



Establishment of Hapuku Rock Marine Farms

Assessment of Effects on Marine Mammals

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Basis of Report

This report has been prepared by SLR Consulting NZ (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Clearwater Mussels Limited (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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Executive Summary

Clearwater Mussels Ltd (**CML**) are proposing the establishment of two new marine farms in the vicinity of their existing 4 Ha farm block at Hapuku Rock in Outer Admiralty Bay.

Marine mammal occurrence and habitat use was determined for the project area using Department of Conservation sighting and stranding data; and available published and unpublished literature. Distributional data was reviewed for a broad portion of the coastal marine area (**CMA**); however, sightings within Admiralty Bay were further interrogated to gain a more comprehensive understanding of how frequently species occur here.

Considering all data sources, while 16 marine mammal species are known from the wider area, only five species – New Zealand fur seals, bottlenose dolphins, dusky dolphins, common dolphins, and killer whales – regularly visit Admiralty Bay and immediate surrounds. In addition to these species, southern right whales and humpback whales are expected to have a possible seasonal presence over the months of winter and spring. Evidence clearly indicates that Admiralty Bay constitutes important foraging habitat for dusky dolphins, and possibly also for common dolphins.

Actual and potential effects on marine mammals from the proposed marine farms were identified as habitat modification (including displacement, behavioural change and habitat degradation), entanglement, vessel strike, underwater noise, marine debris, and cumulative effects. Each of these potential effects has been thoroughly described and assessed in the context of the marine mammal species and habitats that could be affected, and on this basis, the following measures are recommended to minimise and manage potential adverse effects on marine mammals from the proposed activities:

To minimise and manage the potential effects of habitat modification:

- Operational mitigations to reduce the potential for habitat modification effects on dolphins from the proposed new marine farms in Admiralty Bay are limited. In lieu of such controls, a Marine Mammal Monitoring Programme should be developed and implemented to facilitate a better understanding of how dolphins specifically utilise the proposed farm sites and immediate surrounds prior to farm establishment.

To minimise and manage the potential effects of entanglement:

- Compliance with A+ Sustainable Aquaculture Guidelines;
- Installation of the thickest, tautest, lines/droppers practicable;
- Spat holding lines should be weighted;
- No free floating, loose or slack lines;
- All ropes/lines should be maintained under tension;
- Anchor warps should not overlap or cross between farm blocks; and
- Farm maintenance should be prioritised.

To minimise and manage the potential effects of vessel strike:

- Compliance with A+ Sustainable Aquaculture Guidelines;
- Compliance with the MMPR;
- Vigilance for marine mammals maintained;
- Records of marine mammal sightings kept; and
- All vessel strikes and near misses will be recorded and reported.



To minimise and manage the potential effects of underwater noise:

- Vessels and on-board mechanical equipment should be regularly maintained.

To minimise and manage the potential effects of marine debris:

- Compliance with A+ Sustainable Aquaculture Guidelines;
- Adoption of appropriate waste management programmes;
- Comply with Resource Management (Marine Pollution) Regulations 1998; and
- Collect and retrieve any obvious marine debris during extraction and safely dispose of this onshore.

The results of this assessment found that with the adoption of the recommended mitigations, the overall level of impact from the proposed marine farms ranges from negligible to medium. Of ongoing concern is that the presence of dusky dolphins in Admiralty Bay is decreasing and foraging behaviour for this species here has changed. The reason for these changes remain unknown, but the effects of further habitat modification are likely to be more than minor.



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Acronyms and Abbreviations

CML	Clearwater Mussels Limited
CI	Confidence Internal
CMA	Coastal Marine Area
CMU	Coastal Management Units
DOC	Department of Conservation
ENSO	El Niño Southern Oscillation
IMMA	Important Marine Mammal Area
IUCN	International Union for Conservation of Nature
NZTCS	New Zealand Threat Classification System
NZCPS	New Zealand Coastal Policy Statement
RCP	Marlborough Regional Coastal Plan
PMEP	Proposed Marlborough Environment Plan
PTS	Permanent Threshold Shift
SLR	SLR Consulting NZ
SST	Sea Surface Temperature
TTS	Temporary Threshold Shift



1.0 Introduction

Clearwater Mussels Ltd (**CML**) are proposing the establishment of two new marine farms in the vicinity of their existing 4 Ha farm block at Hapuku Rock in Outer Admiralty Bay.

Based on its proximity to deep water and high current flow, the proposed location of the new farm sites has been selected to provide an important nursery function for Greenshell mussel (*Perna canaliculus*) spat. Few such nursery sites are currently available, and it is well-recognised that existing spat nursery capacity in New Zealand is too low to support industry growth. The proposed new farm sites are shown in **Figure 1**.

While Admiralty Bay has a long history of marine farming, it also provides foraging habitat for dusky dolphins in winter and early spring (Pearson, 2009); however, the scientific literature on this topic continues to expand. Because of the spatial overlap between mussel farms and dolphin habitat here, concerns exist relating to habitat loss and changes to dolphin foraging strategies. These concerns have been central to aquaculture management decisions in the embayment in recent years and, consequently, are a focus of this assessment.

The findings of this report are intended to form part of an application by CML under the Fast-track Approvals Act 2024 to establish two new marine farms in Outer Admiralty Bay, specifically to:

- Occupy space in the Coastal Marine Area (**CMA**);
- To erect and place structures in the CMA;
- To disturb the seabed in the CMA; and
- To allow ancillary discharges to water in the CMA.



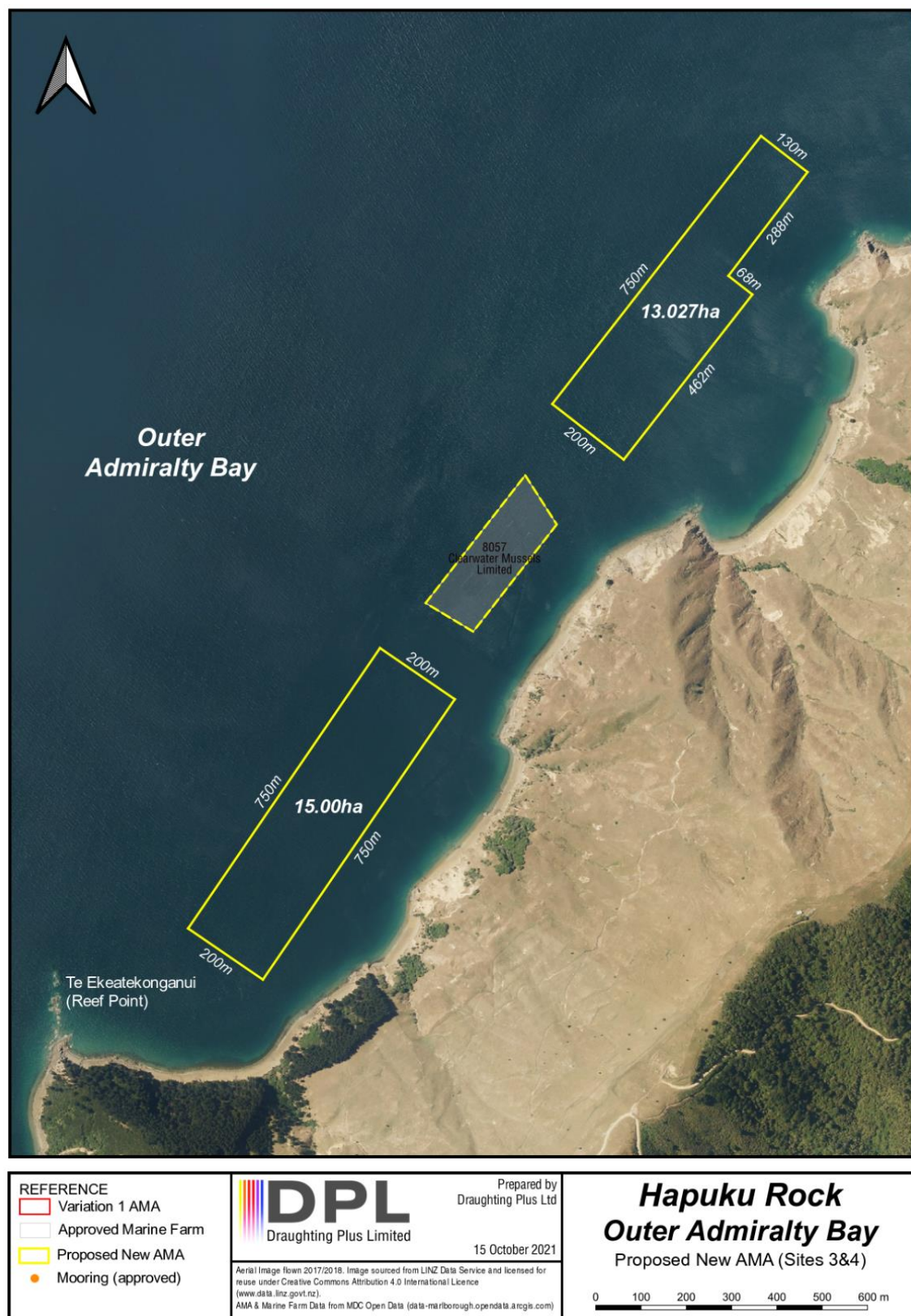


Figure 1 Proposed locations of marine farms at Hapuku Rock, Outer Admiralty Bay



2.0 Project Description

Admiralty Bay has historically been an important site for marine farming (primarily long-line production of Greenshell mussels). **Figure 2** illustrates the proposed placement of the new marine farms in the context of the wider embayment and the existing marine farms that occur in the area.

It is common for Admiralty Bay to be described in two sections delineated by a theoretical line between Whangapoto Point and Clayface Point; where all waters to the south of this line are considered 'Inner Admiralty Bay' and all waters to the north being 'Outer Admiralty Bay', which abuts D'Urville Island to the west and extends towards Cook Strait/South Taranaki Bight. For the purpose of this report and unless otherwise specified, 'Admiralty Bay' is used to collectively describe the entire embayment (i.e. both the inner and outer sections).

The proposed location of the two new marine farms (collectively referred to as 'the project area') occurs along the eastern edge of Outer Admiralty Bay. CML have an existing 4 ha marine farm here and the new farms will flank this existing farm to the northeast (c.13 Ha) and southwest (15 Ha). Water depth across the two farm sites ranges from c. 30 – 50 m.

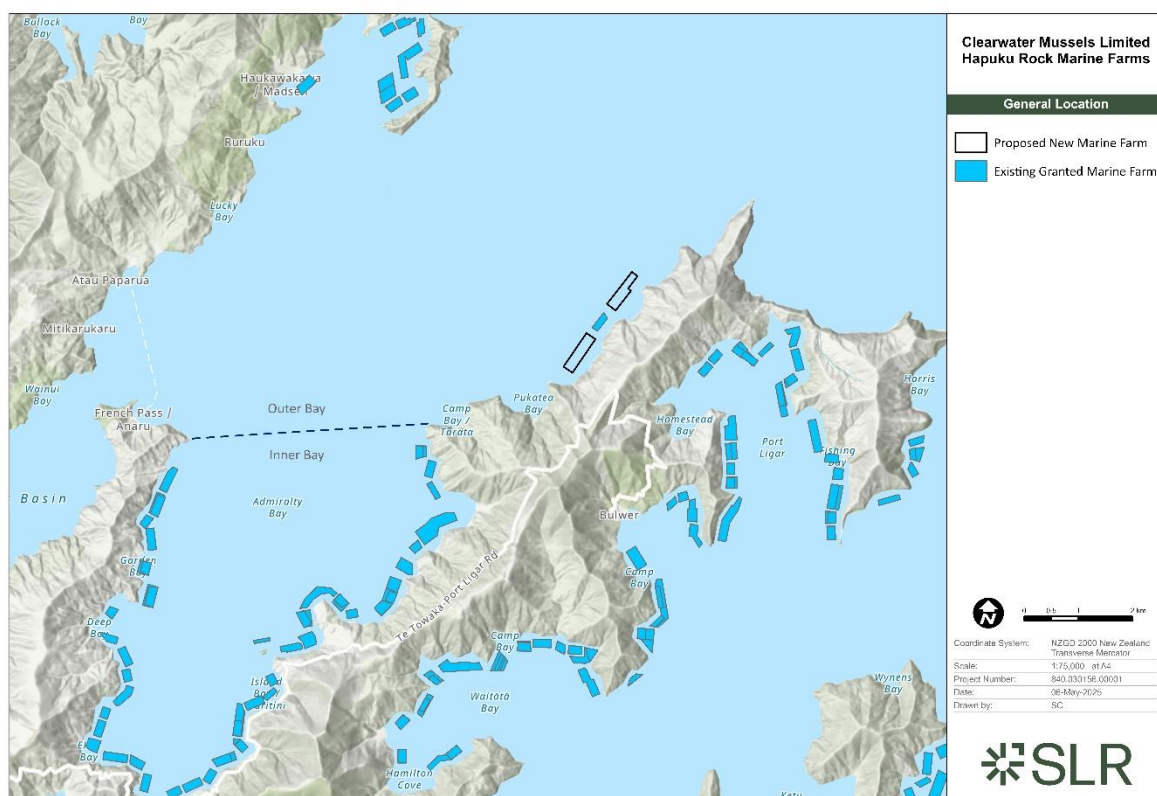


Figure 2 Location of the project area in the context of wider Admiralty Bay

Both proposed new farms will primarily be for spat nursery/holding purposes and CML propose to seed the farms with wild collected spat from Kaitaia, and (eventually) hatchery raised spat. In addition, CML seek to retain the option to use both new farms for grow-out/production purposes.

Specifications for the proposed two new marine farms are provided in **Table 1** below, and the proposed line layout is provided in **Figure 3**. The term of the consent sought is 35 years.



Table 1 Specifications for the proposed new marine farms

Component	Specifications
Backbone lengths	130 m and 75 m as indicated on Figure 3
Backbone gauge	32 mm
Dropper length	12 m
Dropper gauge	12 mm surrounded by seeded spat contained within a stocking. Overall diameter 80 – 120 mm.
Subsurface lines from floats to backbone	20 mm
Float specifications	340 L and 260 L Clamp on floats
Row spacing	27.14 m
Anchors	Screw
Warp length	80 m
Warp gauge	40 mm
Anchor placement	As indicated on Figure 3

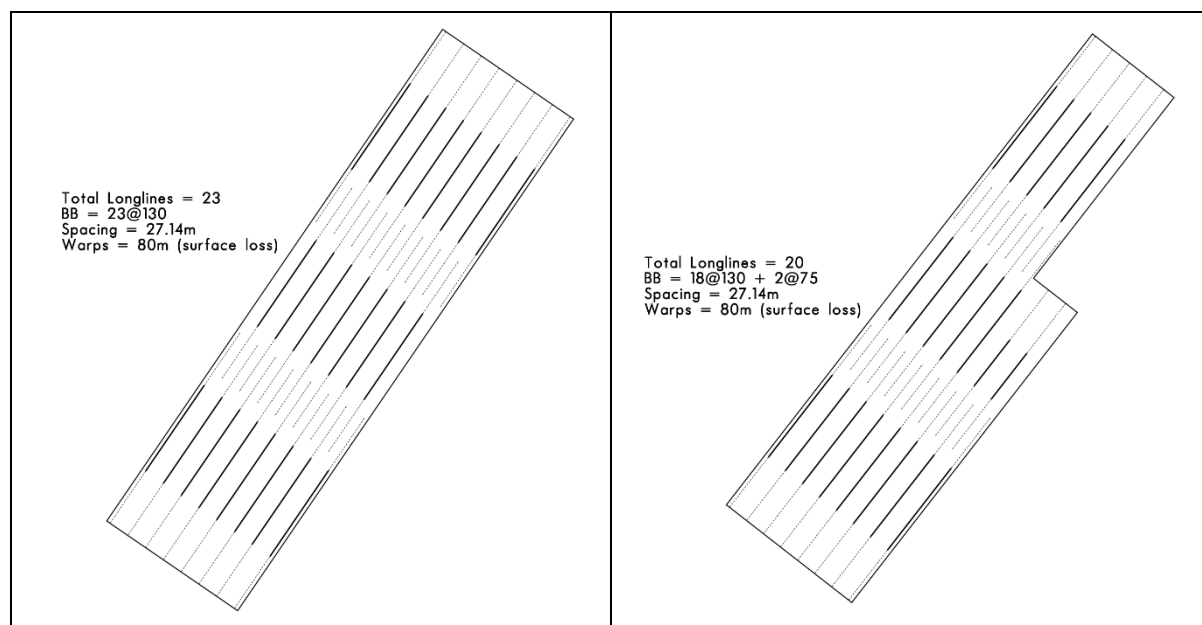


Figure 3 Proposed line layout of the new marine farms

Service vessels will attend the farm periodically to seed, harvest, and maintain the farm. Vessels will travel mostly from Havelock (at the head of Pelorus Sound) to service the proposed farms; however, occasionally they may come from Tarkohe in Golden Bay. The average speed of the service vessels is 11 knots. Vessels currently spend approximately 50 hours a year servicing the existing Hapuku Rock farm site, and this duration is expected to increase proportionally with the establishment of any new farms at this location.



3.0 Description of Existing Environment

This section provides a description of the marine mammal species that have been reported from the project area and surrounds.

Marine mammals have extensive home-ranges and because of this, marine mammal distributional data across a broad spatial scale was assessed to establish a baseline understanding of potential marine mammal presence in the project area. For the purpose of this application, distributional data from northwestern Marlborough Sounds (**Figure 4**) was reviewed to investigate potential marine mammal presence. In addition, and to gain a more comprehensive understanding of how frequently species occur in and around the project area itself, this assessment further interrogated the available data to identify species that are consistently observed inside Admiralty Bay.

3.1 Methodology

Knowledge of marine mammal distribution is typically amassed over long temporal periods from a combination of stranding data, opportunistic sightings data, systematic survey data, and habitat modelling. It is therefore important to analyse multiple data sources when describing marine mammal distribution. For the purpose of this report, the following data sources were analysed to determine the likelihood of marine mammal species being present:

- 1 Sightings data as recorded in the Department of Conservation (**DOC**) Marine Mammals Sightings Database from 1968 to 2025 (DOC Sightings Database) (supplied by H. Hendricks, DOC, 24/02/2025)¹. See **Appendix A**;
- 2 Stranding data as recorded in the DOC Marine Mammals Incident Database from 1873 to 2025 (DOC Incident Database) (supplied by H. Hendricks, DOC, 24/02/2025). See **Appendix A**;
- 3 Habitat modelling and distribution descriptions (Stephenson et al., 2020 and MacKenzie et al., 2022). See **Appendix A**;
- 4 Knowledge of marine mammal distribution and habitat use obtained from published and unpublished scientific literature; where the following data sources were of particular importance to this assessment given their relevance to the Marlborough Sounds:
 - a) For dusky dolphins – McFadden (2003), Markowitz (2004); Markowitz et al. (2004), Würsig et al. (2007), Duprey (2007), Vaughn et al. (2007), Pearson (2008), Vaughn et al. (2010), Pearson et al. (2012), Srinivasan et al. (2012), Piwetz et al (2013), Halliday (2013), Clement & Halliday (2014), Piwetz et al. (2024);
 - b) For bottlenose dolphins – Merrimen (2007) and Merrimen et al. (2009);
 - c) For New Zealand fur seals – Taylor et al (1995); and
 - d) For more general data sources or references covering multiple species – Slooten et al. (2002), Davidson et al. (2011), Halliday (2013), Clement & Elvines (2015).

While these data sources represent the best available information on marine mammal distribution in and around the project area, the following data limitations should be noted:

¹ Entries in the DOC Sightings and Stranding Databases that do not identify marine mammals to species level were excluded from analysis.



- DOC sightings data is generally collected in a non-systematic manner by non-experts.
- Data gaps in the DOC sightings record do not necessarily reflect an absence of marine mammals; rather they typically reflect a lack of observation effort. Conversely, areas with high levels of sightings occur where marine mammal distributions overlap with well-populated areas, research programmes or regions that actively encourage public reporting of certain species;
- While the DOC stranding data gives a broad indication of species occurrence, dead animals can wash ashore well away from where they died; and sick or diseased animals may be outside of their normal range prior to death; and
- Most scientific literature pertaining to marine mammals in Admiralty Bay focus' specifically on Inner Admiralty Bay. It is critical that the relative paucity of data for Outer Admiralty Bay is not interpreted to mean that marine mammals occur less frequently here; rather this simply reflects lower survey effort for this area.

After reviewing all data sources, the likelihood of each marine mammal species being present in Admiralty Bay was determined as:

- Likely – species that are present in the embayment on a relatively frequent basis; hence have a high chance of exposure to the potential effects of the proposed marine farms (noting that large home ranges of marine mammals mean that occurrence of individuals will not be continuous in the project area or embayment);
- Possible – species that occur on a less frequent basis in the embayment; hence may or may not be exposed to the potential effects of the proposed marine farms; and
- Unlikely – species that are seldom reported from within the embayment; hence probably only occur as rare visitors and are unlikely to be exposed to the potential effects of the proposed marine farms.

3.2 Expected Marine Mammal Occurrence

Marine mammal sightings recorded in the DOC Sightings Database that occur in the vicinity of the project area are mapped in **Figure 4**, and marine mammal stranding locations are mapped in **Figure 5**. A total of 16 species are represented in the DOC data. **Appendix A** summarises this data in tabular form, along with published habitat modelling results.

