# Ecological Investigation for Proposed Marine Farm South of the Chetwode Islands

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## Executive Summary

As part of a study of the feasibility of establishing a marine farm in the open waters south of the Chetwode Islands, in the Marlborough Sounds a study of the ecological environment beneath the proposed site was undertaken. The aim of this was to determine if there was anything of significance that would clearly prevent further development of the proposed marine farm site.

Much of the site appears to support a similar range of species however the abundance varied within the site. Dominated by shell debris and hermit crabs, transects 1,2 and 3 appear to support less biodiversity and biomass than the rest of the site. The remaining transects were largely dominated by the small clumps of hardened substrate, most probably a bryozoan coral. These clumps supported a limited range of additional species. Some species of interest occurred at low frequencies beneath the proposed site and included: the occasional brachiopod, a variety of erect bryozoan and hydroid species along with an area of horse mussels. The zone of horse mussels did not appear to be large and seemed to be localised. Further investigation of this area may be required.

Given the open sea aspect and the depths of this proposed farm, along with a less intensive farm layout, it is likely that its impact will be less severe than some marine farms in more sheltered parts of the Marlborough Sounds and further development seems appropriate.

## Introduction

As part of an application for a proposed marine farm out in the open waters south of the Chetwode Islands, a study of the epibenthic community beneath the proposed site was carried out in order to see if the ecological environment appeared to be suitable for further development.

## Methods

The criteria for this assessment are based around the Department of Conservation (D.o.C) 1995: *Guideline for ecological investigation of proposed marine farm areas – Marlborough Sounds.*

In the field, a vessel-mounted global positioning system (GPS) was used to site the corner boundaries of the proposed farm. The site was surveyed using a depth sounder to look for variation in bottom depths and to locate any possible reef structures.

Dredging was the most appropriate method for sampling large areas of the seafloor (Figure 1). Transects 1, 2 and 3 were done with a standard dredge (770 mm wide x 240 mm high) which had a 9 mm mesh. The remaining sampling was done using a standard commercial dredge (approximately 2.4m wide) modified with the additional of a 9 mm mesh. GPS coordinates were taken at the beginning and end of each dredge tow. When the dredge tow was recovered, generally a percentage of the contents were transferred to a sampling bag – including mud if it was present. Sample sizes were approximately 3-8 kg. Dredge contents were stored overnight. After gentle rinsing in a 4mm sieve samples were examined.

## Results & Conclusions

*Physical features*

The proposed farm is situated over relatively deep water with depths varying from approximately 25 to 45 m, with the majority of the site situated in depths over 30 m (Table 1). No unusual structures or aberrations of the seafloor were detected during

the depth sounder surveying. Unlike many of the sheltered bays within the Sounds, this site is strongly affected by strong currents, wind and wave action.

All of the dredge samples from this site contained little or no sediment suggesting the substratum beneath the site is likely to be firm mud rather than soft sediments. Firm glutinous grey/black mud is common in this open sea environment off the end of Pelorus Sound (Bradley 1999).

*Ecological features*

Much of the proposed site appeared to support a similar range of epibenthic species (Table 2). One of the most common species found throughout the proposed site was the snaketail star, *Pectinura maculata* along with hermit crabs, *Pagurus* species (Table 2). The latter inhabited a variety of gastropod shells including: knobbed whelks (*Austrofusus glans*), ostrich foot shells (*Struthiolaria papulosa & S. vermis*), olive shells (*Amalda* species) and turret shells (*Maoricolpus roseus*). Occasional living molluscs were also observed including: ostrich foot shells (*Struthiolaria papulosa*), circular saw shells (*Astraea heliotropium*), knobbed whelks (*Austrofusus glans*), olive shell (*Amalda* sp.), spiny murex (*Poirieria zelandica*), tiger shells (*Calliostoma tigris*), fan scallops (*Chlamys* species), a strawberry cockle (*Nemocardium pulchellum*), little file shell (*Limatula maoria*) and octopi.

