rock, cobble sand)	18 - 20	Kina aggregations, Patiriella, colonial ascidian (yellow), sponges (*Ancorina alata,* encrusting), white stripe anemone, Brittlestars, *Coscinasterias*, sea spider (pycnogonid)	Butterfly perch, tarakihi, blue cod, spotties
Dive 2 West Dive			
Sand/mud, kelp	3 - 9	Brittlestars	Spotties (*Notolabrus celidotus*), juvenile banded wrasse, blue moki
Reef, kelp	10	Kina *(Evechinus chloroticus)*, *Ancorina alata*	Spotties (*Notolabrus celidotus*), schooling triplefins
Sand/stones, algae	11 - 20	Kinas, sea cucumber, Brittlestars, tube anemone (*Cerianthus* sp.), Patiriella, sponge, gastropod & bivalves (circular saw, dosinia), fan worm, solitary ascidians, *Scutus*, white stripe anemone, starfish, colonial ascidian (yellow), *Coscinasterias*	Spotties (*Notolabrus celidotus*), school of triplefins, tarakihi, blue cod, blue moki
Sand/stones, kelp (eklonia, patches red algae)	20 -15	Brittlestars, white stipe anemone, *Cerianthus*, sea cucumber, Patiriella, colonial ascidian (yellow), kina aggregations, wandering anemone	Scarlet wrasse, blue cod (*Parapercis colias*), tarakihi (*Nemadactylus macropterus*), spotties (*Notolabrus celidotus*)
Reef, kelp	15	Crayfish, Brittlestars, solitary ascidians, *Patiriella*, kina *Ancorina alata*	School of tarakihi, blue cod (*Parapercis colias*), scarlet wrasse, blue moki
Sand biogenic clumps, kelp	14 - 11	Brittlestars, *Ancorina alata*	School of tarakihi, butterfly perch , blue cod spotties wrasse
Reef, kelp (*Macrocystis*, ecklonia, *Undaria*)	11	Brittlestars, sponge (*Ancorina alata,* encrusting), *Patiriella*, solitary ascidians (*Cnemidocarpa bicornuata*), kina, shield shell (*Scutus breviculus*)	Spotties, tarakihi, blue moki , leather jacket, butterfly perch, triplefins

3.6.7 Notable ecological features: Tipi Bay

At places within the proposed site and also adjacent areas there were zones of low-relief broken rock and bedrock patches that supported highly diverse biogenic aggregations comprised of bryozoans including the biogenic habitat forming bryozoan *Celleporaria agglutinans*, sponges, ascidians, hydroids, macroalgae and associated invertebrates, including polychaetes. Also associated with this habitat was a diverse range of fishes including butterfly perch, terakihi and blue cod. The main areas of this habitat type within the site were between the cage area and the outer site boundary at both ends of the site (Figure 3-48)

Stands of giant kelp (*Macrocystis pyrifera*) were present within the site, the largest on the bedrock reef habitat at the northeast end, and also scattered along the shoreline at 3 to 5 m depth in places. Stands of this kelp are ecologically important (e.g.Davidson 2011, Steneck et al 2002), as a foundation species, providing vital habitat services for a range of invertebrates and vertebrate species including fish such as butterfish (*Odax pullus*) and blue cod. Beds of seagrass were present in the small embayment, 10 to 20 m inshore of the northeast corner of the site boundary and also in the next small embayment to the south. Seagrass is known to be an important nursery and settlement habitat for a range of fish species including commercially valuable fish species (Morrison et al 2014).

Paua were seen by divers on the reef at the east end of the site and crayfish in the west. Kina were collected in epibenthic sled samples and noted occurring at high densities in patches by divers. Blue cod were frequently seen in video footage and by divers.

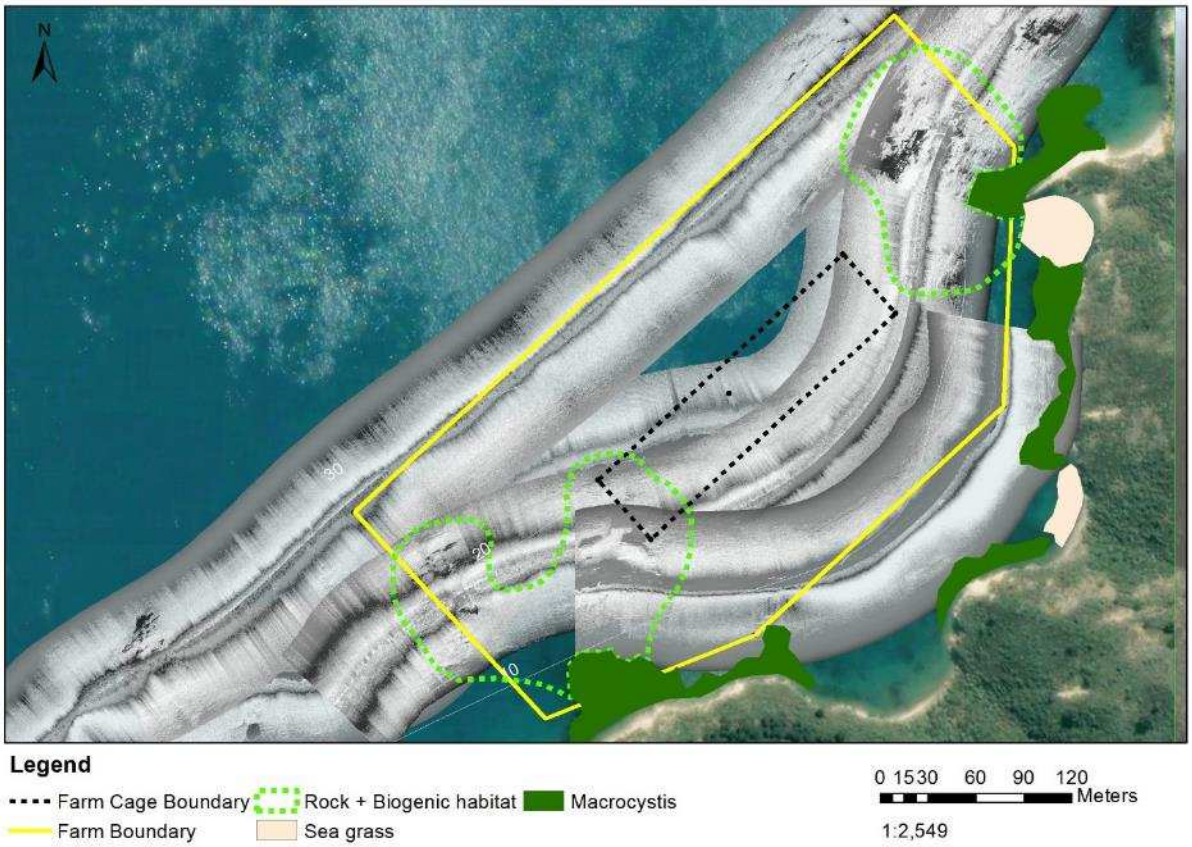

Figure 3-48: Location of notable ecological features at Tipi Bay. A and B are areas of broken rock supporting diverse encrusting biota and biogenic aggregations. Boundaries of notable ecological features are approximate.

3.7 Motukina (82), Tory Channel

3.7.1 Motukina, general site information, station depths and location

The proposed 11 Ha site at Motukina is located on the southern side of Tory Channel directly across the channel from Te Uira-Karapa point on the opposite shore. The proposed farm is positioned over a sloping seabed and depths within the site range from 3 to 45 m (Figure 3-49).

Survey sample positions are shown in (Figure 3-50). A seabed mounted Acoustic Doppler Current profiler is recording the current profiles at this site at the time of report preparation, so the data on currents at the site is not yet available (but will be presented in a subsequent report for Part 2 of this assessment).

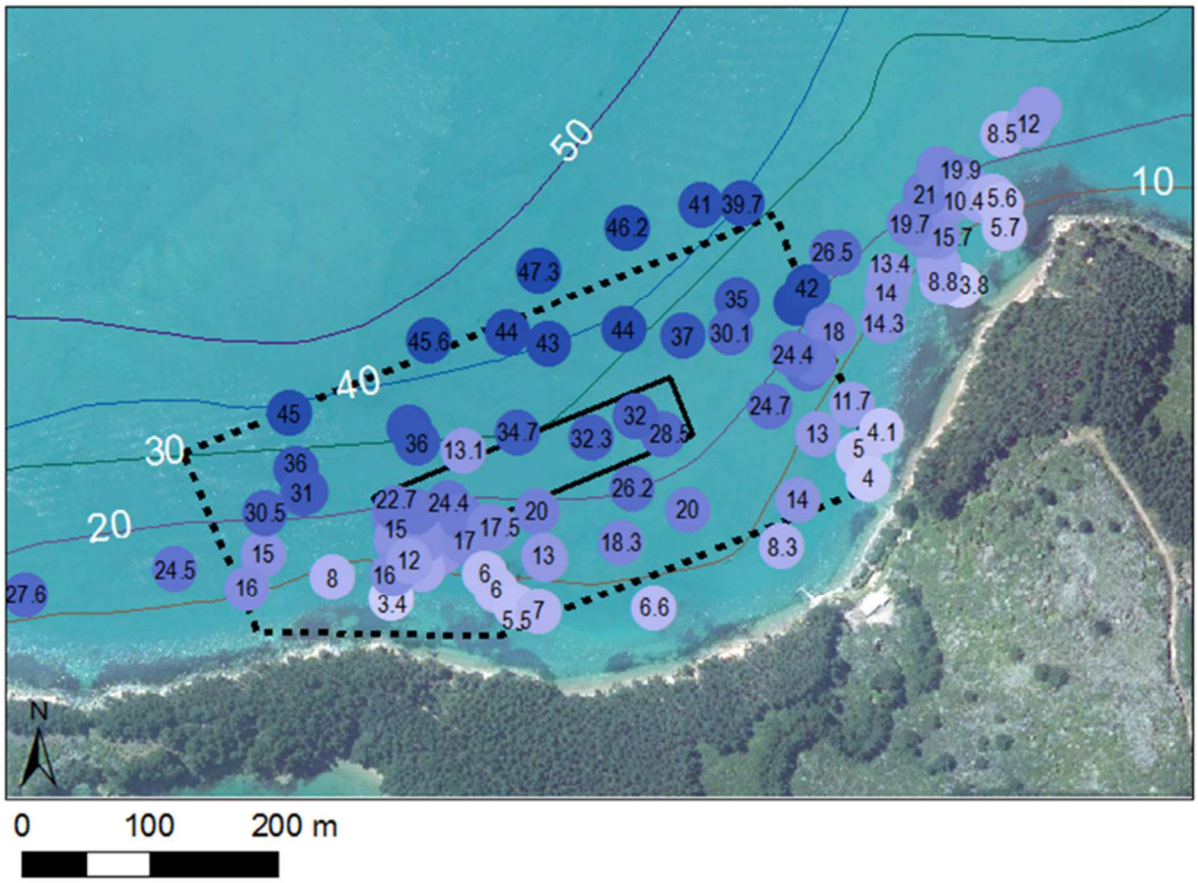

Figure 3-49: Station depths at Motukina, Tory Channel. Colour depicts depth from shallow (white) to dark blue (deep), central values are depths in metres.

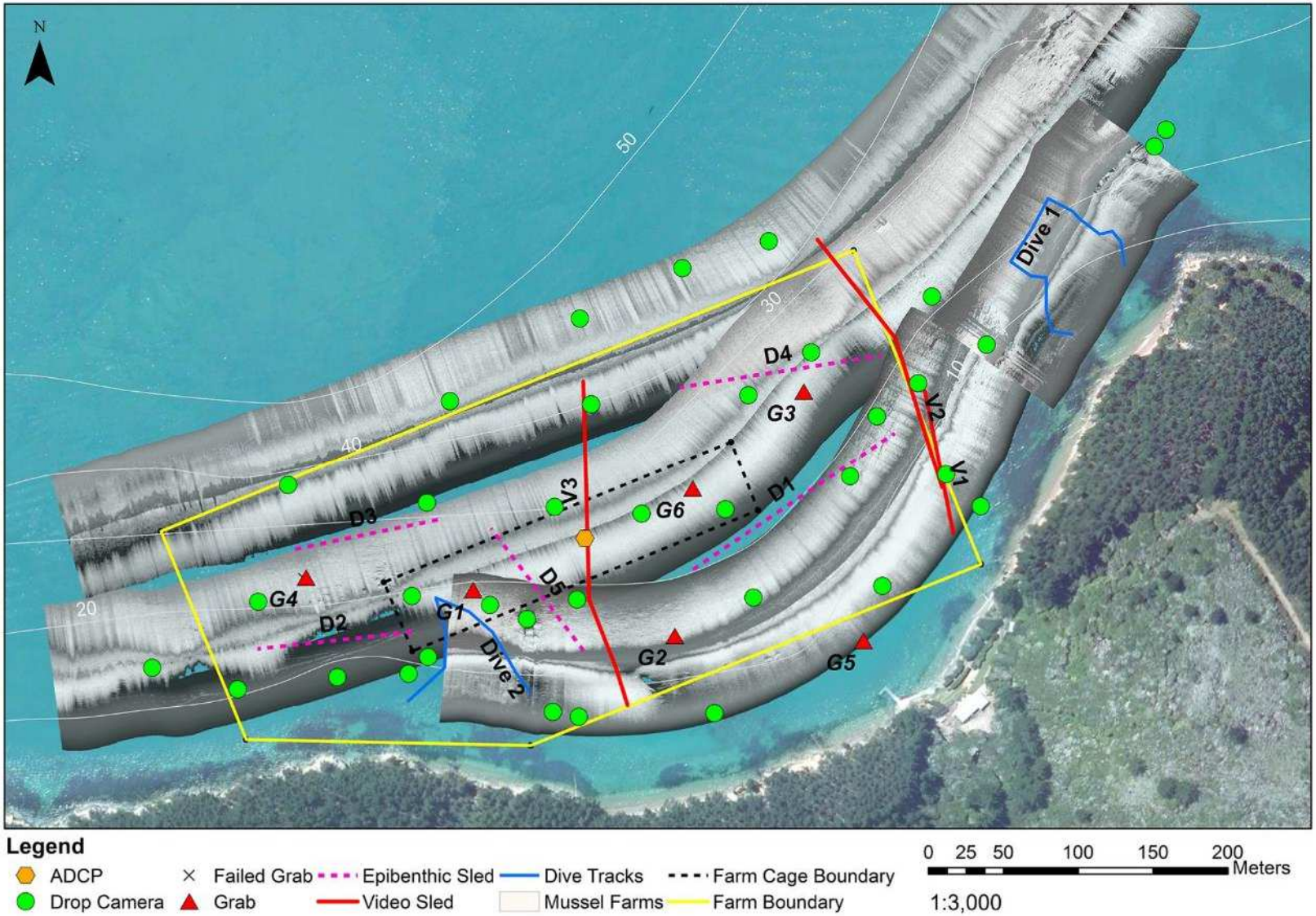

Figure 3-50: Survey sample locations at the Motukina site.

3.7.2 Sediment Composition at Motukina

Six grab samples were collected in depths of 8-34 m under the proposed Motukina Farm Site (Table B-1, Figure 3-51a), with one additional grab station failing due to the presence of large gauge gravel or cobble on the substratum (location depicted as crossed in Figure 3-51a). Although a sample was collected from station G1, this comprised a mixture of loose cobble, gravel and sandy-mud aggregate that was insufficient to take a core/grain-size subsample - although some fauna (Sabellid worms off a cobble) were collected (Table B-1). Visual inspection of the five successful cores recorded muddy sands with varying amounts of gravel and shell material in the sediment (Figure 3-51b). Grain size analyses found sediments at this farm site were comprised of sand (mean 53.23% ± 5.48 SE) and mud (mean 26.90% ± 2.54 SE), with gravel composition varying considerably from 0.4% to 35% (mean 19.87% ± 7.05 SE), with clean muddy sands (little to no gravels) collected from central-inner farm stations, while sediments in the outer boundary areas comprised higher amounts of shell/gravel material.

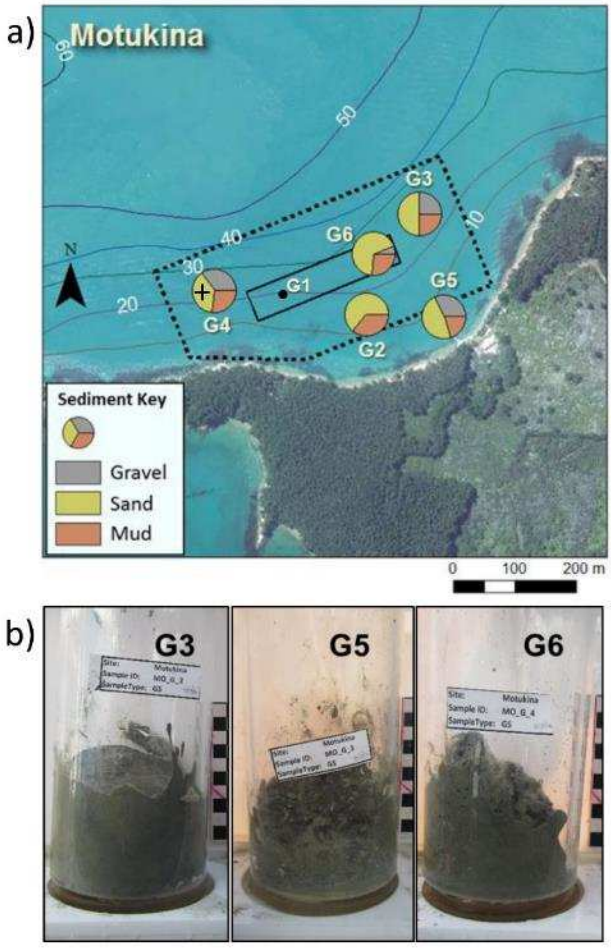

Figure 3-51: Grain size composition (% dry weight) and visual characteristics of sediments collected within the proposed Motukina Farm Site. a) Grain size distribution plots. G1 to G6 = station numbers MOT-G1 to MOT-G6 (MOT-G1 was insufficient for grain size analysis). Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries. b) Examples of the visual characteristics of sediment cores (e.g. G3, G5 and G6) from this site.

3.7.3 Habitats and Communities at Motukina

There were a range of substratum types and habitats noted in the vicinity of this site (Figure 3-52; Figure 3-53; Table 3-17). Rocky reefs extend out from the headlands to the east, and to the west of the proposed site, and areas of broken reef, boulder and cobble lie inshore of the site, and extend some of the way into the site in places, particularly near the eastern boundary, also in the vicinity of the southwest portion of the proposed cage area, and along the inshore boundary at the western end of the site. Inshore, in depths of 10m or less, the sediment was muddy sand with a lesser component of shell hash and some patches of cobble and broken rock. The substratum throughout most of the site in depths between ~18 and 40 m was composed of muddy sand, shell hash and calcareous gravel. The shell hash and gravel components increased with depth and proximity to the fast-flowing main channel. A diverse range of habitats and communities were encountered within the boundary of this site. Inshore areas in depths of <10 m were mostly sand and mud that supported assemblages dominated by infaunal burrowing organisms (Figure 3-52a) or diverse macroalgal communities (Figure 3-52b). Brittlestars (*Ophiopsammus maculata*) were a characteristic component of these inshore habitats.

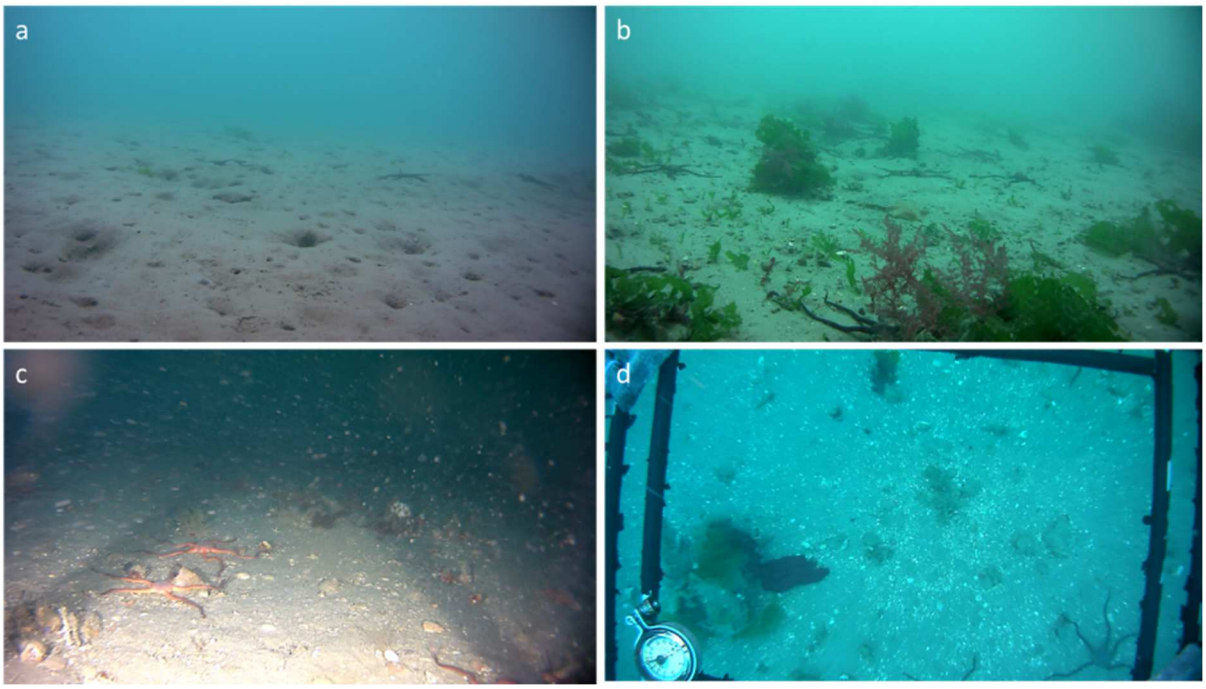

Figure 3-52: Most extensive habitats at the Motukina site. .a) Sandy mud substratum inshore of the site at <10m depth; b) sandy mud and algae, <10 m depth; c) outer boundary of cage area ~28m depth; d) near inner cage boundary, 19 m depth.

Further offshore beneath most of the proposed cage area, and throughout the majority of the greater site in depths between approximately 18 and 40 m where the substratum was composed of variable ratios of sand, silt, shell hash and shell gravel, the habitat was relatively featureless (Figure 3-52 c, d). In this zone, brittlestars (*O. maculata*) were the most common large-bodied epifaunal organism and scattered small biogenic clumps mostly comprising feather hydroids, various sponges, fluffy bryozoans, ascidians, and algae were present.