Importantly, and in addition to the data contained within the DOC Sightings and Incident Databases, Admiralty Bay has been the subject of various marine mammal research projects since the late 1990s. Most of this research has been undertaken by students of Texas A&M University with a specific focus on dusky dolphins. A small number of additional projects have also been undertaken in the embayment by other researchers. To augment the DOC data and to provide a better understanding of marine mammal presence in the bay:

- The most recent dusky dolphin sightings map to include data from Outer Admiralty Bay is presented as **Figure 6**; and
- Sightings of other marine mammal species (i.e. not dusky dolphins) in Admiralty Bay was collated and mapped by Clement & Elvines (2015), and this data is reproduced as **Figure 7**.

Considering all data sources, while 16 marine mammal species are known from the wider area over which data was reviewed, only five species – New Zealand fur seals, bottlenose dolphins, dusky dolphins, common dolphins, and killer whales – regularly visit Admiralty Bay and immediate surrounds. In addition to these species, southern right whales and humpback whales are expected to have a possible seasonal presence over the months of winter and spring.



Other species that probably only occur as rare visitors to the embayment (but are represented in the reviewed data) include, Hector's dolphins, beaked whales, blue whales, pilot whales, minke whales, pygmy right whales, sei whales, southern right whale dolphins, and leopard seals. It is noteworthy that several of these species are primarily offshore deep-water species that are less likely to come into direct contact with the proposed marine farms.

Table 2 provides a summary of important ecological considerations for those species which are considered to have a likely or possible presence in the project area.

In light of the New Zealand Coastal Policy Statement (**NZCPS**), it is important to identify:

- Indigenous taxa that are identified as 'threatened' or 'at risk' in the New Zealand Threat Classification System (**NZTCS**) (NZCPS policy 11(a)(i));
- Taxa listed by the International Union for Conservation of Nature (**IUCN**) as 'threatened' (NZCPS policy 11(a)(ii));
- Habitats of indigenous species where the species are at the limit of their natural range, or are naturally rare (NZCPS policy 11(a)(iv)); and
- Habitats in the coastal environment that are important during the vulnerable life stages of indigenous species (NZCPS policy 11(b)(ii)), where DOC (2010) states that indigenous species can be vulnerable when breeding, as juveniles and during migration; or
- Habitats, including areas and routes, important to migratory species (NZCPS policy 11(b)(v)).

For each species listed in **Table 2**, their NZCPS policy 11(a) and (b) status is included.



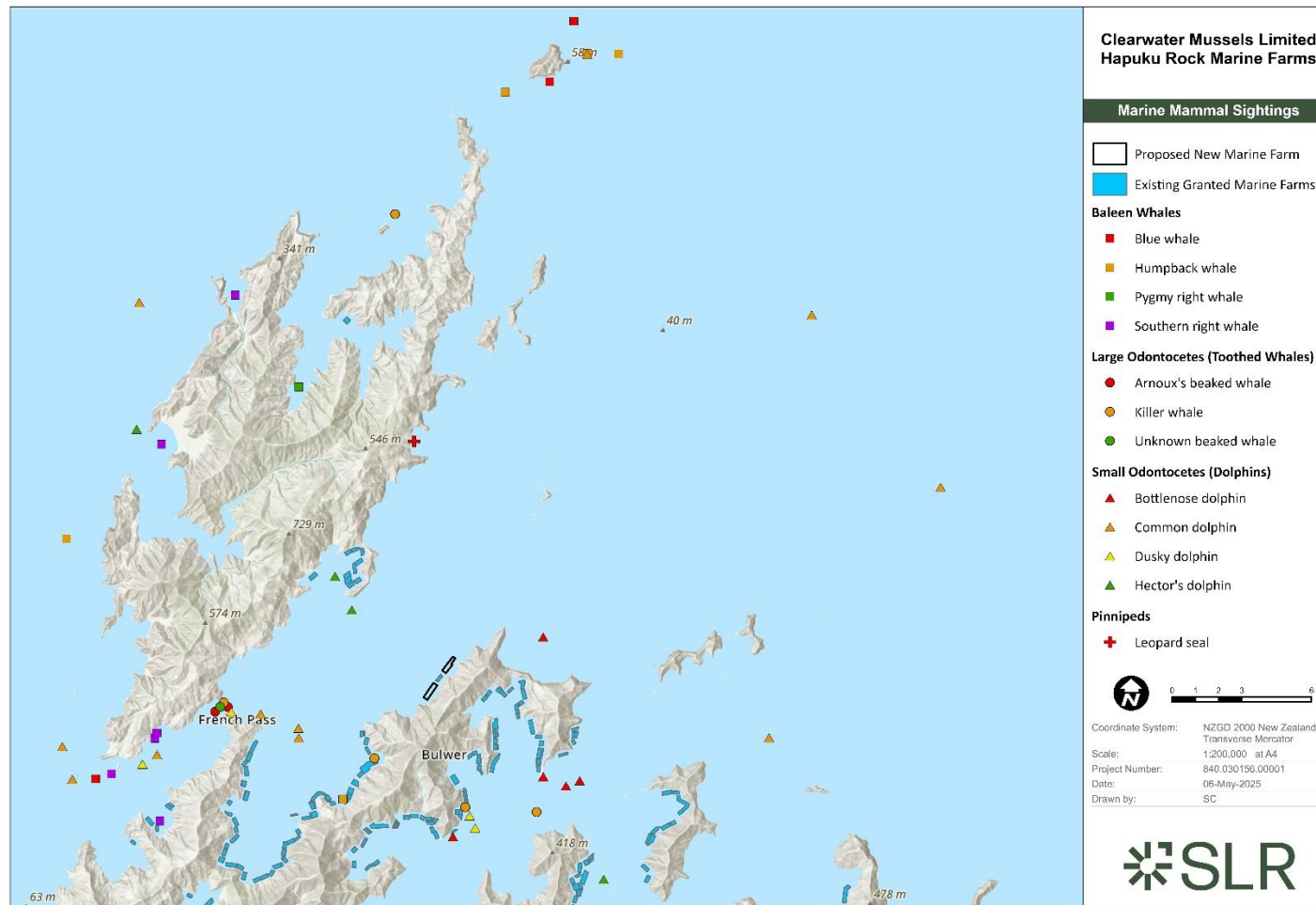


Figure 4 Marine Mammal Sightings Reported by DOC in the Vicinity of the Proposed Marine Farms

Note: Each depicted point represents a sighting entry within the DOC database, where each sighting entry can be either a single animal or a group of animals.



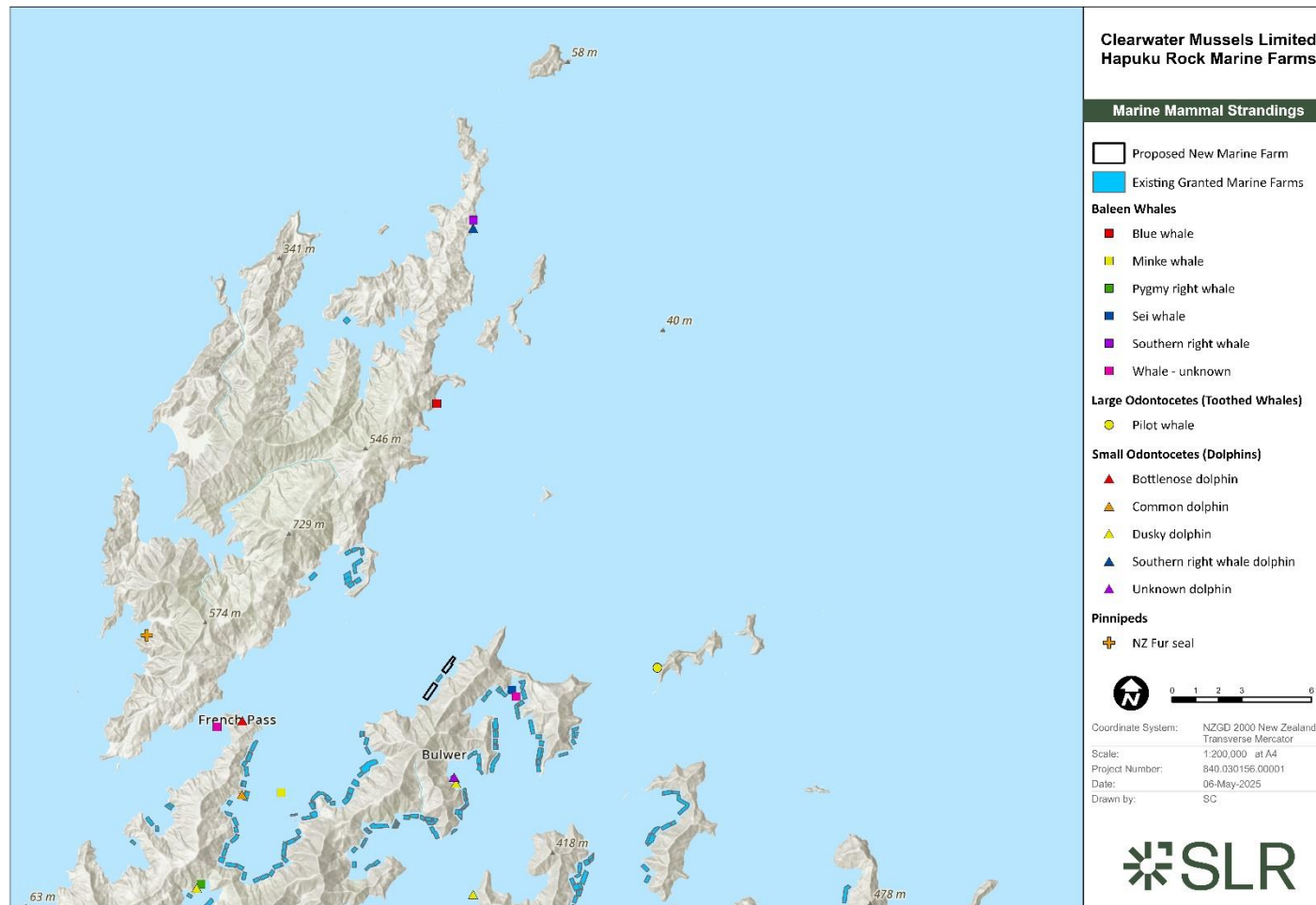


Figure 5 Strandings (and incidents) Reported by DOC in the Vicinity of the Proposed Marine Farms



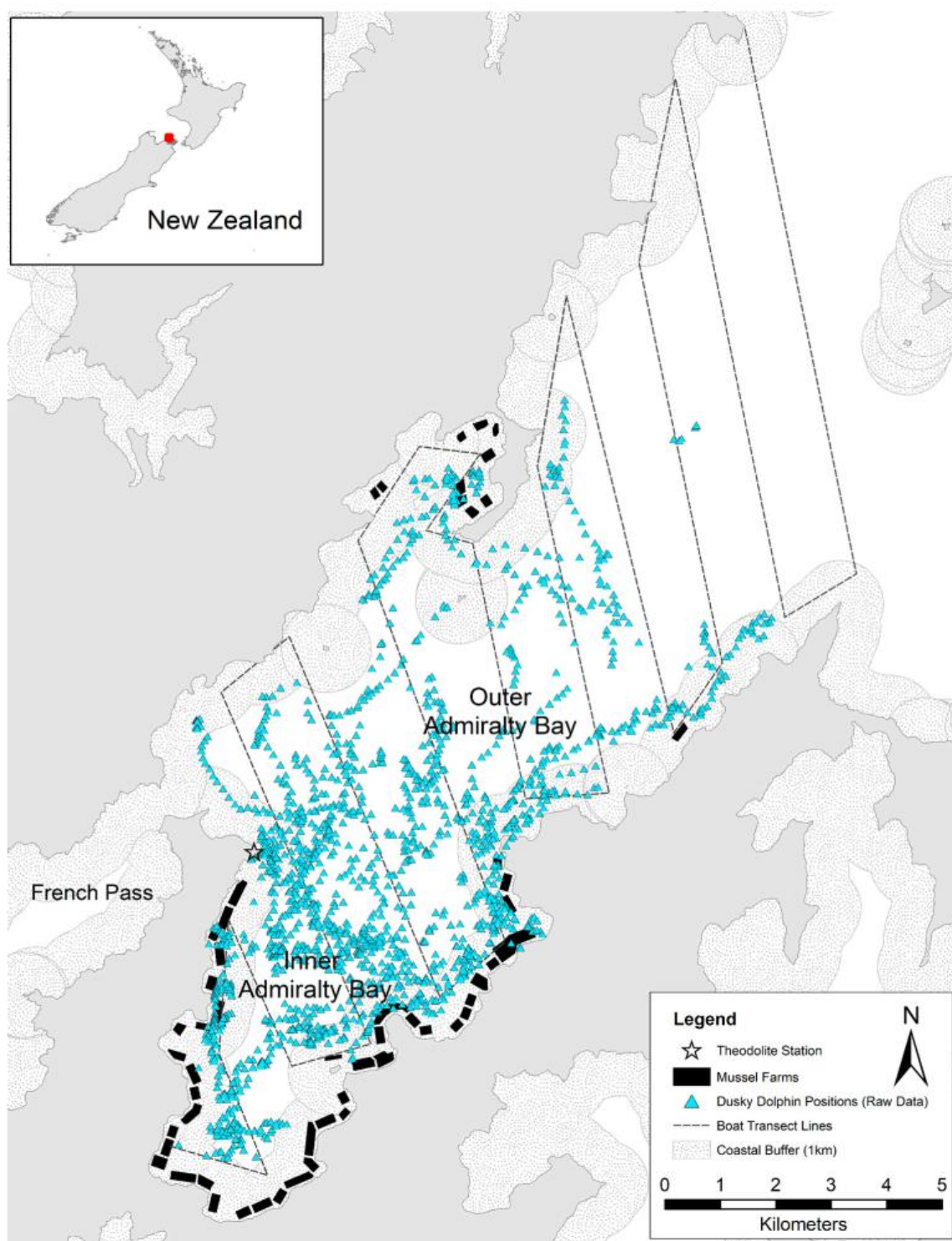


Figure 6 Dusky dolphin locations reported by Piwetz et al. (2024). Data was collected from land-based (theodolite) and boat-based (line transect) surveys of Admiralty Bay during 2011-2012. Black polygons indicate existing mussel farms (Source: Piwetz et al., 2024).

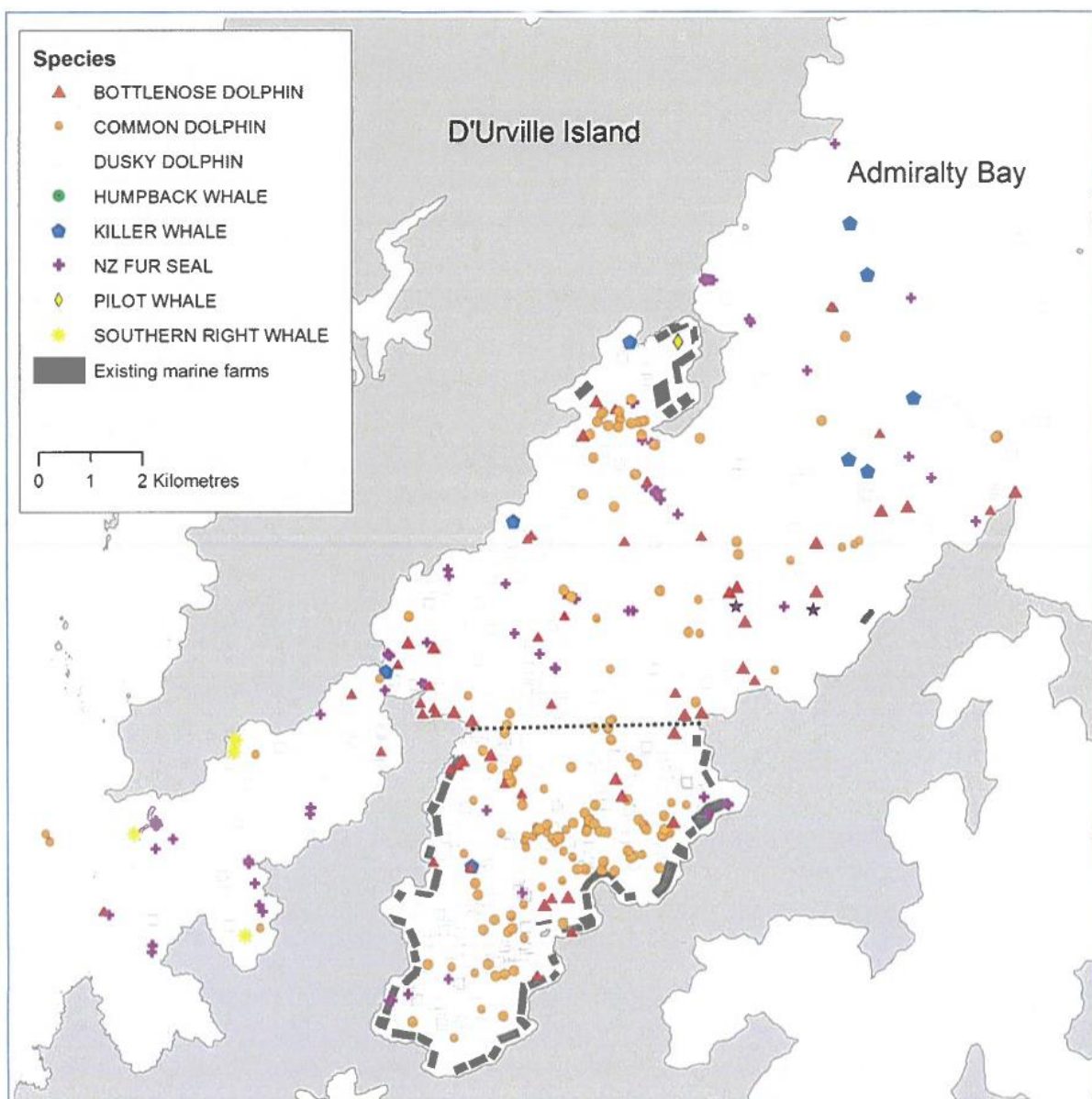


Figure 7 Marine mammal sightings (excluding dusky dolphins) as collated by Clement & Elvines (2015) for Admiralty Bay. Data sources include Merrimen (2009, unpublished. data), DOC (public and unpublished. data), Clement & Halliday (2014: boat-based sightings only). Grey polygons indicate existing mussel farms. Reproduced with permission from D. Clement (May 2025).

Table 2 Marine Mammals ‘likely’ to or ‘possibly’ occurring in/around Admiralty Bay.

Species Threat Classification (NZTCS: Baker et al., 2019) (IUCN Redlist, 2024) NZCPS Policy 11a status	Ecological considerations	Likelihood and frequency of occurrence	Seasonal trends
New Zealand fur seals - Not threatened - Least concern - No policy 11(a) status	Widespread around rocky coastlines of New Zealand where this species is expanding its range northwards (Lalas & Bradshaw, 2001). Breeding sites in the vicinity of the project area include the Trio Islands and Stephens Island (Davidson et al., 2011). Annual pup production was c. 300 in the early 1990s, and presumably this has increased since then (Taylor et al., 1995). The breeding season occurs from mid-November to mid-January (Crawley & Wilson, 1976). Numerous haul-out (non-breeding) sites also occur in and around Admiralty Bay (e.g. Jag Rocks, Bonne Point, Stewart Island, Clayface Point, Garden Point, Chetwode Islands: Taylor et al., 1995; and Hamilton Island: Clement & Halliday, 2014). Fur seals also haul-out on mussel farm buoys throughout Admiralty Bay (Clement & Halliday, 2014). Seals forage on a range of species that vary seasonally and geographically (Baird, 2011). In open water habitats, females typically forage over the continental shelf, and males use deeper pelagic waters of the shelf break (Page et al., 2005). Foraging trips can last for several days (Page et al., 2005) and GPS tagging studies have shown females to forage up to 78 km from breeding colonies, foraging further offshore in winter (Harcourt et al., 2002). They return to shore every few days to rest (Boren, 2005). However, co-operative inshore feeding with dusky dolphins has been described in Admiralty Bay (Markowitz, 2004; Vaughn et al., 2007), where waters of the inner bay appear to be preferred (Halliday, 2013). It is likely that fur seals in and around Admiralty Bay utilise both offshore and nearshore habitat for foraging during different seasons and life stages. Reports of New Zealand fur seals to the DOC Sightings Database are generally biased low as this species is the most regularly encountered coastal marine mammal in New Zealand and most sightings are not reported. Clement & Halliday (2014) described this species as being the only true resident to Admiralty Bay; having highest abundances in the bay during the month of May and lowest abundances in spring/summer when adults presumably depart to attend breeding colonies at locations outside Admiralty Bay.	Likely continuous presence in and around Admiralty Bay.	Year round, residents.
Common dolphins - Not threatened	Abundant and widespread throughout tropical and temperate oceans; occurring around most of the New Zealand coastline, (Berkenbusch et al., 2013). Recent analysis reveals two genetic subpopulations in New Zealand: one on the west coast	Likely frequent presence in and around Admiralty Bay.	Year round – but increased presence in



Species Threat Classification (NZTCS: Baker et al., 2019) (IUCN Redlist, 2024) NZCPS Policy 11a status	Ecological considerations	Likelihood and frequency of occurrence	Seasonal trends
- Least concern - No policy 11(a) status	(which is linked with Tasmania) and one on the east coast (Barcelo et al., 2021). While total abundance is unknown it is likely to be substantial (Berkenbusch et al., 2013), with an estimate of c. 18,000 individuals using the North Island alone (Abraham et al., 2017). Surveys in Admiralty Bay from spring 2011 to autumn 2014 concluded that abundance here was greatest in mid-late winter and early spring, and that individuals were semi-resident during this time for up to three months (Clement & Halliday, 2014). These authors concluded that Admiralty Bay (and the wider Marlborough Sounds) may represent important seasonal habitat for common dolphins, where numbers of common dolphins using the bay have increased since 2005 (Duprey, 2007; Clement & Halliday, 2014; Piwetz et al., 2024). Furthermore, common dolphins are the most frequently encountered cetacean in the wider western Cook Strait region (Torres, 2012) and habitat modelling suggests high habitat suitability in outer Marlborough Sounds including Outer Admiralty Bay (Stephenson et al., 2020). For Admiralty Bay, group sizes of 1 – 177 have been reported, with densities highest in the central bay in September (Clement & Halliday, 2014). While coordinated feeding (prey ball herding) involving mixed groups of common dolphins and dusky dolphins is not uncommon in Admiralty Bay (Markowitz, 2004; Halliday, 2013), Clement & Halliday (2014) noted that as common dolphin numbers increased in spring, the numbers of dusky dolphins showed a corresponding decrease indicating prey competition between these species when common dolphin numbers are high in Admiralty Bay. While not unheard of (e.g. Markowitz, 2004), calves are seldom reported from Admiralty Bay (DOC Sightings Database). Stomach content analysis has revealed a diverse diet of fish and cephalopod species, with arrow squid, jack mackerel and anchovy identified as the primary prey species across New Zealand (Meynier et al., 2008). Noting that prey herding in Admiralty Bay has been observed presumably targeting pilchards and yellow eyed mullet (Clement & Elvines, 2015). Prey availability is a key driver of distribution for this species (Dwyer et al., 2020).		Admiralty Bay in winter and spring.
Dusky dolphins - Not threatened - Least concern	Dusky dolphins are a Southern Hemisphere species present year-round in New Zealand waters (Berkenbusch et al., 2013). They are a long lived (life span 30 – 36 years: Cipriano, 1992) coastal species occurring over the continental slope and	Likely frequent presence in and around Admiralty Bay.	Year round – but increased presence in Admiralty Bay from April to November.



