Record id: 2458
(U080115)
incomplete report.

CAWTHRON

COPY

Ecological Assessment Of A Marine Farm Renewal (U950422), Forsyth Bay, Marlborough Sounds

Dan Govier

Nigel Keeley

Reid Forrest

Prepared for

Sanford Limited

Cawthron Institute
98 Halifax Street East, Private Bag 2
Nelson, New Zealand
Ph. +64 3 548 2319
Fax. + 64 3 546 9464
www.cawthron.org.nz

Reviewed by: Paul Gillespie   Approved for release by: Rowan Strickland

Recommended citation:
Govier D, Keeley N, Forrest R 2008. Ecological Assessment of a Marine Farm Renewal (U950422), Forsyth Bay, Marlborough Sounds. Prepared for Sanford Limited. Cawthron Report No. 1405. 13 p.

CAWTHRON

TABLE OF CONTENTS

LIST OF FIGURES

1. GENERAL INTRODUCTION

1.1. Background

Sanford Ltd (Sanfords) operate a 5.44 ha marine farm (site MPE 412) in Forsyth Bay, Pelorus Sound (Figure 1 and Figure 2) under resource consent U950422 which is due to expire in August 2008. In December 2007, Sanfords commissioned Cawthron Institute (Cawthron) to undertake an ecological assessment at this site to assist the Marlborough District Council in processing the application for the consent renewal.

Ecological impacts from marine farms usually revolve around the sedimentation of organic-rich, fine-grained particles (mussel faeces and pseudofaeces), and the deposition and accumulation of live mussels, mussel shell litter and other biota attached to the ropes, floats and the mussels themselves. A large amount of literature is available on potential impacts attributable to marine farms (Dahlbäck & Gunnarsson 1981; Mattsson & Linden 1983; Kaspar *et al.* 1985; De Jong 1994; Chamberlain *et al.* 2001; Grange 2002; Christensen *et al.*2003). This report provides the findings of the assessment undertaken in January 2008, and describes the existing level of impact beneath and adjacent to the farm.

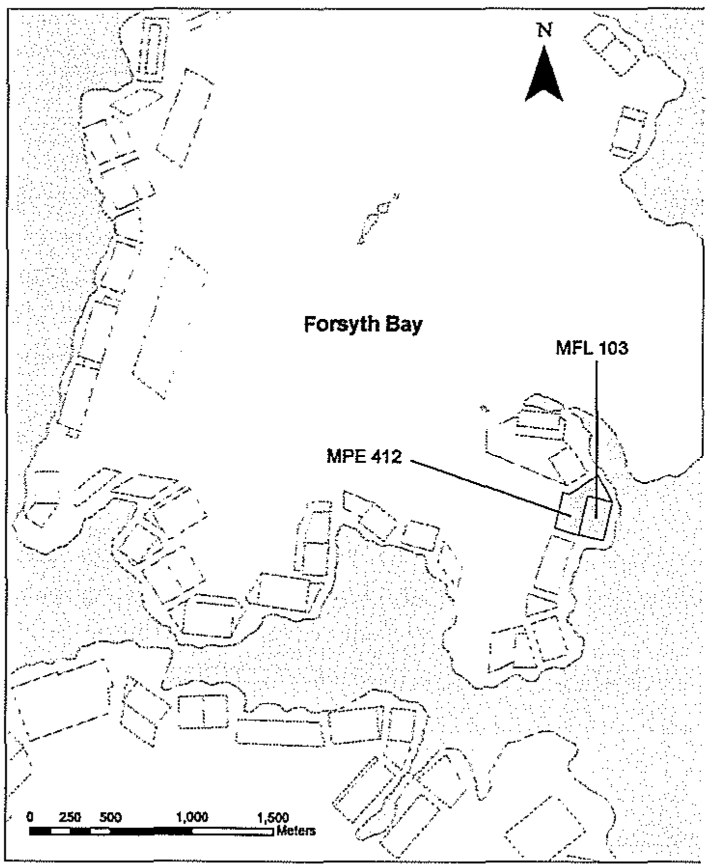

Figure 1. Location of the existing marine farm MPE 412 due for permit renewal in Forsyth Bay, Marlborough Sounds.

sounds, the subtidal slope consists of various habitat types as it grades seaward from the shallow intertidal/subtidal region to the mud basin. These contrasting habitats include combinations of bedrock, boulders, cobbles, sand and shell material, and various amounts of mud.