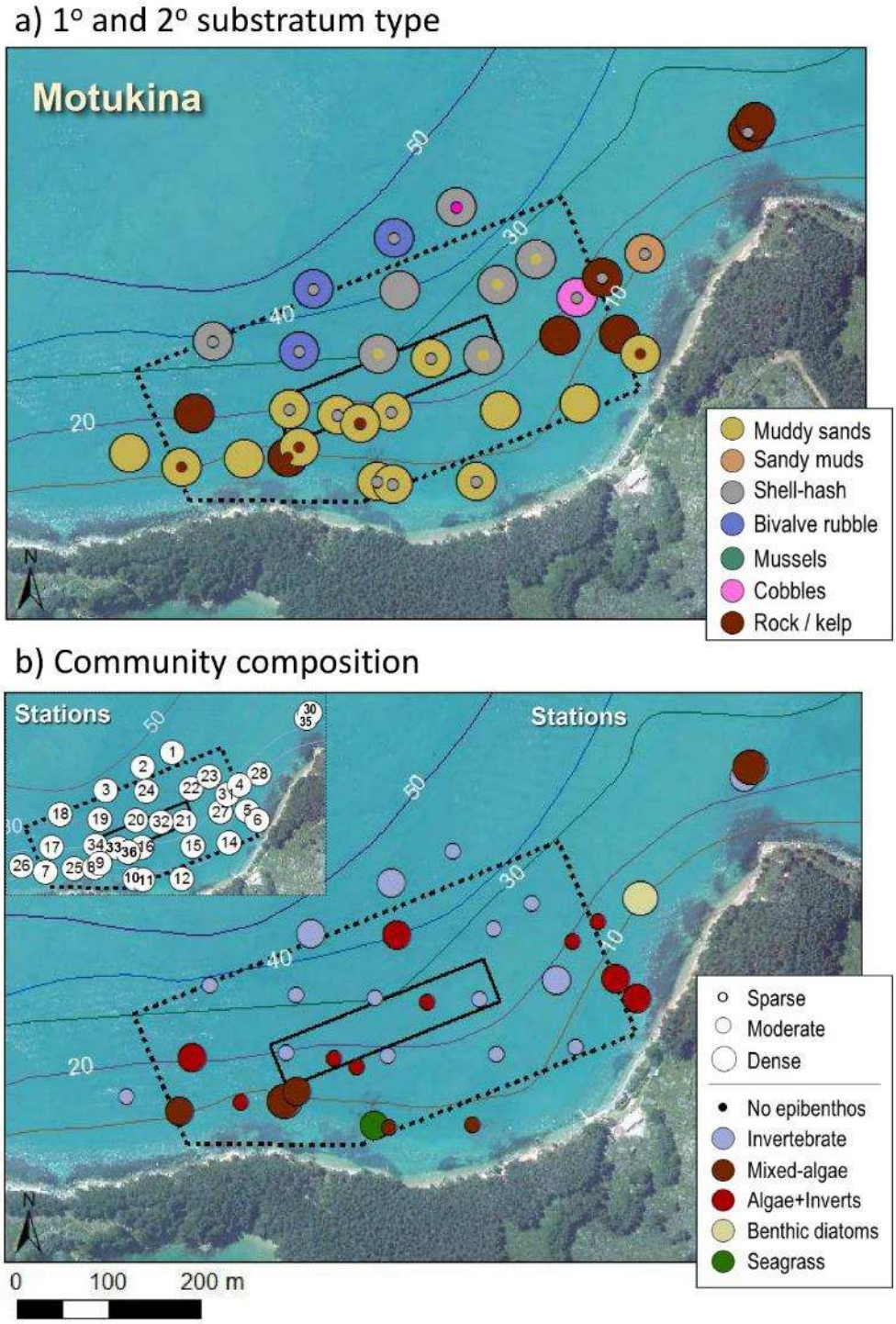

Figure 3-53: Benthic habitat and community composition from drop-camera photo-quadrats within and adjacent to the proposed Motukina Farm Site. a) Primary and Secondary substratum type. Large circles = primary substrata (most dominant habitat: ≥50% of cover), inner smaller circles = Secondary substrata (20-50% of quadrat). For example, rock with some sand will have a large dark brown circle with an inner yellow circle, while homogenous sand would be all yellow. b) Community composition. Circle colour denotes community types, while circle size denote rank abundance (sparse <10% cover; moderate = 10-50% cover, dense = >50% cover). Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries. Depth contours are in metres.

Table 3-17: Ecological features seen in video sled transects at Motukina.

Video #	Habitat	Depth (m)*	Conspicuous biota
V1	Muddy sand, dense coralline turf	3 - 4	Coralline turf, Triplefins
	Sand shell pebble	4 - 5	Brittlestars *Ophiopsammus maculata*), Kina (*Evechinus chloroticus*), Scattered algae
	Bare Muddy Sand	5 - 7	Infaunal burrows and holes
	Bare Muddy Sand Occasional Broken rock	8 - 12	Kina aggregations (*Evechinus Chloroticus*), Red and Green Algae, Kelp
V2	Sand, shell, occasional cobble	9	Kina (*Evechinus Chloroticus*), Brittlestars (*Ophiopsammus maculata*), Coralline algae
	Sand, shell, occasional cobble algal bed (red and green algae)	12 - 17	Red and green algae, Kina (*Evechinus chloroticus*), Brittlestars (*Ophiopsammus maculata*)
	Broken reef interspersed with sandy patches	18 - 28	Very diverse biogenic aggregations. Bryozoan coral (*Celleporaria agglutinans*), feather hydroids, tree hydroids (*Solanderia* sp.), sponges (yellow, orange), colonial ascidians, solitary ascidians, and associated invertebrates.
	Muddy sand, shell whole shell, gravel Occasional biogenic clumps	30 - 40	Hydroids, Anemones, Brittlestars (*Ophiopsammus maculata*), fluffy bryozoans, sponges
V3	Muddy sand Occasional patches of broken rock. Scattered small biogenic clumps.	15 - 25 m	Brittlestars (*Ophiopsammus maculata*), Fluffy bryozoans, Green algae, Red algae, Kina (*Evechinus chloroticus*)
	Shell gravel, Whole shell, muddy sand. Occasional biogenic clumps.	30 - 45 m	Hydroids, ascidians, sponges Finger sponge (*Callyspongia* sp.)

*Depths in this summary table are only indicative and not corrected for chart datum

The broken reef, cobble and/or bedrock patches extending into the eastern and western portions of the proposed licence provided substratum for highly diverse biogenic aggregations formed mostly of bryozoan corals (e.g. *Celleporaria agglutinans*), and various sponges and hydroids, including tree hydroids (*Solanderia* sp.) (Figure 3-54). These areas also provided habitat for numerous reef fish including blue cod (*Parapercis colias*), Tarakihi (*Nemadactlylus macropterus*) and blue moki (*Latridopsis ciliaris*). Some bedrock outcrops and broken reef substratum with stands of giant kelp (*Macrocystis pyrifera*) were present in the inshore portion of the proposed licence area. Patches of kelp occurred within the southwestern portion of the site and extended to just inside the southwestern portion of the proposed cage area (Figure 3-55a, b). Areas of macroalgal beds comprising a range of red and green algal taxa were present inshore at depths of 10-15 m. (Figure 3-55c, d).

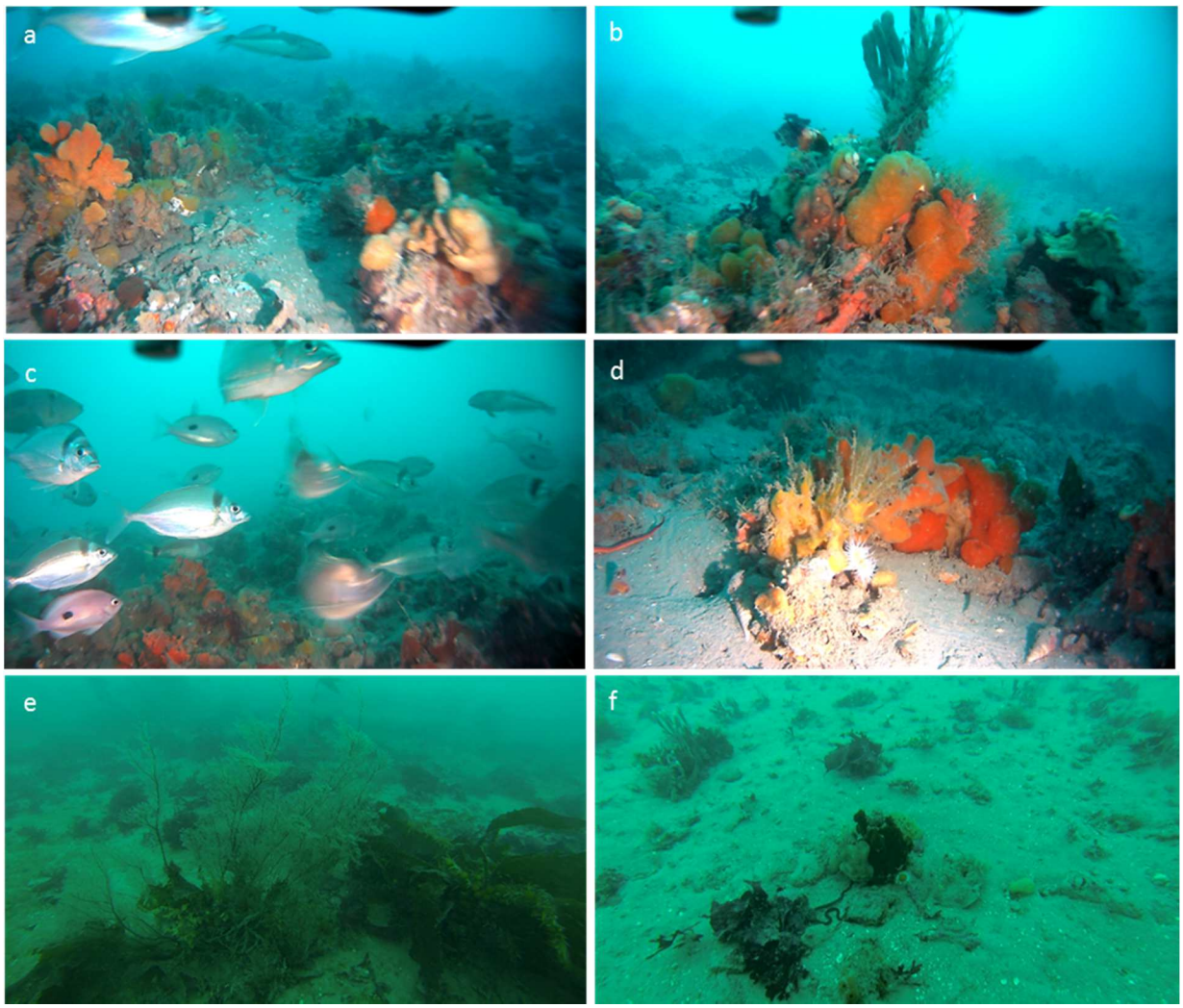

Figure 3-54: Biogenic aggregations on broken rock. a), b), c), d) close to the northeast boundary of the site; e), f) in the southwest portion of the cage area

Large bedrock reefs extended into Tory Channel from the main headlands to the Northeast and Southwest (Motukina Point), however those reefs were situated more than 150m away from the proposed farm consent area, so no detailed survey of those features was conducted at this site.

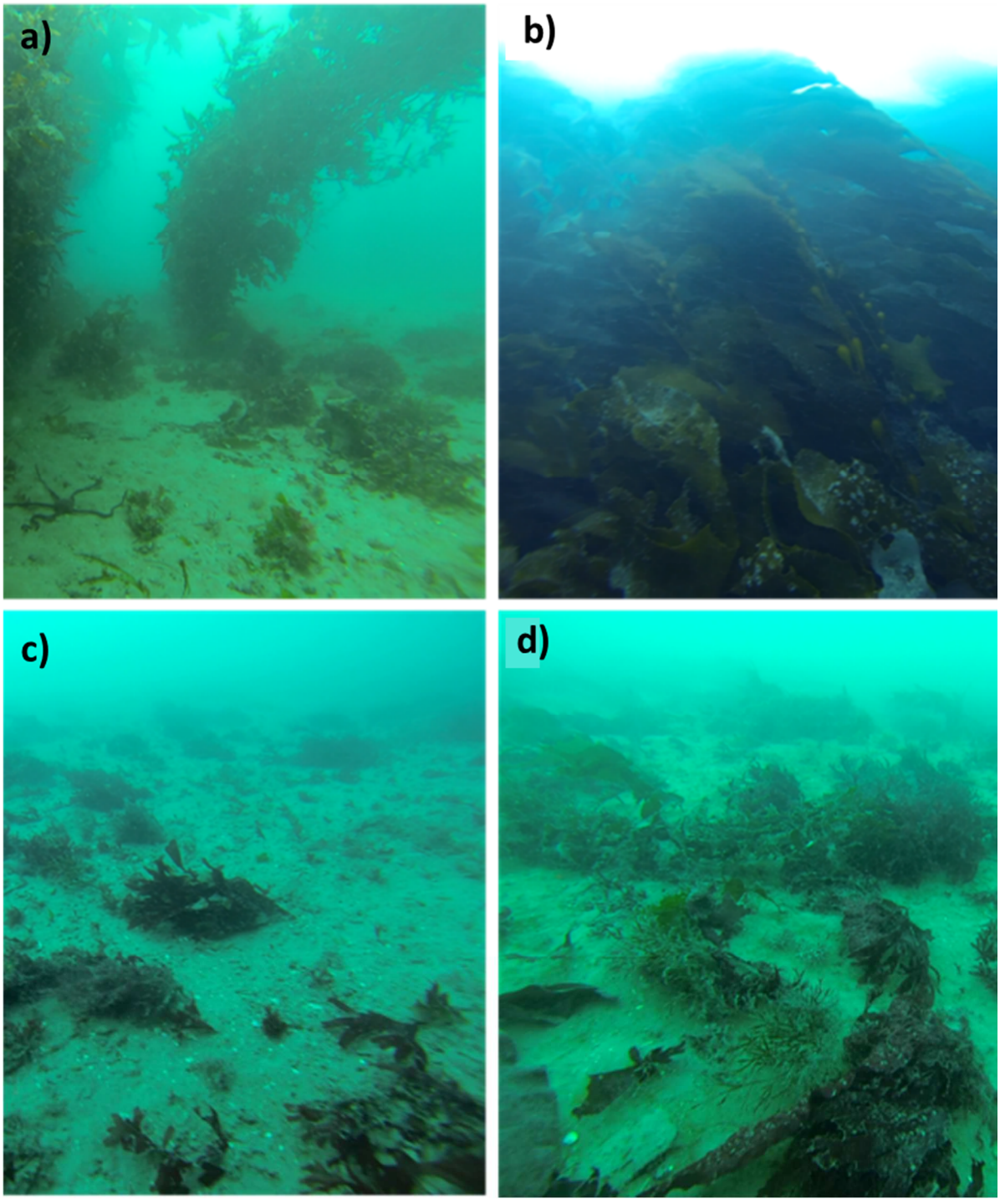

Figure 3-55: Kelp stands and algal beds. a) *Carpophyllum* sp. in the shallows in western dive transect. b) Giant kelp (*Macrocystis pyrifera*) stand at 7 m depth inshore and 100 m east of the farm boundary. c), d) Algal beds at 14 m depth

3.7.4 Epifaunal collections at Motukina

Motukina had the highest diversity of epifauna compared to all other proposed farm sites, comprised of a mix of hard and soft bottom taxa. A total of 209 epifaunal specimens from 54 different taxa was recorded from five epibenthic sled tows collected within and adjacent to the proposed Motukina Farm Site (Table 3-18). The most common taxa collected were Hermit crabs, *Pagurus* sp. (20.8%), Corbula clams, *Corbula zelandica* (12.9%), Brittle star, *Ophiopsammus maculata* (12.4%) and the small brachiopod, *Calloria inconspicua* (4.5% / 9 specimens) (Table 3-18). Other taxa characteristic of this site included starfish (*Patiriella regularis, Coscinasterias muricata* and *Stichaster australis*), gastropods (e.g. *Astraea heliotropium, Buccinulum* sp., *Crepidula fornicata*), reef-building bryozoans (*Celleporaria agglutinans*), hydroids, solitary and colonial Ascidians, sponges (*Halichondria* sp.), sea urchins (*Evechinus chloroticus*) and green, brown and red macroalgae (e.g. *Ulva* sp*., Caulerpa* sp. and *Curdiea* sp.) (Table 3-15, Figure 3-56). Epibenthic catches (as well as the grab samples) collected considerable shell rubble and cobble and mudstone debris as well as biogenic and bryozoan encrusted clumps (Figure 3-56a-d).

Notable taxa included occurrences of the Red-ribbed brachiopod, *Terebratella sanguinea* (6 specimen - stations 1 and 3), Kina, *Evechinus chloroticus* (2 specimens - station 2), Paddle weed (kelp), *Ecklonia radiata* (2 specimen - stations 2 and 3); Wakame (invasive kelp), *Undaria pinnatifida* (2 specimen - stations 2 and 3), reef-building bryozoans, *Celleporaria agglutinans* (8 specimens – stations 1, 2, 4 and 5), and Erect Bryozoan (1 specimen - station 1) and Encrusting Bryozoan (1 specimen - station 4). Encrusting bryozoan clumps were also collected at grab stations (TIP-G2).

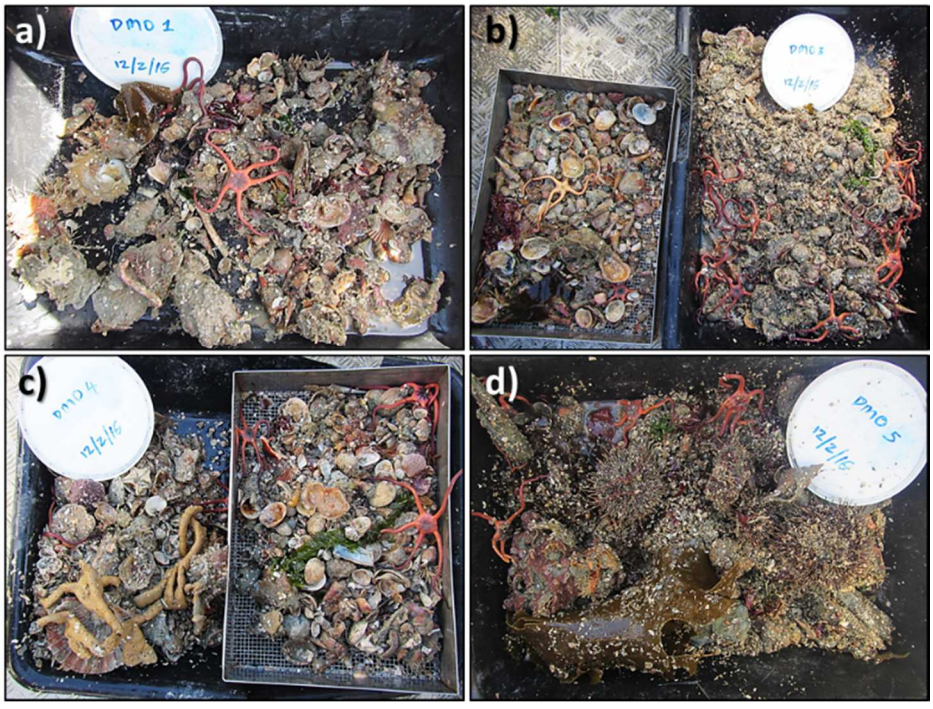

Figure 3-56: Examples of epifauna collected in epibenthic sleds within and adjacent to the proposed Motukina Farm Site. Characteristic species at this site includes: hermit crabs (*Pagurus* sp.), brittlestars (*Ophiopsammus maculata*), Corbula clams (*Corbula zelandica*), Circular saw shell (*Astraea heliotropium*), stars (*Patiriella regularis*), brachiopods (small brachiopods, *Calloria inconspicua* and Red-ribbed brachiopod, *Terebratella sanguinea*), reef-building bryozoa (*Celleporaria agglutinans*) and sea urchins (*Purpurocardia purpurata*), finger sponges, solitary ascidians and red, brown and green macroalgae (e.g. *Ecklonia radiata*, Ulva sp., *Caulerpa* sp).

Table 3-18: Relative abundance of epifauna collected in epibenthic sleds within and adjacent to the proposed Motukina Farm Site, Queen Charlotte Sound. "Tabd"= Total epifaunal abundance; Columns 1-5 depict replicate dredges MOT-D1 to MOT-D5, "✓"= present (1-4 specimens), "C" = common (5-9 specimens), "A"=abundant (>10 specimens). Tabd >= 5 are in blue text.

Taxa group	Common name	Species	Motukina					
			Tabd	1	2	3	4	5
Arthropoda	Sea spider	Pycnogonida	2	✓				✓
Ascidiacea	Solitary sea squirt	Solitary Ascidian	2				✓	✓
	Colonial sea squirt	*Aplidium phortax*	1			✓		
	Sea squirt	Ascidian unknown	1					✓
Asteroidea	Cushion star	*Patiriella regularis*	6			✓	✓	✓
	Eleven armed starfish	*Coscinasterias muricata*	2			✓		
	Reef starfish	*Stichaster australis*	2	✓			✓	
Bivalvia	Corbula clam	*Corbula zelandica*	26	✓		C	A	C
	Purple cockle	*Purpurocardia purpurata*	3			✓	✓	✓
	Strawberry cockle	*Pratulum pulchellum*	3				✓	
	NZ fan shell	*Talochlamys zelandiae*	2	✓		✓		
		Dosina mactracea	1					✓
	File shell	*Limaria orientalis*	1				✓	
	Impact mussel	*Musculus impactus*	1			✓		
	Sunset shell	*Gari lineolata*	1					✓
Brachiopoda	Small brachiopod	*Calloria inconspicua*	9			C	✓	✓
	Brachiopod	*Brachiopod* sml	4	✓				
	Red-ribbed brachiopod	*Terebratella sanguinea*	2	✓				
Bryozoa	Bryozoa	*Celleporaria agglutinans*	8	✓	✓		✓	✓
	Bryozoa	Bryozoan	2		✓			✓
	Branching bryozoan	Bryozoa branching	1				✓	
	Encrusting bryozoan	Bryozoa encrusting	1			✓		
	Green fluffy bryozoa	Bryozoa fluffy green	4	✓		✓		
	Orange fluffy bryozoa	Bryozoan fluffy orange	3	✓			✓	✓
Cephalopoda	Pygmy octopus	*Octopus huttoni*	2	✓				✓
Chlorophyta	Sea rimu	*Caulerpa* sp	1					✓
	Sea lettuce	*Ulva* sp	2			✓	✓	
Chordata	Common triplefin	*Forsterygion lapillum*	1	✓				
	Estuarine triplefin	*Grahamina nigripenne*	1					✓
Crustacea	Hermit crab	*Pagurus* sp	42	✓		✓	A	A
	Squat lobster	Galatheoidea	4				✓	
	Decorator crab	*Notomithrax* sp	2	✓				
	Red half-crab	*Petrolisthes novaezelandiae*	2	✓				✓
	Spider crab	*Halicarcinus* sp.	1			✓		
Echiniodea	Kina	*Evechinus chloroticus*	4				✓	✓
	Red sea urchin	*Pseudechinus albocinctus*	1				✓	
Gastropoda	Circular saw shell	*Astraea heliotropium*	6	✓		✓		✓
	Lined whelk	*Buccinulum* sp	3	✓			✓	
	Screw shell	*Maoricolpus roseus*	3			✓	✓	✓
	Slipper limpet	*Sigapatella* sp	3			✓		

Taxa group	Common name	Species	Motukina					
			Tabd	1	2	3	4	5
	Kelp shell	*Cantharidus* sp	1				✓	
	Top shell	*Calliostoma* sp	1					✓
Holothuroidea	Common sea cucumber	*Australostichopus mollis*	1				✓	
Hydrozoa	Hydroid	Hydroid	4		✓	✓	✓	✓
Mollusca/ Polyplacophora	Blue green chiton	*Chiton glaucus*	1			✓		
Ophiuroidea	Brittle star	*Ophiopsammus maculata*	25			A	C	C
	Brittle star	*Ophionereis fasciata*	2			✓	✓	
Phaeophyceae	Brown macroalgae	Macroalgae brown	2			✓		✓
	Kelp	*Ecklonia radiata*	1					✓
Polychaeta	Sea mouse	Aphroditidae	1				✓	
	Tubeworm	*Serpulidae*	1			✓		
Porifera	Sponge	Sponge	2				✓	✓
	Finger sponge	*Halichondria* sp	2				✓	
Rhodophyta	Red macroalgae	Macroalgae red	3		✓	✓		✓
	Prostrate red algae	*Curdiea* sp	1					✓

3.7.5 Infauna at Motukina

Motukina supported an abundant and diverse infaunal assemblage (including some epifaunal taxa collected in the grabs). A total of 1214 infauna from 74 different taxa was recorded from 6 replicate grab samples collected within the proposed Motukina Farm Site (Table D-8; Figure 3-57a-b). The total numbers of infauna at this farm site were significantly higher than all other proposed farm sites described here, while species richness was the second most diverse (after blowhole North). However, the total numbers of infauna at this farm site were variable between sampling stations (mean abundance of 202.33 ± 40.33 SE, range 90-381 individuals p/grab), yet taxa richness was consistently high (28.17 species ± 2.64 SE, 17-36 species per grab) (Figure 3-57a). High infaunal abundance at this farm site was due to much higher numbers of amphipods (60.4% of total site catch) that dominated these sediment, along with co-occurring polychaetes (15%, e.g. Sabellidae, Capitellidae and Opheliidae), bivalves (7.9%, e.g. *Gonimyrtea concinna*, *Tawera spissa* and *Corbula zelandica*), ostracods (4%) and isopods (3%) (Table D-8; Figure 3-57b). Notable taxa collected in the grabs at Motukina, included rare occurrences of the NZ Scallop, *Pecten novaezelandiae* (1 specimen - station G4), and encrusting and erect bryozoa (5 specimens - stations 1, 2 and 4) (Table D-8).