A range of fish species were found in the commercial dredge samples. Species taken from the entire dredge sample included: a monkfish (*Kathetostoma giganteum*), 2 sole (*Peltorhamphus* sp.), 6 red cod (*Pseudophycis bachus*), 2 leatherjackets (*Parika scaber*), a school shark (*Galeorhinus galeus*), and 2 seahorses (*Hippocampus abdominalis*).

Much of the site appears to contain small clumps of hardened substrate, sometimes with an encrusting coralline species covering the surface — probably the bryozoan species *Celleporaria agglutinans*. Based on the dredging samples, these clumps tended to be very small (often less than 5-8cm in diameter and were generally found to support little apart from polychaete worms, erect and mat-like bryozoan colonies and a slimy/glutinous growth (tentatively identified as an ascidian species).

Other species of interest, as determined by D.o.C guidelines, were observed within the proposed site. Species that occurred infrequently included the small red brachiopod, *Waltonia inconspicua*, large hydroid trees (most likely *Solanderia* species), and a single live scallop (*Pecten novaezelandiae*).

Horse mussels were observed in part of the proposed site (transects 4, 5 & 6). These appeared to provide a base for species such as hydroids, erect and mat-like bryozoan colonies, small finger sponges, pea crabs (*Pinnotheres novazelandiae*), ascidians such as sea squirts along with tubeworms and barnacles (*Balanus decorus*). From dredging it is difficult to gauge the exact distribution and density of the horse mussels. However, the numbers of horse mussels found in each transect (2 in transect 6, 5 in transect 5 and less than 15 in transect 4) suggests that, if there is a horse mussel bed present, it is limited in size. This suggests the zone may be localised around the middle of transect 4/end of transect 5.

*Conclusions*

Much of the site appears to support a similar range of species however the abundance varied within the site. Dominated by shell debris and hermit crabs, transects 1,2 and 3 appear to support less biodiversity and biomass than the rest of the site. The remaining transects were largely dominated by the small clumps of hardened substrate, most probably a bryozoan coral. These clumps supported a limited range of additional species. Transects 4, 5 and 6 appear to support the highest level of biodiversity — much of which appears to be associated with a zone of horse mussels found there. The zone of horse mussels appeared to be localised to part of transect 4. Further investigation of this area may be required.

Other species of interest (as determined by the D.o.C guidelines) were found beneath the proposed site and include; the occasional brachiopod, a variety of erect bryozoan and hydroid species. Exact identification of bryozoan and hydroid species can be difficult so only tentative identifications have been made. Many of these species occurred at low levels.

The open sea aspect of this proposed marine farm is likely to limit any effects the farm may have on the benthic environment beneath it. The ecological effects of mussel farms include sedimentation, nutrition use and deposition of mussels on the seafloor (Cole & Grange 1996, Kaspar et al 1985, Mackenzie 1998). Mussels deposit organic-rich sediments (eg: faeces) - mud-size particles, the effect of which depends on the environment. In a largely sediment-based environment, like that found beneath this proposed site, the effect of sedimentation will be far less than that non-sediment environment (such as a rocky reef). In addition, the depths, the action of wind, wave and, more importantly, currents in this open sea site are likely to minimise the effects of both sedimentation and nutrient use from the mussel farm.

