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ECOLOGICAL ASSESSMENT & REPORTING SERVICES

# Marine Farm 8270, Squally Cove

## Coastal Ecological Impact Assessment

For Mata Maataitati Partnership

December 2023

## REPORT INFORMATION & QUALITY CONTROL

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# Executive Summary

Mata Maataitati Partnership seeks resource consent renewal for marine farm site 8270, Squally Cove. The proposal involves a seaward shift of 8270 into the proposed Variation 1 Aquaculture Management Area (AMA). To understand and evaluate the ecological values present within the receiving environment, Robertson Environmental Limited was engaged to undertake an ecological assessment of the values and potential effects associated with the proposed reconsent. This assessment has been undertaken in accordance with the EIANZ Guidelines (2018).

Desktop, database, and field survey identified two subtidal habitat types associated to the proposed area. The deep subtidal habitat (Coastal Marine (Area) Zone; the Proposed Marlborough Environmental Plan, PMEP) to be covered by shellfish farming structures is soft sediment of low or limited ecological value. The nearshore subtidal reef habitat, identified with higher values in the area immediately inshore of the proposed site, is not directly affected by the proposed activity. Key conclusions of the assessment were as follows:

- The deep subtidal habitat directly affected is soft sediment-dominated, common among the wider Squally Cove and adjacent coastal area, and of relatively low value ecologically.
- With the exception of inshore reef habitat, no habitats, species or communities of scientific, conservation or ecological importance were observed within or directly adjacent to the site or wider surveyed area.
- Regarding native fauna, the proposal presents a low probability risk to marine mammals and seabirds.
- There is negligible risk of biosecurity (marine pests and disease) issues, and no risk of impacts from chemical additives (antibiotics, parasiticides, antifoulants and other therapeutants).
- The magnitude of the potential effects on the coastal receiving environment, both direct and indirect, are low or negligible and the resultant significance of the potential adverse effect is generally **Low** to **Very Low**.

Relocating the 8270 consent into the AMA will position it over soft sediment with minimal ecological value, thus avoiding impact on nearby inshore reef habitat. Therefore, specific mitigation measures like a Structures Exclusion Area are not required.

It is recommended to minimise discharges (fine sediment and organic matter) to water in the receiving environment during marine farm operations. Although, the discharge effects of harvesting mussels are seen as transitory and, in most cases, quickly become indistinguishable from background sedimentation.

Where possible the proposed activity has minimised impacts on Squally Cove and its ecological values and no permanent loss of indigenous biodiversity values is expected to occur.

# 1 Introduction

Gathering information to inform the assessment of effects on the coastal environment is implicit in New Zealand's legislation for sustainable resource management. A key mechanism in this process is to undertake aquaculture ecological assessments, which are designed to consistently and transparently assess the magnitude of impacts of marine farms on local biological communities and habitats, to identify appropriate resource consent conditions, and guide management.

With the Resource Management (National Environmental Standards for Aquaculture) Regulations 2020 (NES-MA) operative as of 1 December 2020, it is important to accurately assess and demarcate ecological values and potential effects to ensure the proposed aquaculture activity complies with the NES-MA.

Resource consents for marine farms in the Marlborough Sounds require an assessment of effects, including ecological effects. The following report is an ecological impact assessment (EcIA) of the proposed reconsenting of marine farm 8270, Squally Cove. It was commissioned by Aquaculture Direct on behalf of the Applicant, Mata Maataitati Partnership (MMP).

## 1.1 Ecological Assessment Scope

With detailed methodology outlined in Section 2, and survey limitations in Section 8, the purpose of this report is to:

- Identify and describe the significance and value of benthic habitat and biota associated with the reconsent (Section 3);
- Describe the potential effects on local ecology arising from the reconsent (Section 4);
- Discuss and present an overall conclusion of the level of potential effects of the reconsent on local ecology (Section 5); and,
- Recommend measures as appropriate to avoid, remedy or mitigate potential effects (including any proposed conditions/management plan required) (Section 6).

## 1.2 Description of Proposed Activity

The location of the 8270 consented boundary and Aquaculture Management Area (AMA - Variation 1) within the surveyed area, along with point locations where benthic observations (via drop camera) were made is shown in Figure 1.1A. The corresponding benthic side-scan sonar imagery is shown in Figure 1.1B.

Existing surface structures at 8270 consist of one block of backbones covering approximately 1.88 ha (63%) of the 3.00 ha consented area. The backbones are on average approximately 120 m in length, and have been used for production mussel crops.

The proposed farm would fall within Coastal Management Unit 'Squally Cove' under Variation 1. It is understood the results presented in this EcIA will inform the reconsent application for 8270 to move the marine farm into the proposed Variation 1 AMA or that proposed in the Marine Farming Association's submission to the Marlborough Environment Plan aquaculture variation (see mapped areas in Figure 1.1A).

For the purposes of this report, the areal footprint of the 8270 AMA as shown in Figure 1.1, is referred to as the '*The Site*'. We note the surveyed area as shown in Figure 1.1A covers the Site in its entirety[1].

[1] and provides for an area of 20 m distance around the proposed consent boundary in accordance with NES-MA requirements.

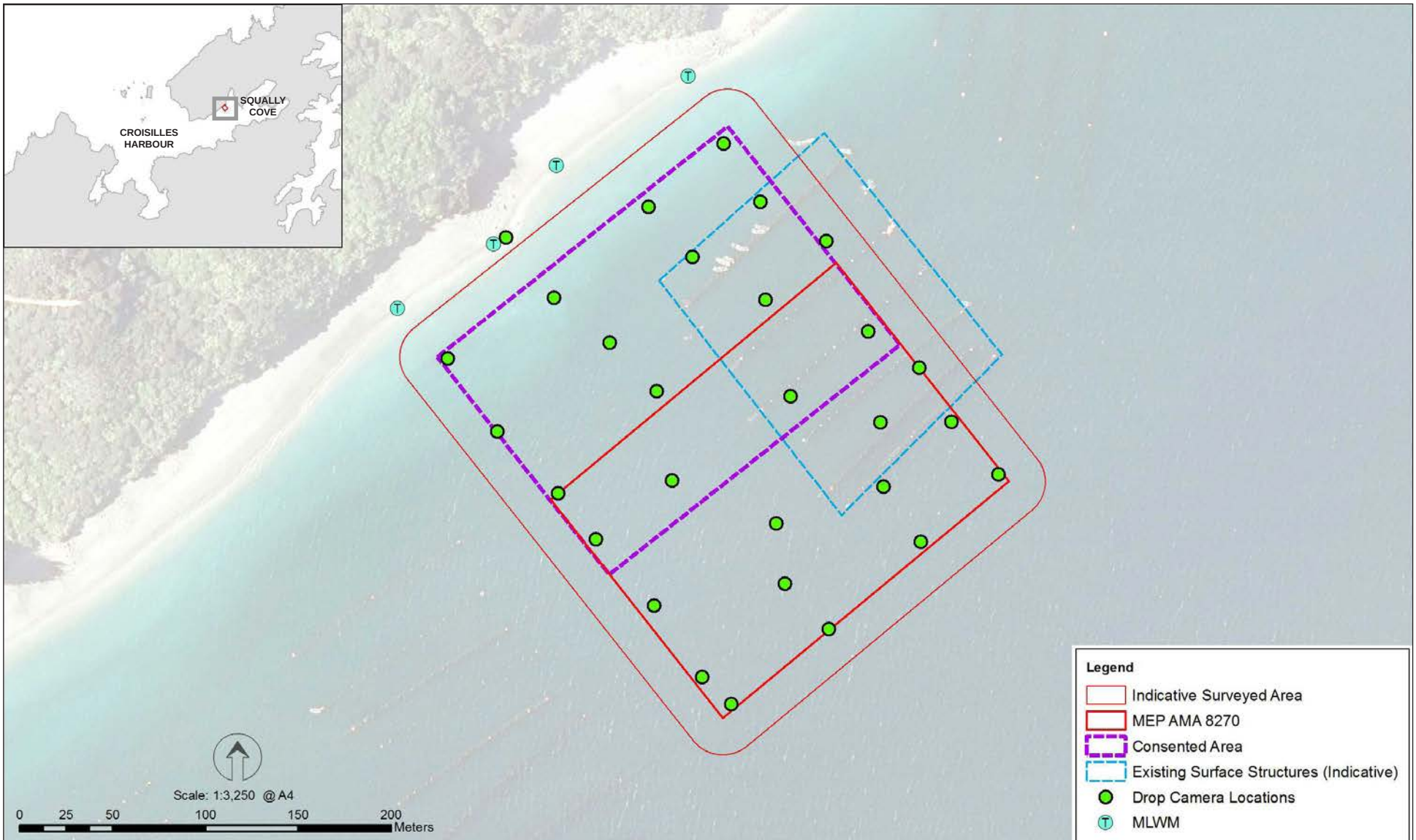


**Figure 1.1A.** Marine farm 8270 surveyed area, Squally Cove, including the Site, proposed AMA and existing consent and surface structures boundaries and locations of benthic sampling stations (drop camera locations) assessed in the present study. Detailed field data is presented in Appendix A.

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PROJECT: MARINE FARM 8270, MMP

Marine Farm 8270 Survey Area

| Date: 12 Dec 2023 | Revision: A | Aerial: LINZ 17/18
Plan map prepared for MMP by Robertson Environmental Limited

*Project Manager*: Ben.Robertson@robertsonenviro.co.nz

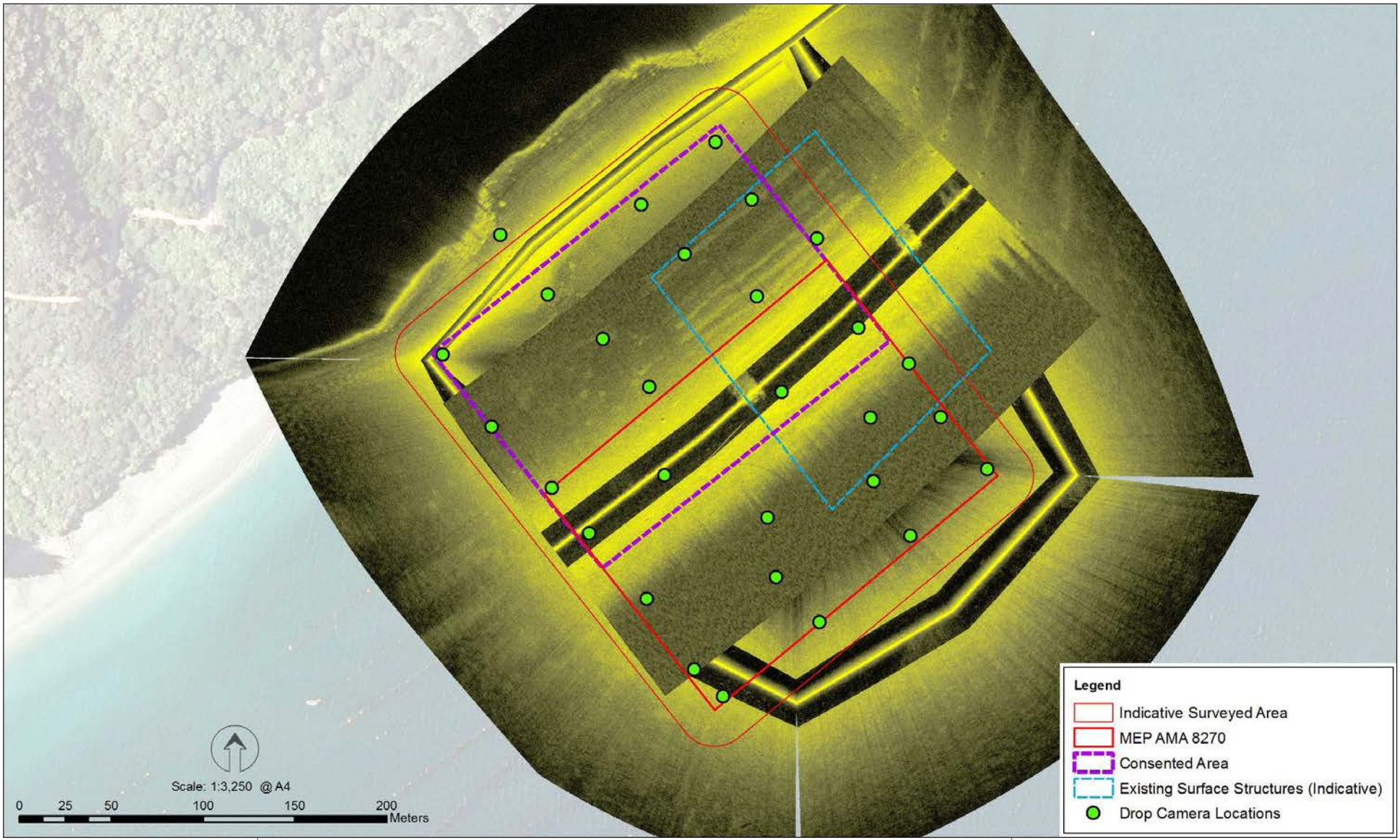


**Figure 1.1B.** Overview of the Site, surveyed area, and high-resolution side-scan sonar imagery used to corroborate benthic habitat types in the present study.

PROJECT: MARINE FARM 8270, MMP

Marine Farm 8270 Survey Area

| Date: 12 Dec 2023 | Revision: A | Aerial: LINZ 17/18
Plan map prepared for MMP by Robertson Environmental Limited

*Project Manager*: Ben.Robertson@robertsonenviro.co.nz

# 2 Assessment Methodology

## 2.1 Desktop Analysis

Existing biological databases and all published information on habitat types and biological values within the study area were researched. This phase also included preparation of site maps and plans to direct the field survey, including plotting of consent corners. Both the consent corners and extent of potential differences in habitat type within the Site were delineated on geographic information systems (GIS) using topographical maps and high resolution aerial photography (LINZ rectified ~0.3 m per pixel resolution flown in 2017/18 - https://data.linz.govt.nz/layer/98968-marlborough-03m-rural-aerial-photos-2017-2018/) prior to site visit. Information was derived from known datasets on landforms, marine farms (MDC's Smart Maps database), climate, and topography of the Site. Preliminary biological communities and habitat types were identified and described through a combination of past reports (MDC database), the use of aerial photographs, and to a lesser extent the New Zealand Land Cover Database version five (LCDB5).