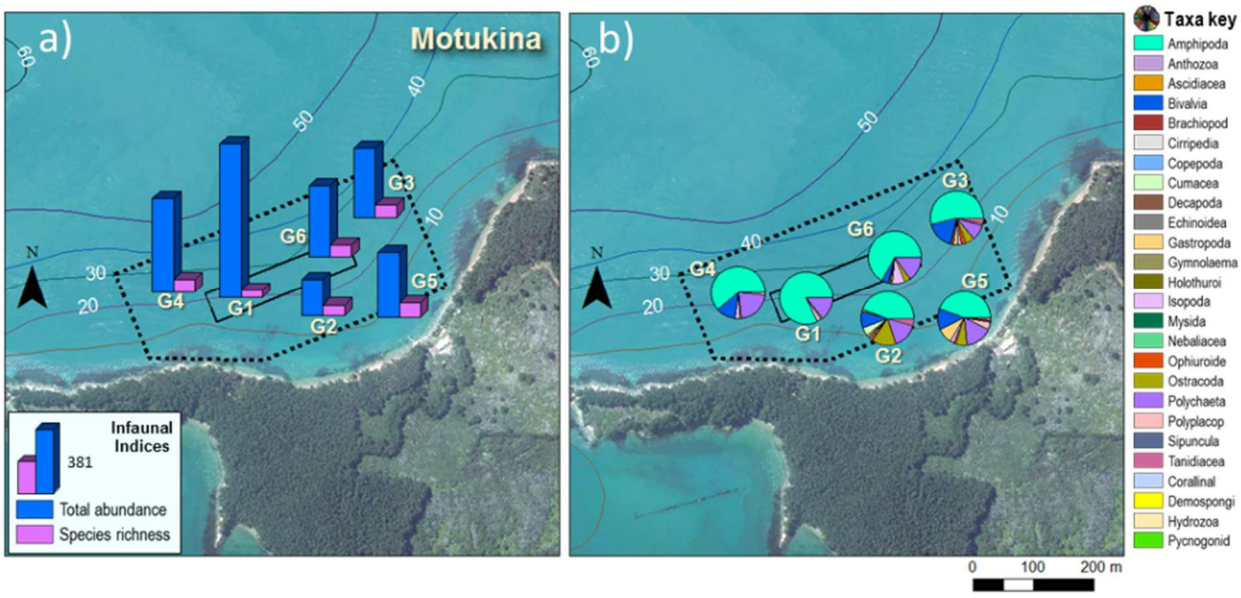

Figure 3-57: Infaunal summary indices and taxonomic grab sampling stations within the proposed Motukina Farm Site in Tory Channel, Queen Charlotte Sound. a) Infaunal total abundance and species richness, b) pie charts showing the taxonomic composition of each sample. G1 to G6 = station numbers MOT-G1 to MOT-G6; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries.

3.7.6 Reef dives at Motukina

Diverse reef communities noted by divers at the Motukina site are noted below in Table 3-19. A high abundance of fish including butterfly perch (*Caesiperca lepidoptera*), tarakihi (*Nemadactylus macropterus*), blue cod (*Parapercis colias*), spotty (*Notolabrus celidotus*), and moki (*Latridopsis ciliaris*) were associated with the broken reef and biogenic aggregations near the northeastern boundary of the site and the southwestern portion of the cage area. Other fish seen in video footage and noted by divers during the survey were sea perch (*Helicolenus percoides*), triple fins (*Forsterygion* sp), scarlet wrasse (*Pseudolabrus miles*), and banded wrasse (*Notolabrus fucicola*).

Table 3-19: Features noted in the reef dives at Motukina.

Habitat	Depth (m)*	Conspicuous biota	Fish
DIVE 1 East end Motukina			
Sand/Shell hash/pebble	4 to 10	Brittlestars (*Ophiopsammus maculata)* Red, Green Ulva, Caulerpa(sparse)	Spotties (*Notolabrus celidotus*)
Sand/Shell hash/pebble with occasional boulder	10	Brittlestars *(O. maculata),* Kinas (*Evechinus chloroticus*), Red,Green (sparse), *Macrocystis* (occasional)	Tarakihi (*Nemadactylus macropterus*), Blue cod (*Parapercis colias*), Spotties
Sand/Shell hash/pebble/Broken rock/bedrock patch reef	12	Brittlestars *(O. maculata),* Kinas, Red/Green (moderate to dense). Kelps (scattered) including *Ecklonia radiata*, *Macrocystis pyrifera* and *Undaria.*	Spotties (*Notolabrus celidotus*), Blue cod (*Parapercis colias*), Wrasse
Low relief bedrock reef and sand patches	17	Tree hydroids (*Solanderia* sp.) Red, Kelps (*Undaria* and *Ecklonia*)	Tarakihi, Blue cod, Moki, Banded wrasse
Sand/Shell hash/pebble/boulder/bedrock patch reefs (low relief). Large Biogenic aggregations	20 to 23	Bryozoan coral *(Celleporaria agglutinans)*, various sponges, Fluffy bryozoans, tree hydroids (*Solanderia*), wandering anemone (*Phlyctenactis tuberculosa*) Red macroalgae, Kelp	Blue cod (*Parapercis colias*), Moki
DIVE 2 West end Motukina			
Sand, seagrass	3.5	Brittlestars, Catseyes (*Turbo smaragdus*)	banded wrasse, spotties
Sand, kelp	4.1	Carpophyllum	Blue moki, Spotties, Blue cod, triplefins
Sand, diatom mat	7.5	*Ophiopsammus maculata*, (moki) Stichopus, *Cookia sulcata*, red algae	Banded wrasse, blue moki, spotties
Sand, kelp Shell hash and cobble	12.1	Hydroid trees (*Solanderia* sp.) *Australostichopus*. Colonial ascidians red macroalgae, kelp	Spotties (*Notolabrus celidotus*), blue cod, flounder
Sand and low relief bedrock patches	14.1	Kina, brittlestars, paua, eleven arm starfish, Fluffy Bryozoans	Spotties, blue cod (*Parapercis colias*), spotties, paua
Sand/Shell/Cobble	15.2	Kina *(Evechinus chloroticus)*, sponge, Patiriella, brittle star	Scarlett wrasse
Sand, broken rock, cobble	18.5	Biogenic clumps, bryozoan, hydroid, scallop (*Pecten novaezelandia*),	blue cod (*Parapercis colias*)
Broken rock, biogenic aggregations	20.5	sponges, Tree hydroids, brittle star, *Australostichopus*, Biscuit star, Sponge, *Patiriella*, *Coscinasterias Undaria*, red algae	blue cod (*Parapercis colias*), banded wrasse

3.7.7 Notable ecological features: Motukina

Much of the central area of the proposed farm site lies over sand/shell hash habitat inhabited by a sparse to moderately dense epibenthic community. There are also areas supporting communities of high biological diversity adjacent to, and extending within the site boundaries. In the vicinity of the eastern site boundary in particular, and also the southwestern corner of the cage boundary, there are areas of broken rock/cobble supporting large biogenic aggregations and associated fish populations that are ecologically significant. The bryozoan coral *Celleporaria agglutinans* was noted in video sled footage and epibenthic sled samples. This is considered to be an important reef building species that creates habitat for diverse biogenic communities, formed by the aggregation of the bryozoan with various hydroids, ascidians and sponges. Associated with these areas are reef fish including schools of tarakihi and butterfly perch (Davidson et al 2011). Another notable organism occurring within the site were hydroid trees (*Solanderia* sp), and this taxon is considered to be characteristic of the subtidal environment in Tory Channel (Brown 2000, Davidson et al. 2011). Several brachiopods were collected in the epifaunal dredge samples but no evidence of a highly dense zone or bed of brachiopods was seen. Inshore of the site and extending into the site in places there are patches of kelp, including the ecologically important giant kelp (*Macrocystis pyrifera*) (e.g. Steneck et al 2002) and also algal beds comprising a diverse range of red and green algae, and geniculate coralline algae. Patches of Kina (*Evechinus chloroticus*) at high densities were observed in places within the broken rock habitats.

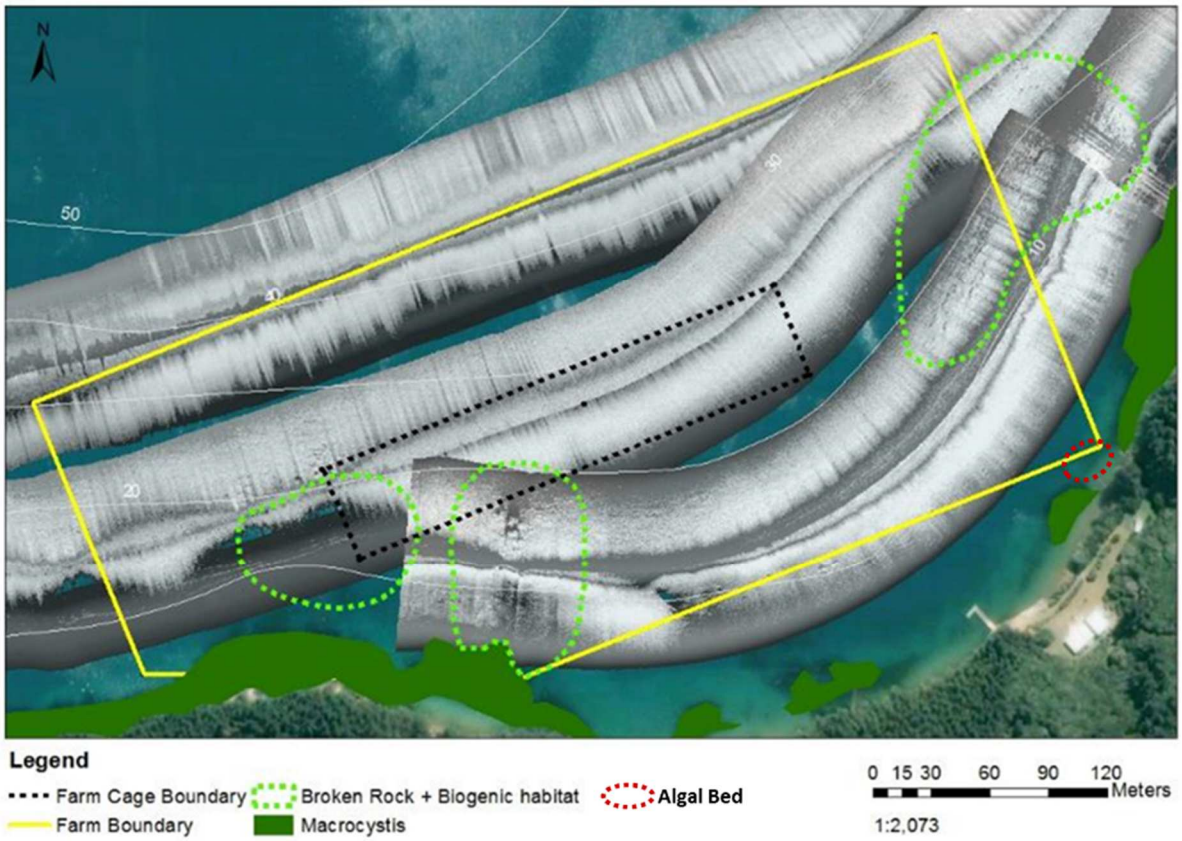

Figure 3-58: Notable ecological features at Motukina. Areas encircled by the green dotted lines represent zones of reef, broken rock and cobble that support diverse communities and biogenic aggregations. Boundaries of notable ecological features are approximate.

3.8 Te Weka Bay (47), Tory Channel

3.8.1 Te Weka Bay, general site information station depths and locations

The proposed 12 Ha site at Te Weka is located on the southern side of Tory Channel between Tapapaweka Point and Katoa Point. The majority of the proposed farm site is over a moderately sloping seabed that varies in depth from ~ 10 m in the southeast corner to 42 m at the northern offshore corner (Figure 3-59). Survey sample positions are shown in Figure 3-60. A seabed mounted Acoustic Doppler Current profiler is recording the current profiles at this site at present, so data to characterise currents at the site is not yet available (but will be presented in a subsequent report for Part 2 of this assessment).

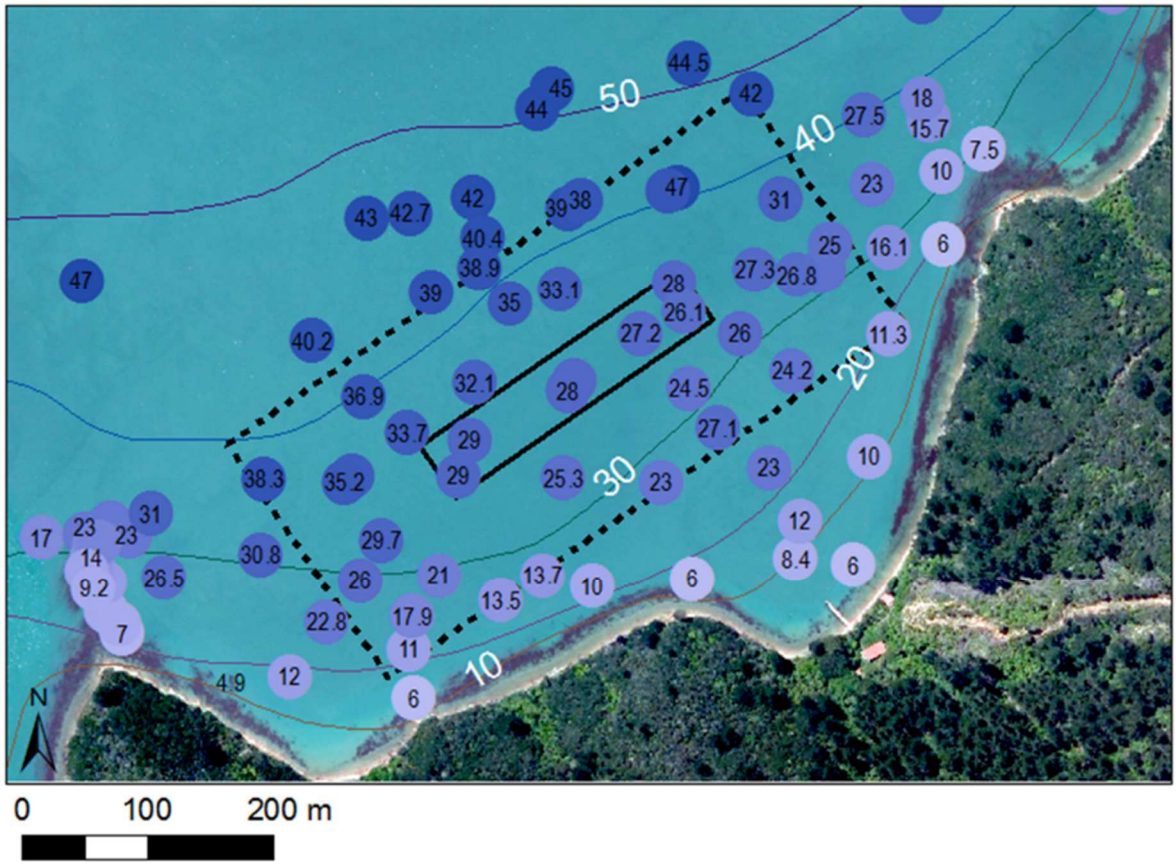

Figure 3-59: Station depths at Te Weka, Tory Channel. Colour depicts depth from shallow (white) to dark blue (deep), central values are depths in metres.

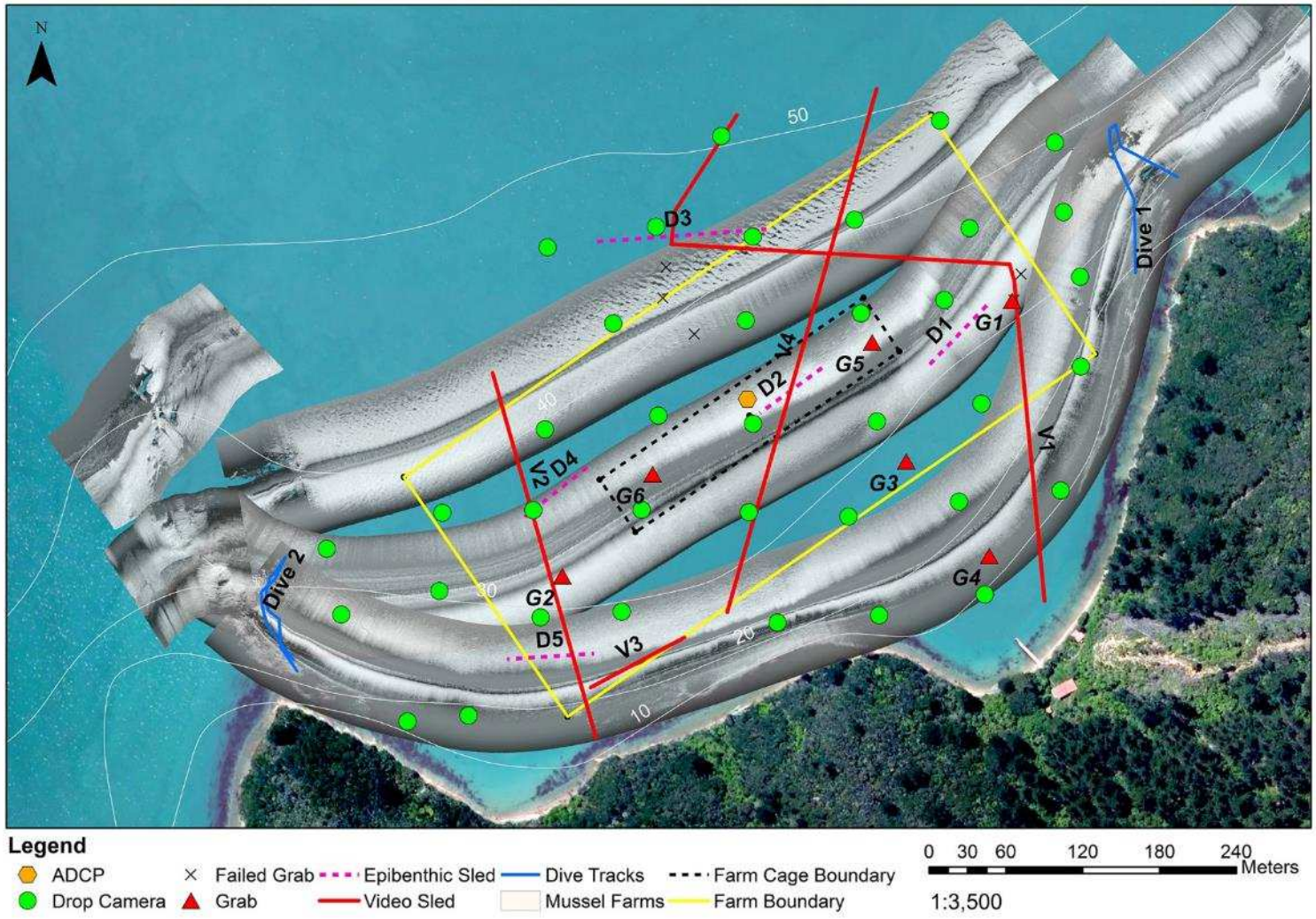

Figure 3-60: Survey sample locations at the Te Weka site.

3.8.2 Sediment composition at Te Weka

Six grab samples were collected in depths of 12-30 m under the proposed Te Weka Farm Site (Table B-1, Figure 3-61a). However, additional grab stations failed to return any sample due to the consolidated shell gravel substratum (n=6 attempts from 3 adjacent offshore stations - depicted as crossed in Figure 3-61a). The remaining 6 grab stations collected smaller volumes of sediment, but collected enough sample for grain size analyses to be undertaken (Table B-1, Figure 3-61b). Visual inspection of the cores found sandy muds, with shell and gravel material recorded at some stations. Grain size analyses found sediments comprised sand (55.53% ± 2.26 SE) and mud (35.87% ± 3.28 SE), with variable amounts of gravel (mean 8.60% ± 2.91 SE, ranging 0.2 - 16.4%).