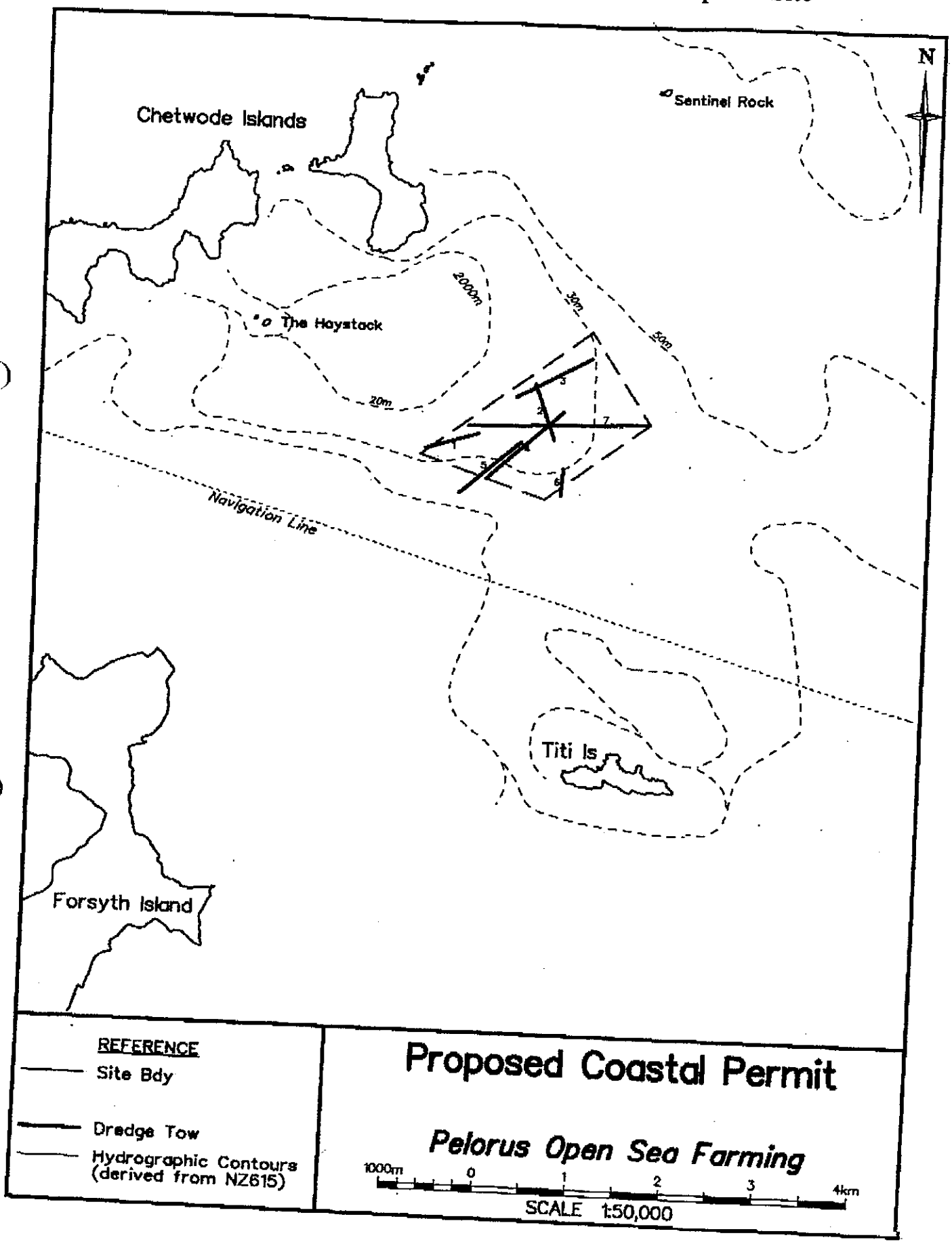
The deposition of live mussels and mussel debris from the proposed farm is another factor that may alter the ecosystem beneath it. Much of the epibenthic community currently found beneath the proposed site is found growing off shells or the hardened substrate clumps scattered throughout the site. This suggests that the deposition of mussel shells (alive or otherwise) is likely to provide an additional base for many of these species to attach to and grow on – perhaps leading to an increase the diversity and abundance of species beneath the site.

From this study, continued development of much of the proposed site seems appropriate. Given the open sea aspect and depths of this proposed farm, along with a less intensive farm layout, it is likely that its impact will be less severe than some marine farms in sheltered parts of the Sounds.

*References*


1. J.M. Bradley (1999) Ecological Investigation for Proposed Marine Farm off the Chetwode Islands. Report prepared for Marlborough District Council.
2. R. Cole & K. Grange (1996) Under the Mussel Farm. Seafood NZ November: 25-26.
3. Department of Conservation (D.o.C) 1995: *Guideline for ecological investigation of proposed marine farm areas – Marlborough Sounds.* Nelson/Marlborough Conservancy, Occasional Publication No. 25.
4. H. Kaspar, P Gillespie, I. Boyer & L. MacKenzie (1985) Effects of mussels Aquaculture on the nitrogen cycle and benthic communities in Kenepuru Sound, Marlborough Sounds, New Zealand. Mar. Biol. 85: 127-136.
5. L. MacKenzie (1998) Blowing the Budget? Nutrient resources and Marlborough Mussel Crop. Seafood NZ March: 41-44.