The threat classification of important marine species was derived from the appropriate threat classification list for each taxa (Freeman et al. 2013; Nelson et al. 2019; Baker et al. 2019; Robertson et al. 2021; International Union for Conservation of Nature, IUNC) and their regional status was derived from Marlborough District Council reports (Davidson et al. 2011) and the Conservation Management Strategy for the Nelson/Marlborough Conservancy (Department of Conservation, 1996-2006).

### 2.1.1 Biogenic Habitats and Macroinvertebrates

Local biogenic habitat and epibenthic macroinvertebrate lists (Appendix D) obtained from various sources (Morton and Miller 1973; Davidson et al. 2010, 2011, 2018; and Anderson et al. 2019) were examined to identify any rare or uncommon biogenic habitat in which to focus field surveys. This list also included potential macroalgae and seagrass habitat.

### 2.1.2 Fish

A list of fish species in the area, as noted in Davidson et al. (2011), was collated (Appendix E).

### 2.1.3 Marine Mammals

A list of mammal species in the area, as noted in Davidson et al. (2011), was collated (Appendix B).

### 2.1.4 Seabirds

A list of bird species in the area, as noted in eBird (Grid BW58 Apr 2020-Nov 2023) and Davidson et al. (2011) and Schuckard et al. (2018), was collated (Appendix C). The species list obtained from the eBird atlas data served as a baseline of species previously recorded in the wider area and therefore potentially present at or near the Site. More recent survey data on NZ King shag populations in the Marlborough Sounds, as presented in McClellan et al. (2020) and Bell et al. (2020), was also considered.

## 2.2 Field Survey

Habitat within and immediately adjacent to the Site, was assessed by field survey. The survey targeted an approximately 6.82 hectare subtidal area based on the proposal (Figure 1.1A). The survey was undertaken by boat (Vessel: Christina A, 12.1 m, MSA 129219) during relatively calm (<10 knot winds) sea conditions on the 26th November 2023. On this day, the tide was high at 0926 (3.57 m) and low at 1538 (0.58 m), and during the survey currents were negligible, with weather conditions mostly fine. Mean Low Water Mark (MLWM) was determined at four (4) locations inshore of the Site's inshore boundary.

The survey vessel was positioned over the low water mark and the position plotted using the onboard GPS unit, while visual assessment of the transition between intertidal and subtidal species was used to determine low tide.

### 2.2.1 Benthic Habitat Classification

Broad ecological or habitat zones in the benthic survey area were identified, and with the aid of a Garmin GPSMAP 8410scx chart plotter unit (accuracy approx. ±5-10 m) linked to two GT51MTHP through-hull high-definition transducers, which provide traditional CHIRP sonar data, right and left SideVu™ imaging (245-275 and 445-465 kHz) as well as DownVu™ imaging (80-160 kHz), broadly delineated. Each habitat was subjectively classified into one of several different qualitative habitat type descriptors according to unique features identified and listed in Table 3.1. A stratified inspection of habitats was then undertaken by remotely operated vehicle (ROV - Custom Heavy BlueROV2 fitted with a Seatrac USBL X110 geopositioning system (accuracy approx. ±5 m) and Seabeam SB10 7.5 cm Scaling Laser) fixed to a stainless steel frame. The camera was lowered to the benthos and a georeferenced photograph (screen-grabbed from video footage) was collected where the frame landed to note seabed substratum and biota for each zone (outlined below). Drop camera stations were selected to obtain a representative range of habitats and depths within the consent, with additional photographs taken when any features of interest (e.g. mussel shell, reef structures, cobbles) were observed on the remote monitor on-board the survey vessel. Detailed field data, including precise locations and depths is presented in Appendix A and drop camera photographs in Appendix B. Reef and biogenic habitats were classified in accordance with NES-MA definitions[2].

Upon completion of field work the broad benthic habitat zones and drop camera positions were then imported into a georeferenced aerial photo of the area using Garmin HomePort (version 2.3.0) and ArcMap 10.5 GIS software. Using a combination of SideVu™ sonar and MDC's multibeam imagery (if available), drop camera photos and colour aerial photos, delineated habitat zones were adjusted accordingly, to more accurately reflect the likely tonal gradations in sonar images of respective habitats, and an indicative map of different benthic habitats was produced.

### 2.2.2 Biogenic Habitat and Macroinvertebrates

The presence of biogenic habitat and epibenthic macroinvertebrates was evaluated at discrete points across a total of 29 drop camera stations located below the farms (including alongside existing droppers and warps) and adjacent areas within the Site (Appendix A & B). At each station, the cover of natural[3] and farm-derived shell material from drop camera photographs were also estimated and ranked (None = no shell, Low = 1-30%, Moderate = 31-50%, Moderate to High = 51-75%, and High = 76-100% cover).

### 2.2.3 Fish

Beyond those documented via drop camera, field surveys for fish were not conducted. Rather, we rely on the vegetation community and habitat type descriptions obtained from the field investigations to identify areas of potential habitat for species likely to occur within the area, as well as published accounts of fish present within nearby habitats.

### 2.2.4 Marine Mammals

Field surveys for marine mammals were not conducted. Rather, we rely on the habitat type descriptions obtained from the field investigations to identify areas of potential habitat for species likely to occur within the area, as well as published accounts of marine mammals present within

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[2] ***Reef*** — (a) means the exposed hard substrate in the coastal marine area formed by geological processes; and (b) includes cobbles equal to, or greater than, 64 mm across, boulders, and bedrock; and (c) includes marine species associated with the reef; but (d) does not include sand or gravel.
***Biogenic habitat*** — (a) means the natural habitat created by the physical structure of living or dead organisms or by the interaction of those organisms with the substrate, including either a hard (reef) or soft (sediment) substrate; but (b) does not include—(i) non-indigenous living organisms; or (ii) organisms attached to a marine farm or other man-made structure; or (iii) holes, mounds, and similar seabed irregularities created by burrowing organisms in soft sediments.

[3] Per NES-MA definition of '***dead shell***' — (a) includes dead shell, broken or whole, equal to or greater than 2 mm across; but (b) excludes shell from a marine farm.

nearby habitats. All incidental mammal observations were recorded while on site and observations of mammals within or adjacent to the Site.

### 2.2.5 Seabirds

Again, field surveys for sea birds were not conducted. Rather, we rely on the habitat typedescriptions obtained from the field investigations to identify areas of potential habitat for species likely to occur within the area, as well as published accounts of birds present within nearby habitats. All incidental bird observations were recorded while on site and observations of birds within or adjacent to the Site.

## 2.3 Assessment of Effects Methodology

The location of the farm falls within the jurisdictional boundary of MDC and its operative Marlborough Sounds Resource Management Plan (MSRMP) and the Proposed Marlborough Environment Plan (PMEP). The Site lies within the boundary of the Coastal Marine Zone 2 (CMZ2) of the MSRMP, and Coastal Marine (Area) Zone under the PMEP. All statutory planning documents relevant to the consenting and ecological assessment of the marine farming activity, and the New Zealand Coastal Policy Statement 2010 (NZCPS) and the NES-MA, were considered in the assessment. The assessment of ecological effects follows the Environment Institute of Australia and NZ Inc. (EIANZ) Impact Assessment (EcIA) guidelines (Roper-Lindsay et al., 2018)[4]. The EcIA approach follows the steps outlined below:

*Step 1: Assessment of ecological values*

Ecological values within the defined Zone of Influence (i.e. study area) are assigned a level on a scale of Low, Moderate, High or Very High based on assessing the values of species, communities, and habitats identified against criteria set out in the EcIA guidelines (see Table 2.1).

**Table 2.1.** Assignment of values to species, vegetation and habitats within the potentially affected marine area (adapted from EIANZ, 2018).

| Value | Species Value requirements | Habitat Value requirements |
|---|---|---|
| Very High | Important for Nationally Threatened species | Meets most of the ecological significance criterion as set out in relevant statutory policies and plans (MSRMP and PMEP) including indigenous biological diversity criteria in Policy 11 of the NZCPS |
| High | Important for Nationally At Risk – species and may provide less suitable habitat for Nationally Threatened species | Meets some of the ecological significance criterion as set out in relevant statutory policies and plans (MSRMP and PMEP), including indigenous biological diversity criteria in Policy 11 of the NZCPS |
| Moderate | No Nationally Threatened or At Risk species, but habitat for locally uncommon or rare species | Habitat type does not meet ecological significance criteria as set out in the relevant statutory policies and plans (MSRMP and PMEP), or the NZCPS but does provide locally important ecosystem services (e.g. food resource, biogeochemical cycling, and seascape connectivity) |

[4] Noting that, in New Zealand, while several regional plans, including the MSRMP/PMEP, have criteria for assigning ecological significance to biota and habitats, there is no published guidance on assessing marine ecological values for direct inclusion into ecological effects assessments for marine environments. We also note the EIANZ Guidelines primarily relate to terrestrial and freshwater ecosystems, as those ecosystems are well covered by ecological literature and have less complex legislative contexts than the coastal environment (Page 3 of the EIANZ Guidelines).

| | | |
|---|---|---|
| Low | No Nationally Threatened, At Risk or locally uncommon or rare species | Nationally or locally common habitat and supporting no Threatened or At Risk species, and does not provide locally important ecosystem services |

*Step 2: Magnitude of effect assessments*

Step 2 of the EcIA guidelines requires an evaluation of the magnitude of effects on ecological values based on the extent of any area which is likely to be affected, intensity and duration of effect. The magnitude of the effect that the consent is expected to have on ecological values is evaluated as being either No effect, Negligible, Low, Moderate, High or Very High, based on the proposed works (footprint size, intensity and duration; see Table 2.2).

**Table 2.2.** Summary of the criteria for describing the magnitude of effect as outlined in EIANZ, 2018.

| Magnitude of effect | Description |
|---|---|
| Very High | Total loss or very major alteration to key elements/features of the baseline conditions such that character/composition/attributes will be fundamentally changed and may be lost from the Site altogether; and/or<br>Loss of a very high proportion of the known population or range of the element/feature |
| High | Major loss or major alteration to key elements/features of the baseline conditions such that post development character/composition/attributes will be fundamentally changed; and/or<br>Loss of a high proportion of the known population or range of the element/feature |
| Moderate | Loss or alteration to one or more key elements/features of the baseline conditions such that character/composition/attributes of baseline will be partially changed; and/or<br>Loss of a moderate proportion of the known population or range of the element / feature |
| Low | Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of baseline condition will be similar to current circumstances/patterns; and/or<br>Having a minor effect on the known population or range of the element/feature |
| Negligible | Very slight change from baseline condition. Change barely distinguishable, approximating the “no change” situation; and/or<br>Having negligible effect on the known population or range of the element/feature. |

*Step 3: Level of effects assessment in the absence of mitigation*

Step 3 of the EcIA guidelines requires the overall level of effect to be determined using a matrix that is based on the ecological values and the magnitude of effects on these values in the absence of any efforts to avoid, remedy or mitigate for potential effects. Level of effect categories include No Effect, Very Low, Low, Moderate, Moderate/High, High and Very High. Table 2.3 shows the EcIA matrix outlining criteria to describe the overall level of ecological effects.

**Table 2.3.** Summary of the criteria for describing the overall level of ecological effects as outlined in EIANZ, 2018.

| Magnitude of effect | Ecological Value | | | | |
|---|---|---|---|---|---|
| | Very High | High | Moderate | Low | Very Low |
| Positive | Net gain | Net gain | Net gain | Net gain | Net gain |
| Very High | **Very high** | **Very high** | **High** | **Moderate** | Low |
| High | **Very high** | **Very high** | **Moderate** | Low | Very low |
| Moderate | **High** | **High** | **Moderate** | Low | Very low |
| Low | **Moderate** | Low | Low | Very low | Very low |
| Negligible | Low | Very low | Very low | Very low | Very low |

### *Step 4: Establish if mitigation is required*

The overall level of effect is used to determine if mitigation (e.g. boundary adjustments) is required. As discussed later in this report, the proposed activity would have only very low to low ecology effects (in terms of Step 3 of the EcIA guidelines), even without taking into account mitigation measures.

# 3 Ecological Description

## 3.1 Site Description

The Site is located offshore of the northern shoreline of Squally Cove (Figure 3.1), approximately 1.2 km east-north-east of Matarau Point, Croisilles Harbour. Matarau Point is a cuspate foreland formed by coastal processes acting to deposit cobble, pebble and small boulder sized material forming a triangular shaped intertidal and subtidal feature. The headland is located on the outer northern shore of Squally Cove, the eastern arm of Croisilles Harbour. Matarau Point is roughly 8 km from the entrance to Croisilles Harbour and some 47 km by sea from the entrance to Port Nelson. The adjacent landscape features coastal hillslopes which rise from a relatively narrow band of rocky cobbled intertidal to ridges approximately 100-150 m in height. Predominantly landuse cover is regenerating mixed native-exotic vegetation (LDCB5).

**Figure 3.1.** Marine Farm 8270 with one block of backbones occupying a subtidal area along the northern shoreline, Squally Cove.

## 3.2 Ecological Context

Based on an initial desktop review of available information we have identified the following ecological habitats associated with the Site.

## 3.3 Marine Environment (Based on Historical Information)

No information on the marine environment to be directly affected by the reconsent could be recovered from the literature. For this reason, relevant information was sought from previous benthic surveys of adjacent marine farm 8269 (Robertson 2022) located immediately west-south-west of the Site. Based on relevant aspects of this previous account, the wider marine study area is delineated by two primary subtidal regions, the relatively shallow nearshore (located inshore of consent) and deeper offshore zone where existing surface structures are situated.