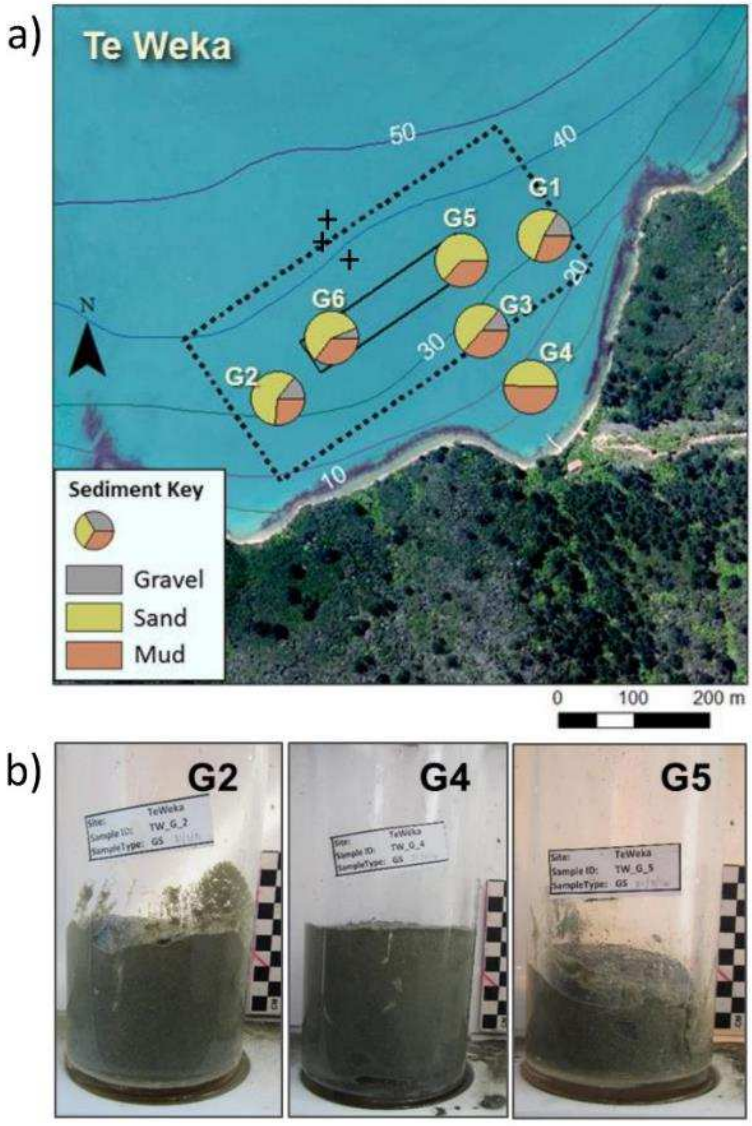

Figure 3-61: Grain size composition (% dry weight) and visual characteristics of sediments collected within the proposed Te Weka Farm Site. a) Grain size distribution plots. G1 to G6 = station numbers TEW-G1 to TEW-G6; **+** indicates the location of failed grabs due to hard ground; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries. b) Examples of the visual characteristics of sediment cores (e.g. G2, G4 and G5) from this site.

3.8.3 Habitats and Communities at Te Weka

A diverse range of benthic habitats and communities were surveyed at the Te Weka site. From the low intertidal out to approximately 15 m depth the sediment is predominantly soft muddy sand (Figure 3-62 a, b and Figure 3-63) and here biotic communities were dominated by polychaetes (densely distributed in places) and other infaunal organisms as well as patches of macroalgae. Epibiota was sparse and brittlestars (*Ophiopsammus maculata*) were the only conspicuous epifaunal organism. Further offshore in depths of approximately 12-16 m, along the southwest portion of the inshore boundary of the site, there were dense beds of red macroalgae, supporting patchy distributions of kina. Beneath most of the proposed cage area, and throughout much of the broader farm site (depths of ~25-35 m), the substratum was composed of varying ratios of sand, silt, shell hash and shell gravel, and biota was relatively sparse (Figure 3-62 c, d and Figure 3-63). In that zone, brittlestars (*O. maculata*) were the most common large-bodied epifaunal organism, along with small and sparsely distributed biogenic clumps comprised of aggregates of hydroids, sponges, fluffy bryozoans, ascidians, and algae. Occasional larger biogenic clumps and a few tree hydroids (*Solanderia* sp.) were also recorded in this zone (Figure 3-62 c, d), particularly in the western side of the site. Further offshore, in the vicinity of the offshore cage boundary in the northeast portion of the site (depths of 35-45 m) dense areas of bivalve rubble were recorded in the video sled transects V1 and V2 (Table 3-20). This offshore bivalve rubble zone comprised semi-consolidated aggregations of whole shell rubble, shell hash that form distinct wave-like biogenic mounds on the seabed, which were depicted as an extensive area in the sidescan imagery (Figure 3-60). This bivalve rubble/biogenic mound zone, supported a diverse epibenthic assemblage, of encrusting and erect epibenthos, including sponges, hydroids, ascidians and bryozoans, and mobile invertebrates including brittlestars, sea cucumbers and hermit crabs (Figure 3-62 f).

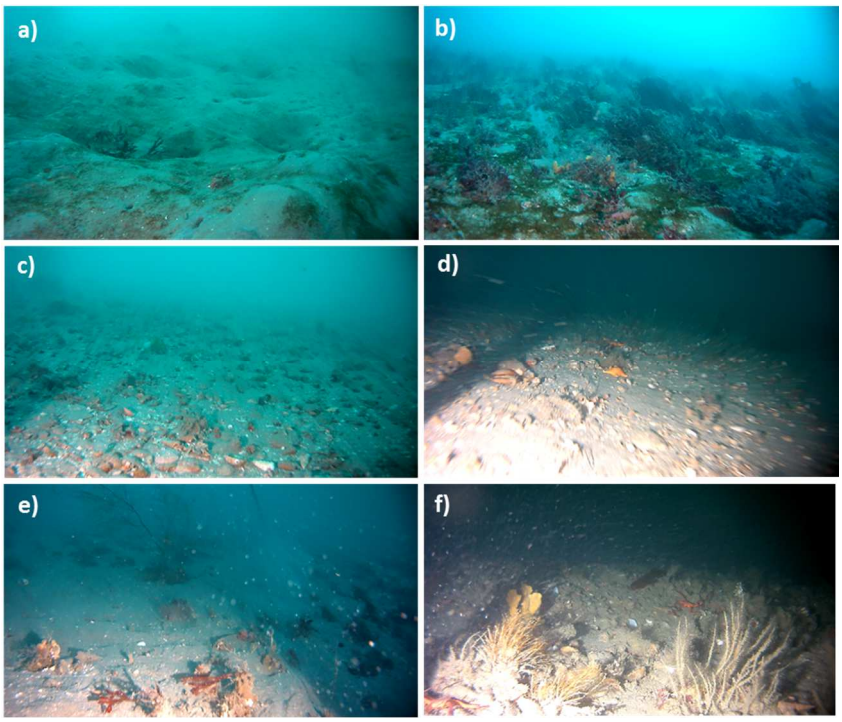

Figure 3-62: Habitats and communities at Te Weka. a) Sandy mud habitat with diatom mat inshore at ~8 m depth; b) Macroalgal bed inshore of the site at ~14 m depth; c), d) Muddy sand/shell rubble/shell hash habitat with sparse epifaunal community within the site at ~25 and ~30 m respectively; e) sand cobble and biogenic clumps including tree hydroids (*Solanderia* sp.) from video sled V2 at the western end of site ~28 m depth; f) wave-like biogenic mounds with diverse biota at ~40 m depth near the offshore boundary of the site.

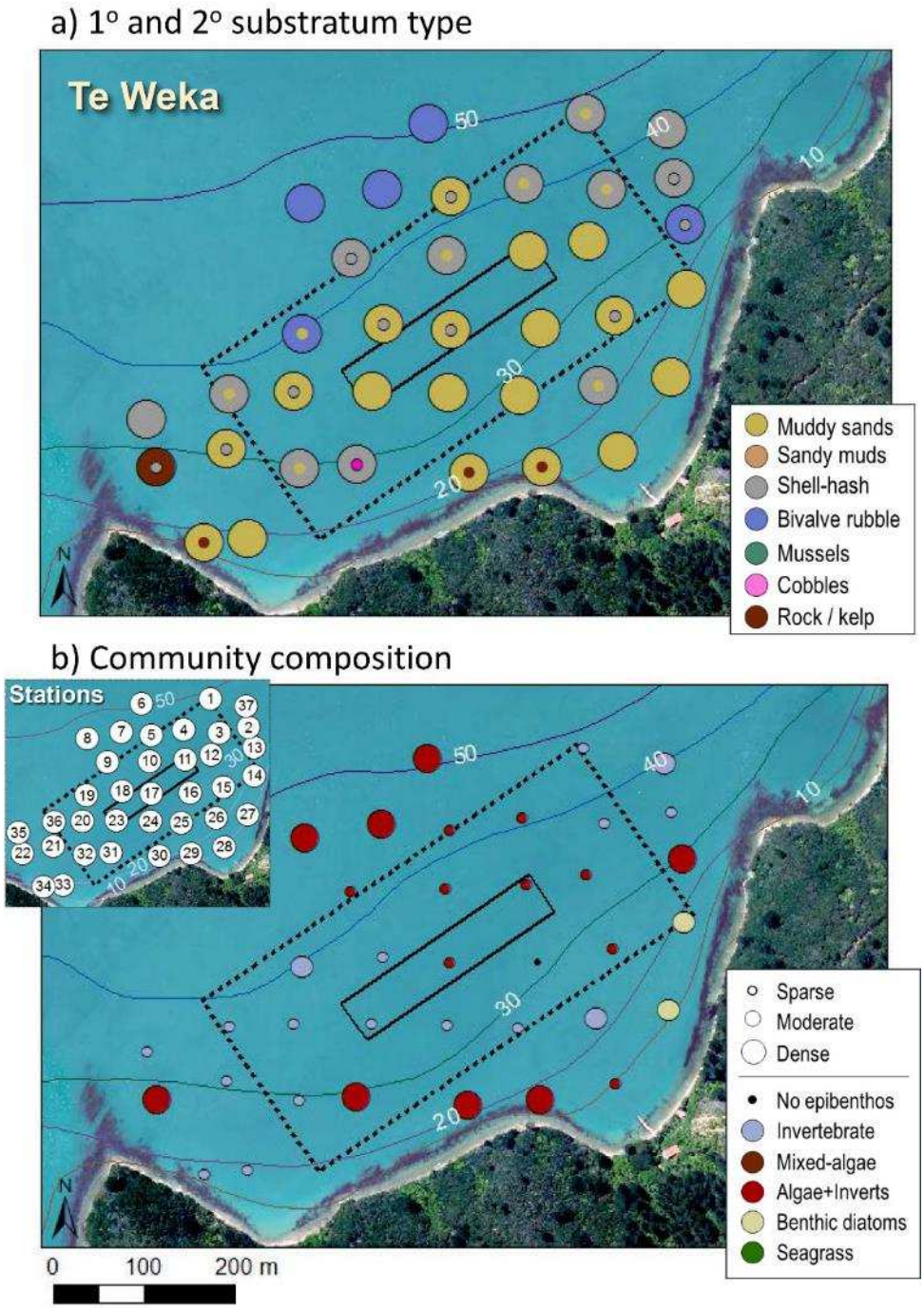

Figure 3-63: Benthic habitat and community composition from drop-camera photo-quadrats within and adjacent to the proposed Te Weka Farm Site. a) Primary and Secondary substratum type. Large circles = primary substrata (most dominant habitat: ≥50% of cover), inner smaller circles = Secondary substrata (20-50% of quadrat). For example, rock with some sand will have a large dark brown circle with an inner yellow circle, while homogenous sand would be all yellow. b) Community composition. Circle colour denotes community types, while circle size denote rank abundance (sparse <10% cover; moderate = 10-50% cover, dense = >50% cover). Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries. Depth contours are in metres.

Table 3-20: Ecological features seen in video sled transects at Te Weka.

Video #	Habitat	Depth (m)*	Conspicuous biota
V1	Biogenic aggregations forming wave-like mounds comprising a matrix of shell rubble and diverse biota	35 - 45	Hydroids, sponges, ascidians, bivalves, algae, brittlestars (*Ophiopsammus maculata*), tubeworms, algae, echinoderms
	Muddy Sand, Shell hash, scattered sparse biota, occasional biogenic clumps	20 - 30	Sponges, feather hydroids, echinoderms, red algae, brittlestars (*Ophiopsammus maculata*), opalfish, scallops (*Pecten novaezelandiae*)
	Muddy sand, Shell hash	10 - 20	Diatom film, sparse red algae
	Muddy sand	<10	Diatom film, infaunal burrows and holes
V2	Biogenic aggregations forming wave-like mounds comprising a matrix of shell rubble and diverse biota	40 - 35	Hydroids, sponges, ascidians, bivalves, algae, brittlestars (*Ophiopsammus maculata*), tubeworms, algae, echinoderms
	Muddy sand, whole shell, shell hash. Occasional small biogenic clumps	22 - 35	Brittlestars (*Ophiopsammus maculata*), sponges, fluffy bryozoans, tree hydroids,
V3	Muddy sand, shell hash. Macroalgal bed.	11 - 14	Diverse red algae, kina
V4	Muddy sand, dense algal bed	14 - 15	Diverse red algae
	Muddy sand, shell hash	18 - 25	Sand, infaunal burrows, brittlestars (*Ophiopsammus maculata*)
	Muddy sand, shell hash, Occasional small biogenic clumps	27 - 35	Brittlestars (*Ophiopsammus maculata*), red algae, green algae
	Whole shell, shell hash, muddy sand	37 - 45	Hydroids, sponges, ascidians, bivalves, algae, brittlestars (*Ophiopsammus maculata*), tubeworms, algae, echinoderms

*Depths in this summary table are only indicative and not corrected for chart datum

3.8.4 Epifaunal collections at the Te Weka

A total of 187 epifaunal specimens from 28 different taxa was recorded from five epibenthic sled tows collected within and adjacent to the proposed Te Weka Farm Site (Table 3-21). The most common taxa collected at this farm site, included the Screw shell, *Maoricolpus roseus* (42.8%), Hermit crabs, *Pagurus* sp. (10.7%), Corbula clams, *Corbula zelan*dica (8%), sea urchins, *Evechinus chloroticus* (3.7% / 7 specimens) and Brittlestars, *Ophiopsammus maculata* (3.2%) (Table 3-21, Figure 3-64). Other characteristic taxa included starfish (*Patiriella regularis* and *Coscinasterias muricata*), File shells (*Limaria orientalis*), Red-ribbed brachiopod, *Terebratella sanguinea* (2.1% / 4 specimens), hydroids, other brittlestars (*Amphiura* sp. and *Ophionereis fasciata*), as well as colonial and solitary ascidians, sea cucumbers (*Australostichopus mollis*), sponges, bryozoan, and green, brown and red macroalgae (*Ulva* sp., kelp, foliose red algae and filamentous red algae). Epifaunal specimens were also collected in the grabs at this site. These included colonial ascidians, fern-shaped hydroids and brittlestars (*Ophiopsammus maculat*) at station TEW-G1, and *Macrocystis* and red foliose macroalgae at a failed grab station).

Notable taxa included occurrences of the Red-ribbed brachiopod, *Terebratella sanguinea* (4 specimen - stations 3 and 4), Kina, *Evechinus chloroticus* (7 specimens - station 2, 3 and 5), Kelp fragment - likely to be *Ecklonia radiata* (1 specimen – station 4); Erect Bryozoa (2 specimen - station 2).

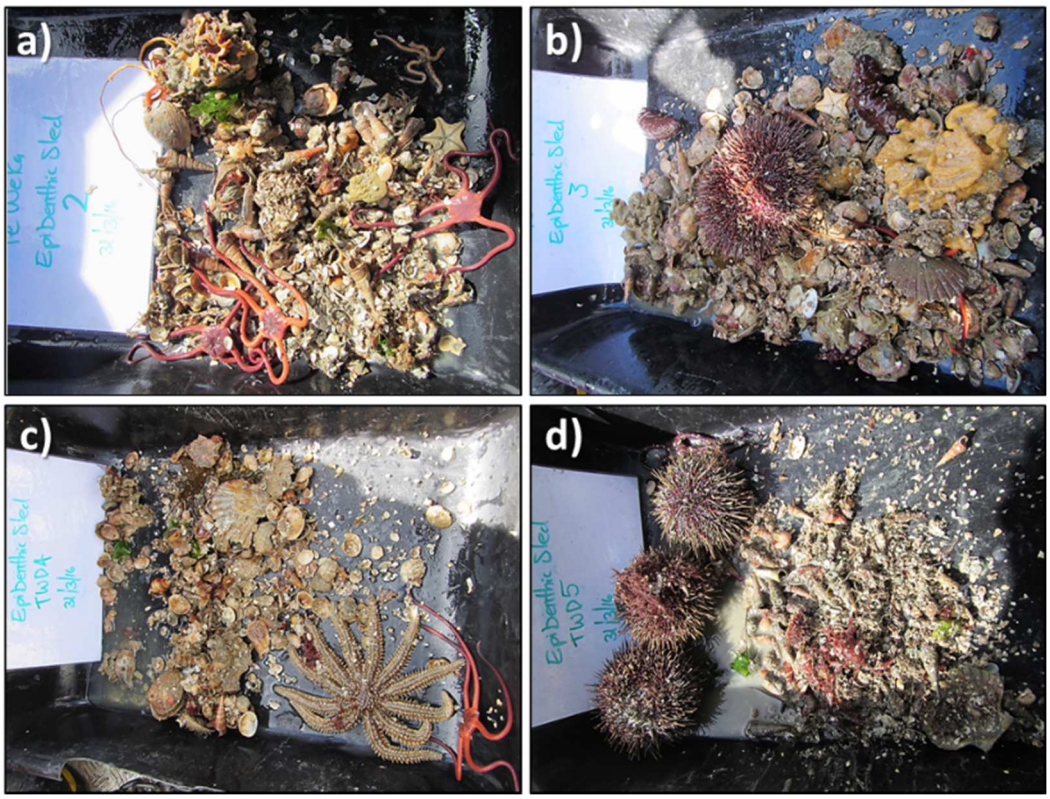

Figure 3-64: Examples of epifauna collected in epibenthic sleds within and adjacent to the proposed Motukina Farm Site. Characteristic species at this site includes: hermit crabs (*Pagurus* sp. in screw shells), brittlestars (mostly *Ophiopsammus maculata*), starfish (e.g. *Coscinasterias muricata* and *Patiriella regularis*), Corbula clams (*Corbula zelandica*), sea urchins (Kina, *Evechinus chloroticus*), red-ribbed brachiopod (*Terebratella sanguinea*), as well as colonial and solitary ascidians, sea cucumber (*Australostichopus mollis*), sponges, bryozoan, red macroalgae.

Table 3-21: Relative abundance of epifauna collected in epibenthic sleds within and adjacent to the proposed Te Weka Farm Site, Queen Charlotte Sound. "Tabd"= Total epifaunal abundance; Columns 1-5 depict replicate dredges TEW-D1 to TEW-D5, "✓"= present (1-4 specimens), "C" = common (5-9 specimens), "A"=abundant (>10 specimens). Tabd >= 5 are in blue text.

Taxa group	Common name	Taxa/Species	Te Weka					
			Tabd	1	2	3	4	5
Ascidiacea	Saddle sea squirt	*Cnemidocarpa nisiotis*	3		✓	✓		
	Saddle sea squirt	*Cnemidocarpa bicornuta*	2				✓	✓
	Colonial sea squirt	Colonial Ascidian	1		✓			
	Compass sea squirt	*Asterocarpa humilis*	1		✓			
Asteroidea	Cushion star	*Patiriella regularis*	3		✓	✓		✓
	Eleven armed starfish	*Coscinasterias muricata*	1				✓	
Bivalvia	Corbula clam	*Corbula zelandica*	15		A			C
		Notocallista multistriata	5		C			
	File shell	*Limaria orientalis*	2			✓		
		Neilo australis	1	✓				
	NZ fan shell	*Talochlamys zelandiae*	1		✓			
	Strawberry cockle	*Pratulum pulchellum*	1		✓			
Brachiopoda	Red-ribbed brachiopod	*Terebratella sanguinea*	4			✓	✓	
Bryozoa	Bryozoa	Bryozoan	2		✓			
	Bryozoa	Bryozoan fluffy orange	1		✓			
Chlorophyta	Sea lettuce	*Ulva* sp	5				✓	✓
Crustacea	Hermit crab	*Pagurus* sp	20		A			A
	Decorator crab	*Notomithrax* sp	2		✓			
	Red half-crab	*Petrolisthes novaezelandiae*	2			✓		
	Crab	*Ebalia laevis*	1	✓				
Echiniodea	Kina	*Evechinus chloroticus*	7		✓	✓		✓
	Heart urchin	*Echinocardium cordatum*	1		✓			
	Red sea urchin	*Pseudechinus albocinctus*	1					✓
Gastropoda	Screw shell	*Maoricolpus roseus*	80		A	A	A	A
	Lined whelk	*Buccinulum* sp	1					✓
Hydrozoa	Hydroid	Hydroid	3		✓	✓		✓
Holothuroidea	Common sea cucumber	*Australostichopus mollis*	2			✓		
Ophiuroidea	Brittle star	*Ophiopsammus maculata*	6	✓		✓	✓	✓
	Brittle star	*Amphiura* sp	2		✓		✓	
	Brittle star	*Ophionereis fasciata*	1	✓				
Phaeophyceae	Kelp	Macroalgae brown	1				✓	
Porifera	Sponge	Erect sponge	2		✓	✓		
Rhodophyta	Red macroalgae	Foliose red algae	3				✓	✓
	Red macroalgae	Filamentous red algae	3				✓	✓

3.8.5 Infauna at Te Weka

A total of 674 infauna from 63 different taxa was recorded from 6 replicate grab samples collected within the proposed Te Weka Farm Site (Table D-9; Figure 3-65a-b). Te Weka supported both moderately high infaunal abundance (mean site abundance of 112.33 ± 12.76 SE, 89-163 indiv. per grab), and taxa richness (28.17 species ± 2.64 SE, range 17-32 species per grab) (Figure 3-65a). Infaunal assemblages from this site were dominated by amphipods (38% of the total site catch) and polychaete worms (33.4%, e.g. Capitellidae, Opheliidae, Sabellidae and Spionida), with bivalves (8.2%, e.g. *Gonimyrtea concinna* and *Corbula zelandica*), cumaceans (4.9%) and isopods (3%) (Table D-9; Figure 3-65b). Notable taxa collected in the grabs at Te Weka, included the Small brachiopod, *Calloria inconspicua* (3 specimens - station G2 and G3) and an encrusting Bryozoan (1 specimen - station G6) (Table D-9).

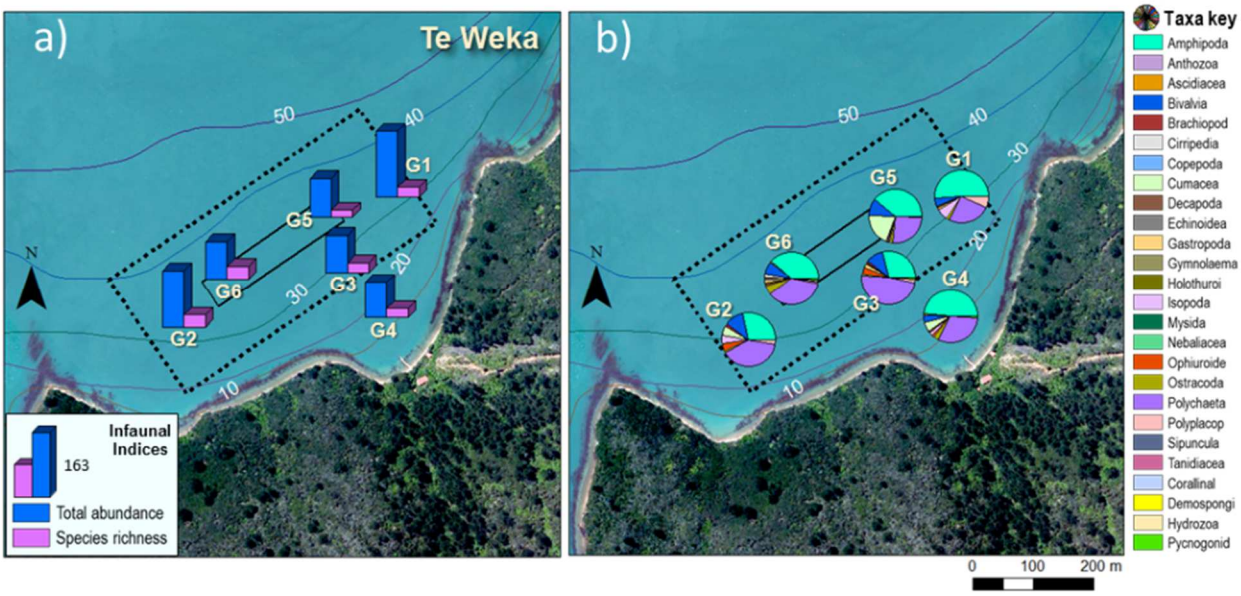

Figure 3-65: Infaunal summary indices and taxonomic grab sampling stations within the proposed Te Weka Farm Site in Tory Channel, Queen Charlotte Sound. a) Infaunal total abundance and species richness, b) pie charts showing the taxonomic composition of each sample. G1 to G6 = station numbers TEW-G1 to TEW-G6; Black dashed-lines indicate the proposed farm site, solid-lines indicate the proposed Cage boundaries..