Species Threat Classification (NZTCS: Baker et al., 2019) (IUCN Redlist, 2024) NZCPS Policy 11a status	Ecological considerations	Likelihood and frequency of occurrence	Seasonal trends
- No policy 11(a) status	shelf in water depths less than 2,000 m, usually in the cooler waters of the South Island and lower North Island (Würsig et al., 2007). Admiralty Bay is regarded as an important seasonal foraging habitat for dusky dolphins (Markowitz et al., 2004; Duprey, 2007; Markowitz et al., 2010; Davidson et al., 2011; Pearson et al., 2012); where individuals that breed in summer in deep waters off Kaikoura (c. 275 km away), and elsewhere, travel to the shallow enclosed waters of Admiralty Bay to capitalise on nearshore foraging opportunities associated with concentrations of small planktivorous fish such as pilchard, yellow eyed mullet, anchovy and sprat (McFadden, 2003; Markowitz et al., 2004; Markowitz, 2004). These movements occur seasonally, with dolphins arriving in Admiralty Bay in mid-April, dolphin presence increasing from mid- (0-29%) to late autumn (89-100%), remaining high through the winter months, and into spring (45-70%) (Clement & Halliday, 2014). Individual dolphins return over successive years (Markowitz, 2004) and the average residency of individuals in Admiralty Bay in any one season was reported to be 16 days in 2005/6 (Pearson, 2009). Dolphins that occur at Admiralty Bay are part of a much wider and larger population, extending at least down the east coast of the South Island. Harlin et al. (2003) estimated the New Zealand population of dusky dolphins was 15,000-17,000 individuals and reported that most dusky dolphins occurring in Admiralty Bay were male. Winter abundance in Admiralty Bay has been assessed by several researchers through time (e.g. Markowitz et al., 2004; Markowitz et al., 2010, Pearson et al., 2012, Piwetz et al., 2013). Total abundance has fluctuated, with an apparent decline since 2003 (Pearson et al., 2012; Piwetz et al., 2024). From 1998 to 2004, total population abundance in winter in Admiralty Bay was estimated to be 711 (95% CI: 608-844), with 220 dolphins present on a weekly basis (Markowitz et al., 2010); while a similar total abundance was calculated for the 2005/2006 seasons: 712 (95% CI: 593 – 938), weekly abundance was lower at 105 (95% CI: 77 – 161) in 2005 and 144 (95% CI: 110 – 196) in 2006 (Pearson et al., 2012). While Piwetz et al., (2013) reported a higher winter abundance in 2011/12 (of 1,147), they noted that encounter rates, group sizes and resight rates declined, suggesting that despite higher numbers of dolphins moving through Admiralty Bay, fewer were remaining to feed. Consistent with this, and of the 343 individuals using Admiralty Bay from spring 2011 to autumn 2014, only 25% of dolphins were observed multiple times across seasons and years, and 52% were rare visitors being sighted only once across the three year study period (with the balance consisting of		



Species Threat Classification (NZTCS: Baker et al., 2019) (IUCN Redlist, 2024) NZCPS Policy 11a status	Ecological considerations	Likelihood and frequency of occurrence	Seasonal trends
	autumn/spring visitors or transients) (Halliday, 2013; Clement & Halliday, 2014). A summary provided by Piwetz et al. (2024) clearly demonstrates an overall decline in encounter rates, mean group sizes, individual resight rates, and the proportion of time spent foraging from 1998 – 2012. Conversely, dusky dolphin presence in Queen Charlotte Sound increased from 1995 - 2002, then again from 2012 to 2014 (Cross, 2019). Recent evidence of a shift in the primary foraging strategies used by dusky dolphins in Admiralty Bay has also emerged, whereby dolphins are now seldom engaging in coordinated prey ball herding (which was previously characteristic of this species in Admiralty Bay; McFadden, 2003; Pearson, 2009; Markowitz et al. 2012) and are spending increased time foraging individually (Clement & Halliday, 2014; Piwetz et al., 2004). This change is discussed more in Section 4.2. Dusky dolphins have been observed in all areas of Admiralty Bay, including Inner Admiralty Bay and Outer Admiralty Bay. However, as highlighted by Clement & Elvines (2015), to date there has been no comprehensive systematic study to fully assesses spatial and temporal distribution patterns across the entire bay. The Proposed Marlborough Environment Plan (PMEP) identifies all of Admiralty Bay (both inner and outer, including the project area) and Current Basin (the area to the south of French Pass) as dusky dolphin distribution (Appendix 28, PEMP).		
Bottlenose dolphin - Nationally endangered - Least concern - Policy 11(a) species	Occur globally in cold temperate and tropical seas. In New Zealand there are four genetically distinct coastal populations: North Island, Marlborough Sounds, Fiordland (Tezanos-Pinto et al., 2009), and Otago/Stewart Island (Brough et al., 2015); plus, an oceanic ecotype (Zaeschmar et al., 2020). A semi-resident population of bottlenose dolphins is known from the Marlborough Sounds; this population was reported to number 211 (% CI: 195 – 232) individuals in 2009 (Merrimen et al., 2009). While this species has a year-round presence in the sounds, where they range widely and across 890 km² (Merrimen et al., 2009) it is likely that their distribution also extends along the west coast of the South Island (Brager & Schneider, 1998, as cited in Halliday, 2013). Therefore, Admiralty Bay forms part of a much larger home range. During 2011 and 2012, Halliday (2013) identified 130 individual bottlenose dolphins from Admiralty Bay, noting that 118 of these were frequently present, with an increased prevalence of this species in Admiralty Bay during spring. Sightings of bottlenose dolphins in Admiralty Bay tended to occur near the shore between	Likely frequent presence in and around Admiralty Bay.	Year round – but increased presence in spring.



Species Threat Classification (NZTCS: Baker et al., 2019) (IUCN Redlist, 2024) NZCPS Policy 11a status	Ecological considerations	Likelihood and frequency of occurrence	Seasonal trends
	French Pass and Clayface Point, animals would then often cross to Whangapoto Point before exiting the bay along the northeastern coastline (Halliday, 2013). Duprey (2007) reported mean group sizes of bottlenose dolphins in Admiralty Bay to be 29 (with a range of 6 to 60). Clement & Halliday (2014) reported that presence of this species in Admiralty Bay was brief, staying several days to weeks. Bottlenose dolphins are considered to be nationally endangered under the NZTCS (Baker et al., 2019) and are consistently sighted in Admiralty Bay throughout the year (Clement & Halliday, 2014). Bottlenose dolphins have a varied diet that consists of a variety of fish and squid (Blanco et al., 2001; Gowans et al., 2008). Bottlenose dolphins have been observed carrying out foraging dives ranging from short dives in shallow habitats to depths of over 500 m (Wells & Scott, 2009). Bottlenose dolphins were less likely to be foraging in Admiralty Bay, using the bay mostly as a resting spot given its sheltered nature and lack of large predators (Halliday, 2013).		
Killer whales/orca - Nationally critical - Data deficient - Policy 11(a) species	Killer whales occur in all oceans across all latitudes. New Zealand's coastal killer whale population is small (65 – 167 individuals; Visser, 2006) and is made up of at least three possible sub-populations based on geographic distribution; a North Island only subpopulation, South Island only subpopulation, and a North and South Island subpopulation (Visser, 2000). Small groups of killer whales are commonly seen around NZ where they travel an average of 100 – 150 km per day (Visser, 2000). Killer whales are commonly seen in the Marlborough Sounds year-round; however, the highest number of sightings occurs in summer (Slooten et al., 2002) with substantially fewer sightings in winter and spring (Pearson, 2009). While the majority of sightings occur in Queen Charlotte Sound and Port underwood, sightings in nearly all parts of the sounds have been reported, including in Admiralty Bay (Slooten et al., 2002). Immature animals are present on a year-round basis (Visser, 2000; Hupman et al., 2015), suggesting no distinct breeding season. A record of an orca birth was made at Ohana Bay in Current Basin (the area to the south of French Pass). The diet of New Zealand killer whales includes 27 prey species (Visser, 2000): rays, sharks, finfish, and cetaceans. Benthic foraging for rays is common particularly inside enclosed harbours and estuarine areas (Visser, 2000). While killer whales not been reported as regularly as those species discussed above in Admiralty Bay, sporadic sightings through time should be expected, and	Likely sporadic presence in and around Admiralty Bay.	Year round - but more common in summer.



Species Threat Classification (NZTCS: Baker et al., 2019) (IUCN Redlist, 2024) NZCPS Policy 11a status	Ecological considerations	Likelihood and frequency of occurrence	Seasonal trends
	habitat modelling suggest patches of high habitat suitability in Admiralty Bay (presumably associated with fur seal haul-out locations) (Stephenson et al., 2020). Clement & Elvines (2015) note that sightings of other marine mammal species in Admiralty Bay decline when orca are present, reflecting fine scale avoidance of an apex predator.		
Humpback whales - Migrant - Endangered - Policy 11(a) species	Humpback whales feed in the circumpolar waters of the Antarctic in summer and migrate to sub-tropical or tropical breeding grounds in winter. Around New Zealand they migrates northwards from May to August (Gibbs & Childerhouse, 2000), and southward from September to December (Dawbin, 1956). Whales use continental shelf waters (Jefferson et al., 2008) but can approach closely to shore when passing headlands (e.g. Gibbs et al., 2017). Cook Strait is a recognised part of primary migration corridor during the northward migration of humpback whales past New Zealand. During winter surveys in Cook Strait (2004 – 2015), 659 whales were observed, and the annual rate of population increase was calculated to be 13% (Gibbs et al., 2017). While relatively few sightings (n = 5) of humpback whales have been reported by DOC inside Admiralty Bay, their occasional seasonal presence here should be expected.	Possible , seasonal presence in both coastal and offshore waters of the region.	Winter
Southern right whales - Recovering - Least concern - Policy 11(a) species	This species originally occupied bays around mainland New Zealand during their winter breeding season (Bannister, 1986; Dawbin, 1986); however, commercial whaling reduced numbers to near extinction (Gaskin, 1963). Evidence now suggests that the New Zealand population is recovering (Carroll et al., 2015) with a slow recolonisation of breeding range around the mainland (Patenaude, 2003; Carroll et al., 2014; Carroll et al., 2015). However, Cranswick (2022) suggests that the recolonisation process is not particularly strong around mainland New Zealand with no sustained increase in sightings between 2011 and 2021. In addition, the number of mother/calf pairs appears to have decreased over this period compared to earlier studies. Carroll et al. (2013) provided the first national abundance estimate for southern right whales of 2,169 (95% CI 1,836 - 2,563). The highest numbers of mother/calf pairs around New Zealand occur in July and August (Carroll et al., 2014), utilising shallow (<20 m) coastal waters for calving and nursing (Patenaude, 2003). Marlborough Sounds are not specifically recognised as a hotspot for southern right whales in winter (Carroll et al., 2014).	Possible seasonal presence in coastal waters of the region.	Winter/spring



3.3 Marine Mammal Habitat of Importance

As described in **Section 3.2**, the wider region (over which distributional data was reviewed) supports a diverse assemblage of marine mammal species.

The IUCN has identified an Important Marine Mammal Area (**IMMA**) which overlaps Admiralty Bay including the proposed marine farms. The location of the 'Marlborough Sounds and Cook Strait IMMA' is shown in **Figure 8**. While this IMMA confers no specific international or legal protection over the area, IMMAs are defined as 'discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation' (IUCN MMPATF, 2025).

The Marlborough Sounds and Cook Strait IMMA was designated on the basis of the following criteria as described by IUCN MMPATF (2025):

- Criterion A – Species or population vulnerability:
“There are seven species or subspecies found in the IMMA that meet this criterion with IUCN threatened or vulnerable status and include Antarctic blue whales, Hector’s dolphins, New Zealand sea lion, pygmy blue whale, humpback whale, sei whale, sperm whale (Douglas et al., 2018). All these species have been reported from the IMMA (DOC Marine Mammal Sighting and Stranding database, 2020) and this IMMA forms an important part of their range within New Zealand and the wider region. Predominantly this IMMA forms an important feeding area for a range of marine mammal species with the high current Cook Strait area being an important source and also the western reaches of Cook Strait include important deep-water feeding habitats. In addition, the IMMA includes a distinct subpopulation of threatened Hector’s dolphins centred around Cloudy/Clifford Bay (e.g. ~900 individuals) with a smaller group also found within Queen Charlotte Sound (e.g. ~50 individuals: Douglas et al., 2018; MacKenzie & Clement, 2014)”.
- Criterion C – Key life cycle activities (sub-criterion C1 reproductive areas):
“Important New Zealand fur seal breeding colonies (e.g. Cape Campbell, The Brothers, Stephens Island, Cape Palliser) occur along the Cook Strait Coastline of both the North and South Islands (Taylor et al., 1995) whose coastal and offshore feeding (particularly for nursing females) are constrained to area restricted foraging completely within the IMMA during the breeding season (MPI, 2017)”.
- Criterion C – Key life cycle activities (sub-criterion C2 feeding areas):
“Important New Zealand fur seal breeding colonies (e.g. Cape Campbell, The Brothers, Stephens Island, Red Rocks, Cape Palliser) occur along the Cook Strait Coastline of both the North and South Islands (Taylor et al. 1995) whose coastal and offshore feeding (particularly for nursing females) are constrained to feeding completely within the IMMA during the breeding season (MPI, 2017). The IMMA includes a nationally and internationally important site for dusky dolphins including culturally important cooperative feeding in Admiralty Bay (Würsig & Würsig, 2010). Arnoux’s, Cuvier’s, and Gray’s beaked whales, and sperm whales have been recorded from sightings, strandings (including with full stomachs) and acoustic surveys particularly within the deep water eastern reaches of Cook Strait highly with data likely to be indicative of important feeding areas (Gaskin, 1968; Goetz & Hupman, 2017; Giorli et al., 2018; Giorli & Goetz, 2019, DOC Marine Mammal Sighting and Stranding database, 2020)”.
- Criterion C – Key life cycle activities (sub-criterion C3 migration routes):
“Historical whaling data confirms this IMMA as an important migration route for humpback whales (Dawbin, 1956), sperm whales (Gaskin, 1968; 1970; 1973) and

southern right whales (Carroll et al., 2014). Recent records, including satellite tracking of blue whales, have also confirmed that this IMMA still contains important migratory pathways for humpback, southern right whales, and blue whales (Bott et al., 2017; Carroll et al., 2013; Goetz et al., 2018; Warren et al., 2021)".

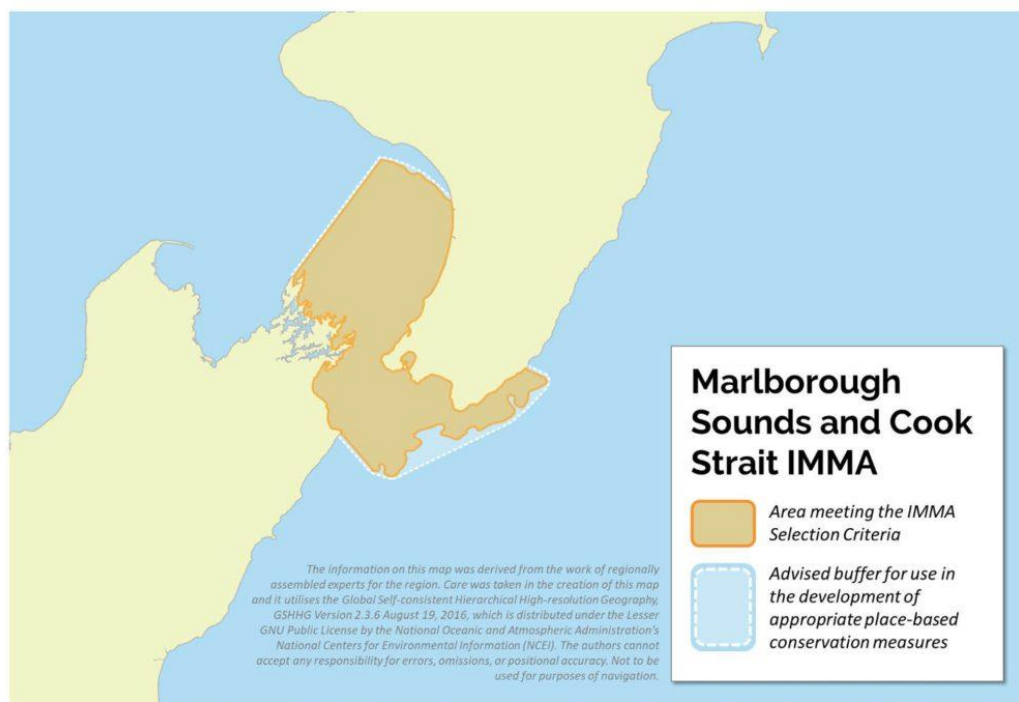


Figure 8 Marlborough Sounds and Cook Strait Important Marine Mammal Area

Following the rationale behind IMMA Criterion C (key life cycle activities), and in keeping with the NZCPS requirements, marine mammal habitat should be assessed in terms of importance during vulnerable life stages and migration (NZCPS Policy 11(b)(ii) and NZCPS Policy 11(b)(v)). Taking a broader approach to this, and accounting for international literature on this topic, it is prudent that the following additional criteria should also be considered when defining important habitat:

- 1 Areas that support concentrations of animals (following Clark et al., 2010);
- 2 Areas that are critical to the conservation of a species, particularly those areas that support a high proportion of a population/subpopulation (following the US Endangered Species Act 1973);
- 3 That nearby alternative habitat of equivalent quality is limited;
- 4 That a high proportion of sightings include calves or juveniles (following Clark et al., 2010); and/or
- 5 Areas that are critical for maintaining a healthy population growth rate (following Hoyt, 2011).

On this basis, important marine mammal habitats would represent areas of concentrated marine mammal presence which habitually support important ecological functions (e.g. feeding, breeding, resting) and where alternative habitat is limited. Following NZCPS Policy 11(b), the regular presence of vulnerable life stages would deem an area to be important, as would habitat important for migratory species.

In terms of this project, analysis of the available data has shown that regional coastal waters are used by 16 marine mammal species. The use of Admiralty Bay for seasonal foraging by dusky dolphins is of particular note. Dusky dolphins have been observed in all areas of Admiralty Bay (inner and outer) (e.g. Vaughn et al., 2007), and in the absence of targeted fine scale distributional data in and around the project area, it must be assumed that this species utilises the proposed farm sites in the same way that they do other parts of the bay. Markowitz (2004) reported lower encounter rates of dolphin groups in Outer Admiralty Bay than Inner Admiralty Bay, but this study only encompassed one winter season, and other studies indicate that both the inner and outer bay are habitually used by concentrations of animals for feeding on a seasonal basis (e.g. Pearson et al., 2012) and that fine scale dolphin distribution varies with oceanic conditions and prey availability (McFadden, 2003; Srinivasan et al., 2012).

Furthermore, Environment Court rulings W36/2006 and W027/2009 recognised Admiralty Bay and Current Basin as 'significant' habitat for dusky dolphins (Clement & Elvines, 2015). There is no new evidence to refute this.

The available evidence clearly indicates that Admiralty Bay (inner and outer, including the project area) supports foraging behaviours of dusky dolphins, and on this basis, it should continue to be considered as important dusky dolphin feeding habitat. In addition, the prevalence of common dolphins has increased inside Admiralty Bay in recent years, and the bay (including the project area) may now also provide important foraging habitat for this species as well.

4.0 Assessment of Environmental Effects

This section addresses both potential direct effects (e.g., entanglement and habitat displacement) and indirect effects (e.g. changes in trophic interactions) of the proposed marine farms on marine mammals. Where considered necessary, mitigation recommendations are made to reduce the risk to marine mammals and to manage any residual effects.