At the time of the 2022 survey, the nearshore subtidal habitat was dominated by coarser fine sediment, whereas the deeper offshore benthos under the marine farm 8269 (and more than likely the Site) was dominated by soft substratum (i.e. silt and clay - referred to herein as 'soft mud'). Fauna residing in or utilising nearshore habitat included sea cucumbers, cushion sea stars and brittle star mostly in association with mussel debris.

Mussel shell debris data from 43 drop camera images collected below the 8269 consent indicated that mussel shell cover at that time ranged from 0-100% cover directly adjacent to the inshore backbone, but was typically absent beyond the farm footprint. The high percentage cover of shell close to the backbones was thought to be related to the period of time this site had been farmed.

No tubeworms, horse mussels, scallops or any species or communities likely to be considered biologically significant were observed during the 2022 survey of adjacent marine farm 8269.

The wider Squally Cove and adjacent coastline is known to provide habitat and refuge for a variety of seabirds and marine mammals, which may include Threatened/At Risk species (further discussed in Section 4 below).

## 3.4 Proposed Consent Boundaries

The inshore depths of the Site boundary ranged from 7.5-9.1 m, while offshore boundary depths were approximately 13.7-14.1 m (Appendix A). The distance between MLWM and the Site's inshore boundary was measured at four positions along the adjacent shoreline. The distance from MLWM positions to the inshore boundary of the existing consented area varied between 29 and 41 meters, while for the proposed Aquaculture Management Area (AMA), it ranged from 100 to 110 meters.

## 3.5 Existing Benthic Habitat

Based on an assessment of sonar and drop camera imagery, a total of four broad benthic habitat types were mapped (Table 3.1). An example, looking northward across the Site, of how subtidal habitat margins were delineated is provided in Figure 3.2. A GIS-based habitat map of the benthic study area is provided in Figure 3.3.

### 3.5.1 Boulder and Cobble Field (Nearshore subtidal reef - inshore of Site)

Inshore of the Site, extending seaward from the head of the main northern point to a depth of approximately 10 m, lies a band of hard substratum, in this case boulder/cobble field habitat (e.g. refer Field Image 'DC 29', Figure 3.3, Appendix A). This nearshore rock-dominated regions is steeply sloping compared to further down the shore and beneath the consented area of 8270, and accounts for approximately 1% of the surveyed area.

No outcropping rock, bedrock, boulder or cobble dominated habitats were recorded within the boundaries of the Site. At the time of the survey, no mussel shell debris was observed on or at the base of the inshore reef feature.

**Table 3.1** Summary of broad benthic habitat types within the surveyed area, Marine Farm 8270, November 2023.

| Dominant Subtidal Feature | | Surveyed Area (ha) | % of Surveyed Area | % of the Site |
|---|---|---|---|---|
| 1. | Reef; boulder/cobble field - *Localised band inshore of the Site* | 0.06 ha | 1% | 0% |
| 2. | Firm Muddy Sand - *30-35 m band seaward of nearshore subtidal habitat inshore and within the Site* | 0.89 ha | 13% | 8% |
| 3. | Soft Mud - *Under and immediately adjacent to majority of the Site* | 5.87 ha | 86% | 92% |
| | **Total** | 6.82 ha | 100% | 100% |

### 3.5.2 Firm Muddy Sand/Soft Mud (deeper offshore subtidal habitat - inshore and within Site)

Down shore of the nearshore subtidal reef habitat is the 30-25 m wide band of firm muddy sand habitat. This inshore part of the Site supported coarser sediments characterised by combinations of natural shell (<40% cover), fine sand and silt (Field Image 'DC 28', Figure 3.3, Appendix B). Beyond the coarse soft sediments, soft mud habitat dominates most of the benthic habitat below the Site. Mussel shell debris was observed in 6 of 28 (21%) drop camera images taken within the Site, and ranged in percentage cover from 0% (none) to 45% (moderate), but when present was typically <15% cover. Moderate (~45% cover) values were very occasionally recorded under or directly adjacent to backbones. Shell debris was predominantly absent from below existing warp structures and offshore of existing surface structures. Although relatively muddy, sediments in this part of the study area did not appear to be expressing symptoms of advanced enrichment (i.e. oxygen depletion at the sediment surface) as can be the case under a scenario of excessive organic loading.

No outcropping rock, bedrock, boulder or cobble dominated habitats were recorded within the boundaries of the Site.

## 3.6 Biogenic Habitat and Macroinvertebrates

### 3.6.1 Reef; cobble field (nearshore subtidal reef - inshore of the Site)

No epibenthic macrofauna or notable biogenic habitat were observed in the drop camera imagery collected from within the mapped reef habitat.

### 3.6.2 Firm Muddy Sand/Soft Mud (Deeper offshore subtidal habitat - inshore and within the Site)

The overall abundance of biogenic habitat is expected to be very low given the generally depauperate nature of soft mud habitat beneath shellfish farms throughout the Marlborough Sounds and Squally Cove (Davidson et al. 2011). Indeed only a few patches of calcareous worm tubes (probably *Oweniidae*) were observed at the relevant drop camera stations located below or adjacent to the Site. Other epibenthic macrofaunal species present at relatively low densities in this part of the surveyed area included sea cucumber (*Stichopus mollis*) and cushion star (*Patiriella regularis*). Small holes, presumably made by infaunal organisms, were also visible at the sediment surface throughout most of this offshore habitat.

No horse mussels, scallop, hydroid, bryozoan, lamp shell species or tubeworm mounds were recorded below the Site or wider surveyed area.

Overall, while calcareous worm tubes were recorded within the surveyed area, they were present at a very low density (<10% cover). The overall ecological value of inhabitant communities is considered to be **Low** given the low diversity, species richness and abundance, and absence of TAR or regionally significant species.

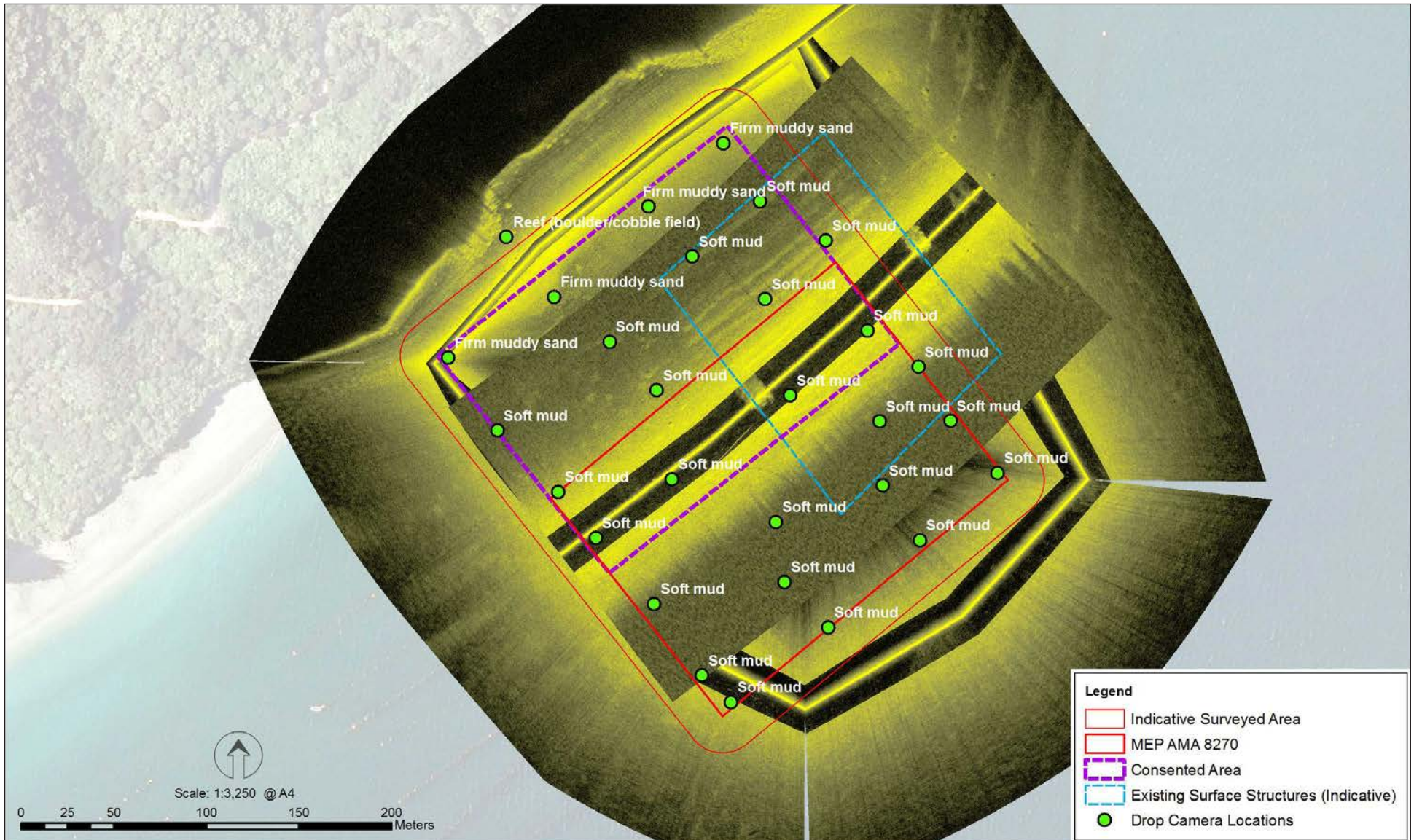


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**Figure 3.2.** Example of the different habitats in the surveyed area and encountered via sonar and drop camera ground-truthing during the field survey, Marine Farm 8270. Note: representative drop camera photos and live HD video feed were used to corroborate habitat types captured in side-scan sonar runs.

PROJECT: MARINE FARM 8270, MMP

Benthic Habitat Occupying Surveyed Area

| Date: 13 December 2023 | Revision: A | Aerial: LINZ 17/18
Plan map prepared for MMP by Robertson Environmental Limited

*Project Manager*: Ben.Robertson@robertsonenviro.co.nz


**Figure 3.3.** Broad scale (indicative) map of dominant benthic habitat assessed in the present study. Detailed field data is presented in Appendix A, with corresponding drop camera imagery in Appendix B.

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## 3.7 Fish

Based on the habitat preference and recorded distributions of fish species (Appendix F), there are several species of fish with the potential to inhabit the wider area of the Site (Davidson et al. 2011) including:

- rāwaru / blue Cod (*Parapercis colias*) — Threatened - Least Concern (Decreasing);
- reperepe / elephant fish (*Callorhinchus milii*) — Threatened - Least Concern (Stable);
- pākaurua / rough skate (*Zearaja natuta*) — Threatened - Least Concern (Stable);
- tāmure / snapper (*Pagrus auratus*) — Threatened - Least Concern (Decreasing); and,
- pakirikiri / spotty (*Notolabrus celidotus*) — Threatened - Least Concern.

The ecological value of fish populations in the coastal receiving environment of the Site is **Moderate** given the likelihood for species to utilise the wider area, which may include TAR species; however, these species are not restricted to these habitats within the Site and likely utilise available habitat within Squally Cove and adjacent coastal marine area. No species of bony fish were recorded during the present survey.

## 3.8 Marine Mammals

Based on the habitat preference and recorded distributions of marine mammal species (refer to Appendix C for details), there are several species of mammal with the potential to inhabit the wider area of the Site (Davidson et al. 2011) including:

- bottlenose dolphin (*Tursiops truncatus*) — Nationally Endangered;
- dusky dolphin (*Lagenorhynchus obscurus*) — Not Threatened;
- Hector's dolphin (*Cephalorhynchus hectori hectori*) — Nationally Vulnerable;
- paikea / humpback whale (*Megaptera novaeangliae*) — Non-Resident Native (Migrant);
- kera wēra / orca (*Orcinus orca*) — Nationally Critical;
- short-beaked common dolphin (*Delphinus delphis*) — Not Threatened; and,
- tohorā / Southern right whale (*Eubalaena australis*) — At Risk - Recovering.

The ecological value of marine mammal populations in the coastal receiving environment of the Site is **Very High** given the likelihood for mammal species to utilise the wider area and which may include TAR species; however, these species are not restricted to these habitats within the Site and likely utilise available habitat within Squally Cove and adjacent bays and other coastal habitat throughout the Marlborough Sounds and Tasman Bay.

## 3.9 Seabirds

Recent shorebird and seabird sightings (refer to Appendix C for details) at Squally Cove and adjacent area included (eBird April 2020-March 2022, and Davidson et al. 2011):

- torea-pango / variable oystercatcher (*Haematopus unicolor*) — At Risk (Recovering);
- pakahā / fluttering shearwater (*Puffinus gavia*) — At Risk (Relict);
- kawau pāteketeke / king shag (*Leucocarbo carunculatus*) — Nationally Endangered;
- tara / white-fronted tern (*Sterna striata striata*) — At Risk (Declining);
- taranui / caspian tern (*Hydroprogne caspia*) — Nationally Vulnerable;
- tākapu / Australasian gannet (*Morus serrator*) — Not Threatened; and,

- kawau tikitiki / spotted shag (*Stictocarbo punctatus*) — Nationally Vulnerable.

Again, the ecological value of shorebird and seabird populations in the coastal receiving environment of the Site is **Very High** given the recent sightings in the vicinity of Squally Cove and known inhabitants of the open coast which include TAR bird species; however, these species are not restricted to these habitats within the Site and likely utilise available habitat within Squally Cove and adjacent bays and other coastal habitat throughout the Marlborough Sounds and Tasman Bay.

A roaming inventory of birds sighted or heard was taken during the field survey at the Site. Of those recorded (several karoro / southern black-backed gull), none were classified as TAR species.