3.8.6 Reef Dives at Te Weka

The reef at Katoa Point extends approximately 200 m to the NNW from the point into Tory channel and to a depth of approximately 50 m. Consequently our dive (Dive 2) only surveyed a very small section of the reef. The currents there are strong and even during slack tide there was considerable water movement in places, and a lot of resuspended sediment in the water. This combination of strong currents and moving sediment appeared to have a scouring effect on the reef in places resulting in barren patches. Habitats and biota noted by divers were otherwise similar to other sites surveyed in Tory Channel. The conspicuous features as noted by divers are shown in Table 3-22.

The dive in the eastern inshore area was conducted over patchy rock, sand and cobble habitat and divers noted a diverse community, and an associated fish assemblage similar to the communities encountered on the reefs at Tipi Bay and Motukina.

Table 3-22: Features noted in the reef dives at Te Weka (Dives 1 and 2).

Habitat	Depth (m)*	Conspicuous biota	Fish
DIVE 1 Eastern dive Te Weka			
Reef (rock, cobble, sand), kina barren	3-5	Kina, Cushion star, brittlestar, Catseyes (*Turbo*), sea cucumber (*Australostichopus mollis*), galeolaria worms, *Coscinasterias*, sponge, colonial ascidian (yellow), solitary ascidian, shield shell (*Scutus breviculus*)	Spotties (*Notolabrus celidotus*), blue moki (*Latridopsis ciliaris*), triplefins
Reef (rock, cobble, sand), algae (*Macrocystis*, red, *Undaria*)	5-9	Kina Patiriella, Brittlestars, sea cucumber, sponge, colonial ascidian (yellow), solitary ascidian, shield shell (*Scutus breviculus*)	Spotties, blue moki, banded wrasse, tarakihi, blue cod (*Parapercis colias*), , triplefins
Sand/cobble, biofilm, algae (red, *Undaria*)	9-13	Kina, Brittlestars, patiriella, scallop s, anemone (white stripe), sponge (yellow), gastropods, *Coscinasterias,* 3&3 star, reef star, sea cucumber fan worms, biscuit star	Schools of terakihi, spotties, scarlet wrasse
Sand/cobble	14-16	Kina *(Evechinus chloroticus)*, *Coscinasterias muricata*, Brittlestars, sponge (encrusting and fan), colonial ascidian (yellow), cushion stars, sea cucumbers, scallops	spotties (*Notolabrus celidotus*)
Sand, shell with biogenic clumps	20	Horse mussel, *Coscinasterias*, patiriella, kina, Brittlestars, bryozoan	Blue cod (*Parapercis colias*)
DIVE 2 Katoa Point Reef, Te Weka			
Boulder, cobble, lots sediment (biofilm), kelp (*Macrocystis, Carpophylum*)	3 – 6	Brittlestars, patiriella, sponges, *Ancorina alata,* gastropod	Banded wrasse, blue cod (*Parapercis colias*), spotties (*Notolabrus celidotus*), butterfly perch (*Caesioperca lepidoptera*)
Rock, kelp (*Ecklonia, Macrocystis, Undaria*,)	10	Ascidians, tree hydroids (*Solanderia* sp.), sponges (*Ancorina alata,* orange fan), bryozoans (*Celleporaria agglutinans*), sea cucumber	Spotties (*Notolabrus celidotus*), tarakihi (*Nemadactylus macropterus*), triplefins
Rock, cobble, algae (red tuft)	15	sponges (*Ancorina alata,* orange fan), bryozoans, *Celleporaria agglutinans*, *Galeolaria* worms, kina, *Coscinasterias muricata*, sea cucumber actinothoe	Spotties (*Notolabrus celidotus*), butterfly perch (*Caesioperca lepidoptera*)
Rock, cobble, sand	20	*Galeolaria* worms in clumps, kina	Spotties, conger eel

3.8.7 Notable features: Te Weka

The proposed site at Te Weka exhibited a diverse range of benthic habitats and communities. Beneath most of the proposed cage area, and broader farm site (depths of ~25-35 m), biota was relatively sparse, and brittlestars (*O. maculata*) were a common conspicuous epifaunal organism, along with small and sparsely distributed biogenic clumps comprised of aggregates of hydroids, sponges, fluffy bryozoans, ascidians, and algae.

Occasional biogenic clumps and a few isolated tree hydroids (*Solanderia* sp.) were noted in in the footage from video sled transect V2 (Table 3-20) recorded in the southwest portion of the site. A macroalgal bed comprised of diverse red seaweeds was noted near the inshore boundary at the southwest end of the site.

Further offshore, in the vicinity of the offshore boundary, particularly in the northeast portion of the site at depths greater than 35 m, distinct wave-like biogenic mounds were recorded. Grab and benthic sled samples confirmed that this feature comprised semi-consolidated aggregations of whole shell rubble and shell hash bound together by a diverse epibenthic assemblage of encrusting and erect taxa, including sponges, hydroids, ascidians and bryozoans, and was also populated by mobile epifauna including brittlestars, sea cucumbers and hermit crabs. This is a distinctive ecological feature that does not appear to be previously documented from the Tory Channel region.

Stands and isolated individual sporophytes of ecologically important kelps (*Macrocystis pyrifera, Carpophyllum* spp.) grew on broken rock, cobble and low relief bedrock habitat along most of the shoreline adjacent to the proposed site. A large bedrock reef extends out from the headland at Katoa point and at its closest point is approximately 100m from the western site boundary (250 m from the cage area boundary), and a smaller reef area lies approximately 60 m to the east of the site boundary (180 m from the cage area boundary). These reef habitats supported diverse reef communities (Table 3-22). Notable taxa seen during the dives included Bryozoan coral (*Celleporaria agglutinans*), clusters of the tubeworm (*Galeolaria hystrix*), tree hydroids (*Solanderia* sp.), kina, and scallops.

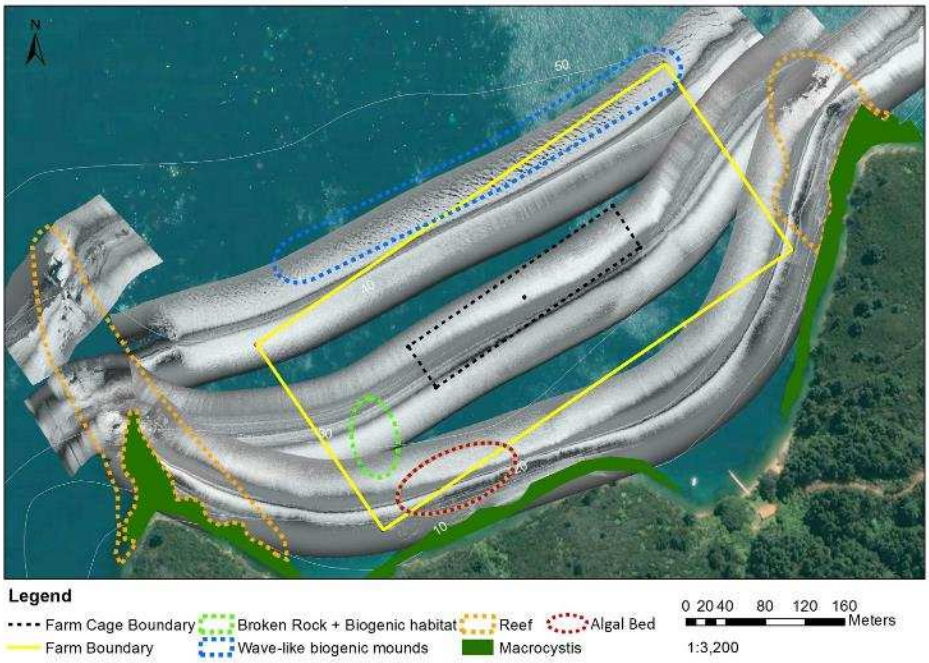

Figure 3-66: Main notable features at Te Weka. Extensive reef on the left encircled by the orange dotted line is the Katoa Point reef. Boundaries of notable ecological features are approximate.

4 Discussion and summary of findings

Pelorus Sound is subject to considerable sedimentation from rivers and erosion from land-based activities. The water circulation in the Sound is characterised as estuarine with a low-saline flow along the surface toward the entrance and denser salt water entering the Sound along the bottom (Proctor and Hadfield 1998, Gibbs 2002, Davidson 2011). These factors combine to produce a relatively fine mud seabed over extensive areas of Pelorus Sound, particularly in sheltered embayments and other areas where currents are less strong. The sites surveyed in Pelorus Sound, reflected this with fine mud being the dominant component of the sediments beneath the proposed farm cage areas at most sites. The faunal communities in these muddy habitats tend to be relatively tolerant of sedimentation and are generally widespread and common throughout the Sound. The mud communities are well documented in many site characterisations and monitoring studies conducted as part of the resource management regulatory process in relation to aquaculture of mussels and salmon farms (e.g. Stenton-Dozey *et al* 2006). Steep areas surveyed inshore on the fringes of the sites where the substratum and currents interact to produce rock, cobble or shell gravel habitats tended to support more diverse epifaunal communities.

In Tory Channel, the fast flowing tidal currents and close proximity to oceanic waters of Cook Strait have a strong influence on the structure of the marine environment such that the ecology of the channel is unique in the Marlborough Sounds Region (Hadfield *et al* 2014). The survey identified significant habitats and communities within, and adjacent to all three of the proposed sites in Tory Channel. Some of the ecological characteristics described at the Tory Channel sites in this survey mirrored those described in a benthic survey conducted by the Cawthron Institute at Ngamahau Bay on the opposite side of Tory Channel (Clark *et al* 2011). In particular, the presence of biogenic clumps comprised of sponges, bryozoans, hydroids and ascidians, the stands of *Macrocystis pyrifera,* and the rocky reef areas supporting diverse assemblages of invertebrates, macroalgae and fish were features common to all of the sites surveyed.

In summary, specific points can be made about the importance of benthic characteristics identified from the surveys detailed in this study. The significance attributed to seabed features within, and in close vicinity of the sites is based on results of previous studies and publications (e.g. Davidson *et al* 2011, DoC 1995) and personal observations of the authors, in consideration of the representativeness, rarity, distribution and functional importance of the features in the context of the Marlborough Sounds region.

The sites either side of Blowhole Point exhibited some notable ecological features, mainly inshore of both of the sites. Their close proximity to the nutrient rich waters in Cook Strait influences the benthic communities to make these sites somewhat distinctive in the context of the Pelorus Sound bioregion. At **Blowhole Point North** site (34), the sandy mud substratum beneath the farm site supported an epifaunal community that was sparse and mostly composed of common and widely distributed taxa. Small biogenic clumps of associated organisms mostly comprising ascidians and hydroids were present in a scattered distribution. Brachiopods were collected in epibenthic sled and grab samples mainly from the southern end of the site. The reef patches and kelp communities fringing the shoreline provided habitat for paua and kina, and the varied shoreline habitats and adjacent subtidal zone is blue cod habitat. Scallops, a valued resource to recreational, and commercial fisheries, were seen in the video sled transects and were collected in grab and dredge samples within and inshore of the boundaries of the site.

At **Blowhole Point South** (122), most of the site was positioned over a sandy mud habitat supporting a rather sparse mixed community of macroalgae and diverse invertebrates. Brachiopods (*Terebratella sanguinea* and *Calloria inconspicua*) were found at positions within and adjacent the site in dredge and grab samples, indicating that they are relatively common in the vicinity of this site. A large reef extends to the southeast of Blowhole Point (and to within ~230 m of the site boundary) providing habitat for a diversity of macroalgae, and sessile and mobile fauna, and associated reef, demersal and pelagic fish species. This reef, together with smaller patches of bedrock, cobble and sand comprise blue cod habitat present around the entire shoreline of the site.

At the **Waitata Reach North** site (125) there were no ecological features of special significance identified beneath the cage area nor in the vicinity of the overall site boundary. All of the habitat and taxa identified at that site can be considered to occur widely in the greater area of Waitata Reach and Pelorus Sound (e.g. Davidson *et al* 2011, DoC 1995, McKnight and Grange 1991). Furthermore, the site is deep and is subject to strong currents, so depositional material is likely to be dispersed more widely and resuspension of settled particles on the seabed is likely to be greater, such that the magnitude of effects is likely to be reduced.

There were no particularly notable or rare communities or taxa recorded on the muddy seabed in the immediate vicinity of the **Richmond South** (106) site, but scallops were relatively abundant within the site, which may be an issue in relation to commercial and recreational fishing interests. Reef habitat supporting a diverse community was present inshore of the site.

At the **Horseshoe Bay** site (124) the most significant ecological feature identified in the survey was the reef habitat and the shell/biogenic habitat to the north of the site. Also, scallops were relatively abundant beneath the cage area and broader site. There was extensive bedrock reef habitat in the vicinity, but not within the proposed farm boundaries.

At **Tipi Bay** there were zones of low-relief broken rock and bedrock patches supporting diverse encrusting biota and biogenic aggregations comprising bryozoans (including *Celleporaria agglutinans*), various sponges, ascidians, hydroids, macroalgae and associated invertebrates including polychaetes. Associated with this habitat was a diverse range of fishes including butterfly perch, terakihi and blue cod. This habitat type within the site was located between the cage area and the outer site boundary at both ends of the Tipi Bay site. Also, ecologically important stands of giant kelp (*Macrocystis pyrifera*) were present within the inshore portion of the site. Kina and paua were present within the greater site boundary area. Small areas of seagrass habitat occurred in places inshore of the site boundary.

The central area of the proposed farm site at **Motukina** lies over sand/shell hash habitat inhabited by a sparse to moderately dense epibenthic community. In the vicinity of the eastern site boundary and the southwestern corner of the cage boundary, there were areas of broken rock/cobble supporting encrusting communities and large biogenic aggregations. The important reef building bryozoan species *Celleporaria agglutinans* was one of the taxa comprising those aggregations along with various hydroids, ascidians and sponges. Associated with that habitat were reef fish populations including schools of tarakihi and butterfly perch. Hydroid trees (*Solanderia* sp), were noted within the site boundary. Inshore of the site and extending into the site in places were patches of kelp, including the ecologically important giant kelp (*Macrocystis pyrifera*) (e.g. Davidson et al 2011) and relatively dense algal beds comprising a diverse range of red and green algae. Patches of kina at high densities were observed in places within the broken rock habitats.

Beneath most of the proposed cage area, and broader farm site at **Te Weka,** biota was relatively sparse, and brittlestars were the most common conspicuous epifaunal organism, along with small and sparsely distributed biogenic clumps comprised of aggregates of hydroids, sponges, fluffy bryozoans, ascidians, and algae. Biogenic clumps and some isolated tree hydroids (*Solanderia* sp.) were noted within the southwest portion of the site. Offshore, in the vicinity of the offshore boundary, at depths greater than 35 m, were wave-like biogenic mounds comprising semi-consolidated aggregations of whole shell rubble and shell hash bound together by a diverse assemblage of sponges, hydroids, ascidians and bryozoans. This biogenic habitat has not been widely described within the greater Marlborough Sounds bioregion and is of value ecologically, and of interest scientifically. Stands of giant kelp (*Macrocystis pyrifera*) grew on broken rock, cobble and low relief bedrock habitat along the shoreline. A large bedrock reef lies approximately 100m to the west of the western site boundary (250 m from the cage area boundary), and a smaller reef area lies approximately 60 m to the east of the eastern site boundary (180 m from the cage area boundary). These reef habitats supported diverse reef communities. Kina were present, and scallops (at low densities) were found within the site.

5 Acknowledgements

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Appendix A Sampling locations within each proposed farm site.

Table A-1: Grab sampling locations within the Proposed Farm Sites. Pelorus Sound (BLN = Blowhole North, BLS = Blowhole South, WAN = Waitata Reach North, WAS = Waitata Reach South, RIC = Richmond Bay, HOR= Horseshoe); Queen Charlotte Sounds (TIP = Tipi Bay, MOT = Motukina, TEW = Te Weka Bay).

Proposed Farm Sites	Grab ID	Latitude	Longitude	Depth (m)
Pelorus Sound (PS) sites:				
Blowhole North	BLN-G1	-40.9305	174.0185	73.1
	BLN-G2	-40.9303	174.0169	37.4
	BLN-G3	-40.9311	174.0172	49
	BLN-G4	-40.9322	174.0171	60
	BLN-G5	-40.9325	174.0159	35.2
	BLN-G6	-40.933	174.0173	58
Blowhole South	BLS-G1	-40.9388	174.0102	51.3
	BLS-G2	-40.9398	174.0105	64.7
	BLS-G3	-40.9393	174.0092	55
	BLS-G4	-40.9403	174.0097	63.5
	BLS-G5	-40.9401	174.0076	53.1
	BLS-G6	-40.9409	174.0083	57.8
	BLS-G7	-40.9427	174.0074	64.5
	BLS-G8	-40.9406	174.0110	42.3
	BLS-G9	-40.9424	174.0092	36.3
Waitata North	WAN-G1	-40.9667	173.9784	60
	WAN-G2	-40.968	173.9786	61
	WAN-G3	-40.9675	173.9772	61.1
	WAN-G4	-40.9685	173.9777	61
	WAN-G5	-40.969	173.9766	61.5
	WAN-G6	-40.9691	173.9745	61.1
Waitata South	WAS-G1	-40.9716	173.9714	63.5
	WAS-G2	-40.971	173.97	61.5
	WAS-G3	-40.9723	173.97	64.2
	WAS-G4	-40.9718	173.9681	61.5
	WAS-G5	-40.9733	173.9678	64.1
	WAS-G6	-40.9726	173.9672	62.1
Richmond Bay	RIC-G1	-41.0125	173.9418	47.1
	RIC-G2	-41.0134	173.9424	37
	RIC-G3	-41.0138	173.9407	46
	RIC-G4	-41.0149	173.9399	44.9
	RIC-G5	-41.0153	173.9385	52.5
	RIC-G6	-41.0161	173.94	42.7
Horseshoe Bay	HOR-G1	-41.0259	173.9368	18.8
	HOR-G2	-41.0252	173.9349	25.7
	HOR-G3	-41.0243	173.9362	25.3
	HOR-G4	-41.0232	173.9359	32.9
	HOR-G5	-41.0223	173.9364	39.2
	HOR-G6	-41.0219	173.9351	45

Proposed Farm Sites	Grab ID	Latitude	Longitude	Depth (m)
Queen Charlotte Sound (QCS) sites:				
Tipi Bay	TIP-G1	-41.22417	174.28659	25
	TIP-G2	-41.22487	174.28625	25
	TIP-G3	-41.22575	174.28623	20.1
	TIP-G4	-41.22668	174.28456	23.1
	TIP-G6	-41.22644	174.28657	13
	TIP-G7	-41.22571	174.28602	24.7
	TIP-G8	-41.22569	174.2852	28.9
Motukina	MOT-G1	-41.24235	174.25978	24.4
	MOT-G2	-41.24261	174.26139	18.3
	MOT-G3	-41.24113	174.2624	30.1
	MOT-G4	-41.24229	174.25845	33.8
	MOT-G5	-41.24262	174.2629	8.3
	MOT-G6	-41.24172	174.26152	32
Te Weka	TEW-G1	-41.24702	174.19259	24.9
	TEW-G2	-41.24899	174.18843	29.7
	TEW-G3	-41.24815	174.19162	27.1
	TEW-G4	-41.24881	174.19241	12
	TEW-G5	-41.2473	174.1913	26.1
	TEW-G6	-41.2483	174.1893	29

Table A-2: Drop Camera photo-quadrat sampling locations. Pelorus sound (BLN = Blowhole North, BLS = Blowhole South, WAN = Waitata Reach North, WAS = Waitata Reach South, RIC = Richmond Bay, HOR= Horseshoe); Queen Charlotte Sounds (TIP = Tipi Bay, MOT = Motukina, TEW = Te Weka Bay. DC1 to DCn = DropCam (photoquadrat) station numbers. OPH= ophiuroids (brittlestars); TAR= Tarakihi.