**Figure 1: Dredge Survey Transects of Proposed Site**



## Table 1: Details of Dredge Survey Transects

| Transect Number | GPS coordinates | Water depth[a] | % of total sample assessed |
|---|---|---|---|
| 1* | 40.55.13S 174.06.75E start | ND | 100% |
| | 40.55.03S 174.07.15E finish | ND | |
| | | | |
| 2* | 40.54.72S 174.07.57E start | ND | 100% |
| | 40.55.05S 174.07.73E finish | ND | |
| | | | |
| 3* | 40.54.55S 174.07.99E start | ND | 100% |
| | 40.54.80S 174.07.43E finish | ND | |
| | | | |
| 4 | 40.55.297S 174.07.228E start | 37.5m | 15% |
| | 40.54.881S 174.07.753E finish | 25.5m | |
| | | | |
| 5 | 40.55.072S 174.07.482E start | 27.5m | 20% |
| | 40.55.390S 174.07.753E finish | 45m | |
| | | | |
| 6 | 40.55.385S 174.07.800E start | 35m | 33% |
| | 40.55.225S 174.07.811E finish | 28.4m | |
| | | | |
| 7 | 40.54.936S 174.08.452E start | 35.3m | 10% |
| | 41.54.985S 174.08.071E finish | 30m | |

* samples taken by standard (not commercial) dredge [a] Depths not adjusted to chart datum. ND; no depths recorded.