# 4 Assessment of Effects on Ecological Values

## 4.1 Positive Effects

Key potential positive effects from the further development of shellfish farms within the Site are (1) the creation of additional and stable habitat with increased biodiversity beneath farms and (2) regulating concentrations of nitrogen from nearshore waters via biodeposition and denitrification (conversion of bioavailable nitrogen to non-bioavailable gases) or sequestration in the sediment.

In this context, responsible development of the Site will be crucial to ensure that ecological benefits are not eroded by suboptimal site selection (location of structures) or farming practices that diminish the same or other ecosystem services (Barrett et al. 2022).

## 4.2 Assessment of Operational Effects

In the absence of efforts to avoid, remedy or mitigate adverse ecological effects, the potential effects on coastal ecological values come primarily from localised effects at approximately the farm scale within the Site.

In the aquaculture of shellfish, local effects can occur in both water column and benthic environments:

- Water column effects typically include phytoplankton depletion and changes in planktonic community composition, dissolved nutrient and particulate release, and impacts of farming structures on water movement and from biofouling communities.
- Benthic effects generally manifest as localised organic enrichment, smothering of organisms by biodeposits, biofouling drop-off and debris altering the composition of the benthos, and shading of benthos by structures thereby affecting localised productivity. The magnitude of effects ultimately depends on the magnitude and frequency of biodeposit and organic loading, and the assimilative capacity of the receiving environment (including the response, or sensitivity, of inhabitant biota).

Inshore reef and biogenic habitats are particularly susceptible to smothering impacts, hence adverse benthic effects of aquaculture activities are required to be managed under the PMEP and NES-MA. The boulder/cobble field habitat mapped within the Site meets the NES-MA definition of ‘reef’. Therefore, the constraints on complying activities apply to the reef and surrounding area.

By contrast, the likelihood of adverse benthic impacts associated with shellfish farming on shallow nearshore habitat and soft-sediment habitat (beyond the inshore reef) is generally low given the distance of the the reef habitat from the proposed AMA coupled with likely reasonable flushing potential at the Site (Davidson and Richards 2014; Davidson 2015). Effects from shading of seabed by structures is considered unlikely. Effects from drop-off of biofouling organisms from the structures can be managed or mitigated through good on-farm husbandry practices.

Biosecurity (marine pests and disease) impacts are not anticipated given the nature of the proposal (shellfish aquaculture) and that A+ members are required to recognise the Biosecurity Act 1993, as well as the Hazardous Substances and New Organisms Act 1996. CML is not seeking to discharge or use chemical additives such as antibiotics, parasiticides and other therapeutants, and so they pose no risk to local ecology.

Surrounding values include ‘Croisilles Harbour (Entrance)’ (1.2) and ‘Lone Rock’ (1.9) located some 2-5 km from the Site. Generally speaking, given their distance from the Site, these significant sites are not likely to be impacted by the proposed activity. There are no mapped ‘Ecologically Significant Marine Sites’ within or near Squally Cove under the PMEP (Figure 4.1), and the Site is not listed as regionally or nationally significant under the MSRMP.

The likelihood (or risk) and magnitude of these effects occurring and the potential level of effects on coastal environments relevant to the proposal are discussed as follows.

### 4.2.1 Coastal Ecology

Table 4.1 integrates specific ecological values described in Section 3 above, and lists the potential effects (direct and indirect) on the marine habitats and fauna within the Site and their magnitude of effect. This is then used to calculate an overall level of effect to each ecological attribute, prior to impact management.

Requirements for the proposed activity to preclude effects on reef habitats under the PMEP and NES-MA are considered separately to this assessment and are addressed as part of impact management (Section 5).

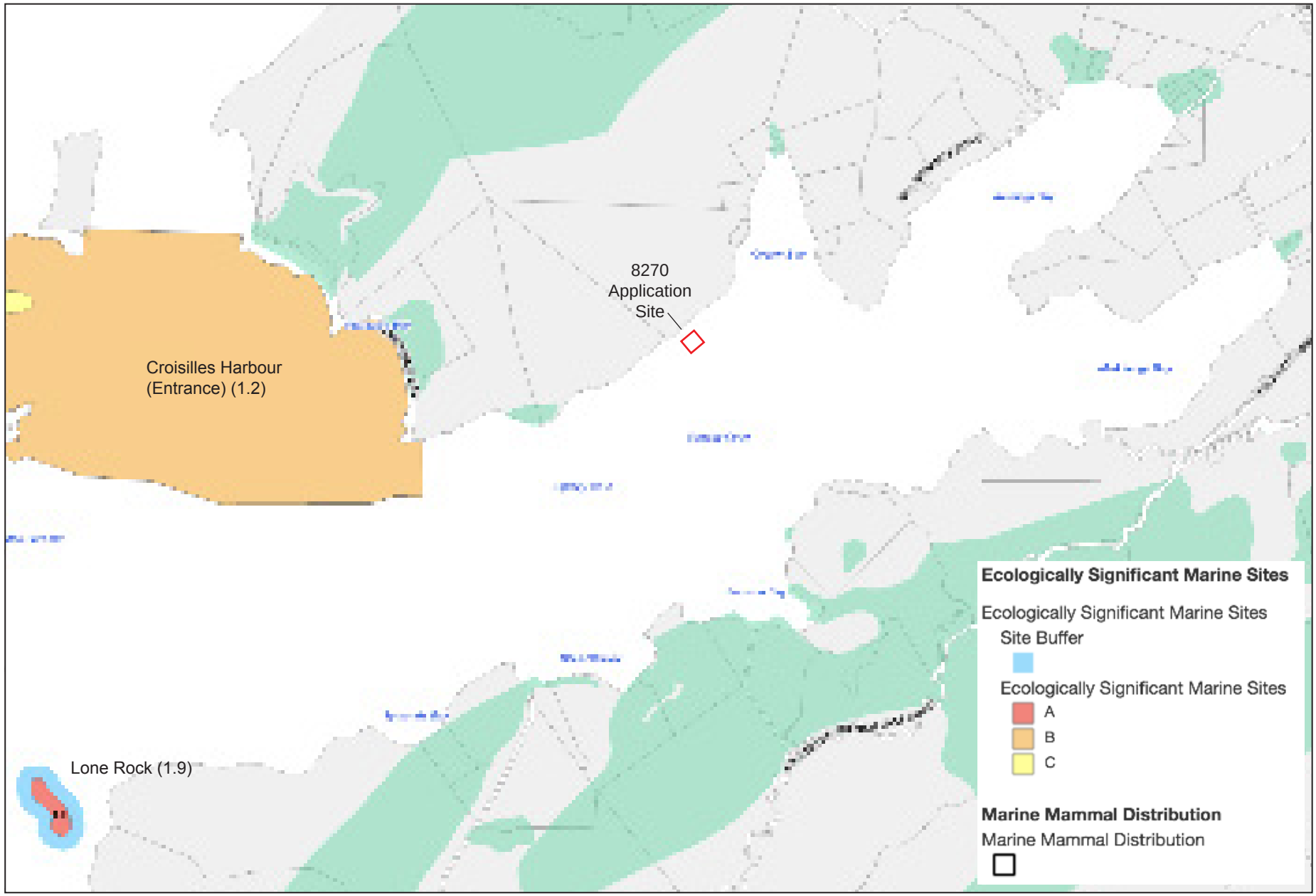


**Figure 4.1.** Marine ecological values associated with 8270 (indicative area outlined in red). Source: MDC Smart Maps database - Environment Plan - Proposed overlays for the MEP - as amended by decisions on 21 Feb 2020.

**Table 4.1.** Magnitude of effects and subsequent level of effect (without mitigation) of the proposed activity on the coastal ecology features present within the Site during the marine farm operation phase.

| Coastal Habitat/ Species | Ecological Value | Effects Description | Magnitude of Effect | Justification of Magnitude | Level of Effect, Without Mitigation |
|---|---|---|---|---|---|
| Inshore Reef (Boulder and Cobble Field - Inshore of the Site) Habitat | High | Fragmentation of habitat/ecosystem and edge effects. | Negligible | No direct impacts given the distance of this habitat from the Site, but perhaps some indirect ones related to potential discharges and noise/activity disturbance of fauna. The likelihood of any such disturbance is considered to be low at this location and any associated effects are almost certainly reversible. | Very Low |
| Soft Sediment (Firm Muddy Sand/Soft Mud - Adjacent to the Site) Habitat | Low | Fragmentation of habitat/ecosystem and edge effects. | Low | Given the habitat's low value with respect to inhabitant epibenthic macrofauna, any impacts from the proposed activity on this soft-sediment dominated habitat are expected to fall within the low-impact range that is characteristic of shellfish farms in the Marlborough Sounds. It is unlikely that the biogeochemical conditions of the benthic environment — such as biotic community structure, surface sediment grain size distribution, and oxygenation/redox conditions — would be significantly adversely affected by the proposed activity.<br>The overall extent of any disturbance is likely to be limited at the scale of the bay and is almost certainly reversible. | Very Low |

**Table 4.1 (Cont.).** Magnitude of effects and subsequent level of effect (without mitigation) of the proposed activity on the coastal ecology features present within the Site during the marine farm operation phase.

| Coastal Habitat/ Species | Ecological Value | Effects Description | Magnitude of Effect | Justification of Magnitude | Level of Effect, Without Mitigation |
|---|---|---|---|---|---|
| Biogenic Habitat & Epibenthic Macro-fauna | Low | Loss or degradation of habitat primarily through depositional effects.<br>Fragmentation of habitat. | Negligible | Given the relatively depauperate epibenthic macrofauna dominated by mobile species occupying soft sediments beyond the biogenic habitat, any impacts on them are expected to be negligible.<br>The overall extent of any disturbance is limited at both a site and bay scale and almost certainly reversible. | Very Low |
| Fish | Moderate | Degradation of feeding habitat values or diminished food resources.<br>Fragmentation of habitat. | Negligible | Because shellfish farms can enhance wild fish abundances by creating a habitat for fish to aggregate (providing food resources and refuge), effects on fish would potentially arise due to fish populations becoming displaced from other habitats or more vulnerable to recreational fishing pressure. However, in general, any effects of the proposed activity on wild fish populations are likely to be very minor, or perhaps ecologically neutral. | Very Low |
| Marine Mammals | Very High | Disturbance or loss of foraging and breeding habitat.<br>Fragmentation of habitat. | Negligible | Effects on mammals may arise through direct (e.g. vessel strike, increased underwater sound and light production and possibly the risk of entanglement) and indirect (e.g. degradation of feeding habitat values or diminished food resources and associated trophic flow-on) impacts. While the former has the greatest potential consequences (i.e. injury or death of a marine mammal), any such effects are expected to be either short-term, or avoidable through species utilising available feeding habitat throughout the wider Squally Cove and adjacent coastal region. | Low |

**Table 4.1 (Cont.).** Magnitude of effects and subsequent level of effect (without mitigation) of the proposed activity on the coastal ecology features present within the Site during the marine farm operation phase.

| Coastal Habitat/ Species | Ecological Value | Effects Description | Magnitude of Effect | Justification of Magnitude | Level of Effect, Without Mitigation |
|---|---|---|---|---|---|
| Seabirds | Very High | Disturbance or loss of foraging and breeding habitat.<br>Fragmentation of habitat. | Negligible | Effects on seabirds would potentially arise due to degradation of feeding habitat values, diminished food resources, or through direct entanglement. However, farming structures may in fact provide alternative roost sites closer to foraging areas as well as promote aggregation of prey fish, and mobile bird species could avoid the latter effects by utilising available feeding habitat throughout the wider Squally Cove and adjacent coastal region. Therefore, the magnitude of effect on birds would be negligible, or perhaps ecologically neutral. | Low |

# 5 Impact Management Recommendations

## 5.1 Recommendations for avoiding or minimising potential adverse effects

In accordance with the EIANZ guidelines measures to avoid, remedy or mitigate effects is focused on ecological features where the level of effect was assessed to be with Moderate, High, or Very High.

This assessment reveals no ecological features within the Site (8270 AMA boundary) with a Moderate or higher level of effect. Consequently, specific mitigation efforts for such impacts (e.g. Structures Exclusion Area) are not deemed necessary. Analysis of habitat maps (see Figures 3.3) indicates that the Site predominantly overlays soft substratum lacking any notable ecological values. Notably, no hard substratum, characterised by reef or biogenic habitats, is found within 20 m of the Site[1].

It is recommended to minimise discharges (fine sediment and organic matter) to water in the receiving environment during marine farm operations. Although, the discharge effects of harvesting mussels are seen as transitory and, in most cases, quickly become indistinguishable from background sedimentation.

## 5.2 Recommendations for addressing adverse residual effects that cannot be avoided or minimised

Monitoring of the coastal receiving environment is not warranted (on ecological grounds) given that the proposed activity is expected to have no more than minor effects on associated ecological values.

[1] Policy 13.21.3 outlines that AMAs are established to provide for the area of existing marine farms within the Enclosed Water CMUs. AMAs within the Enclosed Waters CMUs are generally located, (b) Away from reefs and other areas of significant marine biodiversity value in order to protect the biodiversity values of those habitats. We note “reefs” are defined in V1 as per NES-MA, and that the Council Section 42A officer has accepted a submission that “away from” should be 20 m as per NES-MA.

# 6 Cumulative Effects

As per EIANZ guidelines, assessment of ecological effects of a proposed activity should consider cumulative impacts on the environment and not just the direct effects of the single proposal. For the purposes of this proposal it is considered that the proposed activity and the coastal receiving environment associated with Squally Cove are an appropriate spatial scale for consideration of cumulative effects, given this area provides habitat for mobile fauna species such as native seabirds, marine mammals and fish.