Proposed Farm Sites	DropCam ID	Latitude	Longitude	Depth (m)	Habitat/taxa comment
Pelorus Sound Sites:					
Blowhole North	BLN-DC1	-40.92727	174.01902	40.8	muddy-sands, shell, gravel
	BLN-DC2	-40.92911	174.01877	64.7	muddy-sands, shell,
	BLN-DC3	-40.93065	174.01843	74	muddy-sands, shell
	BLN-DC4	-40.93211	174.01766	70	muddy-sands, shell
	BLN-DC5	-40.93357	174.01759	73	fine muddy-sands, mud, shell
	BLN-DC6	-40.93502	174.01740	73.9	muddy-sands, shell
	BLN-DC7	-40.93573	174.01690	66.7	muddy-sands, shell
	BLN-DC8	-40.93537	174.01564	48	muddy-sands, mud
	BLN-DC9	-40.93380	174.01597	49.5	muddy-sands
	BLN-DC10	-40.93150	174.01572	20	muddy-sands
	BLN-DC11	-40.93105	174.01673	36.5	muddy-sands, hydroid trees
	BLN-DC12	-40.92984	174.01729	42.7	muddy-sands
	BLN-DC13	-40.92900	174.01752	38.6	muddy-sands
	BLN-DC14	-40.92807	174.01765	37	muddy-sands
	BLN-DC15	-40.92751	174.01692	17.2	muddy-sands, algae
	BLN-DC16	-40.92872	174.01630	21.2	muddy-sands, algae
	BLN-DC17	-40.92984	174.01619	15.9	muddy-sands
	BLN-DC18	-40.93071	174.01589	18.2	muddy-sands, shell
	BLN-DC19	-40.93244	174.01509	13.9	muddy-sands, algae
	BLN-DC20	-40.93363	174.01486	20.3	muddy-sands, mussel shell
	BLN-DC21	-40.93475	174.01502	34.4	muddy-sands
	BLN-DC22	-40.93592	174.01438	8.4	muddy-sands
	BLN-DC23	-40.93445	174.01306	3.5	*Carpophyllum*, rock
	BLN-DC24	-40.93342	174.01337	8	muddy-sands, filamentous algae
	BLN-DC25	-40.93265	174.01362	10	muddy-sands
	BLN-DC26	-40.93114	174.01398	12.9	sandy-mud
	BLN-DC27	-40.93007	174.01437	13	algae
	BLN-DC28	-40.92912	174.01473	13.6	algae
	BLN-DC29	-40.92856	174.01520	14	muddy-sands, mussel clump
	BLN-DC30	-40.92755	174.01528	6.3	rock, cobble, sand, kina, *Carpophyllum*
	BLN-DC31	-40.92843	174.01407	10	muddy-sands, algae
	BLN-DC32	-40.92863	174.01276	4.2	muddy-sands
	BLN-DC33	-40.92940	174.01342	9.7	muddy-sands
	BLN-DC34	-40.93041	174.01279	6.3	muddy-sands
	BLN-DC35	-40.93278	174.01233	4.5	muddy-sands
	BLN-DC36	-40.93235	174.01680	48.7	sand, shell
	BLN-DC37	-40.93132	174.01884	81	sand, shell
Blowhole South	BLS-DC1	-40.93923	174.00512	14.7	muddy-sands, shell
	BLS-DC2	-40.93948	174.00555	27.4	muddy-sands, shell
	BLS-DC3	-40.93912	174.01432	53.8	shell gravel, hydroids

Proposed Farm Sites	DropCam ID	Latitude	Longitude	Depth (m)	Habitat/taxa comment
	BLS-DC4	-40.93998	174.01226	65.3	shell gravel, muddy-sands
	BLS-DC5	-40.94121	174.01010	57.5	mud, muddy-sands
	BLS-DC6	-40.94217	174.01005	46.7	mud , muddy-sands
	BLS-DC7	-40.94224	174.00765	42.8	mud
	BLS-DC8	-40.94210	174.00560	44.6	mud, muddy-sands, shell, brittle star
	BLS-DC9	-40.94089	174.00762	54.7	mud, shell gravel
	BLS-DC10	-40.93961	174.00943	59.7	mud, shell gravel
	BLS-DC11	-40.93984	174.01057	56	mud, gravel
	BLS-DC13	-40.93803	174.01203	33.9	muddy-sands, shell gravel
	BLS-DC14	-40.93771	174.01045	28.5	muddy-sands , horse mussel
	BLS-DC15	-40.93816	174.00989	36	sand, filamentous algae
	BLS-DC16	-40.93865	174.01000	48	shell gravel, brittle star
	BLS-DC17	-40.93898	174.00815	45.9	mussel, muddy-sands
	BLS-DC18	-40.93991	174.00687	45.9	shell gravel
	BLS-DC19	-40.94082	174.00550	39.1	shell gravel, muddy-sands
	BLS-DC20	-40.94015	174.00522	27	sponge, shell gravel
	BLS-DC21	-40.93891	174.00513	13	muddy-sands
	BLS-DC22	-40.93882	174.00624	26	shell
	BLS-DC23	-40.93815	174.00586	7	cobbles, muddy-sands
	BLS-DC24	-40.93848	174.00728	29.5	shell gravel, muddy-sands
	BLS-DC25	-40.93861	174.00566	17	shell gravel
	BLS-DC26	-40.93828	174.00920	35.9	muddy-sands
	BLS-DC27	-40.93761	174.00888	25	muddy-sands
	BLS-DC29	-40.94035	174.00904	58.5	muddy-sands, shell
	BLS-DC30	-40.93989	174.00834	55.4	muddy-sands, shell
	BLS-DC31	-40.93912	174.01272	28.1	sandymud
	BLS-DC32	-40.93822	174.01382	51.8	shell
	BLS-DC33	-40.94176	174.01158	64.7	sandy-mud
	BLS-DC34	-40.9431	174.00967	23	sandy-mud
	BLS-DC35	-40.9399	174.01357	31	sandy-mud
	BLS-DC36	-40.9418	174.0087	65	sandy-mud
	BLS-DC37	-40.94154	174.00671	54	sandy-mud
	BLS-DC38	-40.94382	174.00705	55	sandy-mud
	BLS-DC39	-40.94308	174.00582	48	sandy-mud
	BLS-DC40	-40.94279	174.00697	43	sandy-mud
	BLS-DC41	-40.94073	174.01183	51	sandy-mud
	BLS-DC42	-40.94326	174.00837	50.7	sandy-mud
	BLS-DC43	-40.94375	174.00927	37.7	sandy-mud
	BLS-DC44	-40.94446	174.00803	32.8	sandy-mud
	BLS-DC45	-40.94457	174.00654	35.2	sandy-mud
	BLS-DC46	-40.93912	174.01272	50.5	sandy-mud
	BLS-DC47	-40.93822	174.01382	42	sandy-mud
Waitata North	WAN-DC1	-40.96672	173.98057	60.5	mud
	WAN-DC2	-40.96742	173.97941	60.4	mud
	WAN-DC3	-40.96673	173.97909	60	mud, ascidian

Proposed Farm Sites	DropCam ID	Latitude	Longitude	Depth (m)	Habitat/taxa comment
	WAN-DC4	-40.96782	173.97607	59.6	mud, shell
	WAN-DC5	-40.96829	173.97721	60.7	mud
	WAN-DC6	-40.96802	173.97773	60.5	mud
	WAN-DC7	-40.96784	173.97803	60.4	mud
	WAN-DC8	-40.96763	173.97855	60.2	mud
	WAN-DC9	-40.96741	173.97883	60.2	mud
	WAN-DC10	-40.96717	173.97933	60.1	mud
	WAN-DC11	-40.96766	173.97688	59.5	mud
	WAN-DC12	-40.96752	173.97715	59.6	mud, hydroid
	WAN-DC13	-40.96739	173.97735	59.5	mud
	WAN-DC14	-40.96719	173.97764	59.5	mud, shell
	WAN-DC15	-40.96694	173.97798	59.5	mud, small oasis
	WAN-DC16	-40.97010	173.97357	64.5	mud, shell
	WAN-DC17	-40.97007	173.96917	64.5	mud, shell
	WAN-DC18	-40.96979	173.97504	64.5	mud, shell
	WAN-DC19	-40.96869	173.97649	63.3	mud, shell
	WAN-DC20	-40.96809	173.97535	62.2	mud, shell
	WAN-DC21	-40.96880	173.97519	62.9	mud, shell
	WAN-DC23	-40.96577	173.98319	62.5	mud
	WAN-DC23	-40.96630	173.98220	62.5	mud
	WAN-DC24	-40.96490	173.98237	62.5	mud
	WAN-DC25	-40.96497	173.98104	62.5	mud
	WAN-DC26	-40.96594	173.98047	61.4	mud
	WAN-DC27	-40.96639	173.98190	62.5	mud
Waitata South	WAS-DC1	-40.97280	173.96637	61.7	sandy-mud
	WAS-DC2	-40.97238	173.96686	61.4	mud, shell
	WAS-DC3	-40.97222	173.96741	61.5	mud
	WAS-DC4	-40.97197	173.96813	61.5	mud
	WAS-DC5	-40.97175	173.96903	61.7	mud, (hydroid tree)
	WAS-DC6	-40.97142	173.96965	61.5	mud
	WAS-DC7	-40.97098	173.97018	61.1	mud
	WAS-DC8	-40.97052	173.97061	60.5	mud
	WAS-DC9	-40.97376	173.96699	64.1	mud
	WAS-DC10	-40.97371	173.96759	64.5	mud
	WAS-DC11	-40.97331	173.96810		mud
	WAS-DC12	-40.97286	173.96845	63.4	mud, *Talochlamys zelandiae*
	WAS-DC13	-40.97259	173.96871	63	mud, crab
	WAS-DC14	-40.97105	173.97203	62.1	mud, a shell
	WAS-DC15	-40.96988	173.97233	60.3	mud
	WAS-DC16	-40.97184	173.97069	62.7	mud
Richmond Bay	RIC-DC1	-41.01494	173.93770	55.7	mud
	RIC-DC2	-41.01648	173.93751	53.3	mud
	RIC-DC3	-41.01641	173.93986	28	mud, Clump
	RIC-DC4	-41.01481	173.93986	45	mud
	RIC-DC5	-41.01410	173.94059	42.1	mud

Proposed Farm Sites	DropCam ID	Latitude	Longitude	Depth (m)	Habitat/taxa comment
	RIC-DC6	-41.01362	173.93987	50	mud, scallop
	RIC-DC7	-41.01222	173.94045	52	mud
	RIC-DC8	-41.01193	173.94215	47.1	mud
	RIC-DC9	-41.01210	173.94465	32.6	mud
	RIC-DC10	-41.01220	173.94660	20	mud, diatom mat
	RIC-DC11	-41.01258	173.94895	15.5	mud, shell
	RIC-DC12	-41.01353	173.94757	20	mud, shell, red algae
	RIC-DC13	-41.01399	173.94503	17.4	mud, diatom mat
	RIC-DC14	-41.01368	173.94221	34	mud, holes
	RIC-DC15	-41.01375	173.94139	39.4	mud
	RIC-DC16	-41.01450	173.94136	34.9	mud
	RIC-DC17	-41.01498	173.94188	42.9	mud
	RIC-DC18	-41.01411	173.94360	24.7	mud
	RIC-DC19	-41.01502	173.94420	27	mud
	RIC-DC20	-41.01632	173.94442	19	mud, diatom mat
	RIC-DC21	-41.01624	173.94235	9.5	cobble
	RIC-DC22	-41.01658	173.93874	44	mud, shell, hydroid
	RIC-DC23	-41.01425	173.93839	55.2	mud
	RIC-DC24	-41.01537	173.93886	50	mud
	RIC-DC25	-41.01578	173.94052	41	mud
	RIC-DC26	-41.01320	173.94069	47.8	mud
	RIC-DC27	-41.01266	173.94183	45.2	mud
	RIC-DC28	-41.01254	173.94300	38.5	mud
	RIC-DC29	-41.01335	173.94386	25.6	mud
	RIC-DC30	-41.01145	173.94229	48.6	mud
Horseshoe Bay	HOR-DC1	-41.02533	173.93384	31.3	mud
	HOR-DC2	-41.02647	173.93369	27.6	mud
	HOR-DC3	-41.02656	173.93443	23.2	mud
	HOR-DC4	-41.02669	173.93568	20	muddy-sands, diatom mat
	HOR-DC5	-41.02550	173.93583	20.7	muddy-sands, diatom mat
	HOR-DC6	-41.02421	173.93580	25.1	mud
	HOR-DC7	-41.02290	173.93567	35.1	mud, hydroid
	HOR-DC8	-41.02195	173.93581	17.5	mud, oasis, opalfish
	HOR-DC9	-41.02116	173.93586	25.8	mud, *patiriella, stichopus*
	HOR-DC10	-41.02062	173.93497	23	reef
	HOR-DC11	-41.02153	173.93461	48.8	mud, shell
	HOR-DC12	-41.02163	173.93586	36.5	mud
	HOR-DC13	-41.02180	173.93683	26.4	shell drop (mussels)
	HOR-DC14	-41.02166	173.93756	5.9	cobble, reef
	HOR-DC15	-41.02253	173.93802	24	mud, shell, red algae
	HOR-DC16	-41.02254	173.93731	33.3	mussels, scallop
	HOR-DC17	-41.02386	173.93694	29	mud
	HOR-DC18	-41.02416	173.93805	27.3	mud
	HOR-DC19	-41.02526	173.93697	21.4	mud, dead scallop shell
	HOR-DC20	-41.02559	173.93797	20	mud, diatom mat

Proposed Farm Sites	DropCam ID	Latitude	Longitude	Depth (m)	Habitat/taxa comment
	HOR-DC21	-41.02643	173.93807	17.7	mud, diatom mat
	HOR-DC22	-41.02655	173.93708	17.6	mud, diatom mat, hydroid
	HOR-DC23	-41.02357	173.93370	45	mud, scallop, *Talochlamys zelandiae*
	HOR-DC24	-41.02102	173.93509	31	shell
	HOR-DC25	-41.02108	173.93542	26.3	shell
	HOR-DC26	-41.02048	173.93343	57.1	shell gravel, hydroids
	HOR-DC27	-41.02172	173.93355	62.2	muddy-sands, mud, shell gravel
	HOR-DC28	-41.02297	173.93429	43.8	muddy-sands mud
	HOR-DC29	-41.02387	173.93484	32.2	mud muddy-sands
	HOR-DC30	-41.02548	173.93480	24.5	mud muddy-sands
Tory Channel, Queen Charlotte Sound sites:					
Tipi Bay	TIP-DC1	-41.22423	174.28552	35	muddy-sands, shell
Tipi Bay	TIP-DC2	-41.22405	174.28654	30	muddy-sands, cobble
Tipi Bay	TIP-DC3	-41.22520	174.28404	32	shell, OPH
	TIP-DC4	-41.22525	174.28472	31	shell
	TIP-DC5	-41.22528	174.28590	26	shell
	TIP-DC6	-41.22447	174.28675	18	shell and algae
	TIP-DC7	-41.22479	174.28585	27	shell
	TIP-DC8	-41.22618	174.28296	29	shell, OPH
	TIP-DC9	-41.22603	174.28381	29	shell
	TIP-DC10	-41.22607	174.28481	29.9	shell
	TIP-DC11	-41.22605	174.28578	26	mud, shell
	TIP-DC12	-41.22588	174.28676	12	sand,kelp
	TIP-DC13	-41.22530	174.28759	1.7	seagrass
	TIP-DC14	-41.22458	174.28749	7	kelp, *Ecklonia*
	TIP-DC15	-41.22629	174.28732	6	*Ulva*, muddy-sands
	TIP-DC16	-41.22654	174.28740	3.9	kelp, rock
	TIP-DC17	-41.22692	174.28697	9	muddy-sands
	TIP-DC18	-41.22697	174.28602	12	diatom mat
	TIP-DC19	-41.22684	174.28505	17.5	muddy-sands OPH
	TIP-DC20	-41.22697	174.28394	18.7	muddy-sands kelp
	TIP-DC21	-41.22695	174.28303	22.3	muddy-sands, red algae
	TIP-DC22	-41.22784	174.28268	18.8	muddy-sands, kelp
	TIP-DC23	-41.22836	174.28319	3	seagrass
	TIP-DC24	-41.22806	174.28387	3	seagrass
	TIP-DC25	-41.22765	174.28396	6	muddy-sands, kelp
	TIP-DC26	-41.22761	174.28481	3.9	kelp, rock
	TIP-DC27	-41.22714	174.28466	10.8	muddy-sands, diatom mat
	TIP-DC28	-41.22745	174.28567	5	carp,muddy-sands
	TIP-DC29	-41.22765	174.28647	1.7	algae (*Ulva* and red filamentous)
	TIP-DC30	-41.22655	174.28638	11	diatom film
	TIP-DC31	-41.22542	174.28657	16	muddy-sands, kina
	TIP-DC32	-41.22677	174.28468	21.2	muddy-sands, bio oasis
	TIP-DC33	-41.22635	174.28514	27	cobble, shell, algae
Motukina	MOT-DC1	-41.24039	174.26141	46.2	shell gravel

Proposed Farm Sites	DropCam ID	Latitude	Longitude	Depth (m)	Habitat/taxa comment
	MOT-DC2	-41.24071	174.26060	47.3	shell gravel
	MOT-DC3	-41.24121	174.25957	45.6	shell, muddy-sands
	MOT-DC4	-41.24107	174.26331	20.2	muddy-sands mud
	MOT-DC5	-41.24161	174.26354	11.7	mud/muddy-sands
	MOT-DC6	-41.24180	174.26382	4.1	muddy-sands, rock
	MOT-DC7	-41.24297	174.25792	16	muddy-sands, rock
	MOT-DC8	-41.24286	174.25928	16	muddy-sands/kelp
	MOT-DC9	-41.24276	174.25943	12	muddy-sands/kelp
	MOT-DC10	-41.24308	174.26043	5.5	*Caulerpa* muddy-sands
	MOT-DC11	-41.24311	174.26064	7	mud
	MOT-DC12	-41.24307	174.26172	6.6	Mud, some shellbits, OPH
	MOT-DC13	-41.24229	174.26304	14	muddy-sands, kina
	MOT-DC14	-41.24229	174.26304	14	muddy-sands, kina
	MOT-DC15	-41.24237	174.26202	20	muddy-sands, OPH
	MOT-DC15	-41.24237	174.26202	20	muddy-sands, OPH
	MOT-DC16	-41.24240	174.26061	20	muddy-sands
	MOT-DC17	-41.24244	174.25807	30.5	biogenic clump, Rock, OPH
	MOT-DC18	-41.24174	174.25829	42	shell, hydroid
	MOT-DC19	-41.24183	174.25940	37.3	bivalve rubble, hydroid, OPH
	MOT-DC20	-41.24184	174.26042	34.7	mud shell
	MOT-DC21	-41.24184	174.26178	28.5	shell & mud
	MOT-DC22	-41.24115	174.26195	37	shell & mud
	MOT-DC23	-41.24089	174.26245	35	shell & mud
	MOT-DC24	-41.24122	174.26070	43	shell OPH
	MOT-DC25	-41.24289	174.25871	8	mud, diatom film, OPH, red algae, TAR
	MOT-DC26	-41.24285	174.25723	24.5	mud/shell OPH
	MOT-DC27	-41.24163	174.26277	24.7	Murky
	MOT-DC27	-41.24163	174.26277	24.7	biogenic oasis
	MOT-DC28	-41.24083	174.26385	14	mud, shell
	MOT-DC29	-41.23962	174.26516	12	Rock, muddy-sands (reef edge)
	MOT-DC30	-41.23952	174.26525	12.9	reef edge
	MOT-DC31	-41.24127	174.26298	24.4	muddy-sands, OPH
	MOT-DC32	-41.24188	174.26112	32.3	muddy-sands
	MOT-DC33	-41.24244	174.25992	20.7	muddy-sands, red algae, OPH, sponge
	MOT-DC34	-41.24239	174.25929	22.7	muddy-sands
	MOT-DC35	-41.24252	174.26021	16.1	muddy-sands, OPH, kina
	MOT-DC36	-41.24252	174.26021	17.5	muddy-sands, OPH, kina
Te Weka	TEW-DC1	-41.24576	174.19189	42	muddy-sands. shell
	TEW-DC2	-41.24639	174.19306	23	Gravel
	TEW-DC3	-41.24651	174.19218	31	muddy-sands, shell
	TEW-DC4	-41.24646	174.19111	36.2	muddy-sands, shell
	TEW-DC5	-41.24659	174.19016	39	muddy-sands, shell
	TEW-DC6	-41.24588	174.18986	44	biogenic mounds
	TEW-DC7	-41.24653	174.18926	42	shell, *Coscinasterias*

Proposed Farm Sites	DropCam ID	Latitude	Longitude	Depth (m)	Habitat/taxa comment
	TEW-DC8	-41.24668	174.18825	43	biogenic material
	TEW-DC9	-41.24721	174.18887	39	worms
	TEW-DC10	-41.24718	174.19011	33.1	shell
	TEW-DC11	-41.24712	174.19118	28	muddy-sands, OPH
	TEW-DC12	-41.24702	174.19196	27.3	mud
	TEW-DC13	-41.24684	174.19322	16.1	bivalve rubble, shell
	TEW-DC14	-41.24747	174.19324	11.3	muddy-sands
	TEW-DC15	-41.24774	174.19232	24.2	muddy-sands, shell, sponge
	TEW-DC16	-41.24788	174.19134	24.5	mud, infauna holes
	TEW-DC17	-41.24790	174.19019	28	muddy-sands
	TEW-DC18	-41.24786	174.18931	32.1	muddy-sands
	TEW-DC19	-41.24796	174.18825	36.9	mud shell, OPH
	TEW-DC20	-41.24853	174.18815	34.6	mud shell
	TEW-DC21	-41.24911	174.18729	30.8	muddy-sands
	TEW-DC22	-41.24929	174.18638	26.5	shell, stone
	TEW-DC23	-41.24852	174.18916	29	muddy-sands
	TEW-DC24	-41.24853	174.19016	25.3	muddy-sands
	TEW-DC25	-41.24855	174.19109	23	muddy-sands
	TEW-DC26	-41.24843	174.19212	23	muddy-sands, OPH
	TEW-DC27	-41.24834	174.19306	10	muddy-sands
	TEW-DC28	-41.24908	174.19237	9	mud, holes
	TEW-DC29	-41.24924	174.19139	6	muddy-sands, red algae
	TEW-DC30	-41.24930	174.19044	10	muddy-sands, red algae
	TEW-DC31	-41.24924	174.18899	21	muddy-sands, OPH, hermit crab
	TEW-DC32	-41.24929	174.18823	26	muddy-sands, hydroid
	TEW-DC33	-41.24998	174.18758	12	mud, (burrows)
	TEW-DC34	-41.25003	174.18701	49	muddy-sands, *Patiriella*
	TEW-DC35	-41.24883	174.18623	31	Shell (burrows)
	TEW-DC36	-41.24856	174.18730	38.3	mud, shells
	TEW-DC37	-41.24590	174.19297	27.5	shell, kina, OPH

Table A-3: Epibenthic sled start and end tow locations and depths within and adjacent to proposed farm sites. Pelorus sounds (BLN = Blowhole North, BLS = Blowhole South, WAN = Waitata Reach North, WAS = Waitata Reach South, RIC = Richmond Bay, HOR= Horseshoe); Queen Charlotte Sounds (TIP = Tipi Bay, MOT =

Proposed Farm Sites	Epibenthic Sample-ID	Latitude (start)	Longitude (start)	Latitude (end)	Longitude (end)	Depth range (m)
Pelorus Sound (PS) sites:						
Blowhole North	BLN-D1	-40.93057	174.01629	-40.93117	174.01594	20
	BLN-D2	-40.93099	174.01768	-40.93161	174.01747	62-64
	BLN-D3	-40.93191	174.01795	-40.93263	174.01605	40-72
	BLN-D4	-40.93255	174.01762	-40.93256	174.01672	54-70
	BLN-D5	-40.93302	174.01566	-40.93181	174.01641	35-35.5
Blowhole South	BLS-D1	-40.93921	174.01072	-40.93920	174.00965	56.5-59.8
	BLS-D2	-40.93929	174.00968	-40.93926	174.01178	56-58.1
	BLS-D3	-40.93962	174.00748	-40.93925	174.01008	48.1-57.2
	BLS-D4	-40.94137	174.00786	-40.94102	174.01081	56.4-61.5
	BLS-D5	-40.94053	174.00989	-40.93985	174.01273	63.1-64.6
Waitata North	WAN-D1	-40.96795	173.97562	-40.96726	173.97797	60.7-60.9
	WAN-D2	-40.96694	173.97887	-40.96815	173.97763	60.7-61.6
	WAN-D3	-40.96886	173.97755	-40.96834	173.97983	61.8-62
	WAN-D4	-40.96950	173.97834	-40.96817	173.98118	61.7-62.2
	WAN-D5	-40.96779	173.97835	-40.96648	173.98091	60.8-60.9
Waitata South	WAS-D1	-40.97380	173.96747	-40.97355	173.96650	65.2
	WAS-D2	-40.97231	173.96696	-40.97208	173.96769	62.1
	WAS-D3	-40.97287	173.96900	-40.97223	173.96888	64.8
	WAS-D4	-40.97247	173.97001	-40.97193	173.97070	64.8
	WAS-D5	-40.97061	173.97068	-40.97134	173.97041	62.1
Richmond Bay	RIC-D1	-41.01481	173.93826	-41.01578	173.93896	54
	RIC-D2	-41.01590	173.94022	-41.01515	173.94102	33-42
	RIC-D3	-41.01460	173.94064	-41.01327	173.94112	43-46
	RIC-D4	-41.01420	173.94207	-41.01361	173.94253	34-37
	RIC-D5	-41.01267	173.94106	-41.01386	173.93961	50-51
Horseshoe Bay	HOR-D1	-41.02153	173.93484	-41.02331	173.93466	38-45
	HOR-D2	-41.02586	173.93512	.	.	21.8 -
	HOR-D3	-41.02525	173.93650	-41.02387	173.93559	28-32.5
	HOR-D4	-41.02327	173.93778	-41.02198	173.93567	41
	HOR-D5	-41.02197	173.93719	-41.02107	173.93588	24
	HOR-Br-D1	-41.02087	173.93457	-41.02144	173.93565	33.6-40
	HOR-Br-D2	-41.02138	173.93458	-41.02097	173.93555	22.8-49.8
Queen Charlotte Sound (QCS) sites:						
Tipi Bay	TIP-D1	-41.22556	174.28626	-41.22605	174.28553	21
	TIP-D2	-41.22659	174.28562	-41.22697	174.28454	20
	TIP-D3	-41.22702	174.28346	-41.22756	174.28366	18
	TIP-D4	-41.22727	174.28586	-41.22693	174.28624	9
	TIP-D5	-41.22654	174.28531	-41.22653	174.28610	24.1
Motukina	MOT-D1	-41.24137	174.26313	-41.24223	174.26149	26.2
	MOT-D2	-41.24261	174.25930	-41.24273	174.25807	15
	MOT-D3	-41.24212	174.25836	-41.24193	174.25949	36

	MOT-D4	-41.24111	174.26140	-41.24090	174.26301	44
	MOT-D5	-41.24274	174.26070	-41.24198	174.25992	13.1
Te Weka	TEW-D1	-41.24705	174.19235	-41.24748	174.19182	26-26.8
	TEW-D2	-41.24748	174.19086	-41.24783	174.19025	27.2-27.8
	TEW-D3	-41.24653	174.19029	-41.24664	174.18867	38-42.7
	TEW-D4	-41.24822	174.18866	-41.24858	174.18807	33.7-35.2
	TEW-D5	-41.24954	174.18874	-41.24958	174.18793	17.9-22.8

Appendix B Sediment grain-size composition from grabs at each proposed site.