**Table 2: Dredge Survey Results**

Species present beneath the proposed site south of the Chetwode Islands

| Species | Transect Numbers | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| *ALGAE* | | | | | | | |
| Small red algae (*Rhodmyenia leptophylla*) | - | 1 | - | - | - | - | - |
| Venus necklace (*Horm* ) – unattached piece | - | - | - | - | 1 | - | - |
| Brown kelp (*Carpophyllum* – unattached piece | - | - | - | - | 1 | 1 | - |
| *PORIFERA* | | | | | | | |
| Yellow/grey finger sponges | 1 | 1 | - | 2 | 2 | 2 | 1 |
| *CNIDARIA* | | | | | | | |
| Small thecate hydroids | 1 | 1 | - | 1 | 1 | 1 | 2 |
| Medium size thecate hydroids (*Sertularia* sp.?) | 1 | 1 | - | 1 | - | - | - |
| Hydroid trees (*Solanderia racesoma* or other?) | 1 | - | - | 1 | 1 | - | 1 |
| *BRYOZOA* | | | | | | | |
| Coral-like (*Celloporaria agglutinans*) | 1 | 1 | - | - | 1 | 2 | 2-3 |
| Variety of erect bryozoan colonies | 2 | 1 | 1 | 1-2 | 2 | 2 | 2-3 |
| *Celloporaria pumicosa* | 1 | - | - | - | 1 | - | - |
| Lace coral | - | - | - | - | 1 | - | - |
| Orange & white encrusting bryozoan species | - | 1 | - | - | 1 | 1 | 1 |
| *BRACHIOPODA* | | | | | | | |
| Small red brachipod (*Waltonia inconspicua*) | 1 | - | - | - | - | 1 | - |
| *ANNELIDA* | | | | | | | |
| Sea mouse (*Euphione squamosa*) | - | - | - | 1 | - | - | 1 |
| Burrowing worms including: *Perinereis novaehollandiae* and others | 1 | - | - | 2-3 | 1 | 1-2 | 1 |
| Tubeworms (*Pomatoceros terraenovae* & *P. caeruleus* and others) | 1 | - | - | 1 | - | 2 | 2 |
| *ARTHROPODA* | | | | | | | |
| Hermit crabs (*Pagurus* species) | 2-3 | - | 3a | 3a | 2 | 3a | 1 |
| Pea crab (*Pinnotheres novazelandiae*) – inside horse mussels | - | - | - | 1 | 1 | - | - |
| Triangle crab (*Eurynolambrus australis*) | - | - | - | - | - | 1 | - |
| Barnacles (*Balanus decorus*) | - | - | - | 3a | 1 | 1 | - |
| *MOLLUSCA* | | | | | | | |
| Shell debris included: knobbed whelks, ostrich foot & small ostrich foot, turret shells, spiny murex, siphon whelks, olive shells - most of which were inhabited by hermit crabs. Plus shells from deep water venus, fan scallops, scallops, horse mussels & strawberry cockles. | 3b | 3a | 3b | 3b | 3b | 2 | 2 |
| Fan scallops (*Chlamys* species) | - | - | - | 1 | - | 1 | 1 |
| Strawberry cockle (*Nemocardium pulchellum*) | - | - | - | 1 | - | - | - |
| Ostrich foot (*Struthiolaria papulosa*) | - | - | - | - | - | 1 | - |
| Circular saw shells (*Astraea heliotropium*) | 1 | - | - | - | 1 | - | - |
| Knobbed whelk (*Austrofusus glans*) | - | - | - | 1 | 1 | - | - |
| Olive shell (*Amalda* sp.) | - | - | - | 1 | - | - | - |
| Spiny murex (*Poirieria zelandica*) | - | - | - | 1 | - | 1 | - |
| Tiger shell (*Calliostoma tigris*) | - | - | - | - | - | 1 | - |
| Little file shell (*Limatula maoria*) | - | - | - | 1 | - | 1 | - |
| Scallop (*Pecten novaezelandiae*) | - | - | - | - | 1 | - | - |
| Horse mussel (*Atrina pectinata zelandica*) | - | - | - | 2 | 2 | 1 | - |
| *Octopus (*Octopus maorum*) | - | - | - | - | 1 | 1 | - |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *ECHINODERMATA* | | | | | | | |
| Snaketail star (*Pectinura maculata*) | 2 | 2 | 1 | 3a | 2 | 2 | 2 |
| Cushion star (*Patiriella regularis*) | 1 | 1 | - | 1 | 1 | 2 | 1 |
| Biscuit star (*Pentagonaster pulchellus*) | - | - | - | - | - | 1 | 1 |
| 11 arm star (*Coscinasterias calamaria*) | - | 1 | - | 1 | 1 | - | 1 |
| 7 arm star (*Astrostole scabra*) | - | - | - | 1 | - | - | - |
| Comb star (*Astropecten polyacanthus*) | - | - | - | - | 1 | - | - |
| *CHORODATA* | | | | | | | |
| Sea squirt (*Cnemidocarpa bicornuata*) | 1 | - | - | 1-2 | - | 1 | - |
| Unidentified gelatinous yellow/grey ascidian | 1 | - | - | - | - | 2 | 2 |
| *Monkfish (*Kathetostoma giganteum*) | - | - | - | - | 1 | - | - |
| *Sole (*Peltorhamphus* sp.) | - | - | - | - | 1 | 1 | - |
| *Red cod (*Pseudophycis bachus*) | - | - | - | - | - | 1-2 | - |
| *Leatherjacket (*Parika scaber*) | - | - | - | - | - | 1 | - |
| *School shark (*Galeorhinus galeus*) | - | - | - | - | 1 | - | - |
| *Seahorse (*Hippocampus abdominalis*) | - | - | - | 1 | - | - | - |

Relative abundance for observations is given based around those given in D.o.C guidelines:

- **1** = rare - only few individuals (1-5) colonies or plants were observed.
- **2** = occasional (5-15 individuals) seen in low abundances.
- **3a** = common - seen often (>15 individuals or colonies) or:
- **3b** = highly abundant (>50 individuals or colonies).
- * = abundance in entire sample.

The numbers of individuals or colonies listed here are to be used as a guide only. In addition, due to the nature of dredging techniques, few conclusions about the distribution (ie: whether the species occurs as a zone, bed or school) can be drawn from this data.