The effects of phytoplankton depletion through shellfish consumption are generally only detectable at approximately the farm scale, and are of short duration (Morrisey et al. 2006). The significance of associated effects depends on a variety of factors, including the carrying capacity of the environment, prevailing water currents, weather patterns, and catchment-derived nutrient inputs, with effects more pronounced if farms are located in physically constrained shallow areas with slow currents, compared to deep sites with strong flow and good flushing (Zeldis et al. 2008, 2013; Plew 2011; Broekhuizen et al. 2015). The Site is situated within a relatively shallow (predominantly <20 m deep) area of Beatrix Bay with reasonable proximity to the entrance to Croisilles Harbour and Squally Cove, so water residence times are expected to be lower than more quiescent sites located further into the Cove (Davidson and Richards 2014; Davidson 2015). On this basis, it is considered unlikely that significant phytoplankton depletion would occur outside the boundaries of any future shellfish farms located within the Site.

As the existing benthic environment is predominantly soft sediment habitat of limited ecological value, the specific shellfish farming impacts discussed within this report have been minimal and adverse effects have largely been avoided.

It is unlikely the proposal will contribute meaningfully to loss of ecological connectivity or decline in habitat quality at the bay-wide or regional scale. Cumulative adverse effects are therefore not anticipated.

# 7 Summary & Conclusions

An estimate of habitat change resulting from the proposed activity can be undertaken by importing the proposed site design into a GIS environment. This allows a semi-quantitative estimate to be made of the habitat likely to be impacted. The areal footprint of the Site and survey area overlaid on a map of habitat types is shown above in Figure 3.3 with spatial proportions summarised in Table 3.1.

The main effect on local ecology is enhanced rates of sedimentation of organic-rich, fine-grained particles (biodeposits of faeces and pseudofaeces), and the deposition and accumulation of live shellfish, shell litter onto the seabed beneath the farms (Keeley et al. 2009; Stenton-Dozey and Broekhuizen 2019).

The proposed activity would not likely alter the soft sediment-dominated habitat. It is unlikely that those remaining habitats adjacent to the Site would be appreciably altered by the proposal. Given that the size of the survey area was selected based on the spatial extent of the proposed activity, these calculations suggest that featureless soft sediment habitat dominates the benthic environment within Site. Existing reef habitat is located more than 20 meters inshore, beyond the boundaries of the Site. Therefore, it is expected to remain unaffected by the proposal.

Although the proposed marine farm would be situated above a high proportion of the soft-sediment habitat in the surveyed area, the relatively depauperate biological nature of the habitat, in this case dominated by a limited number of highly mobile fauna, means that it is unlikely that significant changes to ecology will occur. Indirectly, ecology in more distant habitats from the Site (e.g. nearshore subtidal habitats) are also unlikely to be affected by the proposed activity given their distance from the Site, relatively large extent, and reasonable flushing potential driven by tides and periodic wind and wave action.

Where possible the proposed activity has minimised impacts on Squally Cove and its ecological values and no permanent loss of indigenous biodiversity values is expected to occur.

Overall, assuming integration of impact mitigation and management measures as outlined above in Section 5, it is considered that any effects resulting from the proposed activity will be relatively localised and therefore minor with regard to the wider marine receiving environment.

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# 9 Limitations & Applicability

As with all one-off field ecological assessments, seasonal or temporal variation in the presence of mobile fauna means that the presence or absence of such fauna cannot be ascertained with great accuracy. Potential seasonal variability is not assessed through one site visit. The composition of the avifauna, fish and mammal communities utilising the area could not be established as the survey was only conducted once in the winter season. The condition of habitat becomes the surrogate for the presence or absence of fauna rather than observed condition on the day of the survey.

This assessment has been carried out in line with the project brief received by Robertson Environmental Limited on the 9th of October 2023. This is assumed in this assessment to be the marine farm consent renewal being sought by this application. We note that this site design may not be final. Depending on the scope of any future development and site design changes, further ecological assessments, including further quantitative assessments may be required.

Robertson Environmental's professional opinions are based on its professional judgement, experience, and training. These opinions are also based upon data derived from the field survey and analysis described in this document, with the support of relevant guidelines (EIANZ, 2018). It is possible that additional surveying, testing and analyses might produce different results and/or different opinions. Should additional information become available, this report should be updated accordingly. Robertson Environmental Limited has relied upon information provided by the Client to inform parts of this document, some of which has not been fully verified by Robertson Environmental Limited. This document may be transmitted, reproduced or disseminated only in its entirety.

# Appendix A:

# Detailed Field Data

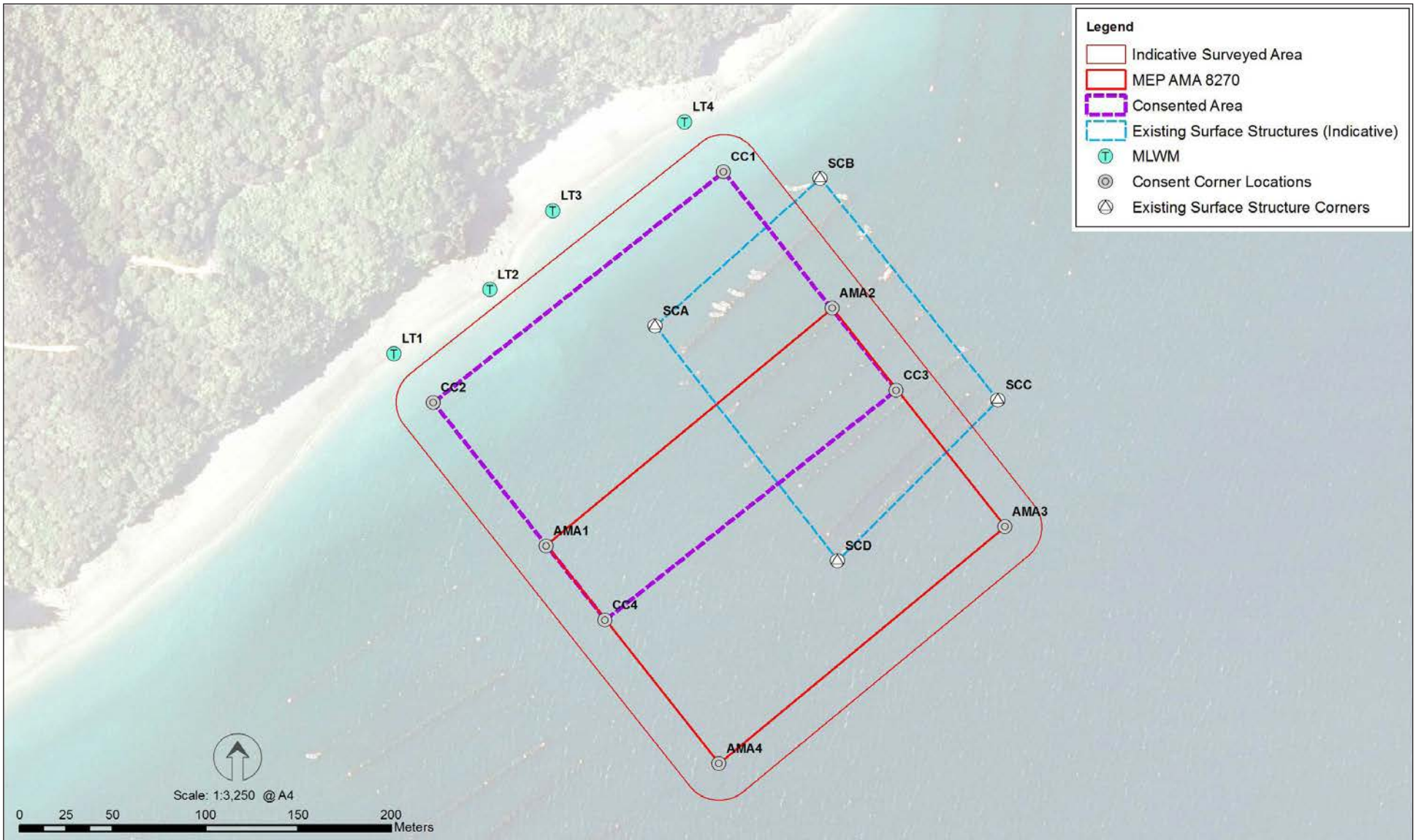


**Figure A.1**. Overview of the Site, surveyed area, and boundary corner locations for 8270, existing consent and structures. Corresponding data is presented below.

PROJECT: MARINE FARM 8270, MMP

Marine Farm 8270 Survey Area

| Date: 13 Dec 2023 | Revision: A | Aerial: LINZ 17/18
Plan map prepared for MMP by Robertson Environmental Limited

*Project Manager*: Ben.Robertson@robertsonenviro.co.nz

| Summary information for Marine Farm 8270 including low tide and the Site boundary corner locations, November 2023. | | | | |
|---|---|---|---|---|
| Station Type | Station Code | Depth (m)[2] | Location | |
| | | | NZTM E | NZTM N |
| Consent Corner | CC1 | 9.3 | 1660097 | 5455735 |
| Consent Corner | CC2 | 7.7 | 1659941 | 5455611 |
| Consent Corner | CC3 | 12.4 | 1660190 | 5455619 |
| Consent Corner | CC4 | 12.9 | 1660034 | 5455494 |
| AMA Corner | AMA1 | 12.4 | 1660001 | 5455535 |
| AMA Corner | AMA2 | 12.9 | 1660156 | 5455663 |
| AMA Corner | AMA3 | 14.1 | 1660249 | 5455544 |
| AMA Corner | AMA4 | 13.8 | 1660094 | 5455418 |
| Surface Structure Corner | SC A | 12.1 | 1660060 | 5455653 |
| Surface Structure Corner | SC B | 12.2 | 1660149 | 5455733 |
| Surface Structure Corner | SC C | 13.4 | 1660245 | 5455613 |
| Surface Structure Corner | SC D | 13.0 | 1660159 | 5455527 |
| Low tide | LT 1 | NA | 1659920 | 5455638 |
| Low tide | LT 2 | NA | 1658871 | 5455674 |
| Low tide | LT 3 | NA | 1660005 | 5455717 |
| Low tide | LT 4 | NA | 1660076 | 5455764 |

[1] Depth adjusted to datum (-1.0 m).

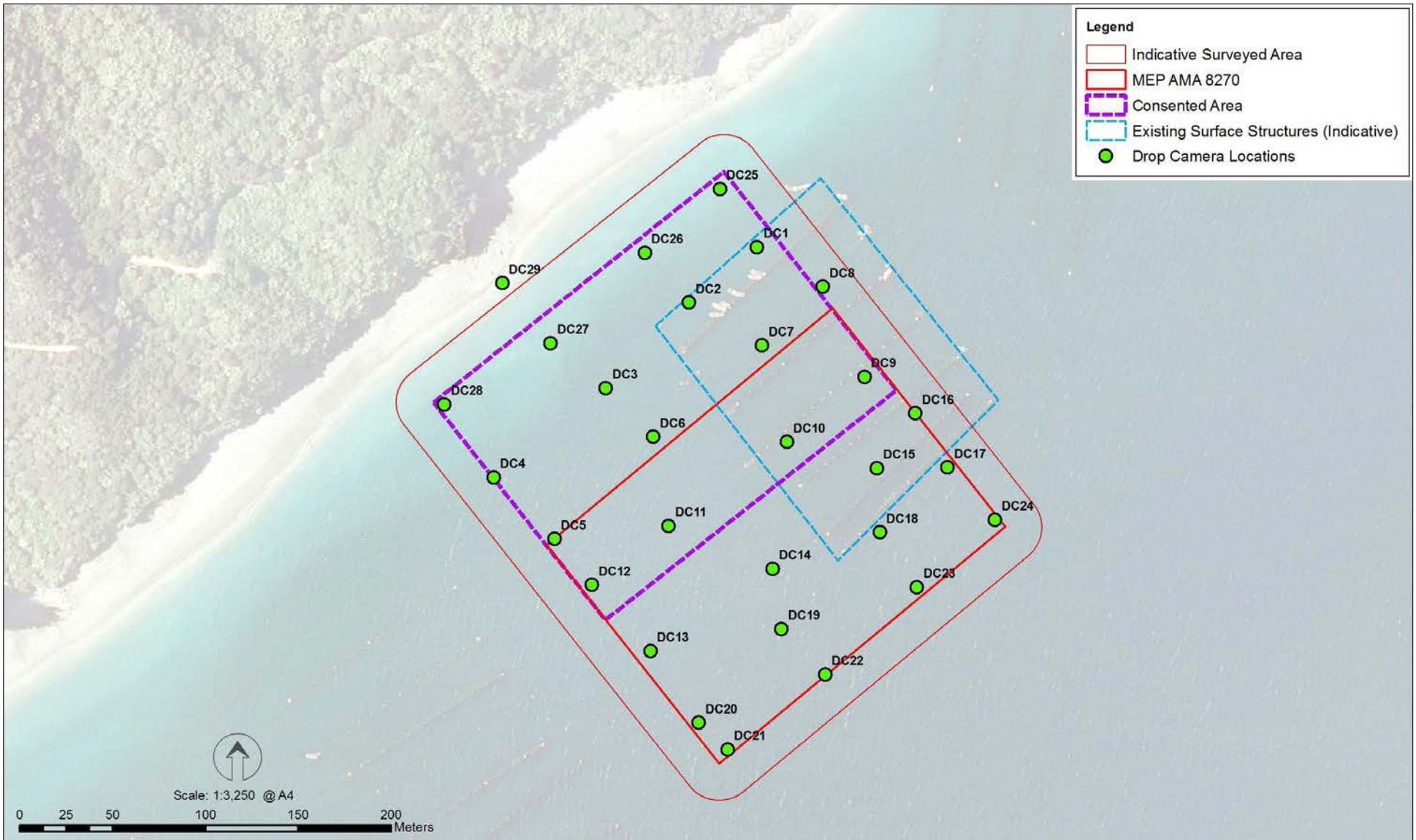


**Figure A.2**. Overview of the Site, surveyed area, and locations of benthic sampling stations (drop camera locations) assessed in the present study. Corresponding data is presented below, with drop camera photographs in Appendix B.