4.1 Methodology

The Ecological Impact Assessment Guidelines for New Zealand 2nd Edition (EIANZ, 2018) broadly inform the assessment methodology that has been implemented in this report. In addition, and because marine mammals are typically highly mobile across large home-ranges, this assessment also considers the likelihood of adverse effects occurring, as marine mammals will not be consistently exposed to the potential effects associated with the proposed marine farms.

In assessing the actual and potential effects of the project on marine mammals the following procedures were followed:

- 1 Describe and assign value to ecological features potentially impacted (see **Section 4.1.1**), in accordance with the definitions presented in **Table 3**;
- 2 Identify and describe the actual and potential effects of the project along with any mitigation measures to avoid, remedy or mitigate these effects (**Sections 4.2 to 4.9**);
- 3 Determine the magnitude of any residual adverse effects, after adoption of the proposed mitigation measures, in accordance with the definitions presented in **Table 4**, noting that ecological value is factored into the process for determining magnitude;
- 4 Determine the likelihood of adverse effects occurring (assuming the adoption of the proposed mitigation measures) in terms of marine mammal species distribution, individual home-ranges and occurrence (year-round vs. seasonal) and also considering the area and timescale over which each effect could occur. The likelihood categories used for this assessment are as follows: negligible (i.e. remote), low, moderate, high, and very high (i.e. almost certain); and
- 5 Consider the 'magnitude' and 'likelihood' ratings, to assign an overall level of effect in accordance with **Table 5**.

In all instances, the duration of effect is considered to be the proposed 35 year term of consent. Noting that if farms are established there will permanently be structures in the water column for the full consent duration.

4.1.1 Assigning Ecological Value

The NZTCS is used as the criterion for assigning ecological value for marine mammal species as outlined in **Table 3**. While the EIANZ Guidelines do not specifically address marine mammal values, the guidelines have been adapted following Boffa Miskell (2020) to provide a suitable framework against which to assess marine mammal ecological values.

Table 3 Criteria for assigning ecological value to marine mammals

Ecological Value	Species Classification
Very high	Nationally Threatened (Nationally Critical, Nationally Endangered, Nationally Vulnerable, or Nationally Increasing) species found in and around the project area either permanently or seasonally.
High	At Risk (Declining) species found in and around the project area either permanently or seasonally.
Moderate	At Risk (Recovering, Relict, or Naturally Uncommon) species found in and around the project area either permanently or seasonally.
Low	Nationally or locally common indigenous species, including those species with a Not Threatened status.

4.1.2 Assessing Magnitude of Potential Effects

The criteria used for describing the magnitude of each potential effect are those presented in **Table 4**.

Table 4 Criteria for describing magnitude of effect (adapted from EIANZ, 2018)

Magnitude	Description
Very high	Total loss of, or very major alteration, to key elements/ features of the baseline conditions such that the post development character/ composition/ attributes will be fundamentally changed and may be lost from the site altogether. Loss of a very high proportion of the known population or range of the element / feature. Habitat changes that are widespread across total habitat area (MacDiarmid et al., 2014). Effects would compromise long-term population viability and would be of extreme ecological significance to threatened marine mammal taxa (i.e. those with a 'very high' or 'high' or 'moderate' ecological value).
High	Major loss or major alteration to key elements/ features of the existing baseline conditions such that the post-development character, composition and/or attributes will be fundamentally changed. Loss of a high proportion of the known population or range of the element / feature. Habitat changes are predicted to affect >20% of total habitat area (MacDiarmid et al., 2014). Effects would be of high ecological significance to threatened marine mammal taxa (i.e., substantial changes to population dynamics are predicted).
Moderate	Loss or alteration to one or more key elements/features of the existing baseline conditions, such that post-development character, composition and/or attributes will be partially changed. Loss of a moderate proportion of the known population or range of the element / feature. Habitat changes are predicted over 5 – 20% of total habitat area (MacDiarmid et al., 2014). Effects would be of moderate ecological significance to threatened marine mammal taxa (i.e., moderate change to population dynamics). Detectable changes to population dynamics of non-threatened marine mammals are predicted.
Low	Minor shift away from baseline conditions. Change arising from the loss/alteration will be discernible, but underlying character, composition and/or attributes of the existing baseline condition will be similar to pre-development circumstances/patterns. Having a minor effect on the known population or range of the element / feature. Any changes to habitat would be highly localised, <5% of total habitat area (following MacDiarmid et al., 2014). Effects would be of low ecological significance to any marine mammal taxa (i.e., no change to population dynamics predicted). In terms of underwater noise effects, a) low level behavioural response; b) short-lived and spatially limited behavioural responses of increased severity; c) exposure to 50-25% listening space reduction (i.e. masking); and d) a soundscape change of 1-3 dB re 1 mPa are considered to be of low magnitude.
Negligible	Very slight change from existing baseline condition. Change barely distinguishable, approximating to the "no change" situation. Having a negligible effect on the known population or range of the element / feature. Any effect on marine mammal taxa would be undetectable and would be of no concern and of no ecological significance. In terms of underwater noise effects, a) infrequent low level behavioural response; b) 0% listening space reduction; c) audibility; and d) a soundscape change of <1 dB re 1 mPa are considered to be of 'negligible' magnitude.
Positive	Improving the existing baseline condition.

4.1.3 Overall Level of Effect

For each marine mammal species, and in respect of each identified effect, the findings for a) magnitude of effect, and b) likelihood of effect were evaluated in accordance with **Table 5**.

While these two components form the main determinants, the overall level of effect must also be regarded alongside ecological value.

Table 5 Matrix for determining ‘Overall Level of Effect’ (adapted from EIANZ, 2018)

		Likelihood of Effect				
		Very high	High	Moderate	Low	Negligible
Magnitude of Potential Effect	Very high	Very high	Very high	High	Medium	Low
	High	Very high	Very high	Medium	Low	Very low
	Moderate	High	High	Medium	Low	Very low
	Low	Medium	Low	Low	Very low	Very low
	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
	Positive	Net gain	Net gain	Net gain	Net gain	Net gain

The potential for interactions between marine mammals and the proposed marine farms is largely dependent on the spatial overlap between the proposed farm sites and marine mammal habitat. In assessing this spatial relationship, the extent of overlap, the significance of the affected habitat, and the severity of the predicted effect (in terms of both individual and population level impacts) are considered.

It is noteworthy that Policy 11 of the NZCPS requires that effects on those species identified as Policy 11(a) species be avoided. Policy 11(a) species that are likely or could possibly be present in Admiralty Bay are listed in **Table 2** as bottlenose dolphins, killer whales, humpback whales, and southern right whales. This requirement is replicated in the PMEP (Policy 8.3.1).

In addition, Policy 11 of the NZCPS requires that significant effects on important habitat during vulnerable life stages, (Policy 11(b)(ii)), and important habitat to migratory species (Policy 11(b)(v)) be avoided, and other adverse effects avoided, remedied, or mitigated. Again, this requirement is replicated in the PMEP (Policy 8.3.1).

The main potential effect on marine mammals that has been identified from the establishment of the proposed two new marine farms is habitat modification. Habitat modification occurs wherever man-made structures are established within marine mammal habitat. In these circumstances, the risks to marine mammals from habitat modification include habitat displacement (resulting from competition for space), behavioural changes (e.g. changes to feeding, breeding, resting and migrating behaviours), and trophic interactions (arising from the presence of mussel farms and their effects on the prey species of marine mammals). Aquaculture structures are no exception and can act as obstacles, barriers and attractants depending on the type of structure and the species affected (Würsig & Gailey, 2002; Clement, 2013; NOAA, 2013, Bath et al., 2023). Additional potential effects include entanglement in farm structures, vessel strike, underwater noise, marine debris, and cumulative effects.

Each of the potential effects identified is thoroughly described in the relevant subsection below along with proposed mitigations and a concluding statement on the Overall Level of Effect.

4.2 Habitat Displacement

Displacement (i.e. spatial exclusion resulting in habitat loss) is typically considered to be the primary effect from inshore mussel farming on marine mammals (Lloyd, 2003; Würsig & Gailey, 2002; Clement, 2013; Bath et al., 2023). The ecological consequence of any displacement depends largely on the importance of the habitat to those species affected. In the most part, exclusion of marine mammals from habitat by shellfish aquaculture in New Zealand has been considered a minor issue (Keeley et al., 2009), although displacement of dusky dolphins from foraging habitat in Admiralty Bay has previously been recognised as a concern (Clement & Elvines, 2015) and several studies have explored this effect (McFadden, 2003; Duprey, 2007; Markowitz et al., 2004; Pearson, 2009) and are discussed below. These studies clearly demonstrate that the presence of mussel farms in Admiralty Bay influences dusky dolphin distribution.

Boat-based line transect surveys were conducted in Admiralty Bay in winter 2002 by McFadden (2003) who reported that 8.1% of the total time spent with dolphin groups (n = 4,180 minutes) occurred within 200 m of a mussel farm, while dolphins were only sighted within the boundaries of mussel farms for 0.19% of the total time.

During a five-year boat-based research study (in the winters of 1998 – 2002) Markowitz et al. (2004) reported that dusky dolphins entered mussel farm boundaries on only eight of 621 occasions, and that dolphins spent significantly less time within the boundary of mussel farms (14.2 minutes) in Admiralty Bay than outside them (147.5 hours). Dolphins feeding inside mussel farms was only reported once during the entire study and the author concluded that dolphins actively avoided marine farms in preference for foraging in open waters (Markowitz, 2004). The vertical structures of cultivation lines probably act as a visual or acoustic barrier to dusky dolphins (Markowitz et al., 2004).

The findings of Duprey (2007) reported avoidance of mussel farms by both dusky dolphins and bottlenose dolphins in Admiralty Bay during the winter of 2005 - where only two of the 332 groups of dusky dolphins observed via land-based surveys, were seen inside mussel farms and of the nine observations of bottlenose dolphins, no groups were observed inside farms. The author states that the large number of dolphin groups observed using all areas of Admiralty Bay suggest the entire bay is important habitat (including Outer Admiralty Bay, Catherine's Cove and French Pass).

Pearson et al (2012) conducted boat-based surveys in winter and spring of 2005 and 2006 in Admiralty Bay and reported that groups of dusky dolphins occurred significantly more often in the nearshore zone without mussel farms than with farms. The authors concluded that *“while mussel farms comprised just 1% of the total area in Admiralty Bay, they appear to represent a source of habitat loss by excluding dusky dolphins”*. Avoidance of mussel farms was further documented by Piwetz et al. (2024) during fieldwork in 2011 and 2012 where again, dolphins were seldom (only 1% of observations) observed inside the boundaries of mussel farms.

Cross (2019) also reported displacement of dusky dolphins from marine farms in nearby Queen Charlotte Sound, where dolphin density increased as distance to the closest marine farm increased. This displacement effect was noticeable out to approximately 3.5 km from farms.

Exclusion of dolphins from areas of shellfish aquaculture in other countries has also been reported. For example, Ribeiro et al. (2007) found that the Chilean dolphin avoided areas with high densities of mussel farms (greater than 60% coverage), but at lower densities (less than 30%) dolphins remained present in and around mussel farms and foraging behaviour

was observed near mussel lines. Furthermore, despite 77 hours of observations and the fact that Peale's dolphin distribution generally overlaps with areas in southern Chile that are extensively used for mussel farming, dolphins were never observed closer than 100 m to mussel farms (Heinrich et al., 2006).

While the potential for displacement is clearly demonstrable for dusky dolphins, Clement (2013) noted that common dolphins and bottlenose dolphins may be attracted to shellfish farms. Diaz-Lopez & Methion (2017) reported that bottlenose dolphins were attracted to mussel farms on the northwest coast of Spain and that they used farmed areas more than unfarmed areas. The authors of this study suggest that this attraction is likely a result of wild fish aggregation around marine farm structures which provide a consistent source of prey for dolphins. While several studies confirm that mussel farms do often provide habitat to some fish species (e.g. Stenton-Dozey & Broekhuizen, 2019; Underwood & Jeffs, 2023; Theuerkauf et al., 2022), the Spanish farms that act as attractants to bottlenose dolphins were configured differently from the conventional long-line cultivation system used in New Zealand, instead in Spain the cultivation lines are hung from rafts, and this configuration potentially results in greater fish aggregating effects than those of long-line farms (Callier et al., 2017).

While avoidance of mussel farms by dusky dolphins in Admiralty Bay is well established, evidence for a slight shift in distribution has recently been reported by Piwetz et al. (2024), where during land- and boat-based surveys in 2011 – 2012, dusky dolphins were more frequently seen to be foraging near mussel farms than had been observed in previous studies. This observation is discussed further in **Section 4.3** in terms of a potential and emerging change in foraging behaviour noted for this species. But even so, the multiple lines of evidence that dusky dolphins avoid entering marine farms in Admiralty Bay remains unrefuted; hence marine farm presence in Admiralty Bay should be interpreted as habitat loss for this species.

In addition to dusky dolphins, and as reported in **Section 3.2**, Admiralty Bay is also frequently used by New Zealand fur seals, bottlenose dolphins, common dolphins, and killer whales. Occasional seasonal presence of humpback whales and southern right whales is also possible. There is comparatively less information about how these other species behave around shellfish farms; however, the bullet points below summarise what is known:

- While Halliday (2013) assessed the spatial distribution of marine mammals in relation to distance to mussel farms and found no statistically significant evidence of attraction or displacement for any species, Clement & Halliday (2014) reported that common dolphins rarely entered mussel farms in Admiralty Bay. Given the strong ecological similarities between dusky dolphins and common dolphins – including 1) strong niche overlap (Halliday, 2013); 2) increased common dolphin presence in Admiralty Bay in recent years (Piwetz et al. 2024); and 3) the high prevalence of foraging behaviours in Admiralty Bay by common dolphins (Clement & Halliday, 2014) – it seems likely that displacement from marine farms also affects common dolphins in Admiralty Bay;
- Evidence of bottlenose dolphins both avoiding mussel farms Duprey (2007) and being attracted to farms (Diaz-Lopez & Methion, 2017) exists. There is no resounding evidence for bottlenose dolphins avoiding mussel farms in Admiralty Bay, indeed their more coastal distribution within the bay (Halliday, 2013) predisposes them to a higher interaction rate with farms than other species. Clement & Elvines (2015) states that when travelling through Admiralty Bay bottlenose dolphins are routinely observed passing inside mussel farms as they make direct movements between coastal locations. In Queen Charlotte Sound, bottlenose dolphin density was not influenced by distance to marine farms, indicating an absence of any displacement effect (Cross, 2019). On the basis of the available information, displacement of

bottlenose dolphins is not predicted as an outcome of the proposed new marine farms at Hapuku Rock;

- Detailed records of killer whales around shellfish farms are virtually absent, but Visser (2007) noted that “New Zealand orca are known to avoid entering marine farms” but also confirms that from time to time they have been observed swimming inside mussel farms (Visser, 2020). On this basis, there is a lack of evidence for either displacement or attraction of this species to/from mussel farms and given their short-term and sporadic presence in Admiralty Bay, any minor displacement effect (if it did occur) would not be of ecological concern;
- Pinnipeds are often attracted to ‘novel structures and habitat’ (Clement, 2013) and New Zealand fur seals are commonly observed resting on mussel floats in Admiralty Bay (Clement & Halliday, 2014) indicating that this species does not avoid farm structures. Roycroft et al. (2004) reported some attraction of common seals to mussel farms in Ireland, postulating that young seals may benefit from foraging opportunities associated with farm structures, and it is possible that fur seals in Admiralty Bay benefit from wild fish aggregations around mussel farms. As such, displacement of New Zealand fur seals is not predicted as an outcome of the proposed new marine farms at Hapuku Rock;
- Little information exists with regards to how baleen whales respond to the presence of coastal mussel farms. However, large scale or offshore developments are generally assumed to pose a greater risk to baleen whales than small inshore developments (Clement, 2013). Concern would arise if multiple farms excluded depleted populations from important nursery grounds (Clement, 2013). Baleen whales rely on visual and acoustic cues to interpret their environment and while migrating some individuals in Australian waters have been recorded swimming into aquaculture areas as they follow traditional migration routes (Kemper et al., 2003). While there is no evidence to suggest that baleen whales specifically avoid marine farms, underwater noise from vessels often results in avoidance behaviours (Sprogis, et al., 2020) and therefore baleen whales may avoid farms during on-water operations. Furthermore, Admiralty Bay does not overlap with the primary migration corridor for baleen whales which occurs in deeper waters of Cook Strait; and
- It is recognised that the proposed marine farm could occasionally displace individual southern right whales from coastal habitat during winter. However, sightings of southern right whales in the bay are uncommon; hence any individual displacement effects would not be routinely expected, and alternative coastal habitat is plentiful throughout Marlborough Sounds.

4.2.1 Recommended Mitigations

While there are few specific operational mitigations that would serve to reduce the potential for displacement of dusky dolphins and common dolphins from the proposed new marine farms in Admiralty Bay, the seasonal removal of spat lines may be beneficial during the peak months of dolphin foraging in Outer Admiralty Bay (see Vaughn et al., 2007).

However, a more considered approach would be the collection of additional baseline data prior to farm installation to facilitate a better understanding of how dolphins specifically utilise the proposed farm sites and immediate surrounds. In recognition that there is a lack of baseline data for Outer Admiralty Bay, monitoring questions should focus on describing the relative importance of the proposed farm sites (incorporating frequency of occurrence, abundance, seasonality, and observations of foraging behaviours). Monitoring would ideally extend over several years to account for interannual variability. On this basis, the development and implementation of a Marine Mammal Monitoring Programme is recommended prior to farm establishment.

Furthermore, if the proposed farms are established, CML should be required to maintain formal records of marine mammal sightings including standardised methods for recording presence/absence, species, location and behaviour.

4.2.2 Assessment Results

MPI (2013) states that the consequences of small-scale avoidance are generally considered to be minor as they affect only individuals, not populations. However, given the importance of Admiralty Bay as foraging habitat for dusky dolphins and possibly common dolphins, the occupation of further marine space by new mussel farms must be very carefully considered.

In the context of the existing nearshore environment of Admiralty Bay being already well occupied by mussel farms (total area of existing marine farms being 217 ha of Admiralty Bay), the two new farms (total of 28 ha.) would not, per se, represent a significant shift away from baseline conditions; however, the magnitude of impact varies with species, depending on the probability and frequency that each species would be expected to occur in the immediate vicinity of the proposed marine farms and their purpose in the bay (foraging or passing through). The overall level of impact of potential displacement on marine mammals arising due to the proposed new Hapuku Rock marine farms ranges from negligible to low (**Table 6**). Note that these assessment findings pertain simply to the potential for displacement from the two new farms. **Section 4.9** relates to the potential cumulative impacts of the proposed farms in light of the habitat loss associated with the high number of existing mussel farms in Admiralty Bay.

Table 6 Displacement effects on marine mammals – assessment findings.

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
New Zealand fur seals	Low	Likely continuous presence in and around Admiralty Bay.	Negligible, very slight change from baseline conditions. No concern.	Negligible, no avoidance expected	Negligible
Common dolphins	Low	Likely frequent presence in and around Admiralty Bay, especially in mid-late winter and early spring.	Low, minor shift away from baseline conditions (loss of c. 28 ha. foraging habitat). Low ecological significance in terms of overall habitat availability.	Moderate, avoidance expected, but effects only experienced intermittently due to non-continuous presence	Low
Dusky dolphins	Low	Likely frequent presence in and around Admiralty Bay, especially from late autumn to late spring.	Low, minor shift away from baseline conditions (loss of c. 28 ha. foraging habitat). Low ecological significance in terms of overall habitat availability.	Moderate, avoidance expected, but effects only experienced intermittently due to non-continuous presence	Low

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
Bottlenose dolphins	Very High	Likely frequent presence in and around Admiralty Bay.	Low, minor shift away from baseline conditions (expect to swim through farms as exiting bay).	Negligible, no avoidance expected	Very low
Killer whales	Very High	Likely sporadic presence in and around Admiralty Bay.	Negligible, very slight change from baseline conditions. No concern	Low, any avoidance would be infrequent	Negligible
Humpback whales	Low	Possible, seasonal presence in both coastal and offshore waters of the region.	Negligible, very slight change from baseline conditions. No concern	Negligible, no avoidance expected	Negligible
Southern right whales	Moderate	Possible seasonal presence in coastal waters of the region.	Low, minor shift away from baseline conditions	Low, any avoidance would be infrequent	Very low

4.3 Behavioural Changes

Another potential risk of habitat modification from marine farm presence is behavioural change, where structures in the coastal environment elicit changes to feeding, breeding, resting and/or migration behaviours in marine mammals.

In general terms, changes to feeding behaviours around aquaculture areas are typically associated with attraction of marine mammals to finfish farms (Kemper et al., 2003; Clement, 2013; Callier et al., 2017), although some species may also be attracted to shellfish farms (Clement, 2013) and may benefit from aggregations of wild fish that occur around farm structures (e.g. Diaz-Lopez & Methion, 2017). As discussed in the previous section, dusky dolphins in Admiralty Bay avoid mussel farms; however, evidence has recently emerged that foraging behaviours of dusky dolphins in Admiralty Bay are changing, and the presence of marine farms may (or may not) be implicated.

Contrary to earlier studies that reported a high degree of group foraging where dusky dolphins in Admiralty Bay worked together to herd prey balls of planktivorous fish (e.g. McFadden, 2003; Markowitz et al., 2004; Vaughn et al., 2007; Duprey, 2007), both Clement & Halliday (2014) and Piwetz et al., (2024) reported that prey ball herding was seldom observed during surveys undertaken from 2010 - 2014 and none was seen near mussel farms. Instead, the occurrence of individual foraging was increasing in Admiralty Bay and that this was commonly observed near, but not inside, mussel farms.