Table B-1: Grain size composition (% dry weight) and descriptions of sediments under each Proposed Farm Site. Pelorus sounds (BLN = Blowhole North, BLS = Blowhole South, WAN/WAS = Waitata Reach North and South, respectively, RIC = Richmond Bay, HOR= Horseshoe Bay); Queen Charlotte Sounds (TIP = Tipi Bay, MOT = Motukina, TEW = Te Weka).

Location	Grab_Id	Latitude	Longitude	Depth (m)	% Sand	% Mud	% Gravel	> 2mm notes	Field sediment description
Blowhole North	BLN-G1	-40.93045	174.01846	73.1	24.93	49.93	25.15	Shell	Brown/mud/sand/shell
	BLN-G2	-40.93030	174.01694	37.4	26.90	72.81	0.30	Shell	Brown muddy sand
	BLN-G3	-40.93105	174.01715	49	43.27	51.37	5.35	Shell	Shell gravel
	BLN-G4	-40.93222	174.01714	60	37.54	53.74	8.72	Shell/gravel	Brown sand/shell/mud
	BLN-G5	-40.93253	174.01593	35.2	28.67	62.77	8.56	Shell	Sand and shell
	BLN-G6	-40.93297	174.01733	58	32.32	47.09	20.59	Shell	Grey/brown muddy sand
Blowhole South	BLS-G1	-40.93880	174.01017	51.3	33.39	53.69	12.92	Shell	Grey/brown muddy sand
	BLS-G2	-40.93982	174.01048	64.7	34.43	40.56	25.02	Shell/detritus	Grey/brown muddy sand
	BLS-G3	-40.93925	174.00916	55	33.69	49.61	16.71	Shell/gravel	Grey/brown muddy sand
	BLS-G4	-40.94031	174.00966	63.5	29.07	63.14	7.79	Shell/gravel	Grey/brown muddy sand
	BLS-G5	-40.94006	174.00762	53.1	23.00	47.78	29.22	Shell/gravel	Grey/brown muddy sand shell
	BLS-G6	-40.94091	174.00829	57.8	32.76	59.60	7.64	Shell/gravel	Grey/brown muddy sand
	BLS-G7	-40.9428	174.0074	65.5	0.16	38.19	61.65	Shell/gravel	Grey/brown sandy mud
	BLS-G8	-40.9407	174.011	42.3	1.78	36.05	62.17	Shell/gravel	Grey/brown sandy mud
	BLS-G9	-40.9424	174.0092	36.3	0.78	38.46	60.76	Shell/gravel	Grey/brown sandy mud
Waitata North	WAN-G1	-40.96670	173.97836	60	35.86	61.52	2.62	Shell	Grey brown mud
	WAN-G2	-40.96803	173.97859	61	37.84	62.02	0.14	Shell/gravel	Grey brown mud, faint sulphide smell
	WAN-G3	-40.96746	173.97716	61.1	35.52	61.79	2.69	Shell	Grey brown mud
	WAN-G4	-40.96847	173.97769	61	30.14	69.67	0.19	Shell	Grey brown mud
	WAN-G5	-40.96901	173.97662	61.5	32.53	67.17	0.30	Shell	Grey brown mud, sulphide smell
	WAN-G6	-40.96908	173.97454	61.1	28.88	70.73	0.39	Shell	Grey brown mud
Waitata South	WAS-G1	-40.97155	173.97140	63.5	35.59	62.87	1.54	Shell	Grey brown mud
	WAS-G2	-40.97101	173.97004	61.5	37.20	61.33	1.47	Shell	Grey brown mud
	WAS-G3	-40.97229	173.96997	64.2	34.52	64.86	0.63	Shell	Grey brown mud
	WAS-G4	-40.97176	173.96813	61.5	34.45	63.52	2.03	Shell	Grey brown mud

Location	Grab_Id	Latitude	Longitude	Depth (m)	% Sand	% Mud	% Gravel	> 2mm notes	Field sediment description
	WAS-G5	-40.97329	173.96777	64.1	40.96	51.29	7.75	Shell	Grey brown mud, mild enrichment
	WAS-G6	-40.97255	173.96718	62.1	38.83	59.13	2.05	Shell	Grey brown mud, diatoms, and sulphide smell
Richmond Bay	RIC-G1	-41.01250	173.94175	47.1	9.89	89.22	0.88	Shell	Grey/brown mud (clean/ devoid of gravel)
	RIC-G2	-41.01340	173.94236	37	9.78	90.00	0.22	Shell	Grey/brown mud (clean/ devoid of gravel)
	RIC-G3	-41.01376	173.94067	46	18.98	80.09	0.94	Shell	Grey/brown mud (clean/ devoid of gravel)
	RIC-G4	-41.01490	173.93993	44.9	9.58	90.16	0.26	Shell	Grey/brown mud (clean/ devoid of gravel)
	RIC-G5	-41.01533	173.93851	52.5	12.86	87.01	0.13	Shell	Grey/brown mud (clean/ devoid of gravel)
	RIC-G6	-41.01608	173.93996	42.7	6.40	93.48	0.12	Shell	Grey/brown mud (clean/ devoid of gravel)
Horseshoe Bay	HOR-G1	-41.02592	173.93678	18.8	22.99	76.36	0.66	Shell	Grey brown mud
	HOR-G2	-41.02523	173.93491	25.7	19.06	79.76	1.18	Shell	Grey brown mud
	HOR-G3	-41.02432	173.93615	25.3	12.40	87.52	0.08	Shell	Grey brown mud
	HOR-G4	-41.02322	173.93589	32.9	10.18	89.80	0.02	Shell	Grey brown mud, in mussel farm shell
	HOR-G5	-41.02226	173.93644	39.2	4.93	81.32	13.75	Shell	Mud and mussel
	HOR-G6	-41.02192	173.93514	45	5.15	94.44	0.41	Shell	-
Tipi Bay	TIP-G2	-41.22487	174.28625	25	37.76	31.00	31.24	Shell/bryoz.	Shell/dead bryozoan
	TIP-G3	-41.22575	174.28623	20.1	49.43	35.17	15.40	Shell/gravel	Sand/gravel/mud
	TIP-G4	-41.22668	174.28456	23.1	29.80	12.12	58.08	Shell/rock	Sand/gravel/mud
	TIP-G6	-41.22644	174.28657	13	50.09	49.91	0.00		Sand/mud
	TIP-G7	-41.22571	174.28602	24.7	62.83	19.98	17.19	Shell	Sand/Gravel/Mud, (poor penetration)
	TIP-G8	-41.22569	174.28520	28.9	58.24	15.59	26.17	Shell	Sand/shell, (poor penetration)
Motukina	MOT-G1	-41.24235	174.25978	24.4	n/a	n/a	n/a	Gravel	Cobble/gravel/shell (no grainsize sample) fauna collected (Sabellid worms off cobble)
	MOT-G2	-41.24261	174.26139	18.3	63.67	35.87	0.47	Shell	Grey sandy mud
	MOT-G3	-41.24113	174.26240	30.1	49.15	25.35	25.49	Shell/gravel	Grey sandy mud, shell
	MOT-G4	-41.24229	174.25845	33.8	38.06	26.82	35.12	Shell/gravel	Muddy-sand, shell
	MOT-G5	-41.24262	174.26290	8.3	47.49	20.06	32.44	Shell/gravel	Muddy-sand, little shell, gravel
	MOT-G6	-41.24172	174.26152	32	67.79	26.37	5.84	Shell	Muddy-sand, little shell
Te Weka	TEW-G1	-41.24702	174.19259	24.9	52.90	30.73	16.37	Shell	Very small volume
	TEW-G2	-41.24899	174.18843	29.7	59.15	26.62	14.22	Shell	Muddy-sand, shell
	TEW-G3	-41.24815	174.19162	27.1	49.93	36.19	13.88	Shell	Muddy-sand, shell
	TEW-G4	-41.24881	174.19241	12	49.45	50.38	0.17	Shell	Muddy-sand

Location	Grab_Id	Latitude	Longitude	Depth (m)	% Sand	% Mud	% Gravel	> 2mm notes	Field sediment description
	TEW-G5	-41.24732	174.19129	26.1	62.84	36.17	0.99	Shell	Muddy-sand
	TEW-G6	-41.24827	174.18926	29	58.89	35.12	5.98	Shell	Muddy-sand, shell

Appendix C Drop-camera; broad taxonomic groups.

Table C-1: Drop-camera occurrences of broad taxonomic groups. Pelorus sounds (BLN = Blowhole North, BLS = Blowhole South, WAN = Waitata Reach North, WAS = Waitata Reach South, RIC = Richmond Bay, HOR= Horseshoe); Queen Charlotte Sounds (TIP = Tipi Bay, MOT = Motukina, TEW = Te Weka Bay). Sample effort = number of drop-camera stations sampled at each farm site. Vales = the percentage of sites where that taxa was present (e.g. "57"= 57% of sites contained that taxa-group); Bold values indicate >30% occurrence for a taxa at that farm site.

Taxa / habitat groups	PS						QCS		
	BLN	BLS	(WAN	WAS)	RIC	HOR	TIP	MOT	TEW
Sample effort	(n=37)	(n=28)	(n=27)	(n=16)	(n=30)	(n=30)	(n=33)	(n=38)	(n=37)
Burrows/trails	**57**	21	**85**	**94**	**57**	**43**	**30**	13	**32**
Hydroids	**46**	29	**37**	**38**	**30**	**47**	27	**39**	**65**
Red Macroalgae	**43**	18	-	-	23	**30**	**36**	**42**	**46**
Algal turf	22	18	**30**	13	**37**	**43**	12	24	11
Sponges	16	21	11	-	10	17	**33**	42	27
Coralline algae	14	11	-	-	10	7	**52**	26	27
Ophiuroids	-	18	-	-	-	3	**30**	**37**	24
Bryozoans	3	11	11	-	7	7	24	29	16
Benthic diatoms	**35**	-	-	-	13	17	12	21	22
Bivalves	**32**	29	22	19	13	**30**	-	-	3
Green macroalgae	22	14	-	-	-	-	**36**	21	3
Ascidians	11	11	15	13	3	3	6	5	22
Starfishes	8	11	-	-	3	13	12	8	19
Brown macroalgae	5	14	-	-	-	-	24	13	-
Fishes	11	4	4	-	7	3	6	11	5
Crabs	14	18	-	13	3	-	-	3	14
Polychaetes	14	4	-	-	3	17	-	3	3
Colpomenia	3	-	-	-	-	3	6	5	5
Brown drift algae	-	-	-	-	-	-	6	8	3
Epiphytic algae	-	-	-	-	-	-	12	5	-
Seagrass	-	4	-	-	-	-	12	3	-
Gastropod	-	4	-	6	3	-	3	-	3
Urchins	3	4	-	-	-	-	3	5	3
Anemones	-	4	4	6	-	3	-	-	-
Holothurians	5	4	-	-	-	7	-	-	-
Barnacles	3	-	-	-	-	-	3	-	-
Brachiopods	-	7	-	-	-	-	-	-	3
Hard coral (colonial)	3	-	-	-	-	3	-	-	-
Softcoral	-	-	-	-	-	-	-	-	3
Barren (no taxa)	-	4	4	-	13	3	-	-	-

Appendix D Lists of infauna taxa and mean abundances per grab-sampling station for each Proposed Farm Site

Table D-1: Infaunal species recorded under the proposed Blowhole North Farm Site, Pelorus Sound. Columns 1-6 depict replicate grabs BN-G1 to BN-G6; "Tabd"= Total infaunal abundance; Occur = presence across grabs. Tabd >= 10 are in blue text.

Taxa group	Taxa/species	Tabd	Occur	Blowhole North					
				1	2	3	4	5	6
Amphipoda	Amphipoda	101	5	10	11	42	10	15	13
	Caprillidae	2	1					2	
Ascidiacea	*Cnemidocarpa bicornuta*	1	1	1					
	Cnemidocarpa nisiotis	1	1				1		
	Cystodytes dellechiajei	1	1			1			
Bivalvia	*Corbula zelandica*	11	2	3			7		1
	Gonimyrtea concinna	7	2			1	6		
	Arthritica sp.	6	3	1	1			4	
	Limaria orientalis	6	1			6			
	Hiatella arctica	5	2	1		4			
	Tawera spissa	4	2	3				1	
	Ennucula strangei	2	2		1	1			
	Melliteryx parva	2	1		1				1
	Pratulum pulchellum	2	1			2			
	Purpurocardia purpurata	2	2	1				1	
	Theora lubrica	2	1					2	
	Bivalve sp C. (juv)	2	1					2	
	Anomia trigonopsis	1	1			1			
	Dosinia sp. (juv)	1	1					1	
	Linucula hartvigiana	1	1		1				
	Pecten novaezelandiae	1	1					1	
	Poroleda lanceolata	1	1		1				
	Bivalve sp A. (juv)	1	1		1				
	Bivalve sp B. (juv)	1	1		1				
	Bivalve (damaged/unidentified)	1	1	1					
Brachiopoda	*Terebratella sanguinea*								3
	Calloria inconspicua	1	1				1		
Cirripedia	Barnacle	3	1					3	
Copepoda	Copepoda								1
Cumacea	Cumacea	19	3	1	4			13	1
Crustacea	*Pagurus* sp.	14	3	1			4	1	8
	Petrolisthes novaezelandiae	11	2			9	2		
	Crab zoea	10	3	1		1		8	
	Periclimenes yaldwyni	2	1			2			
	Halicarcinus sp.	1	1			1			
	Notomithrax sp.	1	1					1	
	Decapod								1
Echinoidea	*Echinocardium cordatum*	2	1					2	

Taxa group	Taxa/species	Tabd	Occur	Blowhole North					
				1	2	3	4	5	6
Gastropoda	*Odostomia* sp.	12	2		1			11	
	Philine sp.	6	3	1	2			3	
	Amalda sp. (juv)	4	1					4	
	Gastropod sp A	4	2	1	3				
	Maoricolpus roseus	3	2			1	2		
	Gastropod sp B. (juv)	2	2	1		1			
	Sigapatella tenuis	1	1			1			
	Turbonilla sp.	1	1					1	
	Gastropod sp C. (juv)	1	1	1					
	Gastropod sp D. (juv)	1	1	1					
Gymnolaemata	Erect Bryozoan	1	1			1			
Holothuroidea	*Heterothyone alba*	1	1			1			
Isopoda	Isopoda	31	5	6	3	10	1	11	
Mysida	*Tenagomysis longisquama*	1	1			1			
Nebaliacea	*Nebalia* sp.								1
Ophiuroidea	*Amphiura* sp.	21	3		1	14	2		4
	Ophiopsammus maculata	1	1			1			
Ostracoda	Ostracoda	26	5	3	3	5	1	12	2
Polychaeta	Chaetopteridae	30	2		20	10			
	Maldanidae	16	5	4	3	1	4	2	2
	Glyceridae	15	5	3	3	1	2	2	4
	Lumbrineridae	13	3	3	1			5	4
	Eunicidae	7	2			5	1		1
	Dorvillidae	6	4	1		2	1	1	1
	Cossuridae	5	4		1	1	2	1	
	Hesionidae	4	2			3		1	
	Sigalionidae	4	2		2			2	
	Spionidae	4	1					2	2
	Syllidae	4	1			4			
	Cirratulidae	3	2		1			1	1
	Nephtyidae	3	2		2			1	
	Onuphidae	3	2		1			2	
	Capitellidae	2	1			2			
	Paraonidae	2	1					2	
	Phyllodocidae	2	1			2			
	Sternaspidae	2	1					2	
	Terebellidae	2	2	1		1			
	Opheliidae	1	1			1			
	Oweniidae	1	1			1			
	Polynoidae	1	1					1	
	Trichobranchidae	1	1				1		
Polyplacophora	Chiton (juv)	10	3	2		3	1		4
Sipuncula	*Sipunculus* sp.	4	2			3	1		
Tanidiacea	Tanidiacea	82	4		1	74	3	1	3

Table D-2: Infaunal species recorded under the proposed Blowhole South Farm Site, Pelorus Sound.
Columns 1-6 depict replicate grabs BS-G1 to BS-G6; "Tabd"= Total infaunal abundance; Occur = presence across grabs. Tabd >= 10 are in blue text.

				Blowhole South								
Taxa group	**Taxa/species**	**Tabd**	**Occur**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Amphipoda	Amphipoda	91	9	4	1	13	22	9	20	8	6	8
	Caprillidae	1	1						1			
Ascidiacea	*Cnemidocarpa drygalskii*	2	1						2			
Bivalvia	*Gonimyrtea concinna*	12	4	1		7	3	1				
	Pratulum pulchellum	6	4	2		1	2		1			
	Corbula zelandica	5	3			3		1	1			
	Parathyasira neozelanica	5	4	2		1				1		1
	Ennucula strangei	6	3				1	1		4		
	Limaria orientalis	2	2		1	1						
	Maoricrypta sodalis	2	1			2						
	Tawera spissa	3	2			2				1		
	Anomia trigonopsis	1	1			1						
	Arthritica sp.	3	3			1				1	1	
	Hiatella arctica	1	1			1						
	Saccella bellula	3	3				1			1		1
	Thyasira peroniana	1	1				1					
	Linucula hartvigiana	6	2							4		2
	Purpurocardia purpurata	1	1								1	
	Melliteryx parva	6	1								6	
	Juvenile bivalve	1	1							1		
	Venerupis largillierti	1	1			1						
Brachiopoda	*Calloria inconspicua*	8	1		8							
	Terebratella sanguinea	2	1			2						
Cirripedia	Barnacle	1	1			1						
Copepoda	Copepoda	2	1									2
Cumacea	Cumacea	53	9	1	1	4	13	3	9	8	3	11
Crustacea	*Petrolisthes novaezelandiae*	11	2		5			6				
	Pagurus sp.	6	4	1		3			1			1
	Periclimenes yaldwyni	4	3		2		1	1				
	Crab zoea	1	1						1			
Echinoidea	*Echinocardium chordata*	11	2							4		7
Gastropoda	*Maoricolpus roseus*	3	2		2	1						
	Sigapatella tenuis	3	2	2	1							
	Zeacolpus pagoda	2	2	1					1			
	Amalda sp.	2	2				1				1	
	Odostomia sp.	2	2			1				1		
	Zeacolpus vittatus	1	1	1								
	Juvenile gastropod	1	1								1	
Holothuroidea	*Pentadactyla longidentis*	1	1									1
Isopoda	Isopoda	9	6			2	1	2	1	1	2	
Ophiuroidea	Amphiura sp.	18	7		1	3	3	4	4		2	1
Ostracoda	Ostracoda	39	6			1	5		2	16	3	12
Polychaeta	Lumbrineridae	26	9	1	1	4	2	4	1	6	2	5
	Eunicidae	10	3	1	7			2				
	Capitellidae	10	6	1	1	2		2			3	1
	Cossuridae	14	5		1	1	2				6	4

Taxa group	Taxa/species	Tabd	Occur	Blowhole Point South								
				1	2	3	4	5	6	7	8	9
	Glyceridae	10	5			1	1		2		5	1
	Maldanidae	6	5	2	1	1				1	1	
	Ampharetidae	3	2			2	1					
	Oweniidae	3	2	2		1						
	Phyllodocidae	3	1					3				
	Syllidae	5	3		3						1	1
	Chaetopteridae	2	2		1			1				
	Hesionidae	3	2					2		1		
	Nephtyidae	5	3				2			2		1
	Sigalionidae	6	4				2			2	1	1
	Cirratulidae	10	4		1					5	1	3
	Dorvillidae	1	1		1							
	Flabelligeridae	3	3				1			1		1
	Onuphidae	3	3		1					1		1
	Opheliidae	1	1					1				
	Orbiniidae	3	2		1					2		
	Paraonidae	5	2					1		4		
	Sabellidae	1	1			1						
	Spionidae	1	1				1					
	Polynoidae	1	1								1	
	Nereidae	1	1								1	
Polyplacophora	Chiton (juv)	2	2	1		1						
	Notoplax rubiginosa	1	1					1				
Scaphopoda	Scaphopoda	2	2							1		1
Tanidiacea	Tanidiacea	15	5		5	3	3	1	3			

Table D-3: Infaunal species recorded under the proposed Waitata North Farm Site, Pelorus Sound.
Columns 1-6 depict replicate grabs WN-G1 to WN-G6; "Tabd"= Total infaunal abundance; Occur = presence across grabs. Tabd >= 10 are in blue text.