PROJECT: MARINE FARM 8270, MMP

Marine Farm 8270 Survey Area

| Date: 13 Dec 2023 | Revision: A | Aerial: LINZ 17/18
Plan map prepared for MMP by Robertson Environmental Limited

*Project Manager*: Ben.Robertson@robertsonenviro.co.nz

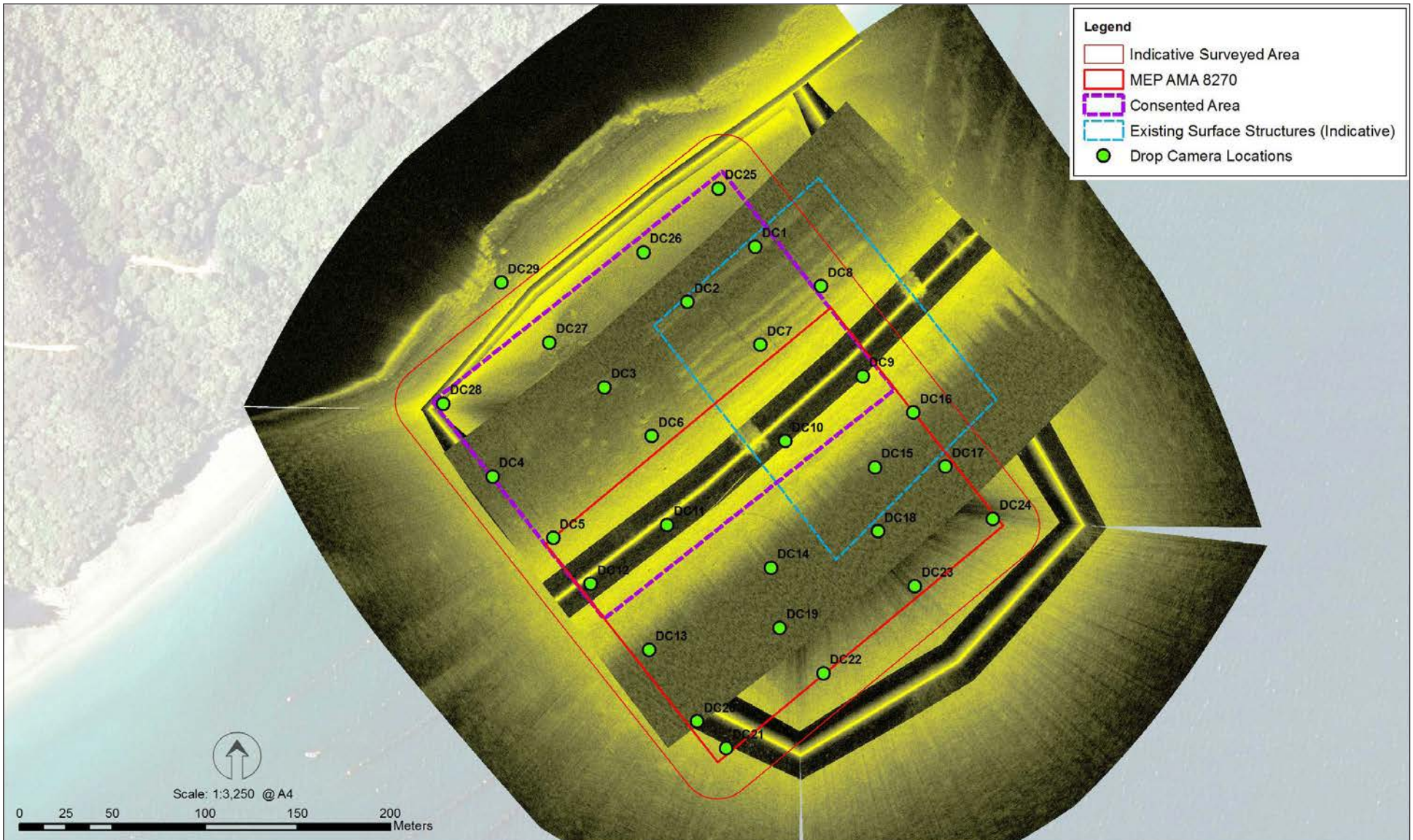


**Figure A.3**. Overview of the Site, surveyed area, and high-resolution side-scan sonar imagery used to corroborate benthic habitat types in the present study.

PROJECT: MARINE FARM 8270, MMP

Marine Farm 8270 Sonar Image

| Date: 13 Dec 2023 | Revision: A | Aerial: LINZ 17/18
Plan map prepared for MMP by Robertson Environmental Limited

*Project Manager*: Ben.Robertson@robertsonenviro.co.nz

| Summary of benthic imagery locations, substratum type, mussel shell debris and species present, in relation to PMEP and NES-MA, marine farm 8270, November 2023. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Station ID | Depth (m) | NZTM E | NZTM N | Dominant substra-tum | % Natu-ral Shell | Mussel Shell Debris | % Mus-sel Shell Debris | Species Present | Suitability in terms of PMEP (Policy 13.21.3) and NES-MA (S4, 7-9) |
| DC1 | 12.2 | 1660115 | 5455696 | Soft mud | <5 | Moderate | 45 | Sea cucumber | Suitable |
| DC2 | 12.0 | 1660079 | 5455666 | Soft mud | - | None | - | Cushion star (Patiriella regularis) | Suitable |
| DC3 | 12.6 | 1660034 | 5455620 | Soft mud | <5 | None | - | - | Suitable |
| DC4 | 12.6 | 1659974 | 5455572 | Soft mud | <5 | None | - | - | Suitable |
| DC5 | 12.5 | 1660006 | 5455539 | Soft mud | <5 | None | - | Cushion star (Patiriella regularis) | Suitable |
| DC6 | 12.2 | 1660060 | 5455594 | Soft mud | <5 | None | - | - | Suitable |
| DC7 | 11.9 | 1660118 | 5455643 | Soft mud | <5 | None | - | - | Suitable |
| DC8 | 11.9 | 1660151 | 5455675 | Soft mud | <5 | None | - | - | Suitable |
| DC9 | 12.4 | 1660173 | 5455626 | Soft mud | <5 | Low | 8 | - | Suitable |
| DC10 | 12.2 | 1660132 | 5455591 | Soft mud | <5 | Low | 5 | - | Suitable |
| DC11 | 12.6 | 1660068 | 5455546 | Soft mud | <5 | None | - | Cushion star (Patiriella regularis), tube worm (<10% cover) | Suitable |
| DC12 | 12.8 | 1660027 | 5455514 | Soft mud | - | - | - | - | Suitable |
| DC13 | 13.4 | 1660058 | 5455479 | Soft mud | <5 | - | - | - | Suitable |
| DC14 | 13.4 | 1660124 | 5455523 | Soft mud | <5 | - | - | Cushion star (Patiriella regularis) | Suitable |
| DC15 | 12.8 | 1660180 | 5455577 | Soft mud | <5 | - | - | - | Suitable |
| DC16 | 12.9 | 1660201 | 5455607 | Soft mud | <5 | Low | 5 | Sea cucumber | Suitable |
| DC17 | 13.0 | 1660218 | 5455578 | Soft mud | <5 | - | - | - | Suitable |
| DC18 | 13.3 | 1660182 | 5455543 | Soft mud | <5 | Low | 10 | - | Suitable |
| DC19 | 13.7 | 1660129 | 5455490 | Soft mud | - | - | - | - | Suitable |
| DC20 | 13.8 | 1660084 | 5455440 | Soft mud | <5 | None | - | Tube worm (<10% cover) | Suitable |
| DC21 | 14.1 | 1660100 | 5455426 | Soft mud | - | Low | 5 | - | Suitable |
| DC22 | 14.0 | 1660152 | 5455466 | Soft mud | - | - | - | - | Suitable |
| DC23 | 13.8 | 1660202 | 5455513 | Soft mud | <5 | - | - | Tube worm (<10% cover) | Suitable |
| DC24 | 13.7 | 1660244 | 5455549 | Soft mud | <5 | - | - | Tube worm (<10% cover) | Suitable |
| DC25 | 9.3 | 1660096 | 5455728 | Firm mud-dy sand | - | - | - | Tube worm (<10% cover), unid. algae | Suitable |

| Summary of benthic imagery locations, substratum type, mussel shell debris and species present, in relation to PMEP and NES-MA, marine farm 8270, November 2023. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Station ID | Depth (m) | NZTM E | NZTM N | Dominant substratum | % Natural Shell | Mussel Shell Debris | % Mussel Shell Debris | Species Present | Suitability in terms of PMEP (Policy 13.21.3) and NES-MA (S4, 7-9) |
| DC26 | 10.8 | 1660055 | 5455693 | Firm muddy sand | - | - | - | Unid. algae | Suitable |
| DC27 | 8.3 | 1660004 | 5455645 | Firm muddy sand | - | - | - | Unid. algae | Suitable |
| DC28 | 7.7 | 1659947 | 5455612 | Firm muddy sand | - | - | - | Unid. algae | Suitable |
| DC29 | 3.3 | 1659978 | 5455677 | Reef (boulder/ cobble field) | - | - | - | Unid. algae | Unsuitable |

# Appendix B:

# Benthic Imagery (Drop Camera Screen Grabs)

## Marine Farm 8270 - Squally Cove

Image 1-8 (Left to right, top to bottom): DC 1-8 (as listed in Appendix A). Direct HD video output often provided a clearer image and was therefore used to confirm habitat and biota captured in drop camera screen grabs whilst in the field.

## Marine Farm 8270 - Squally Cove

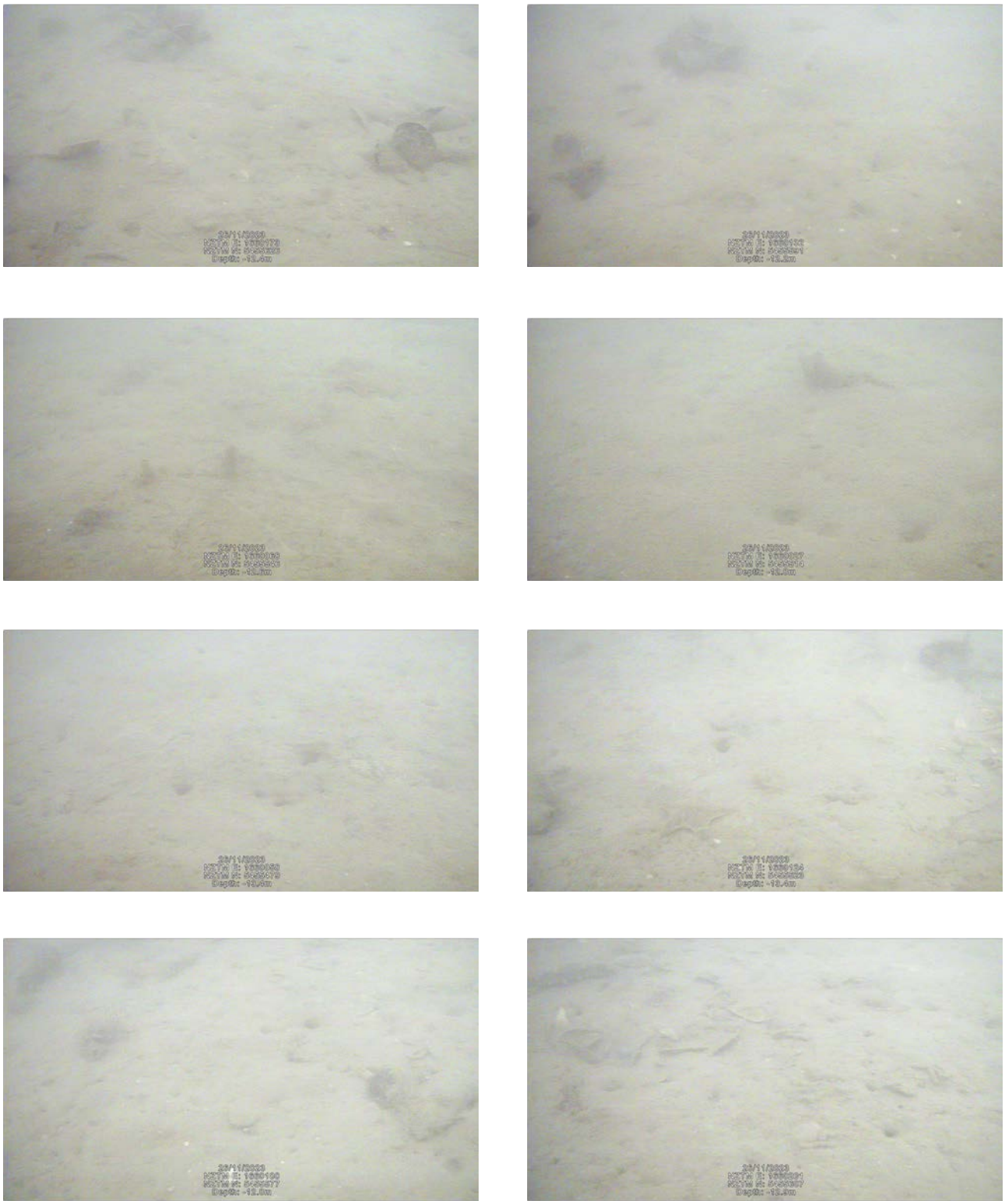

Image 9-16 (Left to right, top to bottom): DC 9-16 (as listed in Appendix A). Direct HD video output often provided a clearer image and was therefore used to confirm habitat and biota captured in drop camera screen grabs whilst in the field.