Several studies have reported that mussel farms interfere with the coordinated efforts required to successfully herd prey balls. For example, Markowitz et al. (2004) concluded that “objects, such as floats and lines, at the surface and in the water column could impair dusky dolphin foraging by directly impeding dolphin movements or by acting as visual or acoustic obstructions”. These authors also suggested that marine farm structures had the potential to disrupt echolocation making prey targets more difficult to detect in and around marine farm

structures. Pearson et al. (2012) also reported that “mussel lines interrupt feeding bouts and interfere with the ability of dolphins to contain and capture schooling fish”.

It follows that the presence of mussel farms in Admiralty Bay may play a role in the apparent change in foraging strategies (from prey ball herding to individual hunting) of dusky dolphins in Admiralty Bay. However, as discussed by Piwetz et al. (2024) other factors may also be involved, “ranging from natural cycles of prey distribution and inter-specific interactions to human-altered habitat modification and localised climate change that effects environmental features (e.g. water temperature, salinity and loss of biodiversity)”. The fact that the vast majority of mussel farms in Admiralty Bay were established in the 1980s and 1990s (see **Appendix B** for a timeline of mussel farm establishment in Admiralty Bay), suggests that the presence of farm structures is not solely responsible for this behavioural change which emerged between 2006 (e.g. the last field season reported by Vaughn et al., 2007) and 2011 (e.g. the first field season reported by Piwetz et al., 2024 and Clement & Halliday, 2014). A fundamental question that requires attention as a starting point to unravelling the reason behind the observed behavioural change, is whether pilchards (and other potential prey species) are still present in Admiralty Bay.

Regardless of the cause, the move away from coordinated prey ball herding in dusky dolphins presumably confers energetic consequences; where group foraging is advantageous over individual foraging in areas of patchy prey resources where the presence of other dolphins improve prey detection. Piwetz et al. (2024) observed an overall increase in the proportion of time dolphins spent foraging between 2005/06 and 2011/12 and hypothesised that individual foraging was less efficient leading to an increase in time dolphins need to search for and obtain prey and leaving less time for resting and socialising.

In the context of the apparent change in foraging strategy of dusky dolphins in Admiralty Bay, the presence of mussel farms could now potentially confer some benefits to dolphins. Indeed, Pearson (2008) reported that foraging behaviours were positively correlated with mussel farms (while still noting that foraging inside farms was clearly compromised by the presence of structures). On this basis, it is possible that dolphins that are engaged in individual foraging target wild fish aggregations around the periphery of mussel farms. However, currently there is a lack of data regarding potential fish prey distribution and biomass in and around mussel farms in Admiralty Bay to confirm or refute this (Taylor, 2016).

Known prey species of dusky dolphins include pilchard, anchovy, garfish, yellow-eyed mullet, and possibly sprat (Taylor, 2016). Morrissey et al. (2006) characterised fish assemblages at mussel farms in the top of the South Island, concluding that fish abundance on mussel lines was low and predominantly consisted of triple fins, spotties, leather jackets and jack mackerel. While yellow-eyed mullet (a known prey species of dusky dolphins) were observed to pass through farms, regular use of farm habitat was not observed by this species and few large species of recreational or commercial importance were recorded (Morrissey et al., 2006). In addition, snapper, spotties and leather jackets are known to feed on farmed mussels in Marlborough Sounds (Hayden, 1995; Morrissey et al., 2006; Underwood et al., 2024) and stargazers, blue cod and flatfish are occasionally present in association with mussel farms (Stenton-Dozey & Broekhuizen, 2019). Further research would be required to determine whether dolphin prey species benefit from the presence of mussel farms and whether, dolphins in turn, benefit from potential prey concentrations.

Despite there being uncertainty in 1) the role that mussel farms have played in the behavioural change of dusky dolphins in Admiralty Bay; and 2) the ongoing effect of mussel farms on prey availability (also see **Section 4.4**), the behavioural plasticity of dusky dolphins, as it relates to foraging strategy, is a positive trait that presumably supports adaptations in changing environments.

As identified earlier, New Zealand fur seals are commonly observed resting on mussel floats in Admiralty Bay (Clement & Halliday, 2014) and it is not uncommon for this species to opportunistically utilise man-made structures (such as mussel farms) as additional haul-out habitat. The behavioural implication here is attraction and is not anticipated to have any adverse outcomes.

No behavioural changes associated (or potentially associated) with mussel farms are apparent for other marine mammal species in Admiralty Bay. However, the increased presence of common dolphins in the embayment since the early 2000s (summarised by Piwetz et al., 2024) is noteworthy and interspecific behavioural interactions between common and dusky dolphins are likely to increase, although the co-occurrence of these two species are often observed in other regions and to date have not been described as aggressive (Markowitz, 2004) although competition for prey could arise when large numbers of common dolphins are present in Admiralty Bay (Piwetz et al., 2024).

4.3.1 Recommended Mitigations

There are no specific mitigations that are recommended in relation to reducing potential behavioural changes; however further monitoring of dolphin presence and behaviour in and around the project area may help to clarify the role that mussel farms play in the observed foraging strategy changes of dusky dolphins in Admiralty Bay. As recommended in **Section 4.2.1**, the development and implementation of a Marine Mammal Monitoring Programme is recommended prior to farm establishment.

The implementation of the monitoring proposal presented by Taylor (2016) to determine whether mussel farms provide any benefit to small pelagic finfish prey species of dusky dolphin in Admiralty Bay would also be helpful. Such a study would assist with evaluating any potential energetic consequences of a switch to individual foraging by dolphins, as would assessing the ongoing abundance of pilchards and other preferred prey species of dolphins in the bay.

4.3.2 Assessment Results

Foraging behaviour of dusky dolphins in Admiralty Bay has changed in the last 20 years from cooperative prey ball herding in open water to individual foraging strategies that commonly occur near (but not inside) mussel farms. While individual foraging strategies are energetically more demanding, dolphins may have been forced to adopt these strategies given herding behaviours appear to be compromised for unknown reasons which may or may not include 1) the presence of mussel farms, 2) changes in prey availability (see **Section 4.4**), and 3) changes in dolphin abundance (see **Section 4.9**).

The overall level of impact of potential behavioural changes on marine mammals arising due to the proposed marine farms ranges from net gain to medium (**Table 7**).

Table 7 Behavioural effects on marine mammals – assessment findings.

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
New Zealand fur seals	Low	Likely continuous presence in and around Admiralty Bay.	Positive, increase in haul-out opportunities.	High	Net gain

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
Common dolphins	Low	Likely frequent presence in and around Admiralty Bay, especially in mid-late winter and early spring.	Negligible, very slight change from baseline conditions. No concern.	Low	Negligible
Dusky dolphins	Low	Likely frequent presence in and around Admiralty Bay, especially from late autumn to late spring.	Moderate, partial change to foraging behaviour, detectable changes to population dynamics.	Moderate, effects only experienced intermittently due to non-continuous presence	Medium
Bottlenose dolphins	Very High	Likely frequent presence in and around Admiralty Bay.	Negligible, very slight change from baseline conditions. No concern.	Negligible	Negligible
Killer whales	Very High	Likely sporadic presence in and around Admiralty Bay.	Negligible, very slight change from baseline conditions. No concern.	Negligible	Negligible
Humpback whales	Low	Possible, seasonal presence in both coastal and offshore waters of the region.	Negligible, very slight change from baseline conditions. No concern.	Negligible	Negligible
Southern right whales	Moderate	Possible seasonal presence in coastal waters of the region.	Negligible, very slight change from baseline conditions. No concern.	Negligible	Negligible

4.4 Trophic Interactions

Mussel farming results in effects on both the seabed and the water column, both of which have the potential to result in trophic interactions for marine mammals.

Seabed effects are summarised by Keeley (2009) as “biodeposits and drop-off of shell and associated biota” leading to sediment smothering and enrichment. However, Stenton-Dozey & Broekhuizen (2019) noted that mussel shell mounds and clumps of live mussels beneath farms oftentimes create heterogenous habitat that supports other flora and fauna (i.e. scavengers, detritivores and predators) and stabilises sediments. These authors found that species richness and abundance was slightly elevated under farms compared to non-farmed areas. While benthic effects are usually highly localised, ranging from tens to hundreds of metres (MPI, 2013), water depth and current characteristics play a key part in determining the benthic zone of impact. As the project area occurs in deep water of Outer Admiralty Bay and experiences regular tidal influences and wave action, the predicted seabed effects associated with the proposed mussel farms are likely to be relatively low level compared to

what would be expected at farm sites in shallow and more sheltered waters (Davidson, 2021).

Changes to benthic communities can have flow on effects for benthic predators (Würsig & Gailey, 2002). Of the marine mammals identified as potentially being present in and around the project area, Admiralty Bay is generally regarded as foraging habitat for dusky dolphins, common dolphins, and New Zealand fur seals. Noting that on occasion killer whales and bottlenose dolphins may opportunistically forage in the area as they are passing through. Benthic prey is reportedly taken by all these species (**Table 8**). However, for the following reasons seabed effects are unlikely to be of ecological significance:

- The zone of benthic impact is predicted to be low level and localised around the proposed farm structures (Davidson, 2021);
- Marine mammals are highly mobile and have ample opportunity to avoid areas of seabed effects around marine farms;
- Dusky dolphins and common dolphins are known to target small schooling pelagic fish in Admiralty Bay and benthic prey is not an important part of their diet here;
- Fur seals are opportunistic and potentially benefit from wild fish aggregations (including benthic prey) under mussel farms; and
- Admiralty Bay is not habitually used as foraging habitat by bottlenose dolphins or killer whales.

Table 8 Foraging ecology of marine mammals that could occur in Admiralty Bay.

Species	Foraging Ecology	Benthic Prey?
Dusky dolphin	In New Zealand, prey type and foraging strategy depends on season/region; with dolphins in Kaikoura feeding at night on meso-pelagic prey (e.g. squid and myctophid fish) in the deep scattering layer, and dolphins in Admiralty Bay feeding on small pelagic schooling fish (e.g. pilchard, yellow-eyed mullet and sprat) during the day (Würsig et al., 2007). While demersal species have been recorded, prey is typically pelagic for this species (de Castro et al. 2016).	No
Common dolphin	Diet is diverse, with primary prey being pelagic arrow squid, jack mackerel and anchovy. However, full diet does include some benthic prey (Meynier et al., 2008). Diet changes with body size, sex and season (Peters et al., 2020). Diet includes both benthic and pelagic prey.	Yes
Bottlenose dolphin	Varied diet of fish and squid (Blanco et al., 2001; Gowans et al., 2008, Constantine & Baker, 1997). Foraging dives in both shallow and deep habitats (to depths of over 500 m) (Wells & Scott, 2009). Diet includes both benthic and pelagic prey.	Yes
Killer whale	North Island killer whales are generalist foragers that opportunistically take advantage of prey (Visser, 2007). Benthic foraging for rays is known to be common around New Zealand's coast (Visser, 1999). Diet includes both benthic and pelagic prey.	Yes

Species	Foraging Ecology	Benthic Prey?
New Zealand fur seal	Forage on a range of species. Relative importance of each prey item is seasonal: arrow squid are important in summer and autumn, lanternfish are taken year-round, barracouta and jack mackerel are major contributors to the summer diet, while red cod, ahuru, and octopus are important in winter (Harcourt et al., 2002). Diet includes both benthic and pelagic prey.	Yes
Humpback whale	Feed on krill and small pelagic schooling fish by lunge feeding in mid- or surface waters (Murase et al., 2002). Diet does not include benthic prey.	No
Southern right whale	Do not typically feed during coastal winter presence in New Zealand (Carroll et al., 2011). Utilise offshore summer feeding grounds in Antarctic waters to feed on krill by lunge feeding in mid- or surface waters. Diet does not include benthic prey.	No

Given that Admiralty Bay provides seasonally important foraging habitat for dusky dolphins (and possibly common dolphins) that target small pelagic schooling fish in the bay, water column effects could influence prey availability for these dolphins. The effects of mussel farms on surrounding waters is variable; in some circumstances increased nitrogen levels (La Rosa et al., 2002) and decreased chlorophyll *a* levels (a proxy for phytoplankton) (Grange and Cole 1997; Ogilvie et al. 2000) have been observed in and around mussel farms. These findings are attributed to mussels being net producers of dissolved inorganic nitrogen and direct consumers of phytoplankton. Conversely, and in terms of chlorophyll *a*, both Newcombe and Broekhuizen (2020) and Giles (2021) reported a lack of evidence to support the notion that chlorophyll *a* (or phytoplankton) levels are linked to mussel farming in the Marlborough Sounds. Hartstein (2021) states that *“it is not that the [water column] effects of farms at a regional scale are unknown, but rather that those effects are difficult to tease out from background variation, likely because the size of that effect size is small”*. It is unknown to what extent the existing mussel farms are depleting phytoplankton abundance in Admiralty Bay, but it is theoretically possible that phytoplankton depletions or reduced nutrient turnover could reduce the abundance and distribution of the planktivorous fish that dolphins target in the bay (Srinivasan et al., 2012).

Predator distribution is intrinsically linked to that of their prey. In keeping with this, McFadden (2003) hypothesised that decreased dusky dolphin sightings in winter 2002 related to prey availability and that decreased sightings could potentially be explained by a shift in prey distribution away from Inner Admiralty Bay during the study period. Likewise, Markowitz (2004) also noted that dolphin abundance and distribution is likely to be related to prey availability and that some years dusky dolphins used Outer Admiralty Bay more when prey was limited in Inner Admiralty Bay. Markowitz (2004) concluded that dolphin use of Admiralty Bay showed inter-annual variation, apparently linked to the local abundance and distribution of prey, whereby the distribution of schooling fish accounts for observed inter-annual differences in encounter rates and abundance.

While the presence of mussel farms could theoretically affect prey distribution, climatic and oceanic processes are known drivers of ecosystem productivity. To explore declining trends in dusky dolphin encounter rates (number of groups seen per hour of survey effort) from 2001 to 2006, Srinivasan et al. (2012) investigated trophic relationships, and oceanographic and climatic variables affecting Admiralty Bay and concluded that lower dolphin encounter rates and feeding activity in winter corresponded with reduced sea surface temperatures (SST), and climatic characteristics of cooler El Niño Southern Oscillation (ENSO) events. Conversely, increased dolphin encounter rates were linked to increased SST. The distribution and spawning preferences of pilchards in particular are linked to SST and upwelling conditions (Lluch-Belda et al. 1992). On this basis, it appears likely that

oceanographic and climatic variables play a greater role in the distribution and availability of schooling fish in Admiralty Bay than the presence of marine farms. Interestingly, while low dolphin encounter rates corresponded with El Niño patterns during the winters of 2001 to 2006 (Srinivasan et al., 2012), Piwetz et al. (2024) also reported low encounter rates in winter 2011 and 2012, but these years were not characteristic of El Niño (Statistics New Zealand, 2025). Hence, the relationship between dolphin presence and ENSO events may not be entirely clear cut.

Regardless of the cause of prey variability in Admiralty Bay (natural fluctuations or anthropogenic or a combination of factors), it is interesting that McFadden (2003) documented that returning dolphins (i.e. individuals that had previously been seen in the bay) were encountered on significantly more days than new dolphins. This author hypothesised that returning animals have expectations of resource availability based on previous experience, and new animals that encounter low prey levels are less likely to remain. It follows that if prey availability in Admiralty Bay decreases, then dolphin abundance would be expected to decrease through time as positive prey experiences decline. Current decreases in dusky dolphin abundance in Admiralty Bay (as reported by Piwetz et al., 2024; and summarised in **Table 2**) could therefore be attributed to reduced prey availability; however, the role that existing mussel farms play in this relationship is unknown. It is however noteworthy that most mussel farms in Admiralty Bay were established in the 1980s and 1990s, with over 80% of the current total farmed area here occupied by 1998 (see **Appendix B** for an establishment timeframe of mussel farms in Admiralty Bay). Any water column effects associated with mussel farming would therefore have been present prior to 2003 which marked the beginning of the reported decline in dolphin presence in the bay.

Given the niche overlap between dusky dolphins and common dolphins (Halliday, 2013), it seems likely that any trophic level effects that arise for dusky dolphins will also be relevant to common dolphins. Resident fur seals could also be subject to similar effects given they too have been observed foraging on small schooling planktivorous fish in Admiralty Bay (McFadden, 2003; Markowitz, 2004). Trophic effects will be less of a concern for other species that are less frequently present in Admiralty Bay (killer whales) or that utilise the bay for reasons primarily other than foraging (bottlenose dolphins, humpback whales, southern right whales).

4.4.1 Recommended Mitigations

Some seabed effects and water column effects are unavoidable in the presence of mussel farms. Furthermore, the trophic interactions and the role that these have on marine mammal distribution and abundance in the bay are unclear. Therefore, no specific mitigations are recommended in relation to potential trophic interactions associated with the establishment of marine farms. However, further research into the ongoing abundance and use of Admiralty Bay by pilchards and other potential dolphin prey species would be helpful in elucidating potential drivers for dolphin distribution and abundance.

4.4.2 Assessment Results

While it is possible that marine mammals will be adversely affected by potential trophic interactions associated with the proposal, 1) it seems unlikely that benthic effects from the establishment of the two new farms will result in ecologically significant effects, and 2) the effects of mussel farms in altering prey availability is unclear but the establishment of the two new farms is unlikely to be as influential as larger scale climatic and oceanic processes. On this basis, the overall level of impact of potential trophic interactions ranges from negligible to very low (**Table 9**).

Table 9 Trophic Interaction effects on marine mammals – assessment findings.

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
New Zealand fur seals	Low	Likely continuous presence in and around Admiralty Bay.	Low, minor shift away from baseline conditions. No change to population dynamics.	Low probability of mussel farms significantly influencing prey availability	Very low
Common dolphins	Low	Likely frequent presence in and around Admiralty Bay especially in mid-late winter and early spring.	Low, minor shift away from baseline conditions. No change to population dynamics.	Low probability of mussel farms significantly influencing prey availability	Very low
Dusky dolphins	Low	Likely frequent presence in and around Admiralty Bay, especially from late autumn to late spring.	Low, minor shift away from baseline conditions. No change to population dynamics.	Low probability of mussel farms significantly influencing prey availability	Very low
Bottlenose dolphins	Very High	Likely frequent presence in and around Admiralty Bay.	Negligible, very slight change from baseline conditions. No concern.	Negligible	Negligible
Killer whales	Very High	Likely sporadic presence in and around Admiralty Bay.	Negligible, very slight change from baseline conditions. No concern.	Negligible	Negligible
Humpback whales	Low	Possible, seasonal presence in both coastal and offshore waters of the region.	Negligible, very slight change from baseline conditions. No concern.	Negligible	Negligible
Southern right whales	Moderate	Possible seasonal presence in coastal waters of the region.	Negligible, very slight change from baseline conditions. No concern.	Negligible	Negligible

4.5 Entanglement

Despite a long history of mussel farming in New Zealand (c. 50 years) few marine mammal entanglements have been reported. **Table 10** summarises the known fatal entanglements in aquaculture structures in New Zealand. In total, only five fatalities in mussel farms have been recorded, and for two of these it is probable that the whale was already dead before it

became entangled. In contrast, 16 fatalities in finfish farms are reported over the same period.

In addition, a juvenile humpback whale was entangled in a mussel farm in Marlborough in 2011; noting that this whale already had a craypot buoy tangled around its tail and had been marked with buoys by DOC the day before to assist with tracking the whales movements. It was freed alive by marine farm workers (Stuff, 2011).

Table 10 Fatal marine mammal entanglements in New Zealand aquaculture structures reported over the last 50 years.

Culture Type	Species Entangled	Number of Fatal Entanglements
Mussel Spat Catching Farm	Bryde's whale (both Hauraki Gulf)	2
Mussel Spat Catching Farm	Humpback whale (Firth of Thames)	1*
Mussel Cultivation Farm	Sei whale (Port Ligar)	1*
Mussel Cultivation Farm	Minke whale (Admiralty Bay)	1
Salmon Sea-Cage Farm	NZ fur seal	6
Salmon Sea-Cage Farm	Dusky dolphin	7
Salmon Sea-Cage Farm	Hector's dolphin	2
Salmon Sea-Cage Farm	Bottlenose dolphin	1
Notes: - Incidents marked with an asterisk denote animals found in an advanced state of decomposition and likely dead before they became entangled (A. Baxter, DOC, pers. comm 2019; and NZ Herald, 2015). - While the DOC Incident Database reports two entangled whales in Port Ligar (a day apart), this is likely a data entry replication, with two incident reports filed for the same animal. - Locational information only provided in relation to mussel farms (most relevant to this proposal).		

Both the attributes of species that may come into contact with farm structures, and farm design/maintenance/operation affect the risk of marine mammal entanglement. In terms of the biological attributes, MPI (2013) summarised factors that influence entanglement risk for different marine mammal species as:

- Echolocation: species that echolocate can more readily detect obstacles in the water column;
- Behaviour: inquisitive animals will be more at risk, as will species that have a propensity to roll;
- Morphology and size: large baleen whales with large fins/flukes and gaping mouths may be more at risk from entanglement in structures; and
- Agility: smaller agile species may be at less risk.

Even on a global scale only a small number of marine mammal fatalities have been attributed to mussel farming structures: a harbour porpoise and a juvenile humpback whale both reportedly died after becoming entangled in single dropper spat collecting lines in Iceland in 1998 and 2010 respectively (Price et al., 2017). In addition, one humpback whale calf was cut free after becoming entangled in a mussel crop line in Western Australia in 2005 and one juvenile North Pacific right whale was released after becoming entangled in a mussel farm anchor line in South Korean waters in 2015 (as summarised by Price et al., 2017). In contrast it is not uncommon for baleen whales (namely humpback and minke whales) to be observed by mussel farm workers in Iceland, and despite this, no fatal whale entanglement incidents in cultivation ropes have been reported (Young, 2015).