Taxa group	Taxa/species	Tabd	Occur	Waitata North					
				1	2	3	4	5	6
Amphipoda	Amphipoda	122	6	9	5	14	15	29	50
	Caprillidae	1	1						1
Ascidiacea	*Pyura picta*	1	1	1					
Bivalvia	*Ennucula strangei*	15	5	4		3	2	2	4
	Linucula hartvigiana	9	2					5	4
	Pratulum pulchellum	5	2	1					4
	Serratina charlottae	5	3	2		1			2
	Melliteryx parva	3	2	2		1			
	Notocallista multistriata	3	3		1	1		1	
	Parathyasira neozelanica	3	2	2				1	
	Neilo australis	1	1			1			
	Poroleda lanceolata	1	1			1			
	Purpurocardia purpurata	1	1				1		

Taxa group	Taxa/species	Tabd	Occur	Waitata North					
				1	2	3	4	5	6
	Saccella bellula	1	1		1				
	Theora lubrica	1	1				1		
	Bivalve sp F.	1	1						1
Copepoda	Copepoda	3	2	2					1
Cumacea	Cumacea	62	5		7	8	12	8	27
Crustacea	Crab zoea	3	2					1	2
	Petrolisthes novaezelandiae	3	1	3					
	Biffarius filholi	1	1			1			
	Ebalia laevis	1	1						1
	Periclimenes yaldwyni	1	1	1					
	Decapod sp A.	1	1	1					
Echinoidea	*Echinocardium cordatum*	2	2	1		1			
Gastropoda	*Sigapatella tenuis*	3	1						3
	Strutholaria vermis	3	3	1		1			1
	Gastropod sp A	3	1						3
	Alcithoe fusus	1	1					1	
	Zeatrophon ambiguus	1	1						1
Holothuroidea	*Pentadactyla longidentis*	3	3	1		1		1	
	Heterothyone alba	1	1			1			
Isopoda	Isopoda	6	2	1					5
Ophiuroidea	*Amphiura* sp.	7	2	2					5
Ostracoda	Ostracoda	15	5	1	2	1		3	8
Polychaeta	Glyceridae	20	6	2	5	5	1	4	3
	Lumbrineridae	20	5	3	2	4		3	8
	Cossuridae	18	6	2	1	4	3	7	1
	Cirratulidae	10	4	4		1		3	2
	Spionidae	8	4	2	2		3	1	
	Maldanidae	7	4	1		1	2		3
	Flabelligeridae	4	3			1		1	2
	Nephtyidae	4	4	1	1	1	1		
	Syllidae	4	3	2	1	1			
	Capitellidae	3	1	3					
	Dorvillidae	3	1	3					
	Orbiniidae	3	3	1		1			1
	Onuphidae	2	2	1		1			
	Chaetopteridae	1	1					1	
	Sabellidae	1	1			1			
	Sigalionidae	1	1			1			
Sipuncula	*Sipunculus* sp.	1	1		1				

Table D-4: Infaunal species recorded under the proposed Waitata South Farm Site, Pelorus Sound. Columns 1-6 depict replicate grabs WS-G1 to WS-G6; "Tabd"= Total infaunal abundance; Occur = presence across grabs. Tabd >= 10 are in blue text.

Taxa group	Taxa/species	Tabd	Occur	Waitata South					
				1	2	3	4	5	6
Amphipoda	Amphipoda	135	6	15	23	35	30	30	2
	Caprillidae	9	3	2		6		1	
Anthozoa	*Virgularia gracillima*	1	1				1		
Bivalvia	*Ennucula strangei*	21	6	3	4	5	5	3	1
	Parathyasira neozelanica	14	4		5	2	2		5
	Pratulum pulchellum	12	4	1	4	1		6	
	Linucula hartvigiana	7	4		1	1	3	2	
	Arthritica sp.	6	2		2		4		
	Corbula zelandica	5	3	1	1		3		
	Melliteryx parva	4	3		1	2			1
	Serratina charlottae	4	3	1		1	2		
	Notocallista multistriata	3	3			1	1	1	
	Bivalve sp E.	2	2		1			1	
	Leptomya retiaria	1	1		1				
	Peronaea spenceri	1	1				1		
Copepoda	Copepoda	1	1				1		
Cumacea	Cumacea	55	5	6	12	15	10	12	
Crustacea	Ebalia laevis	2	2		1		1		
	Petrolisthes novaezelandiae	2	1		2				
	Nectocarcinus integrifrons	1	1		1				
	Pagurus sp.	1	1				1		
Echinoidea	*Echinocardium cordatum*	2	2			1	1		
Gastropoda	Gastropod sp A	10	1			10			
	Sigapatella tenuis	6	2	2			4		
	Antalis nana	3	1			3			
	Amalda novaezelandiae	1	1	1					
	Strutholaria vermis	1	1		1				
Isopoda	Isopoda	8	3	1		3	4		
Mysida	Mysid Shrimp	1	1		1				
Ophiuroidea	*Amphiura* sp.	5	3		1	2	2		
Ostracoda	Ostracoda	27	5	1	7	8	7	4	
Polychaeta	Lumbrineridae	22	5	3	6	7	4	2	
	Glyceridae	15	5	3	2	2	1	7	
	Maldanidae	12	6	3	1	3	3	1	1
	Cirratulidae	10	5	3		1	2	3	1
	Capitellidae	7	4		1	1	2	3	
	Syllidae	7	3	1	3			3	
	Orbiniidae	6	4	2	2	1			1
	Spionidae	6	5	1	1		2	1	1
	Flabelligeridae	5	4		1		2	1	1
	Sigalionidae	5	5	1	1	1	1		1

Taxa group	Taxa/species	Tabd	Occur	Waitata South					
				1	2	3	4	5	6
Polychaeta	Dorvillidae	4	3		1		1	2	
(cont.)	Cossuridae	3	3	1	1			1	
	Nereidae	3	3	1	1		1		
	Oweniidae	2	2		1		1		
	Ampharetidae	1	1						1
	Hesionidae	1	1					1	
	Nephtyidae	1	1						1
	Paraonidae	1	1				1		
	Trichobranchidae	1	1					1	
Tanidiacea	Tanidiacea	4	2		3			1	

Table D-5: Infaunal species recorded under the proposed Richmond Bay Farm Site, Pelorus Sound.
Columns 1-6 depict replicate grabs R-G1 to R-G6; "Tabd"= Total infaunal abundance; Occur = presence across grabs. Tabd >= 10 are in blue text.

Taxa group	Taxa/species	Tabd	Occur	Richmond Bay					
				1	2	3	4	5	6
Amphipoda	Amphipoda	54	6	11	14	16	6	3	4
	Caprillidae	1	1	1					
Ascidiacea	*Cystodytes dellechiajei*	1	1			1			
Bivalvia	*Ennucula strangei*	16	4	2	6		7		1
	Melliteryx parva	6	1		6				
	Anomia trigonopsis	2	1	2					
	Neilo australis	2	2				1		1
	Corbula zelandica	1	1		1				
	Hiatella arctica	1	1			1			
	Parathyasira neozelanica	1	1		1				
	Pecten novaezelandiae	1	1				1		
	Pratulum pulchellum	1	1			1			
Cumacea	Cumacea	38	6	2	10	18	1	1	6
Crustacea	*Ebalia laevis*	2	1	2					
	Petrolisthes novaezelandiae	2	1			2			
	Crab zoea	1	1			1			
	Halicarcinus sp.	1	1			1			
	Pagurus sp.	1	1				1		
	Pontophilus australis	1	1	1					
	Decapod sp A.	1	1						1
Echinoidea	*Echinocardium cordatum*	3	1		3				
Gastropoda	Gastropod sp D. (juv)	3	1		3				
	Amalda novaezelandiae	1	1					1	
	Poirieria zelandica	1	1						1
Isopoda	Isopoda	6	3	1	3			2	

Taxa group	Taxa/species	Tabd	Occur	Richmond Bay					
				1	2	3	4	5	6
Ostracoda	Ostracoda	15	4	4	9	1		1	
Polychaeta	Glyceridae	8	3			1		5	2
	Maldanidae	8	6	1	1	2	2	1	1
	Capitellidae	7	4			2	3	1	1
	Dorvillidae	6	1			6			
	Lumbrineridae	6	3	1	4	1			
	Spionidae	6	4		2	2	1	1	
	Cirratulidae	5	2		1	4			
	Cossuridae	4	3		1			1	2
	Chaetopteridae	3	2			2	1		
	Orbiniidae	3	3		1	1			1
	Sigalionidae	3	3	1	1	1			
	Ampharetidae	2	2		1	1			
	Onuphidae	2	2	1	1				
	Syllidae	2	1			2			
	Flabelligeridae	1	1			1			
	Nephtyidae	1	1						1
	Nereidae	1	1			1			
	Opheliidae	1	1			1			
	Pectinaridae	1	1		1				
	Sternaspidae	1	1		1				
Tanidiacea	Tanidiacea	5	3	1		3			1

Table D-6: Infaunal species recorded under the proposed Horseshoe Bay Farm Site, Pelorus Sound.
Column 1-6 depict replicate grabs H-G1 to H-G6; "Tabd"= Total infaunal abundance; Occur = presence across grabs. Tabd >= 10 are in blue text.

Taxa group	Taxa/species	Tabd	Occur	Horseshoe Bay					
				1	2	3	4	5	6
Amphipoda	Amphipoda	103	6	16	1	9	7	65	5
	Caprillidae	2	1		2				
Anthozoa	*Virgularia gracillima*	1	1				1		
Bivalvia	*Ennucula strangei*	11	6	1	3	3	2	1	1
	Limaria orientalis	5	2	4				1	
	Mytilus edulis	5	1					5	
	Leptomya retiaria	3	2	2	1				
	Linucula hartvigiana	3	1					3	
	Notocallista multistriata	3	2				1		2
	Hiatella arctica	2	1	2					
	Theora lubrica	2	1					2	
	Arthritica sp.	1	1	1					
	Leptomya sp.	1	1					1	
	Pecten novaezelandiae	1	1	1					
	Bivalve sp D. (juv)	1	1		1				
Cumacea	Cumacea	13	5		4	5	1	2	1
Crustacea	*Halicarcinus* sp.	3	3	1		1		1	
	Decapod sp A.	3	1					3	
	Notomithrax sp.	1	1	1					
	Pagurus sp.	1	1		1				
	Petrolisthes novaezelandiae	1	1	1					
	Pinnotheres novaezelandiae	1	1					1	
Echinoidea	*Echinocardium cordatum*	1	1		1				
Gastropoda	*Alcithoe fusus*	1	1				1		
Holothuroidea	*Pentadactyla longidentis*	1	1			1			
Isopoda	Isopoda	11	1					11	
Nebaliacea	Nebalia sp.	1	1					1	
Ophiuroidea	*Amphiura* sp.	6	2	4				2	
Ostracoda	Ostracoda	13	3		3		1	9	
Polychaeta	Chaetopteridae	53	3		50	1			2
	Dorvillidae	12	2					10	2
	Maldanidae	11	3	7		2			2
	Spionidae	8	5	1	1	2	2	2	
	Glyceridae	7	3				2	1	4
	Lumbrineridae	5	3				1	2	2
	Cirratulidae	4	3	2			1	1	
	Capitellidae	3	2		1			2	
	Syllidae	3	2	1					2
	Cossuridae	2	2	1		1			
	Nereidae	2	2					1	1
	Orbiniidae	2	1				2		

Taxa group	Taxa/species	Tabd	Occur	Horseshoe Bay					
				1	2	3	4	5	6
	Sigalionidae	2	1				2		
	Ampharetidae	1	1	1					
	Eunicidae	1	1						1
	Onuphidae	1	1	1					
	Opheliidae	1	1						1
	Paraonidae	1	1	1					
Tanidiacea	Tanidiacea	25	4	8	13	3		1	

Table D-7: Infaunal species recorded under the proposed Tipi Bay Farm Site, Tory Channel, queen Charlotte Sound. Columns labelled 2-8 depict replicate grabs TP-G2 to TP-G8; "Tabd"= Total infaunal abundance; Occur = presence across grabs. Tabd >= 10 are in blue text.

Taxa group	Taxa/species	Tabd	Occur	Tipi Bay					
				2	3	4	6	7	8
Amphipoda	Amphipoda	220	5	48		11	3	66	92
	Caprillidae	3	3	1	1			1	
Ascidiacea	*Molgula* sp.	9	1	9					
	Pyura rugata	5	1	5					
	Asterocarpa cerea	2	1	2					
	Molgula mortenseni	2	1	2					
	Cnemidocarpa nisiotis	1	1			1			
	Corella eumyota	1	1	1					
	Cystodytes dellechiajei	1	1	1					
	Pyura cancellata	1	1	1					
Bivalvia	*Corbula zelandica*	9	3			3		5	1
	Pratulum pulchellum	8	2					6	2
	Gonimyrtea concinna	7	2			3			4
	Gari sp.	4	3				1	1	2
	Hiatella arctica	4	1	4					
	Tawera spissa	4	2			3		1	
	Barbatia novaezelandiae	3	1	3					
	Notocallista multistriata	3	1					3	
	Myadora antipodum	2	1					2	
	Nucula nitidula	2	2	1	1				
	Scalpomactra scalpellum	2	1					2	
	Anomia trigonopsis	1	1	1					
	Cardita aoteana	1	1	1					
	Hunkydora novozelandica	1	1					1	
	Limaria orientalis	1	1						1
	Modiolarca impacta	1	1	1					
	Solemya parkinsonii	1	1				1		
	Tellinidae (juv)	1	1				1		
	Zelithophaga truncata	1	1	1					

Taxa group	Taxa/species	Tabd	Occur	Tipi Bay					
				2	3	4	6	7	8
Brachiopoda	*Calloria inconspicua*	2	1	2					
Cumacea	Cumacea	3	3	1		1	1		
Crustacea	*Pagurus* sp.	2	1					2	
	Munida gregaria	1	1	1					
Demospongiae	Unidentified Sponge	1	1	1					
Gastropoda	*Maoricolpus roseus*	9	2	8		1			
	Amalda novaezelandiae	3	1				3		
	Sigapatella novaezelandiae	3	2	2		1			
	Gastropod sp E.	1	1	1					
	Gastropod sp F. (juv)	1	1			1			
Gymnolaemata	Erect Bryozoan	2	2	1				1	
Gymnolaemata	Encrusting Bryozoan	1	1	1					
Hydrozoa	Hydrozoa	1	1	1					
Isopoda	Isopoda	40	4	28		8		2	2
Ophiuroidea	*Amphiura* sp.	5	4	1		1		1	2
	Ophionereis fasciata	2	1	2					
	Ophiopteris antipodium	1	1	1					
Ostracoda	Ostracoda	27	5	13		8	4	1	1
Phaeophyceae	Encrusting brown algae	1	1	1					
Polychaeta	Chaetopteridae	10	1		10				
	Capitellidae	8	4			1	2	1	4
	Sabellidae	8	4	2		4		1	1
	Glyceridae	7	5	1		2	1	1	2
	Opheliidae	7	4	2			1	2	2
	Cirratulidae	4	3			1	2	1	
	Orbiniidae	4	1				4		
	Eunicidae	3	1	3					
	Lumbrineridae	3	2			2			1
	Serpulidae	3	1	3					
	Maldanidae	2	2	1		1			
	Nephtyidae	2	2			1	1		
	Spionidae	2	1			2			
	Hesionidae	1	1	1					
	Nereidae	1	1			1			
	Phyllodocidae	1	1	1					
	Syllidae	1	1						1
Pycnogonida	Pycnogonid	1	1						1
Rhodophyta	Branching red algae	1	1	1					
	Filamentous red algae	1	1	1					
Tanidiacea	Tanidiacea	31	1	31					

Table D-8: Infaunal species recorded under the proposed Motukina Farm Site, Tory Channel, Queen Charlotte Sound. Columns 1-6 depict replicate grabs MO-G1 to MO-G6; "Tabd"= Total infaunal abundance; Occur = presence across grabs. Tabd >= 10 are in blue text.

Taxa group	Taxa/species	Tabd	Occur	Motukina					
				1	2	3	4	5	6
Amphipoda	Amphipoda	733	6	296	33	91	138	70	105
	Caprillidae	21	4	4	7			1	9
Anthozoa	Unidentified Anemone	1	1						1
Ascidiacea	*Polyzoa reticulata*	2	2			1	1		
	Asterocarpa cerea	1	1	1					
	Cystodytes dellechiajei	1	1		1				
	Molgula sp.	1	1						1
	Pyura sp.	1	1	1					
Bivalvia	*Gonimyrtea concinna*	28	5		2	7	11	7	1
	Tawera spissa	15	3			8	4	3	
	Corbula zelandica	14	4	3		5	5		1
	Nucula nitidula	6	4		1	2	2	1	
	Pratulum pulchellum	6	3			3	1	2	
	Bivalve sp H.	6	2					3	3
	Hiatella arctica	3	3			1		1	1
	Bivalve sp G.	3	1		3				
	Myadora antipodum	2	1				2		
	Serratina charlottae	2	1					2	
	Talochlamys zelandiae	2	1			2			
	Arthritica sp.	1	1		1				
	Cuspidaria trailli	1	1						1
	Dosinia maoriana	1	1					1	
	Gari lineolata	1	1		1				
	Gari sp.	1	1				1		
	Neilo australis	1	1					1	
	Notocallista multistriata	1	1			1			
	Pecten novaezelandiae	1	1				1		
	Zelithophaga truncata	1	1		1				
Chlorophyta	*Ulva* sp.	1	1					1	
Corallinales	Coralline alga	1	1				1		
Cumacea	Cumacea	7	2	2	5				
Crustacea	*Halicarcinus* sp.	4	4	1		1	1		1
	Pagurus sp.	2	2			1			1
Gastropoda	Gastropod sp H.	7	1					7	
	Maoricolpus roseus	5	3		1			3	1
	Micrelenchus sp.	4	1					4	
	Philine sp.	2	1			2			
	Gastropod sp A.	2	1			2			
	Amalda novaezelandiae	1	1					1	
	Sigapatella novaezelandiae	1	1			1			
	Sigapatella tenuis	1	1						1

Taxa group	Taxa/species	Tabd	Occur	Motukina					
				1	2	3	4	5	6
Gymnolaemata	Encrusting Bryozoan	3	3	1	1		1		
	Erect Bryozoan	2	2	1					1
Hydrozoa	Hydrozoa	5	5	1		1	1	1	1
Isopoda	Isopoda	36	6	8	1	4	6	4	13
Nebaliacea	*Nebalia* sp.	1	1					1	
Ophiuroidea	*Amphiura* sp.	12	6	3	1	4	2	1	1
	Ophiopsammus maculata	1	1					1	
Ostracoda	Ostracoda	48	6	6	13	9	3	11	6
Polychaeta	Sabellidae	67	6	50	1	1	4	5	6
	Capitellidae	15	3			1	10	4	
	Opheliidae	15	3		2		8	5	
	Maldanidae	13	3	1		3	9		
	Lumbrineridae	11	5		1	1	4	2	3
	Glyceridae	10	5		2	4	2	1	1
	Cirratulidae	7	4		2	2	1		2
	Spionidae	7	4		1	1	1		4
	Syllidae	7	3				5	1	1
	Nereidae	6	4		1	2		2	1
	Ampharetidae	5	3		1		1		3
	Phyllodocidae	4	1					4	
	Dorvillidae	3	2				1		2
	Orbiniidae	3	2		1		2		
	Paraonidae	3	1						3
	Polynoidae	2	2	1			1		
	Serpulidae	2	1		2				
	Eunicidae	1	1			1			
	Nephtyidae	1	1					1	
Polyplacophora	Chiton (juv)	12	3			2	3	7	
	Rhysoplax sp.	1	1					1	
Rhodophyta	Branching red algae	1	1					1	
	Filamentous red algae	1	1					1	
Sipuncula	Si*punculus* sp.	2	1					2	
Tanaidiacea	Tanaidiacea	12	4	1	4	6	1		

NB: Epifaunal taxa collected in grab stations at this site included a Bryozoa (Green fluffy) at station G3, and *Ulva* sp. and foliose red macroalgae at station G5.

Table D-9: Infaunal species recorded under the proposed Te Weka Farm Site, Tory Channel, Queen Charlotte Sound. Columns 1-6 depict replicate grabs BN-G1 to BN-G6; "Tabd"= Total infaunal abundance; Occur = presence across grabs. Tabd >= 10 are in blue text.

Taxa group	Taxa/species	Tabd	Occur	Te Weka					
				1	2	3	4	5	6
Amphipoda	Amphipoda	256	6	79	35	27	43	37	35
	Caprillidae	8	3	3	4				1
Anthozoa	*Edwardsia* sp.	1	1		1				
	Unidentified Anemone	1	1	1					
Ascidiacea	*Polyzoa reticulata*	3	3	1	1		1		
	Pyura sp.	1	1						1
Bivalvia	*Gonimyrtea concinna*	19	6	6	8	1	1	1	2
	Corbula zelandica	9	3		5	2			2
	Pratulum pulchellum	4	3		1			2	1
	Leptomya retiaria	3	1			3			
	Tawera spissa	3	2	2		1			
	Bivalve sp G.	3	1					3	
	Myadora antipodum	2	2		1	1			
	Notocallista multistriata	2	1					2	
	Tellinota edgari	2	2				1	1	
	Arthritica sp.	1	1				1		
	Borniola reniformis	1	1		1				
	Dosinia maoriana	1	1				1		
	Gari lineolata	1	1					1	
	Gari sp.	1	1			1			
	Hiatella arctica	1	1						1
	Nucula nitidula	1	1			1			
	Talochlamys zelandiae	1	1						1
Brachiopoda	*Calloria inconspicua*	3	2		2	1			
Corallinales	Coralline alga	1	1						1
Cumacea	Cumacea	33	4	1	8		5	19	
Crustacea	*Pagurus* sp.	3	2	2		1			
	Barnacle sp A.	2	1						2
	Ebalia laevis	1	1					1	
	Hemiplax hirtipes	1	1				1		
Echinoidea	*Echinocardium cordatum*	2	2					1	1
Gastropoda	*Sigapatella novaezelandiae*	2	2			1			1
	Maoricolpus roseus	1	1	1					
	Sigapatella tenuis	1	1	1					
	Gastropod sp G.	1	1						1
	Zeacolpus pagoda	1	1			1			
Gymnolaemata	Encrusting Bryozoan	1	1						1
Isopoda	Isopoda	20	3	11	7		2		
Ophiuroidea	*Amphiura* sp.	12	4		6	4	1		1
Ostracoda	Ostracoda	16	6	3	2	1	3	2	5
Polychaeta	Capitellidae	65	6	12	18	22	2	1	10

Taxa group	Taxa/species	Tabd	Occur	Te Weka					
				1	2	3	4	5	6
	Opheliidae	31	6	13	7	3	3	1	4
	Sabellidae	21	5	2	5	9	4		1
	Spionidae	20	5		2	1	5	8	4
	Cirratulidae	13	5	2		1	3	4	3
	Paraonidae	12	2					10	2
	Dorvillidae	10	4	3	4		1		2
	Lumbrineridae	10	5	2	2	2	3		1
	Glyceridae	8	3		4	2	2		
	Syllidae	8	4	2	2	2	2		
	Ampharetidae	7	4	1	2	2			2
	Nephtyidae	6	3	1	2		3		
	Phyllodocidae	5	4	2	1	1			1
	Polynoidae	2	2		1				1
	Terebellidae	2	2		1				1
	Cossuridae	1	1						1
	Flabelligeridae	1	1						1
	Nereidae	1	1		1				
	Orbiniidae	1	1	1					
	Serpulidae	1	1		1				
Polyplacophora	Chiton (juv)	17	3	11	4	2			
Pycnogonida	Unidentified Pycnogonid	5	5		1	1	1	1	1
Tanidiacea	Tanidiacea	1	1						1

NB: epifaunal taxa collected in station G1 inlcuded fern hydroids; ascidians, ophiuroids, *Macrocystis* and foliose red macroalgae.