## Marine Farm 8270 - Squally Cove

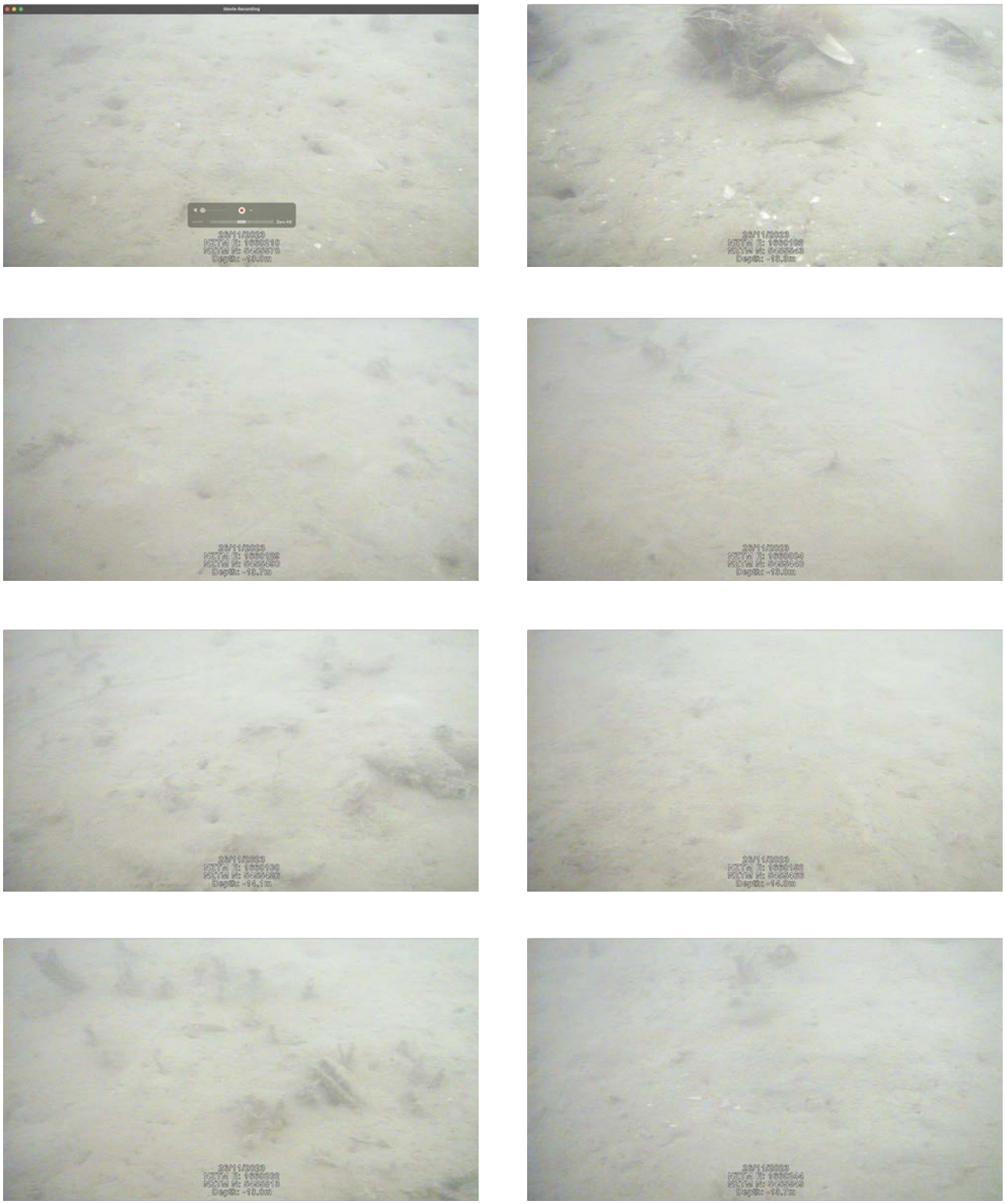

Image 17-24 (Left to right, top to bottom): DC 17-24 (as listed in Appendix A). Direct HD video output often provided a clearer image and was therefore used to confirm habitat and biota captured in drop camera screen grabs whilst in the field.

## Marine Farm 8270 - Squally Cove





Image 25-29 (Left to right, top to bottom): DC 25-29(as listed in Appendix A). Direct HD video output often provided a clearer image and was therefore used to confirm habitat and biota captured in drop camera screen grabs whilst in the field.

# Appendix C:

# Potential Marine Mammal Species

| Summary the threat classification, habitat preferences and distribution of mammal species known to occur within the Marlborough Sounds area. | | | | | | |
|---|---|---|---|---|---|---|
| **Species** | **Common name** | **Threat classification (DOC) (2019) [1]** | **Threat classification (IUCN) [2]** | **Date last assessed (IUCN)** | **Significant Species Marlborough (MDC) [3]** | **Distribution [3]** |
| *Tursiops truncatus* | Bottlenose Dolphin | Threatened - Nationally endangered | Threatened - Least Concern | 2018 | Significant Species - Conservation grounds | New Zealand is at the southern most point of their range. Limits to the range of this species appear to be temperature related. Around 450 individuals live in the North Island area, ranging from Doubtless Bay in Northland to Tauranga. There are currently 31 individual dolphins visiting the Bay of Islands area (from 2017-2019 data). Around 63 live in Doubtful Sound, Fiordland (as at 1998). Another group range from the Marlborough Sounds to Westport. The only known population estimate for the Marlborough Sounds is 211 semi-resident animals. |
| *Lagenorhynchus obscurus* | Dusky Dolphin | Not Threatened | Threatened - Least Concern | 2018 | Significant Species | They are widely distributed around the South island and southern North Island but are rarely seen north of Hawke's Bay. They have been observed throughout much of the Marlborough Sounds, including Admiralty Bay, Queen Charlotte Sound and Tory Channel, Marlborough Sounds and Croisilles Harbour. Admiralty Bay is now recognised as an important feeding area for some over- wintering dolphins that are found off Kaikoura during the summer. Feeding in Admiralty Bay occurs during daylight hours, with primary targets being small schooling fishes e.g. pilchards. The Admiralty Bay winter population represents a significant portion of the New Zealand dusky dolphin population. This population has been the focus of continued scientific interest regarding the relationship between aquaculture activities and dolphins. |
| *Cephalorhynchus hectori hectori* | Hector's Dolphin | Threatened - Nationally Vulnerable | Threatened - Endangered (Decreasing) | 2008 | Significant Species - Conservation grounds | Two sub-species of Hector's dolphins exist: Maui's dolphin is only found off the west coast of the north island; Hector's dolphin is found around the South island of new Zealand except Fiordland. In Marlborough the Hector's Dolphin is known to inhabit an area in the central Queen Charlotte Sound and a second area in Cloudy and Clifford Bays. |

| Species | Common name | Threat classification (DOC) (2019) [1] | Threat classification (IUCN) [2] | Date last assessed (IUCN) | Significant Species Marlborough (MDC) [3] | Distribution [3] |
|---|---|---|---|---|---|---|
| *Megaptera novaeangliae* | Humpback Whale | Non-Resident Native - Migrant | Threatened - Least Concern (Increasing) | 2018 | Significant Species - Scientific and conservation and grounds | In Marlborough humpback whales migrate northward from late May to early August, travelling up the east coast of the South island before dividing into two groups: one moving through Cook Strait and up the west coast of the north island; the other continuing up the east coast of the north island. South bound humpbacks mostly pass along the west coasts of both islands, between mid November and early December. |
| *Orcinus orca* | Killer Whale, Orca | Threatened - Nationally Critical | Threatened - Data Deficient | 2017 | Significant Species - Conservation grounds | They are the most cosmopolitan of all marine mammals, being found in all waters from tropics to polar regions. Within new Zealand there appear to be three main populations: (1) north island, (2) South island and (3) a population that appears to move between the both islands. Killer whales have been recorded from throughout much of Marlborough and may be encountered at any time of the year. |
| *Delphinus delphis* | Short-beaked Common Dolphin | Not Threatened | Threatened - Least Concern | 2008 | Significant Species | The New Zealand distribution is not well documented, however common dolphins are known from as far south as Fiordland, through to Kaikoura, the eastern coast of the north island and the Hauraki Gulf. Common dolphin are also present off the west coast of the North Island, from Northland through to the South Taranaki Bight and Cook Strait. In Marlborough common dolphin are known from Queen Charlotte Sound and Cook Strait; French Pass and Admiralty Bay area and also Cloudy and Clifford Bays. |
| *Eubalaena australis* | Southern Right Whale | At Risk - Recovering | Threatened - Least Concern | 2017 | Significant Species - Conservation grounds | They have a circumpolar distribution between 20 and 55 degrees south. Southern right whales are occasionally seen in the Marlborough region during winter and spring. Sightings are primarily in Cloudy and Clifford Bay, Tory Channel and Queen Charlotte Sound, however sightings have occurred in other areas and seasons. Historically, New Zealand was considered to have two of the seven recognised southern right whale breeding grounds in the South Pacific to indian ocean Basin: (1) mainland New Zealand; and (2) Auckland Islands. |

1. Baker et al. (2019).
2. Listed as 'Threatened' by the International Union for Conservation of Nature (IUNC). https://www.iucnredlist.org/species.
3. Davidson et al. (2011).

| Species | Common name | Threat classification (DOC) (2019) [1] | Threat classification (IUCN) [2] | Date last assessed (IUCN) | Significant Species Marlborough (MDC) [3] | Distribution [3] |
|---|---|---|---|---|---|---|
| *Arctocephalus forsteri* | New Zealand Fur Seal | Not Threatened | Threatened - Least Concern (Increasing) | 2014 | Significant Species - Scientific and conservation and grounds | They are widely distributed around mainland New Zealand as well as offshore islands and sub-Antarctic islands and can be found as far north as Three Kings islands. They are widely distributed in the Marlborough Sounds and east coast region. In Marlborough breeding colonies exist at Stephens Island and Trio islands. There are numerous haul outs throughout the Marlborough Sounds region. In at least some parts of the region (e.g. Admiralty Bay, French Pass, Current Basin), the haulout sites can vary through-out the year. Fur seals are regularly seen near salmon farms. Fur seals frequently feed on pelagic schooling fishes such as hoki, jack mackerel, and barracouta, as well as arrow squid. They also occasionally feed on penguins and shearwaters. Adult females tend to forage at night, in depths ranging from 15 m to 163 m. |

1. Baker et al. (2019).
2. Listed as 'Threatened' by the International Union for Conservation of Nature (IUNC). https://www.iucnredlist.org/species.
3. Davidson et al. (2011).

# Appendix D:

# Potential Seabird Species

| Summary the threat classification of seabird species recently sighted within grid BW58 (eBird - New Zealand Bird Atlas 2023). | | | | |
|---|---|---|---|---|
| Species | Common name | Threat classification[1] | Observation | |
| | | | Location | Date |
| *Eudyptula minor* | kororā / little Penguin | At Risk (Declining) | 324 Bill Bryants Road, Squally Cove, Marlborough, NZ (-41.047, 173.747) | 23 Nov 2023 |
| *Haematopus unicolor* | tōrea pango / variable oystercatcher | At Risk (Recovering) | 324 Bill Bryants Road, Squally Cove, Marlborough, NZ (-41.047, 173.747)AA | 22 Nov 2023 |
| *Morus serrator* | tākapu / Australasian gannet | Not Threatened | 324 Bill Bryants Road, Squally Cove, Marlborough, NZ (-41.047, 173.747)AA | 22 Nov 2023 |
| *Phalacrocorax carbo novaehollandiae* | māpunga / black shag | At Risk (Relict) | 324 Bill Bryants Road, Squally Cove, Marlborough, NZ (-41.047, 173.747)AA | 22 Nov 2023 |
| *Larus bulleri* | tarāpuka / black-billed Gull | At Risk (Declining) | 324 Bill Bryants Road, Squally Cove, Marlborough, NZ (-41.047, 173.747)AB | 21 Nov 2023 |
| *Stictocarbo punctatus* | spotted shag | Threatened - Nationally Vulnerable | 324 Bill Bryants Road, Squally Cove, Marlborough, NZ (-41.047, 173.747)AB | 21 Nov 2023 |
| *Larus dominicanus* | karoro / southern black-backed gull | Not Threatened | Elaine Bay, Marlborough Sounds | 7 Sep 2023 |
| *Phalacrocorax melanoleucos brevirostris* | kawaupaka / little shag | At Risk (Relict) | 23 Kamahi Road, Tennyson Inlet, Marlborough, NZ (-41.087, 173.766) | 2 Jul 2023 |
| *Egretta novaehollandiae* | white-faced Heron | Not Threatened | 23 Kamahi Road, Tennyson Inlet, Marlborough, NZ (-41.087, 173.766) | 2 Jul 2023 |
| *Larus novaehollandiae scopulinus* | tarāpunga / red-billed gull | At Risk (Declining) | Elaine Bay, Marlborough Sounds | 20 Feb 2023 |
| *Sterna striata striata* | tara / white-fronted Tern | At Risk (Declining) | Elaine Bay, Marlborough Sounds | 20 Feb 2023 |
| *Hydroprogne caspia* | taranui / caspian tern | Threatened - Nationally Vulnerable | Deep Bay, Marlborough Sounds Ward NZ-Marlborough (-41.0710,173.7762) | 10 Feb 2023 |
| *Puffinus gavia* | pakahā / fluttering shearwater | At Risk (Relict) | Tennyson Inlet, Marlborough, NZ (-41.084, 173.791) | 17 Jun 2021 |
| *Phalacrocorax sulcirostris* | kawau tūī / little black shag | At Risk (Naturally Uncommon) | Tennyson Inlet kayak count, Marlborough, NZ (-41.089, 173.787) | 16 Jun 2021 |
| *Leucocarbo carunculatus* | kawau pāteketeke / king shag | Threatened - Nationally Endangered | Pelorus Sound, Elaine Bay | 21 May 2020 |
| *Phalacrocorax varius varius* | pied shag | At Risk (Recovering) | Archers Road, Tennyson Inlet, NZ (-41.112, 173.763) | 6 May 2020 |
| *Platalea regia* | kōtuku ngutupapa / royal spoonbill | At Risk (Naturally Uncommon) | Archers Road, Tennyson Inlet, NZ (-41.108, 173.76) | 16 Apr 2020 |

[1] Robertson et al. (2021).