It is generally recognised that marine mammals are at a higher risk of entanglement when they interact with lines that are slack in the water as opposed to lines that are maintained under tension (Lloyd, 2003; Keeley et al., 2009; Clement, 2013; Würsig, 2020). For

entanglement to occur a line needs to first catch on or wrap around a body part of a marine mammal (Johnson et al., 2005; Benjamins et al., 2012).

The lines used for mussel cultivation are taut under the growing product load (MPI, 2013; Price et al., 2017) where tension increases as the weight of the crop progresses towards a harvestable size. Of relevance to the CML proposal is that mussel spat holding lines are comparatively light weight and under less tension compared to mussel cultivation ropes. It is noteworthy that all but one of the relevant examples of mussel farm fatalities listed in **Table 10** are attributable to spat collecting lines. MPI (2013) concludes that the risk of entanglement of medium-to-large-sized whales is thought to be greater for spat lines than cultivation lines. This conclusion is echoed by Young (2015) who found that spat-collecting ropes, or the buoy lines connected to them, posed a greater entanglement risk than other ropes used in the mussel cultivation process.

It follows that the risk of entanglement from mussel production should be viewed as a continuum where risk will be highest in instances when freshly deployed bare spat collecting lines are present in the water column and lowest for cultivation lines holding a mature crop. While the deployment of spat holding lines, as proposed by CML in the project area, will represent an intermediate risk, it is noteworthy that at the start of each harvest cycle, all cultivation farms begin with lines that are under significantly less tension than those holding a mature crop, yet still very few marine mammals have reportedly been entangled in cultivation farms. On this basis, tangible risk to marine mammals from mussel longline operations probably only occurs in the early stages of the spat collecting cycle. This risk profile is reflected in the entanglement record where fatal entanglements (although extremely rare events) are more prevalent in spat collecting operations than cultivation lines.

Overall, entanglement of marine mammals in mussel farms is low risk when farm sites are selected to minimise overlap between farming activities and important marine mammal habitat and when good farm management practices are adopted, i.e. lines are kept tensioned, and no loose ropes are left trailing at the surface or in the water column (Clement, 2013; MPI, 2013). The specific considerations for odontocetes (dolphins and toothed whales) and baleen whales are discussed below, noting that baleen whales will only occur as occasional visitors to Admiralty Bay.

Odontocetes echolocate to navigate and forage, and in most cases this ability allows them to navigate through or around mussel farms (Lloyd, 2003; Markowitz et al., 2004). While this does not ensure complete protection (as they do not echolocate continuously; Würsig, 2020), the risk of entanglement in mussel longlines is typically lower for odontocetes than baleen whales (Lloyd, 2003), and no records of entanglement have been reported for odontocetes in mussel farms to date (**Table 10**).

The odontocetes expected to be present in and around the project area are common dolphins, dusky dolphins, bottlenose dolphins, and orca. These species all have extensive home-ranges, and their coastal nature means that these species are not naïve to manmade objects and probably encounter lines and buoys (moorings, cray pots, etc) on a reasonably frequent basis. Interestingly, entanglements in cray pot lines have been reported for most odontocete species expected in the project area (common dolphin x1, bottlenose dolphins x1; DOC Marine Mammal Stranding Database and orca x6; Laverick et al., 2017); however, the prevalence of this gear in coastal waterways compared to the relatively low number of entanglements suggests that entanglements are rare occurrences. Furthermore, being set individually, and being relatively thin (8 – 16 mm) with a length of slack line near the surface, cray pot lines would pose a higher entanglement risk than mussel lines (cultivation or spat lines) as they would be more difficult to detect.

Overall, the likelihood of entanglement of odontocetes in mussel farm structures in the project area is negligible.

Baleen whales are predicted to be present as occasional visitors in the project area. While baleen whales don't echolocate, evidence suggests that they can detect and avoid lines in the water, for instance Kot et al. (2012) monitored the response of minke whales to vertical underwater ropes in a coastal environment and noted that individual whales slowed down and altered their bearing to avoid the rope. Here detection mechanisms were hypothesised to be both visual and passive acoustic (related to the production of low frequency sounds).

Despite this, the small number of fatal baleen whale entanglements in mussel farm lines in New Zealand (**Table 10**) suggest that, while unlikely, entanglement is still possible. The likelihood of baleen whale entanglement in the proposed farms is considered to be low for the following reasons:

- The project area does not overlap with the Cook Strait whale migratory pathway;
- The project area is unlikely to be used as feeding habitat by baleen whales. In particular, lunge feeding around farm structures (which could increase the risk of entanglement) is unlikely;
- It is probable that baleen whales can detect and avoid lines in the water;
- The proposed mussel farm lines will be hung in dense aggregations which will improve their detectability and no bare spat catching lines will be deployed; and
- Humpback and southern right whales are seasonal visitors to the Marlborough Sounds (DOC Sightings Database) where most of the mussel cultivation in New Zealand occurs (59% of total Greenshell mussel production; Aquaculture NZ, 2025) and no fatal entanglements have yet been reported for these species here.

While New Zealand fur seals can be attracted to mussel farms, the smaller size of this species and their agility underwater put them at lower entanglement risk than larger less agile species (MPI, 2013). In general, pinnipeds are less likely to suffer negative impacts from shellfish farms than whales or dolphins (Würsig & Gailey, 2002), with no reported entanglements globally (Price et al., 2017). On this basis, the likelihood of entanglement for New Zealand fur seals (or other pinniped species) from the proposed farms is negligible.

4.5.1 Recommended Mitigations

CML are members of Aquaculture New Zealand and operate their marine farms in accordance with the A+ New Zealand Sustainable Aquaculture Guidelines and follow all the best management practices in there as they relate to marine mammals including ensuring structural integrity of the farm. They have had no line breakages on the existing Hapuku farm since it commenced operations in 1996.

To minimise the potential effects of entanglement on marine mammals from the establishment of the proposed farms the following mitigations should be implemented:

- Ongoing compliance with the A+ New Zealand Sustainable Aquaculture Programme;
- The thickest, tautest, lines/droppers practicable should be used to increase detectability of all obstacles by marine mammals and to reduce the potential for entanglement;
- In particular, spat holding operations should avoid the use of thin, loose lines. Instead, droppers with a weighted core that are designed to remain hanging vertically in the water column should be used, thereby minimising any slack in the droppers and reducing the potential formation of any loops within the vertical portion of the rope that could encircle part of a marine mammal; and
- The proposed farms should be operated in accordance with best practice, i.e. no free or loose ropes/lines; all ropes/lines should be maintained under tension, anchor

warps should not overlap or cross between farm blocks; farm maintenance should be prioritised (e.g., keeping ropes/lines well tensioned, promptly repairing any damaged equipment etc.).

4.5.2 Assessment Results

As reported in **Section 3.2**, Admiralty Bay is frequently used by several marine mammal species; and is specifically recognised as important seasonal foraging habitat for dusky dolphins (**Section 3.3**). As well as providing habitat for marine mammals, Admiralty Bay is occupied by a large number of mussel farms and despite this few entanglements have been reported. In particular, over the 20 years of operating the existing Hapuku Rock farm, no marine mammal entanglement incidents have occurred.

Assuming the recommended mitigations outlined in **Section 4.5.1** are adopted, the likelihood of entanglement of marine mammals is negligible (odontocetes and pinnipeds) to low (baleen whales). The magnitude of effect is considered to be negligible, as no fatalities are anticipated. On this basis, the overall level of impact is negligible for all marine mammal species (**Table 11**).

Table 11 Entanglement effects on marine mammals – assessment findings.

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
New Zealand fur seals	Low	Likely continuous presence in and around Admiralty Bay.	Negligible, no discernible effect on the known population. no concern.	Negligible	Negligible
Common dolphins	Low	Likely frequent presence in and around Admiralty Bay especially in mid-late winter and early spring.	Negligible, no discernible effect on the known population. no concern.	Negligible	Negligible
Dusky dolphins	Low	Likely frequent presence in and around Admiralty Bay, especially from late autumn to late spring.	Negligible, no discernible effect on the known population. no concern.	Negligible	Negligible
Bottlenose dolphins	Very High	Likely frequent presence in and around Admiralty Bay.	Negligible, no discernible effect on the known population. no concern.	Negligible	Negligible
Killer whales	Very High	Likely sporadic presence in and around Admiralty Bay.	Negligible, no discernible effect on the known population. no concern.	Negligible	Negligible

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
Humpback whales	Low	Possible, seasonal presence in both coastal and offshore waters of the region.	Negligible, no discernible effect on the known population. no concern.	Low	Negligible
Southern right whales	Moderate	Possible seasonal presence in coastal waters of the region.	Negligible, no discernible effect on the known population. no concern.	Low	Negligible

4.6 Vessel Strike

Collisions between vessels and marine mammals are recognised as an increasing conservation concern globally (IWC, 2014). Vessel strikes usually involve a vessel's bow or propeller (Peel et al., 2018) and typically result in physical trauma (with a potential decrease in animal fitness over time) or death (immediately or subsequent to the incident) (Moore et al., 2013).

A number of factors influence the likelihood of collisions as follows:

- Vessel size – larger vessels (> 80 m) are more frequently involved in collisions with marine mammals than smaller vessels (Laist et al., 2001; Jensen & Silber, 2003). This is influenced by the fact that large vessels typically have deeper drafts (i.e. a larger strike zone), less manoeuvrability (i.e. greater response time to initiate and adjust an avoidance manoeuvre), and larger distances to avoid an animal (Schoeman et al., 2020);
- Vessel speed – A vessel poses a higher risk when travelling at speed due to the higher speeds resulting in a stronger impact/force (Schoeman et al., 2020), increasing the risk of blunt force trauma (Wang et al., 2007). Higher vessel speeds also decrease the probability of detection of marine mammals (and vice versa), increasing the probability of collision (Gende et al., 2011). Most lethal marine mammal collisions involve vessels travelling at faster speeds (> 12 knots; Laist et al., 2001; Vanderlaan & Taggart, 2007);
- Species – Although large whales are the most common victims of ship strike (e.g. fin whales, right whales, humpback whales, minke whales and sperm whales) (Laist et al., 2001; Jensen & Silber, 2003; Van Waerebeek et al., 2007)), a recent global review of ship strike incidents by Schoeman et al. (2020) found a total of 61 marine mammal species have been involved in a ship strike incident, including several smaller species; and
- Behaviour – i.e. behaviour at the surface, behavioural response to vessels, and hearing capability. Behaviours such as resting, foraging, nursing, and socialising likely distract animals from detecting risks (e.g. an approaching vessel) (Dukas, 2002). Species that remain at or near the sea surface for extended periods are particularly vulnerable to collisions (Laist et al., 2001; Constantine et al. 2012), as are species that are attracted to vessels (Bejder et al. 1999; Würsig et al., 1998).

All marine mammal species, including all species with a potential presence in the wider region through which service vessels will transit, are at risk of being involved in a collision incident. However, the size and agility of dolphins and seals mean that these groups are more adept at avoiding contact with vessels (Schoeman et al., 2020). Available evidence

(i.e. Jensen & Silber, 2003) suggests that the risk is greatest for large whales (e.g. baleen whales such as humpback and southern right whales).

Vessel speed is the most influential factor in determining the severity of a vessel-strike incident (Jensen & Silber, 2003), with faster vessel speed resulting in a higher probability of mortality in the event of a collision (Jensen & Silber, 2003; Schoeman et al., 2020). Jensen & Silber (2003) reported that the mean vessel speed resulting in ship strike mortality was 18.6 knots. Similarly, Laist et al. (2001) reported that most lethal ship-strikes involved vessels travelling at speeds ≥ 14 knots, while Vanderlaan and Taggart (2007) reported that the probability of a lethal injury dropped below 0.5 when vessels travelled at a speed of 11.8 knots or less.

As described in **Section 2.0**, vessels will travel mostly from Havelock (at the head of Pelorus Sound) to service the proposed farms; however occasionally they may come from Tarakohe in Golden Bay. The average speed of the service vessels is 11 knots. In keeping with the findings of Vanderlaan and Taggart (2007), this operational speed (which on average is less than the threshold of 12 knots) will reduce the probability of a lethal vessel strike.

CML are members of the 'A+ New Zealand Sustainable Aquaculture' programme and adhere to the following requirements that contribute to minimising the risk of vessel strike:

- Reducing vessel speed in the vicinity of marine mammals; and
- Ensuring vessels have access to and comply with the DOC guidelines for 'sharing our coasts with marine mammals' (DOC, 2025).

4.6.1 Recommended Mitigations

The mitigation recommendations provided below outline legal obligations and additional measures that are easy and practical to implement, and which serve to further minimise the already low operational risk of vessel strike from the proposed mussel farming activities on marine mammals. The recommended mitigations are:

- Ongoing compliance with the A+ New Zealand Sustainable Aquaculture Programme;
- Service vessels must be operated in accordance with the Marine Mammal Protection Regulations 1992 (MMPR); The MMPR stipulate the requirements for operating vessels around marine mammals including:
 - Vessel operators shall endeavour not to disrupt the normal movement or behaviour of marine mammals;
 - Care should be taken not to separate any individuals from, or scatter any groups of marine mammals and no vessel shall proceed through a pod of dolphins;
 - No sudden or repeated change in the speed or direction of any vessel shall occur in the vicinity of marine mammals (except in emergency circumstances);
 - No vessel shall cut off the path of a marine mammal;
 - Vessels less than 300 m from a marine mammal shall move at a constant slow (no wake) speed. In the case of dolphins, vessels may exceed this speed in order to out-distance the dolphins but must increase speed gradually, and shall not exceed 10 knots within 300 metres of any dolphin;
 - No vessel shall approach within 50 m of a whale, and if a whale approaches a vessel, the vessel shall make every attempt to keep out of the path of the whale and to maintain a minimum distance of 50 m; and
 - No vessel shall approach within 200 m of a baleen whale or sperm whale with a calf.

- Vessel Masters and crew should maintain vigilance for marine mammals during marine farming operations and complete a marine mammal sighting form for each cetacean sighting that is made; and
- All vessel strike incidents or near incidents, regardless of outcome, should be recorded and reported.

4.6.2 Assessment Results

Compliance with the MMPR regulations during the proposed activities will serve to reduce the likelihood of marine mammal vessel strikes. The following considerations are also of relevance:

- Despite being attracted to vessels, the size and agility of dolphins and fur seals (the main species that work vessels are likely to encounter in and around Admiralty Bay) means that these groups are more successful at avoiding potential collisions.
- The coastal region is regularly frequented by commercial and recreational vessels so marine mammals in the region are not naïve to vessel presence here;
- CML have been undertaking marine farming operations in Admiralty Bay since 1996 and have never recorded a collision incident between a farm vessel and any marine mammal; and
- Vessel movements do not specifically require consent.

While it is recognised that the likelihood of vessel strike varies with species (on the basis that baleen whales are more prone to ship strike incidents), with the implementation of the recommended mitigations, no collisions are anticipated. The overall level of impact of vessel strike from the proposed marine farming activities (including transit) is negligible (**Table 12**).

Table 12 Vessel strike effects on marine mammals – assessment findings.

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
New Zealand fur seals	Low	Likely continuous presence in and around Admiralty Bay.	Negligible, no discernible effect on the known population. no concern.	Negligible	Negligible
Common dolphins	Low	Likely frequent presence in and around Admiralty Bay especially in mid-late winter and early spring.	Negligible, no discernible effect on the known population. no concern.	Negligible	Negligible
Dusky dolphins	Low	Likely frequent presence in and around Admiralty Bay, especially from late autumn to late spring.	Negligible, no discernible effect on the known population. no concern.	Negligible	Negligible
Bottlenose dolphins	Very High	Likely frequent presence in and around Admiralty Bay.	Negligible, no discernible effect on the known population. no concern.	Negligible	Negligible

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
Killer whales	Very High	Likely sporadic presence in and around Admiralty Bay.	Negligible, no discernible effect on the known population. no concern.	Negligible	Negligible
Humpback whales	Low	Possible, seasonal presence in both coastal and offshore waters of the region.	Negligible, no discernible effect on the known population. no concern.	Low	Negligible
Southern right whales	Moderate	Possible seasonal presence in coastal waters of the region.	Negligible, no discernible effect on the known population. no concern.	Low	Negligible

4.7 Underwater noise

The use and interpretation of sound is fundamental to marine mammal survival; being used for communication (e.g. Quick & Janik, 2012), foraging, navigation, reproduction, parental care, avoidance of predators, and maintaining an overall awareness of their environment (Thomas et al., 1992; Johnson et al., 2009). Toothed whales and dolphins use echolocation to forage and navigate, whilst all marine mammals are believed to use passive listening to gather useful navigational cues (e.g. the sound of waves breaking on coastline etc.). Marine mammals are therefore susceptible to effects from anthropogenic underwater noise. Underwater noise can result in 1) physiological consequences, 2) behavioural responses, and/or 3) the masking of biologically important sounds. These potential effects are summarised below:

- **Physiological Effects:** Marine mammals may be subject to several potential physiological effects from underwater noise, including stress responses (Romano et al., 2004), organ damage (Cox et al., 2006) and permanent or temporary threshold shifts (**PTS** or **TTS**, i.e. permanent or temporary hearing loss) (DOC, 2013; Lucke et al., 2009). However, for most marine mammals, the sound intensity (energy levels, frequencies and duration) required to elicit physiological effects are unknown (Richardson et al., 1995). Permanent physiological damage to date has only been associated with very high intensity underwater noise such as military sonar (Cox et al., 2006; Ketten, 2014), and most mobile species, if given the opportunity, avoid the range in which physiological effects occur. On this basis physiological effects are irrelevant to the proposed establishment of the two marine farms.
- **Masking:** Masking refers to the reduced ability of individuals to receive and interpret important naturally occurring acoustic signals (e.g. marine mammal vocalisations) in the presence of anthropogenic noise (Erbe & Farmer, 2000). The likelihood of masking is determined by how much overlap occurs between the frequency of animal vocalisations and the frequency of anthropogenic sounds (Richardson et al., 1995). Low frequency sounds travel further through water than high frequency sounds; hence, low frequency anthropogenic noise is often associated with masking the low frequency calls of baleen whales (Simmonds et al., 2004; Clark et al., 2009). While some species are known to compensate for masking by changing the frequency of vocalisations (e.g. right whales; Parks et al., 2007 and bottlenose dolphins; Sobreira

et al., 2023), increasing calling rate (bottlenose dolphins; Buckstaff, 2004) and changing call durations (e.g. killer whales; Foote et al., 2004 and bottlenose dolphins; Sobreira et al., 2023), even relatively low intensity underwater noise can cause some masking. The biological significance of any masking will depend on 1) the significance of the habitat affected and 2) the duration of the impact, where widespread and ongoing masking in habitat of high importance will lead to consequences of greatest ecological significance.

- **Behavioural Effects:** Underwater anthropogenic noise most commonly results in interruption to marine mammal behaviours (e.g. feeding, breeding, migrating or resting) (e.g. Finneran et al., 2000) and/or the displacement of marine mammals from habitat (e.g. Thompson et al., 2013). It is not unusual for high intensity acoustic disturbance to result in temporary avoidance by marine mammals (Stone & Tasker, 2006); however, some species are reportedly attracted to low/medium intensity disturbance (e.g. Würsig et al., 1998; Simmonds et al., 2004; Lalas & McConnell, 2016; Mills et al., 2024). Avoidance can be particularly significant if long-term displacement from important habitat occurs.

In order to assess the potential effects of underwater noise on marine mammals, an understanding of the noise characteristics is required. Construction noise will persist for only two weeks while anchors and backbones are installed. The noisiest component of construction will be during placement of the screw anchors. Baltzer et al. (2020) measured the noise generated during the placement of screw anchors during the establishment of a mussel spat farm in the Wadden Sea, concluding that the sound exposure level of the source was 148.2 dB re 1 $\mu\text{Pa}^2\text{s}$, and the median SEL ranged from 120 to 99 dB re 1 $\mu\text{Pa}^2\text{s}$ at 394 m and 2,300 m from the source respectively. This study also concluded that most energy was <1 kHz, meaning that screw anchor installation noise is mostly low frequency in nature.

The US National Marine Fisheries Service (NMFS) set out the threshold noise levels which are predicted to elicit physiological and behavioural effects for marine mammals (NMFS, 2024; NMFS, 2023). By comparing the indicative construction noise characteristics with the guidelines, the potential for physiological effects can be completely dismissed, as screw anchor installation noise is much quieter than the levels required to cause permanent hearing damage (which ranges from 195 to 201 dB re 1 $\mu\text{Pa}^2\text{s}$ depending on species) and temporary hearing damage (which ranges from 161 to 181 dB re 1 $\mu\text{Pa}^2\text{s}$ depending on species). NMFS (2023) recommends a threshold of 120 dB re 1 μPa is used to predict the onset of behavioural response. Using the findings of Baltzer et al. (2020) as a reasonable proxy, no behavioural responses beyond 400 m would be expected from screw anchor installation in Admiralty Bay. Within 400 m, construction noise could result in some short-term behavioural effects, for example attraction of more curious species (e.g. New Zealand fur seals, common dolphins, bottlenose dolphins: Clement, 2013); or displacement of other species (orca: Morton & Symonds, 2002). Construction noise could also result in some short-term masking of marine mammal vocalisations.

Vessel noise (including the use of generators, winches, pumps etc) will also form a component of the construction phase and will persist intermittently through the duration of the project as work vessels visit the farm periodically to seed and harvest the lines and to undertake any required farm maintenance. Vessels currently spend approximately 50 hours a year servicing the existing Hapuku Rock farm site, and this duration is expected to increase proportionally with the establishment of any new farms at this location. The use of vessels in the CMA does not however require a permit; and although vessel noise would be expected to be broadband (i.e. produce a mixture of low, medium and high frequencies), and intermittent exposure of marine mammals could cause some minor and short-term behavioural changes (e.g. temporary avoidance or attraction), the duration of exposure for any farm visit will be relatively short-lived (i.e. no more than an 8 hour work day at any one

time) and long periods between visits will mean that baseline soundscape conditions persist for the vast majority of the time in the outer bay. In addition, noise levels associated with ongoing farm operations are expected to be minimal relative to other coastal underwater noise sources (Clement, 2013; MPI, 2013).

The ecological significance of any underwater noise impact will generally be greatest when:

- The frequency of the anthropogenic noise overlaps with the frequency of animal vocalisations resulting in masking (Erbe et al., 2016). In terms of the proposal, the loudest component of the project will be low frequency noise associated with the installation of screw anchors. Low frequency baleen whales are seldom present in the bay. While broadband vessel noise will occur periodically, no more than minor temporary behavioural responses would be expected near the farm;
- The volume and intensity of the anthropogenic noise is high, and the duration is long or continuous (McGregor et al., 2013). In terms of the proposal, no high intensity underwater noise will be generated during the project. While the installation of screw anchors represents the most intense noise, the sound exposure levels are considered to be relatively low compared with many other common forms of underwater noise in the coastal environment (e.g. pile driving, dredging, commercial shipping etc.). All noise generated will be short-term in nature;
- The noise occurs in shallow or confined waters that provides important habitat to resident or threatened animal populations with small home ranges (Forney et al., 2013), and animals are subject to noise during periods of critical life history (e.g., breeding, feeding, resting, migrating etc.) (Dunlop et al., 2017). In terms of the proposal, Admiralty Bay is frequented by several species (see **Section 3.2**) including dolphins that can be seasonally resident for the purpose of foraging over extended periods (days to months). However, the relatively low intensity of the generated noise ensures that the potential effects will be limited to temporary and spatially restricted behavioural responses. Hence, large parts of unaffected habitat will be available to any marine mammals that may be present in Admiralty Bay during both construction and farm servicing activities; and
- The biological significance of any masking will depend on 1) the significance of the habitat affected and 2) the duration of the impact, where widespread and ongoing masking in habitat of high importance will lead to consequences of greatest ecological significance. In terms of the proposal, and despite Admiralty Bay being important foraging habitat for dusky dolphins and possibly common dolphins, the duration of any potential masking effect will be temporary and intermittent. Furthermore, it is likely that marine mammals that frequently use this habitat are most likely accustomed to equivalent ambient noise levels given the high number of existing marine farms in the bay.

4.7.1 Recommended Mitigations

As no physiological effects are predicted and the potential for behavioural responses in marine mammals will be limited to within 400 m of the construction site, and probably even closer to any service vessel, the only mitigation recommended to address underwater noise effects associated with the project is that vessels and on-board mechanical equipment be regularly maintained, including lubrication and repair of winches, generators, propulsion components and other potential noise sources in order to minimise the levels of underwater noise that are generated by construction activities and ongoing farm maintenance.

4.7.2 Assessment Results

The operational noise from construction activities will be of relatively low intensity and will be short-term in nature, taking place over several weeks. Some short-term behavioural effects

could occur within 400 m of construction activities and low-level masking is also possible during the construction period. The magnitude of effect during construction activities would be (at most) low.

Ongoing servicing of the farm by work vessels will be highly intermittent and associated underwater noise will be of no greater impact than that of other existing marine farms. Infrequent low level and spatially constrained behavioural responses and masking could also occur when service vessels are present in the project area. Furthermore, it is likely that marine mammals that frequently use Admiralty Bay are already accustomed to vessel noise associated with marine farm activities. The magnitude of effect during ongoing farm servicing would be negligible.

The assessment results are summarised in **Table 13**. With the recommended mitigations in place, the overall level of predicted effects will be low or very low during the construction phase, and negligible once construction is complete.

Table 13 Underwater noise effects on marine mammals – assessment findings.

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
New Zealand fur seals	Low	Likely continuous presence in and around Admiralty Bay.	Low during construction and negligible beyond.	Moderate	Low during construction
					Negligible beyond
Common dolphins	Low	Likely frequent presence in and around Admiralty Bay especially in mid-late winter and early spring.	Low during construction and negligible beyond.	Moderate	Low during construction
					Negligible beyond
Dusky dolphins	Low	Likely frequent presence in and around Admiralty Bay, especially from late autumn to late spring.	Low during construction and negligible beyond.	Moderate	Low during construction
					Negligible beyond
Bottlenose dolphins	Very High	Likely frequent presence in and around Admiralty Bay.	Low during construction and negligible beyond.	Moderate	Low during construction
					Negligible beyond
Killer whales	Very High	Likely sporadic presence in and around Admiralty Bay.	Low during construction and negligible beyond.	Low, less likely to be present	Very low during construction
					Negligible beyond
Humpback whales	Low	Possible, seasonal presence in both coastal and offshore waters of the region.	Low during construction and negligible beyond.	Negligible	Very low during construction
					Negligible beyond
Southern right whales	Moderate	Possible seasonal presence in coastal waters of the region.	Low during construction and negligible beyond.	Negligible	Very low during construction
					Negligible beyond

4.8 Marine debris

The term marine debris covers “*any persistent, manufactured or processed solid material discarded, disposed of or abandoned in the marine environment*” (Kruse et al., 2023). Marine litter, particularly plastics, can have negative effects on marine mammals primarily due to ingestion and entanglement (Panti et al., 2019). Any maritime vessel or marine or coastal operation is a potential source of marine debris, noting that the pathway for debris to enter the marine environment, relates to deliberate littering as well as accidental loss (e.g. plastic litter blowing overboard) or equipment failure (e.g. loss of floats or lines from marine farms to the environment).

When marine mammals encounter debris in their habitat, they are at risk of 1) becoming entangled (especially in thin lines or loose ropes, fishing nets etc) which can lead to injury or drowning; or 2) of ingesting foreign objects which in extreme cases can result in blockage of the digestive tract leading to death by starvation. Sublethal effects of ingestion may also present as malnutrition, disease and exposure to toxins (as summarised by Baulch & Perry, 2014).

Marine debris poses a significant threat to marine mammals on a global scale. While the rate of interactions between marine mammals and marine debris in New Zealand has not been quantified; Baulch and Perry (2014) reported approximately 500 marine litter interactions with cetaceans globally since the 1960s and concluded that the number of reported cases had steadily increased over this time. These authors reported that ingestion of debris had been reported for 48 cetacean species and entanglement in debris for 14 species.

Source reduction and debris removal are the primary methods of mitigation of potential effects of marine debris on marine mammals. New Zealand legislation requires that all vessels in the CMA (both commercial and recreational) comply with the Resource Management (Marine Pollution) Regulations 1998. These regulations give effect to Annex V of the MARPOL Convention which aims to eliminate and reduce the amount of debris being lost to sea from ships.

While marine farms have historically represented a significant source of marine debris to the coastal environment in parts of New Zealand (Lloyd, 2003), systems and operational practices have improved substantially through time, and the issue of marine debris from farms has decreased. CML are members of the ‘A+ New Zealand Sustainable Aquaculture’ programme and adhere to the following requirements relating to marine debris:

- Structures should be fit for purpose and installed and maintained so as to minimise the effects on the surrounding environment (i.e. ensuring structural integrity of the farm);
- Development of a contingency plan in the event of structural damage or loss;
- Implementation of best practice methods to reduce non-organic waste and minimise marine farm debris;
- Conduct staff training to reduce waste to marine environment and procedures to follow in event of structural damage or loss;
- Monitor (and presumably seek to minimise) the number of complaints from residents received regarding the level of debris on beaches;
- Organise and participate in beach clean-ups;
- Record shoreline waste and aim for a reduction in the percentage of marine debris attributable to marine farms.

CML have had no line breakages on the existing Hapuku Rock farm since it has been operating (1996) and the 'Clamp Float'² system that is proposed on the new farms has revolutionised float attachment practices in the mussel cultivation industry; whereby industry testing over three years has resulted in no loss of floats and significant reductions in the length of lashing being used by the industry (S&S Floats, 2025).

4.8.1 Recommended Mitigations

To minimise any adverse effects on marine mammals from marine debris the following strategies are recommended:

- Ongoing compliance with the A+ New Zealand Sustainable Aquaculture Programme;
- Adoption of appropriate waste management practices during all components of the proposed marine farming activities;
- Compliance with Resource Management (Marine Pollution) Regulations 1998; and
- A commitment to collect and retrieve obvious debris objects of marine debris during the course of operations and to safely dispose of these onshore.

4.8.2 Assessment Results

Assuming the above recommended mitigations are adopted, the likelihood of detrimental marine debris effects on marine mammals from the proposed activities are low. On this basis, the overall level of impact will be negligible (Table 14).

Table 14 Marine debris effects on marine mammals – assessment findings.

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
New Zealand fur seals	Low	Likely continuous presence in and around Admiralty Bay.	Negligible, no discernible effect on the known population	Low	Negligible
Common dolphins	Low	Likely frequent presence in and around Admiralty Bay especially in mid-late winter and early spring.	Negligible, no discernible effect on the known population	Low	Negligible
Dusky dolphins	Low	Likely frequent presence in and around Admiralty Bay, especially from late autumn to late spring.	Negligible, no discernible effect on the known population	Low	Negligible
Bottlenose dolphins	Very High	Likely frequent presence in and around Admiralty Bay.	Negligible, no discernible effect on the known population	Low	Negligible

² Further details available at: <https://www.ssfloats.co.nz/clamp-floats>.

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
Killer whales	Very High	Likely sporadic presence in and around Admiralty Bay.	Negligible, no discernible effect on the known population	Low	Negligible
Humpback whales	Low	Possible, seasonal presence in both coastal and offshore waters of the region.	Negligible, no discernible effect on the known population	Low	Negligible
Southern right whales	Moderate	Possible seasonal presence in coastal waters of the region.	Negligible, no discernible effect on the known population	Low	Negligible

4.9 Cumulative Effects

Stressors on marine mammals are often not experienced in isolation (spatially or temporally), and as a result, an individual/group may be simultaneously exposed to a number of stressors from one activity with multiple stresses, and/or from multiple activities occurring simultaneously or consecutively (Hague et al., 2022). Cumulative effects are a result of incremental, sustained, and combined consequences of human actions and natural variations over time.

Assessing the potential for cumulative effects on marine mammals is challenging given the wide range of variables that can influence how wildlife populations are affected, e.g. other threats that a population may be facing, unquantified long-term pervasive effects from habitat degradation, undescribed anthropogenic or natural effects, etc. Tools to effectively quantify cumulative effects are not widely available (Wright & Khyn, 2014; Hague et al., 2022), and cumulative effects on marine mammals from multiple stressors are largely unknown due to a paucity of data. Therefore, the following discussion forms the basis of a qualitative assessment which is currently regarded as the best approach on which to assess potential cumulative effects.

While cumulative effects will be of most relevance to threatened species, where cumulative stressors impact important habitat of non-threatened species, cumulative effects could be substantial for these species too.

With regard to the Admiralty Bay proposal, habitat modification is the most significant potential impact that has been identified for marine mammals. The effects of habitat modification are of particular concern for dusky dolphins (and possibly common dolphins) for which the bay is considered important foraging habitat. There are multiple lines of evidence to suggest that existing mussel farms are already causing dolphin displacement, and the establishment of the proposed new farms must therefore be considered in this context. The total area of existing marine farms in Admiralty Bay is 217 ha (2.54%), and with the addition of the proposed new farms, this would increase to a total of 245 ha, accounting for 2.87% of Admiralty Bay.

Because the majority of existing farms occur in Inner Admiralty Bay, the outer bay, in contrast, provides a relatively natural habitat for dolphins where there are large nearshore areas that are free from aquaculture structures and that remain available to marine mammals. As displacement of dusky and common dolphins from mussel farms is expected (see **Section 4.2**), the establishment of the two new proposed farms would compromise this habitat availability.

Further to displacement and the associated cumulative effects on space, the additive nature of other habitat modification effects should also be considered. In **Sections 4.3 and 4.4**, evidence is presented that in recent years 1) dusky dolphins in Admiralty Bay have changed their foraging strategy; and 2) the preferred prey of dusky dolphins may be reducing in Admiralty Bay. Despite the role of mussel farms in these changes being unclear, these observations (especially when coupled with displacement from mussel farms) point to long-term pervasive effects from habitat degradation for dolphins in Admiralty Bay.

It is probable that the culmination of these effects are implicated in the apparent decline in the number of dusky dolphins returning to Admiralty Bay through time (which was reported by Piwetz et al., 2024). While total abundance of dusky dolphins has varied across research years, there has been a general trend of decline since 2003 (see **Table 2** for summary). Furthermore, and since 2011, it has been reported that individual dolphins are less likely to remain in the bay for extended periods and instead are more likely to pass through as transients (Piwetz et al., 2013; Clement & Halliday, 2014). In addition, dolphins are less likely to be engaged in energetically advantageous prey ball herding and are more likely to be observed foraging individually. While it is tempting to interpret this to mean that habitat in Admiralty Bay is becoming less important to dusky dolphins and therefore the relative significance of mussel farm impacts on dolphins will be lower, no systematic field work on dolphins has occurred in the bay since 2014 and substantial uncertainty remains over the current state of the population and the role that mussel farms are playing in the apparent ecosystem flux in Admiralty Bay.

In addition, several authors have documented a decline in dusky dolphin group sizes in Admiralty Bay through time, noting that group size is positively correlated with the likelihood of foraging and the prevalence of prey ball herding (Pearson, 2008; Pearson, 2009; Piwetz et al., 2013; Piwetz et al., 2024). In essence, smaller groups appear to be less capable of successfully managing large prey balls and the declining presence of dolphins through time may exacerbate this and perpetuate this trend. Following Lusseau et al. (2004), this trend is also likely to be linked to prey availability where dolphin group sizes are constrained by prey abundance.

As well as the potential effects of mussel farming, it is also important to acknowledge that multiple other threats to marine mammals are present in coastal New Zealand, including bycatch in fishing gear, disturbance or boat strike from high levels of vessel traffic, underwater noise, habitat degradation (e.g. dredging, trawling, climate change); land-based sedimentation, nutrient enrichment, exposure to contaminants, and coastal development. In particular, the issue of climate change is becoming more prevalent, and while the effects of climate change are difficult to predict, Roberts & Hendricks (2022), list the following climate change hazards that have the potential to influence marine mammals:

- Increasing sea temperature – altering marine mammal and prey distributions;
- Changes in ocean circulation – altering prey availability;
- Changes in atmospheric climate – altering rainfall intensity, storm frequency, and wave conditions. Increased terrestrial run-off could affect the flow of nutrients, sediments, pollutants and/or pathogens into coastal waters;
- Ocean acidification – altering prey availability;
- Rising sea levels – altering coastal habitat; and
- Change in ecosystem structure – altering ocean productivity and food web structure.

These potential climate change hazards are likely to interact with existing stressors to alter ecosystem processes, particularly those affecting prey availability and threats already faced by marine mammals may be exacerbated by these changes (Macinnis-Ng et al., 2021).

4.9.1 Recommended Mitigations

The mitigation measures outlined in the previous sections serve to reduce the potential individual effects associated with the proposed activities on marine mammals; hence minimise the risk of additional cumulative effects. However, additional monitoring is recommended to ascertain the present-day status of dusky dolphins in and around the project area; noting that active field research on dolphins in Admiralty Bay has not been conducted since 2014, **in particular there is no information available to evaluate whether dusky dolphin presence in the bay has continued to decline.** On this basis, the development and implementation of a Marine Mammal Monitoring Programme is recommended prior to farm establishment.

4.9.2 Assessment Results

The greatest contributor to cumulative effects from the project is habitat modification. While the findings of **Sections 4.2, 4.3, and 4.4** are also of relevance here, this assessment considers all potential effects 1) in combination; 2) in the context of the existing mussel farms in Admiralty Bay and 3) alongside other anthropogenic threats that marine mammals face in coastal habitats. The overall level of effect ranges from negligible to medium (**Table 15**).

Table 15 Cumulative effects on marine mammals – assessment findings.

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
New Zealand fur seals	Low	Likely continuous presence in and around Admiralty Bay.	Negligible, very slight change from baseline conditions, no detectable adverse effects. No concern.	Low	Negligible
Common dolphins	Low	Likely frequent presence in and around Admiralty Bay especially in mid-late winter and early spring.	Low, minor shift away from baseline conditions, no change to population dynamics.	Low	Very low
Dusky dolphins	Low	Likely frequent presence in and around Admiralty Bay, especially from late autumn to late spring.	Moderate, alteration to key ecological elements (important foraging habitat), detectable changes to population dynamics.	Moderate	Medium
Bottlenose dolphins	Very High	Likely frequent presence in and around Admiralty Bay.	Low, minor shift away from baseline conditions. No change to population dynamics.	Negligible	Very low

Species	Ecological value	Likelihood of presence	Magnitude of effect	Likelihood of effect	Overall level of effect
Killer whales	Very High	Likely sporadic presence in and around Admiralty Bay.	Negligible, very slight change from baseline conditions. No concern.	Low	Negligible
Humpback whales	Low	Possible, seasonal presence in both coastal and offshore waters of the region.	Negligible, very slight change from baseline conditions. No concern.	Negligible	Negligible
Southern right whales	Moderate	Possible seasonal presence in coastal waters of the region.	Negligible, very slight change from baseline conditions. No concern.	Negligible	Negligible

4.10 Summary of Findings

The table below provides a summary of findings, in terms of the assigned overall level of predicted impact on marine mammal species posed by each actual or potential impact identified.

Table 16 Summary of assessment findings – potential effects on marine mammals.

Potential Effect	Summary of Proposed Mitigations	Magnitude of Effect	Likelihood of Effect	Overall level of effect
Habitat displacement	Development and implementation of a Marine Mammal Monitoring Programme prior to farm establishment.	Negligible to Low	Negligible to High	Negligible to Low
Behavioural changes	Development and implementation of a Marine Mammal Monitoring Programme prior to farm establishment.	Positive to Moderate	Negligible to High	Net gain to Medium
Trophic Interactions	Development and implementation of a Marine Mammal Monitoring Programme prior to farm establishment.	Negligible to Low	Negligible to Low	Negligible to Very low
Entanglement	Compliance with A+ Sustainable Aquaculture Guidelines. Thickest, tautest, lines/droppers practicable should be used. Spat holding lines should be weighted. No free floating, loose or slack lines. All ropes/lines should be maintained under tension. Anchor warps should not overlap or cross between farm blocks. Farm maintenance should be prioritised.	Negligible	Negligible to Low	Negligible
Vessel strike	Compliance with A+ Sustainable Aquaculture Guidelines. Compliance with the MMPR. Vigilance for marine mammals maintained. Records of marine mammal sightings kept. All vessel strikes and near misses will be recorded and reported.	Negligible	Negligible to Low	Negligible



Potential Effect	Summary of Proposed Mitigations	Magnitude of Effect	Likelihood of Effect	Overall level of effect
Underwater noise – during construction	Vessels and on-board mechanical equipment should be regularly maintained, including lubrication and repair of winches, generators, propulsion components and other potential noise sources.	Low	Negligible to Moderate	Very low to Low
Underwater noise – ongoing		Negligible	Negligible to Moderate	Negligible
Marine debris	Compliance with A+ Sustainable Aquaculture Guidelines. Adoption of appropriate waste management programmes Comply with Resource Management (Marine Pollution) Regulations 1998. Collect and retrieve any obvious marine debris during extraction and safely dispose of this onshore.	Negligible	Low	Negligible
Cumulative Effects	Development and implementation of a Marine Mammal Monitoring Programme prior to farm establishment.	Negligible to Moderate	Negligible to Moderate	Negligible to Medium



4.11 Assessment against relevant NZCPS and PMEP policies

In terms of the PMEP (Policy 8.3.1) and NZCPS Policy 11(a) which both require that effects on threatened marine mammal taxa (populations) are avoided, the results of my assessment confirm that no population level effects are predicted on those threatened species that are likely to be present, namely: bottlenose dolphins, killer whales, southern right whales, and humpback whales.

Both the PMEP (Policy 8.3.1) and NZCPS policy 11(b), require that significant effects on habitats that are important during 'vulnerable life stages' be avoided and guidance around this by DOC (2010) states that indigenous species can be vulnerable when breeding, as juveniles and during migration. While Admiralty Bay does represent important foraging habitat for dusky and possibly common dolphins, there is no evidence to suggest that it constitutes important breeding or migration habitat for any marine mammal species.

In terms of marine farming policies outlined in the PMEP, the project area occurs within the Coastal Section – Outer Pelorus Coastal Management Unit (**CMU**) and the Admiralty Bay Dusky Dolphin Marine Mammal Distribution Overlay³. The PMEP states that new aquaculture is a prohibited activity outside of Aquaculture Management Areas (AMAs) in the enclosed water and near-shore CMUs. New AMAs can be created if they meet the criteria in Policy 13.21.3. Policy 13.21.3 (h) requires that new AMAs be located away from areas known to provide significant feeding or breeding habitat for New Zealand King Shag, elephant fish, dolphins and other important species.

Given the project area overlaps with significant habitat of dusky dolphins its appropriateness under Policy 13.21.3 of the PMEP is not straight forward.