# Appendix E:

# Potential Biogenic Habitat & Macroinvertebrates

| Species | Common name | Threat classification (DOC) (2016) [1] | Significant Species Marlborough (MDC) [2] | Distribution [2,3] | Habitat [2] |
|---|---|---|---|---|---|
| *Haliotis iris* | Black Foot Paua | N/A | Significant Species - Iconic species in Marlborough as they highly regarded as a recreational and commercial catch. | Black-foot paua are endemic to New Zealand. In Marlborough they have been recorded throughout much of the Marlborough Sounds apart from inner Marlborough Sounds. They are most common from exposed outer Sounds locations and areas with macroalgal forest. | Lives in shallow coastal waters, usually in large groups on rocky reefs. |
| *Galeopsis porcellanicus* | Bryozoan Coral | N/A | Significant Species - In Marlborough as they provide biogenic habitat for a variety of species. | Endemic, throughout NZ from Three Kings Islands to Foveaux Strait and the Antipodes Islands. | Found on rock or shelly gravel in sublittoral fringe to 235 m. In Marlborough it is known from areas with relatively strong tidal currents. |
| *Notoplax latalamina* | Chiton | N/A | Significant Species - Endemic to the outer Marlborough Sounds being recorded nowhere else. | Endemic to the outer Marlborough Sounds being recorded nowhere else. The type locality of the species is 200 m depth off Stephen's island (Takaporewa). It has also been observed by divers from Croisilles Harbour to Sentinel Rock in the outer Marlborough Sounds. This species appears to be naturally rare, and is sparsely distributed in the outer north-west Marlborough Sounds and Cook Strait. | Found on rocky reefs between 6 to 200 m depth, associated with large sponges growing in areas of moderate to high current flow. |
| *Neothyris lenticularis* | Giant Lampshell | N/A | Significant Species - Scientific and conservation values. | This species and genus is endemic to New Zealand and sub Antarctic waters. They are known from 200 m depth at Stephens island and form large beds in Cook and Foveaux Straits. In Marlborough it is widespread in deep waters of Cook Strait, but has also been recorded from a variety of shallow locations in East Bay, Arapawa island and several locations in inner Queen Charlotte Sound. | Found on a variety of substrates from solid rock platforms and walls to coarse sandy rubble. |
| *Atrina zelandica* | Horse Mussel | N/A | Significant Species - Can form a biogenic habitat in high densities. | They are found in muddy to sandy soft-sediment habitats around the coast of New Zealand from extreme low water to 70 m depth. In the Marlborough Sounds they are often found in the soft sediments. Dense beds of greater than 10 per square metre have been recorded from particular areas such as Grove Arm, Wet inlet and Port Gore. | Inhabit soft sediments with most of the shell embedded in the sea floor and anchored to sediment by byssus threads. The exposed shells provide attachment for an array of algae and invertebrates such as sponges and sea squirts. |

1. Freeman et al. (2013). 2. Nelson et al. (2019). 3. Davidson et al. (2011). 4. Page (2017).

| Species | Common name | Threat classification (DOC) (2016) [1] | Significant Species Marlborough (MDC) [2] | Distribution [2,3] | Habitat [2] |
|---|---|---|---|---|---|
| *Jasus edwardsii* | Rock Lobster | N/A | Significant Species - Highly regarded as a recreational and commercial catch. Dominant or keystone predator. | They are found from Three Kings, north, South, Stewart and Chatham islands, south to Auckland islands. In Marlborough they have been recorded throughout the Sounds where suitable rock habitat exists, except central and inner Marlborough Sounds. Port underwood where large numbers of juveniles can be observed in the shallows. | Most common from outer Sounds locations and areas swept by moderate to strong tidal currents in rocky reef and on occasion, soft sediment habitats. |
| *Pecten novaezelandiae* | Scallop | N/A | Significant Species - Iconic species in Marlborough as they highly regarded as a recreational and commercial catch. | They are found throughout the Marlborough Sounds except inner Marlborough Sounds (including inner Kenepuru Sound) and Port underwood. They are particularly abundant in Croisilles Harbour entrance, the many bays in Queen Charlotte Sound and some outer Sound locations. | Found on a variety of soft substrata from mud to fine gravels, however adults appear to prefer coarse sediments (e.g. shell gravel and grit). They are usually most abundant in areas with some tidal flow. |
| *Celleporaria agglutinans* | Separation point coral | Not Threatened | Significant Species - Form dense beds that provide habitat for a variety of other species. | In New Zealand it is commonly known as Separation Point coral, Tasman Bay coral or 'hard coral' and occurs from the Three Kings islands to Foveaux Strait at about 3 to 220 m depth. In Marlborough particularly large concentrations of colonies are known from Current Basin, Chetwode and Titi islands. | Grows on rocky and soft sediment substrata, but only tends to form large, conspicuous colonies on soft sediments in high current areas. |
| *Galeolaria hystrix* | Tubeworm | N/A | Significant Species - Tubeworm mounds represent a significant biogenic habitat in Marlborough as they are utilised by a variety of species enhancing local biodiversity and potentially providing habitat for a variety of juvenile fishes. | Found on the rocky shores throughout Marlborough, however mounds are restricted only known to occur in the sheltered waters of the Marlborough Sounds and Port underwood. Particularly dense growths of these mounds are restricted to locations such The Knobbies and Perano Shoal. There are three major reefs in the region. One is in Queen Charlotte Sound and two are in Port Underwood at the Knobbies and Whataroa Bay. | Most abundant on rocky sheltered shores devoid of macroalgae but swept by tidal currents. Mounds are absent from areas exposed to ocean storms. |

1. Freeman et al. (2013). 2. Nelson et al. (2019). 3. Davidson et al. (2011). 4. Page (2017).

| Species | Common name | Threat classification (DOC) (2016) [1] | Significant Species Marlborough (MDC) [2] | Distribution [2,3] | Habitat [2] |
|---|---|---|---|---|---|
| *Macrocystis pyrifera* | Giant Kelp | At Risk (Declining) | Significant species - In Marlborough because in areas where it is dominant it can alter abiotic and biotic conditions by dampening water motion, altering sedimentation, shading the sea floor, scrubbing nutrients from the water column, stabilising substrata, and they can provide physical habitat for organisms both above and below the benthic boundary. | The giant kelp is found throughout New Zealand's marine environment. The range and extent of beds in the Marlborough Sounds has declined, with beds now absent from the eastern coast of D'urville island. Beds in the Marlborough Sounds are largely confined to sheltered eastern outer sound locations. Giant kelp beds are also located north and south of Cape Campbell. | Generally attaches to rock substrata, occasionally horse mussels, from low water to at least 18 m depth. The lower depth limit is determined by light and habitat availability. Note this species may also be a useful indicator of global warming as its distributional limit has been moving southward. |
| *Adamsiella chauvinii* | Red Alga | Not Threatened | Significant species - In Marlborough because where it forms dense beds it appears to provide habitat for a variety of species including bivalves, holothurians and fishes. | Endemic to New Zealand. In Marlborough it often forms dense beds in particular areas of Port Underwood, East Bay, and inner Queen Charlotte Sound (Houhou Point, Hauatehoro Point,Wedge Point, Ngakutu Point). | Found growing on a variety of substrata from rock to sand and mud. |
| *Rhodymenia* sp. | Red Algae | Data Deficient | Significant Species - In Marlborough because they provide an important food source for a variety of species, including urchins and some herbivorous fishes | New Zealand waters. | Occur on a variety of substrata including rock, tube worm colonies and horse mussel shells. They may also be intertidal but most beds are subtidal in harbours and inlets. |
| *Lithothamnion* sp. | Rhodoliths | Data Deficient | Significant Species - Play an important role in the global calcium carbonate budget. | In the Marlborough Soiunds rhodoliths are known from a small number of distinct locations including Picnic Bay in Marlborough Sounds, and Ponganui Bay and Catherine Cove, D'urville island. | Many species that form rhodoliths may also be found encrusting reefs and other hard substrata. Rhodoliths may form around small particles of rock, shell or coral, or may develop from fragments of coralline algae eroded from reefs. |

1. Freeman et al. (2013). 2. Nelson et al. (2019). 3. Davidson et al. (2011). 4. Page (2017).

# Appendix F:

# Potential Fish Species

| Species | Common name | Threat classification (IUNC) [1] | Date last assessed (IUCN) | Significant Species Marlborough (MDC) [2] | Distribution [2] | Habitat [2] |
|---|---|---|---|---|---|---|
| *Paraper-cis colias* | Blue Cod | Threatened - Least Concern (Decreasing) | 2009 | Significant Species - Iconic species, dominant or key-stone predator. | Blue cod are endemic to New Zealand and are found from the Three Kings islands in the north to the Snares islands in the south. They are a common reef fish in Marlborough, Kai-koura, Fiordland, Stewart island and the Chathams islands. | Found throughout Marlborough on rocky habitats and offshore biogenic soft bottom habitats. Small juveniles appear at about 5 cm length on sandy or shelly bottoms that provide some cover (e.g. dead whole shells or cob-bles). |
| *Cal-lorhinchus milii* | Elephant Fish | Threatened - Least Concern (Stable) | 2015 | Significant Spe-cies - Accessibility of the spawning areas makes them of importance to scientists | This chimaera resides on continental shelves of cool tem-perate areas to depths to at least 656 feet (200 m). It has also been reported to migrate into estuaries and inshore bays during the spring months to mate. They occur through-out New Zealand coastal waters but are most common around the South island. Spawning grounds have been identified at several locations in the Marlborough Sounds. Observations suggest that highest densities of egg cases occur in Garne Bay, Marlborough Sounds, but other impor-tant areas include Saville Bay, Kumutoto Bay and Grove Arm. | Adults are most often found on soft bottom habitats, from the surf zone to 227 m depth. Adults migrate into inshore waters, including harbours and estuaries to breed. |
| *Zearaja natuta* | Rough Skate | Threatened - Least Concern (Stable) | 2017 | "Significant Spe-cies - breeds in the sheltered bays of the Marlborough Sounds and its | Endemic to the outer Marlborough Sounds being recorded nowhere else. The type locality of the species is 200 m depth off Stephen's island (Takaporewa). It has also been observed by divers from Croisilles Harbour to Sentinel Rock in the outer Marlborough Sounds. This species appears to be naturally rare, and is sparsely distributed in the outer north-west Marlborough Sounds and Cook Strait. | Found on rocky reefs between 6 to 200 m depth, associated with large sponges growing in areas of moderate to high current flow. |
| *Pagrus auratus* | Snapper | Threatened - Least Concern (Decreasing) | 2009 | Significant Spe-cies - Significant Species - Iconic species, dominant or keystone preda-tor. | In New Zealand they are found mainly in warmer coastal waters from Three Kings islands south to Cook Strait on the east coast; and to Tasman Bay and Westport on the west. Occasional individuals have been recorded from Foveaux Strait and Chatham Islands. Snapper are present through-out Marlborough but are more common in the west. | Young fish school in shallow water and sheltered areas and move out to deeper water in winter. |
| *Noto-labrus celidotus* | Spotty | Threatened - Least Concern | 2008 | N/A | Endemic to the waters around New Zealand, including Stewart Island. | Found on reefs at depths from 22 to 145 m, though most com-mon in shallower parts of that range. |

1. International Union for Conservation of Nature (IUNC) - https://www.iucnredlist.org/species.
2. Davidson et al. (2011).

# Footnotes

[1] Robertson, B.P. 2023. Ecological Impact Assessment for Resource Consent Renewal - Marine Farm 8270, Squally Cove. Report Prepared by Robertson Environmental for Mata Maataitati Partnership. Robertson Environmental Report No. 0160

[2] www.aplusaquaculture.nz

[3] Fisheries New Zealand 2020. *Resource Management (National Environmental Standards for Marine Aquaculture) Regulations 2020 DRAFT Consenting Guide – November 2020*

[4] Allan, S (2018). *Review of the proposed national environmental standard for marine aquaculture (NES-MA) for consistency with the New Zealand Coastal Policy Statement 2010.* Prepared for the Department of Conservation.
Handley et al 2017 *History of seabed change* at p 25.

[5] Handley, S. 2016. *History of benthic change in Queen Charlotte Sound/Totaranui, Marlborough.* Prepared for Marlborough District Council. NIWA client report No: NEL2015-018: https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sgxanf9/hierarchy/Documents/Environment/Coastal/Scientific%20Investigations%20List/History_of_Benthic_Change_in_Queen_Charlotte_Sound_Totaranui_Marlborough.pdf; and Handley, S. 2015. *The history of benthic change in Port Underwood (Te Horiere), Marlborough*. Prepared by NIWA for Marlborough District Council. NIWA client report NEL2015-001, NIWA project ELF15202: https://www.marlborough.govt.nz/repository/libraries/id:1w1mps0ir17q9sgxanf9/hierarchy/Documents/Environment/Coastal/Scientific%20Investigations%20List/HistorySeabedChangePelorusSound.pdf

[6] MacDiarmid, A.; McKenzie, A.; Sturman, J.; Beaumont, J.; Mikaloff-Fletcher, S.; Dunne, J. (2012). *Assessment of Anthropogenic Threats to New Zealand Marine Habitats, New Zealand Aquatic Environment and Biodiversity Report No. 93, 2012*; and Ministry for the Environment & Statistics New Zealand (2016) *New Zealand's Environmental Reporting Series: Our marine environment 2016* at 24. A copy is available here: http://www.mfe.govt.nz/sites/default/files/media/Environmental%20reporting/our-marine-environment.pdf

[7] For example Ministry for Primary Industries *Literature Review of Ecological Effects of Aquaculture – Cumulative Effects* (August 2013, Cawthron Institute/NIWA), at pp 12-3 to 12-4; Stewart, B. *Mussel Farming in Central Port Underwood* (Ryder Consulting, 3 December 2015, prepared for the Kenepuru and Central Sounds Residents Association) at [50]; and *Further Submissions of the Marine Farming Association and Aquaculture New Zealand Limited on the proposed Marlborough Environment Plan (23 June 2017)*, at points 66, 73 and 78.

www.robertsonenvironmental.co.nz