In addition, the A+ Sustainable Aquaculture Guidelines promote avoidance of key wildlife sites. The establishment of the two new mussel farms in the project area is therefore in conflict with this guidance.

5.0 Conclusion

This report describes the marine mammal populations in and around the Admiralty Bay project area and assesses the potential effects on marine mammals from the proposed establishment of two new mussel farms at Hapuku Rock in the outer bay. While Inner Admiralty Bay already supports a large number of mussel farms, farm density in Outer Admiralty Bay is much lower.

Marine mammal data from a range of different sources (including opportunistic observations, systematic visual surveys, stranding data, and habitat modelling) was assessed to determine the species that use the waters in and around the project area and to assess the likelihood of each species being present here.

While at least 16 marine mammal species are reported for the wider region, the available data suggests that only five species – New Zealand fur seals, bottlenose dolphins, dusky dolphins, common dolphins, and killer whales – regularly visit Admiralty Bay and immediate surrounds. In addition to these species, southern right whales and humpback whales are expected to have a possible seasonal presence over the months of winter and spring. Admiralty Bay is considered as important foraging habitat for dusky dolphins and may be of similar significance to common dolphins that have recently started using the area more frequently.

³ https://www.marlborough.govt.nz/repository/libraries/id:2ifzri1o01cxbymxkvwz/hierarchy/documents/your-council/environmental-policy-and-plans/mep-decisions/maps/ecologically-significant-marine/Marine_Mammal_Distribution_-_Admiralty_Bay_Dusky_Dolphin.pdf

Several potential effects of the proposed farms have been identified and assessed in this report, including habitat modification, entanglement, vessel strike, underwater noise, marine debris, and cumulative effects.

In particular, three potential consequences of habitat modification are discussed in detail, these are habitat displacement, behaviour change and trophic interactions.

In regard to dusky dolphins, it is highly noteworthy that presence of dusky dolphins in Admiralty Bay has declined since 2003, and those dolphins that are present are typically forming smaller groups and are seldom observed herding prey balls (which was once a commonly observed foraging strategy) in the bay. Furthermore, individual dolphins are less likely to remain in the bay for extended periods and instead are passing through the bay in a more transient manner. The reasons for these changes are unclear, although they may (at least in part) be attributable to existing effects of mussel farms; however, it is likely that several other factors are also involved (including larger oceanic and climatic changes which drive prey distribution).

The results of this assessment found that without further information it is difficult to accurately predict the potential effects of the two proposed new farms, but on the basis of the information at hand and assuming the adoption of several recommended mitigations, the overall level of effect from the proposed activities ranges from negligible to medium. In particular, several effects associated with the establishment of the two new farms could have moderate ecological consequences for dusky dolphins; hence it would be prudent to proceed with caution until further information is available.

One of the key recommendations of this report is that a Marine Mammal Monitoring Programme should be developed and implemented prior to farm establishment. Without further information, it is difficult to reconcile the establishment of new marine farms in the context of the following studies which all caution against marine farm expansion in Admiralty Bay:

- Duprey (2007) states that Admiralty Bay is an important winter foraging ground for dusky dolphins, and further aquaculture development in the bay would remove available foraging habitat;
- Markowitz et al. (2004) states that impacts due to changes in dolphin habitat should be carefully monitored and minimized wherever possible; and
- Pearson et al. (2012) states that expansion of mussel farms would represent further habitat loss and may limit the ability of dusky dolphins to forage effectively. The authors of this study recommended that immediate measures such as halting further expansion of mussel farming in Admiralty Bay should be implemented.

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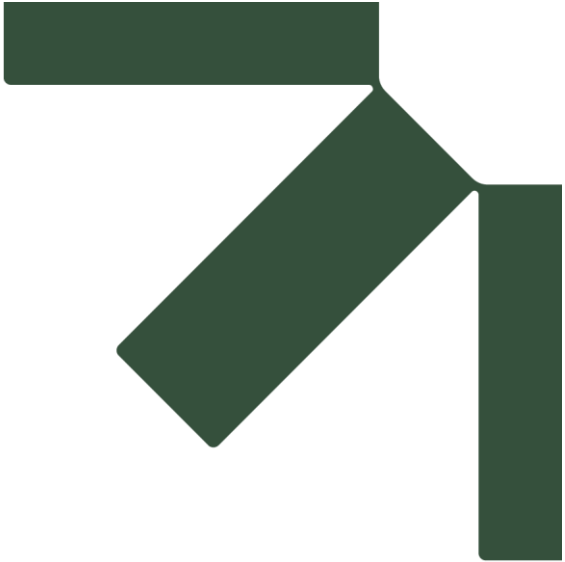
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Appendix A Marine Mammals and their Likelihood of Occurrence in the Region

Establishment of Hapuku Rock Marine Farms

Assessment of Effects on Marine Mammals

Clearwater Mussels Limited

SLR Project No.: 840.030156.00001

3 July 2025

Common Name	Scientific Name	NZ Conservation Status (Baker et al., 2019)	Qualifier *	IUCN Conservation Status www.redlist.org	DOC Sightings database (No. in and around Admiralty Bay)	DOC Incident database (No. in and around Admiralty Bay)	Modelled habitat suitability of region (Stephenson et al., 2020/ MacKenzie et al., 2022)	Likelihood of Presence in the Region
Andrew's beaked whale	<i>Mesoplodon bowdoini</i>	Data deficient	S?O	Data deficient	0	0	Low/Low	Unlikely
Antarctic fur seal	<i>Arctocephalus gazella</i>	Vagrant	SO	Least Concern	0	0	NA/Low	Unlikely
Arnoux's beaked whale	<i>Berardius arnuxii</i>	Data deficient	S?O	Least concern	3**	0	Low/Low	Unlikely
Blue whales (species unknown)	<i>Antarctic blue whales</i> <i>Balaenoptera musculus intermedia</i> <i>Pygmy blue whales</i> <i>B. m. brevicauda</i>	Data deficient Data deficient	TO S?O	Critically endangered Endangered	 3	 1	 Low-Moderate/ Low-Moderate	Unlikely
Bottlenose dolphin	<i>Tursiops truncatus</i>	Nationally endangered	De, PF, SO, Sp	Least concern	5	1	Low-Moderate/Low	Likely
Bryde's whale	<i>Balaenoptera edeni</i>	Nationally critical	CD, DP, SO	Least concern	0	0	Low/Low	Unlikely
Common dolphin	<i>Delphinus delphis</i>	Not threatened	DP,SO	Least concern	11	1	Low-Moderate/Low	Likely
Crab eater seal	<i>Lobodon carcinophaga</i>	Vagrant	SO	Least concern	0	0	NA/Low	Unlikely
Cuvier's beaked whale	<i>Ziphius cavirostris</i>	Data deficient	SO	Least concern	0	0	Low/Low	Unlikely
Dense beaked whale	<i>Mesoplodon densirostris</i>	Data deficient	S?O	Least concern	0	0	Low/Low	Unlikely
Dusky dolphin	<i>Lagenorhynchus obscurus</i>	Not threatened	S?O	Least concern	4	2	Low/Low	Likely
Dwarf sperm whale	<i>Kogia sima</i>	Data deficient	S?O	Least concern	0	0	NA/Low	Unlikely
False killer whale	<i>Pseudorca crassidens</i>	Naturally uncommon	DP, T?O	Near Threatened	0	0	Low/Low	Unlikely
Fin whale	<i>Balaenoptera physalus</i>	Data deficient	TO	Vulnerable	0	0	Low-Moderate/Moderate	Unlikely
Fraser's dolphin	<i>Lagenodelphis hosei</i>	Data deficient	SO	Least concern	0	0	NA/Low	Unlikely
Ginkgo-toothed whale	<i>Mesoplodon ginkgodens</i>	Data deficient	S?O	Data deficient	0	0	NA/Moderate	Unlikely
Gray's beaked whale	<i>Mesoplodon grayi</i>	Not threatened	S?O	Least concern	0	0	Low/Low	Unlikely
Hector's beaked whale	<i>Mesoplodon hectori</i>	Data deficient	S?O	Data deficient	0	0	NA/Low	Unlikely
Hector's dolphin	<i>Cephalorhynchus hectori spp.</i>	Nationally critical Nationally vulnerable	CD CD, DP, PF	Critically En Endangered	4	0	Low-Moderate/Low	Unlikely
Hourglass dolphin	<i>Lagenorhynchus cruciger</i>	Data deficient	SO	Least concern	0	0	Low/Low	Unlikely
Humpback whale	<i>Megaptera novaeangliae</i>	Migrant	SO	Endangered	5	0	Moderate/Moderate	Possible
Killer whale	<i>Orcinus orca</i>	Nationally critical	DP, S?O, Sp	Data deficient	5	0	Low-Moderate/Low	Likely
Leopard seal	<i>Hydrurga leptonyx</i>	Naturally uncommon	De, SO	Least concern	1	0	NA/Low	Unlikely
Lesser/pygmy beaked whale	<i>Mesoplodon peruvianus</i>	Data deficient	S?O	Least concern	0	0	NA/Low	Unlikely
Long-finned pilot whale	<i>Globicephala melas</i>	Not threatened	DP, S?O	Least concern	0	1	Low/Low-Moderate	Unlikely
Melon-headed whale	<i>Peponocephala electra</i>	Vagrant	SO	Least concern	0	0	NA/Low	Unlikely
Minke whales (species unknown)	<i>Antarctic minke whale</i> <i>Balaenoptera bonaerensis</i> <i>Dwarf minke whale</i> <i>Balaenoptera acutorostrata</i>	Data deficient Data deficient	DP, SO DP, SO	Near Threatened Least concern	0	1	Low-Moderate/Low	Unlikely
New Zealand sea lion	<i>Phocarcos hookeri</i>	Nationally vulnerable	CD, RR	Endangered	0	0	NA/Low	Unlikely



Common Name	Scientific Name	NZ Conservation Status (Baker et al., 2019)	Qualifier *	IUCN Conservation Status www.redlist.org	DOC Sightings database (No. in and around Admiralty Bay)	DOC Incident database (No. in and around Admiralty Bay)	Modelled habitat suitability of region (Stephenson et al., 2020/ MacKenzie et al., 2022)	Likelihood of Presence in the Region
New Zealand fur seal	<i>Arctocephalus forsteri</i>	Not threatened	Inc, SO	Least Concern	0***	1	NA/High	Likely
Pantropical spotted dolphin	<i>Stenella attenuata</i>	Vagrant	SO	Least concern	0	0	NA/Low	Unlikely
Pygmy killer whale	<i>Feresa attenuata</i>	Vagrant	DP, S?O	Least concern	0	0	NA/Low	Unlikely
Pygmy right whale	<i>Caperea marginata</i>	Data deficient	S?O	Least concern	1	1	NA/High	Unlikely
Pygmy sperm whale	<i>Kogia breviceps</i>	Data deficient	DP, S?O	Least concern	0	0	Low/Low	Unlikely
Risso's dolphin	<i>Grampus griseus</i>	Data deficient	SO	Least concern	0	0	Low/Low	Unlikely
Ross seal	<i>Ommatophoca rossii</i>	Vagrant	SO	Least concern	0	0	NA/Low	Unlikely
Rough-toothed dolphin	<i>Steno bredanensis</i>	Data deficient	SO	Least concern	0	0	NA/Low	Unlikely
Sei whale	<i>Balaenoptera borealis</i>	Data deficient	TO	Endangered	0	1****	Low-Moderate/ Low-Moderate	Unlikely
Shepherd's beaked whale	<i>Tasmacetus shepherdi</i>	Data deficient	SO	Data deficient	0	0	Low/Low	Unlikely
Short-finned pilot whale	<i>Globicephala macrorhynchus</i>	Data deficient	S?O	Least concern	0	0	Low/Low	Unlikely
Southern bottlenose whale	<i>Hyperoodon planifrons</i>	Data deficient	SO	Least concern	0	0	Low/Low	Unlikely
Southern elephant seal	<i>Mirounga leonina</i>	Nationally critical	RR, SO	Least concern	0	0	NA/Low	Unlikely
Southern right whale	<i>Eubalaena australis</i>	Recovering	OL, RR, SO	Least concern	6	1	Low/Low	Possible
Southern right whale dolphin	<i>Lissodelphis peronii</i>	Data deficient	DP,S?O	Least concern	0	1	Low/Low	Unlikely
Spade-toothed whale	<i>Mesoplodon traversii</i>	Data deficient	S?O	Data deficient	0	0	NA/Low-Moderate	Unlikely
Spectacled porpoise	<i>Phocoena dioptrica</i>	Data deficient	S?O	Least concern	0	0	Low/Low	Unlikely
Sperm whale	<i>Physeter macrocephalus</i>	Data deficient	DP, TO	Vulnerable	0	0	Low/Low	Unlikely
Strap-toothed whale	<i>Mesoplodon layardii</i>	Data deficient	S?O	Least concern	0	0	NA/Low	Unlikely
Striped dolphin	<i>Stenella coeruleoalba</i>	Data deficient	SO	Least concern	0	0	Low/Low	Unlikely
Subantarctic fur seal	<i>Arctocephalus tropicalis</i>	Vagrant	SO	Least concern	0	0	NA/Low	Unlikely
True's beaked whale	<i>Mesoplodon mirus</i>	Data deficient	S?O	Least concern	0	0	NA/High	Unlikely
Weddell seal	<i>Leptonychotes weddelli</i>	Vagrant	SO	Least concern	0	0	NA/Low	Unlikely

KEY
 * Qualifiers to the New Zealand Threat Classification System are as follows: Secure Overseas (SO), Uncertain whether the taxon is secure overseas (S?O), Threatened Overseas (TO), Data Poor (DP), Conservation Dependent (CD), Sparse (Sp), Range Restricted (RR), Increasing (Inc), One Location (OL), Designated (De), Population Fragmentation (PF).
 ** This count includes one sighting that was not specified to species level but is assumed to be this species on account of other verified sightings.
 *** These counts are likely biased low, as people tend not to report live fur seal sightings to DOC.
 **** Assumed to be a sei whale following note in Table 10.



Appendix B Timeline of Mussel Farm Establishment in Admiralty Bay

Establishment of Hapuku Rock Marine Farms

Assessment of Effects on Marine Mammals

Clearwater Mussels Limited

SLR Project No.: 840.030156.00001

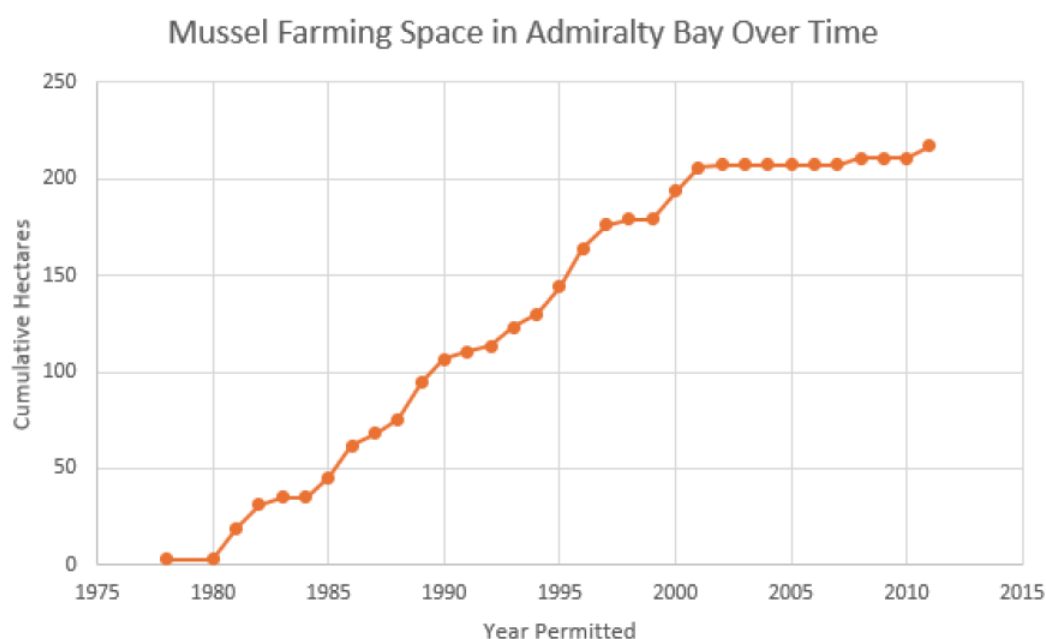
3 July 2025

Content for this appendix was provided by Aquaculture Direct Limited.

Marine Farming in Admiralty Bay

Marine farming in Admiralty Bay commenced in the late 1970s and grew steadily through the 1980s and early 1990s. In 1996, at the request of the Marlborough District Council (MDC), the Government initiated a moratorium by Order in Council on new farms while the MDC progressed the Marlborough Sounds Resource Management Plan¹. This moratorium expired in mid-1999 but was followed soon after by the national moratorium imposed by the Government in 2001². That moratorium was not lifted until 2004, and negligible growth has occurred in Admiralty Bay since then.

The following is an indicative representation of the growth of marine farming space over time. Note that the date indicates the year permitted, e.g. if a marine farm license or resource consent was granted subject to a marine farming permit, the date reflects the year the marine farming permit was granted. Farms were generally established soon after their permitting date as shown in aerial views³.

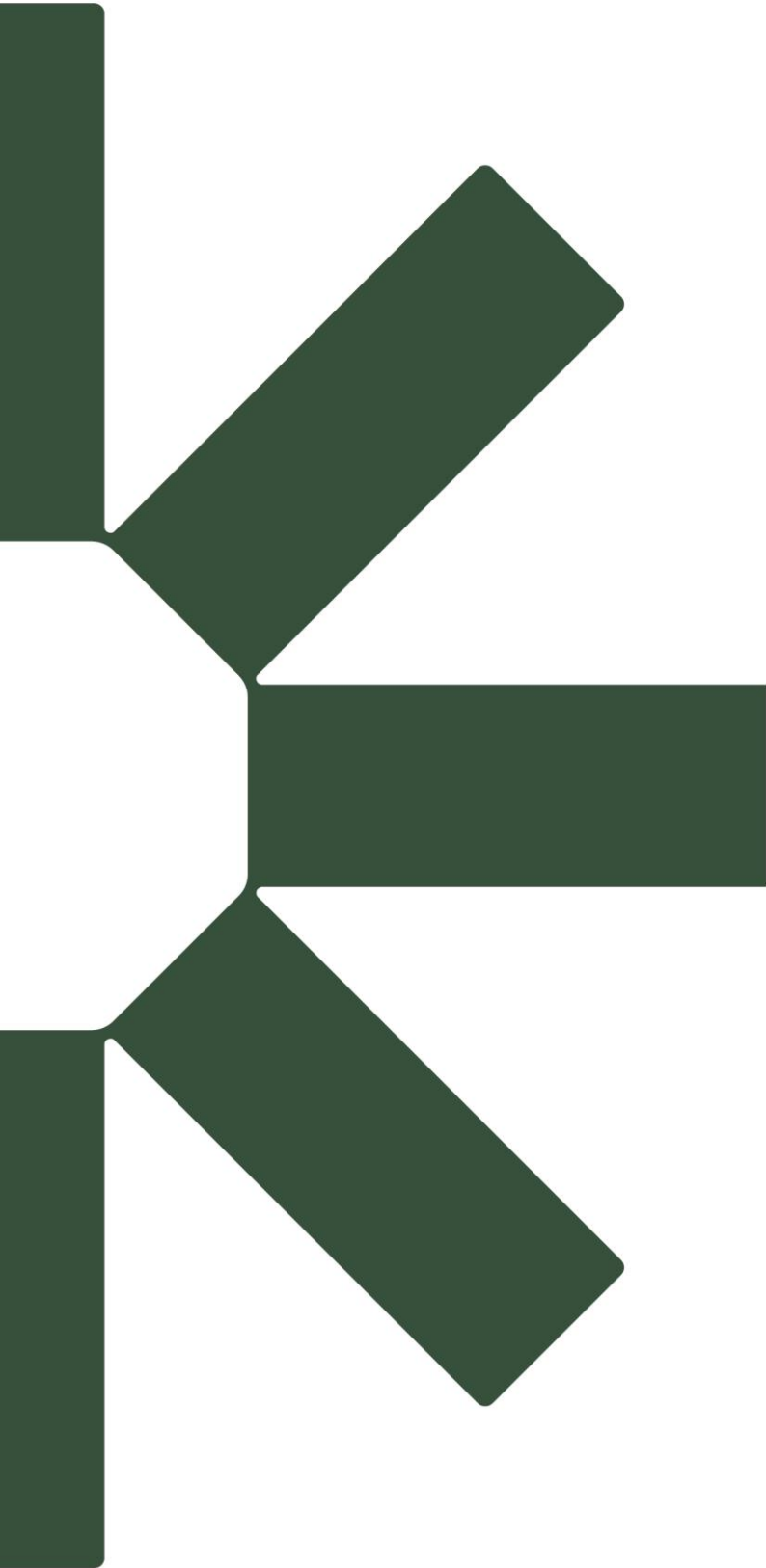


Indicative growth in marine farming hectares in Admiralty Bay over time

¹ <https://www.epa.govt.nz/assets/FileAPI/proposal/NSP000002/Applicants-proposal-documents/5fed38496d/Appendix-D-Chronology-of-planning-for-marine-farming-in-the-Marlborough-Sounds.pdf>

² <https://environment.govt.nz/assets/Publications/Files/aquaculture-reform-nov02.pdf>

³ <https://marlborough.maps.arcgis.com/apps/webappviewer/index.html?id=b8bddfb24c294a6f9a9ce6cf3c3cfbd2>



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