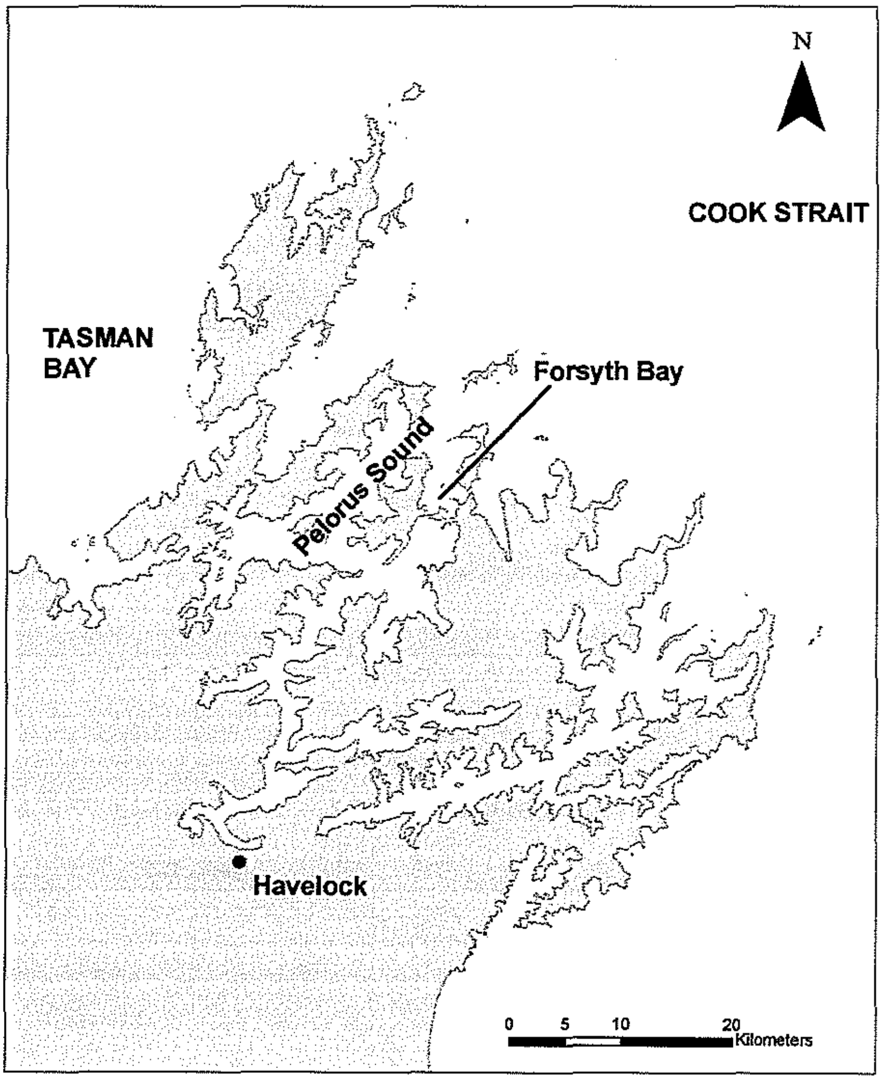

Figure 2. Forsyth Bay and its wider surroundings.

3. SAMPLING METHODOLOGIES

3.1. General sampling approach

A benthic survey was carried out by Cawthron on 8 January 2008. The physical, chemical and biological properties of the seabed were assessed from diver observations, remote video observations and analyses of the sediments from beneath and adjacent to the existing marine

3.3. Sediment physical and chemical properties

One sediment core (63 mm diameter x 70 mm deep) was collected by a van-Veen grab from each of three sites strategically positioned stations within the existing marine farm (Figure 3). The colour of the sediment profile and the presence/absence of any anoxic patches and the detection of any H_2S odours were recorded, and the redox potential discontinuity (RPD) layer[1] was measured (if present). The top 25 mm of the sediment cores was retained for laboratory analyses of grain size distribution (wet sieving and calculating dry weight percentage of mud, sand and gravel-sized fractions) and organic content as ash free dry weight or AFDW (drying at 105 °C followed by ashing at 550 °C).

3.4. Sediment biological properties

3.4.1. Seabed habitats and Epibiota

Seabed habitats and associated epibiota within and around the site were characterised from observations made during dive and remote video transects (Figure 3). The remote video transects were used due to the depth of the site being beyond safe diveable depths (according to Cawthron's diving protocol). One dive transect was undertaken which ran from within the southern boundary of the marine farm, at a depth of 29 m, up into the shallow subtidal region of the shore. This enabled divers to inspect the seabed as near as possible to the actively farmed area of the lease as well as the adjacent inshore communities.

3.4.2. Infauna

One sediment core (130 mm diameter x 100 mm deep) was extracted from a quantitative van-Veen grab sample from each site to determine the biological properties of the sediments. Animals living within the sediment matrix were retained on a 0.5 mm mesh, preserved in 70% ethanol and transported back to Cawthron where they were sorted, identified to the lowest taxonomic level feasible (*e.g.* species or family) and counted.

4. RESULTS AND DISCUSSION

4.1. Site bathymetry

Most of the lease is situated in relatively deep (30-36 m) water over a flat mud bottom. The northern triangle of the lease encompasses a portion of the steeply sloping basin wall up to a depth of ~20 m, but as already noted this area was not occupied by mussel culture lines (Figure

[1] The boundary layer between oxygenated and oxygen depleted sediment is termed the Redox Potential Discontinuity (RPD) Layer. It is often distinct as seen by a sharp colour change from light grey/brown to black. The sedimentation of organic-rich particles from a mussel farm can result in migration of the RPD upwards towards the sediment surface due to enhanced oxygen depletion.

4.2. Seabed composition

Sediments beneath the site were primarily mud and soft in consistency. No anoxic patches were observed from the sediment cores which is consistent with sediments from similar unimpacted habitats in the Marlborough Sounds. No distinguishable RPD layer was present and cores were uniformly light brown/grey in colour (Figure 6). Sediment grain size composition was relatively uniform and strongly dominated by mud, containing, on average, 84% mud, 13% sand and 3% gravel (Figure 7). The organic content (AFDW) of the sediments ranged between 3.1% and 4.5% (mean = 3.9%, refer Figure 8), indicating a relatively productive but healthy seabed and the sediments were not likely to be enriched. However, the deep basins in the Marlborough Sounds comprise effective depositional areas, which naturally accumulate mud and organic particles. The levels of organic material found beneath this site are not unusually elevated compared to reported values (away from mussel farms) within Forsyth Bay and other regions of the Marlborough Sounds (various Cawthron reports) that naturally accumulate fine particulate inorganic and organic materials.

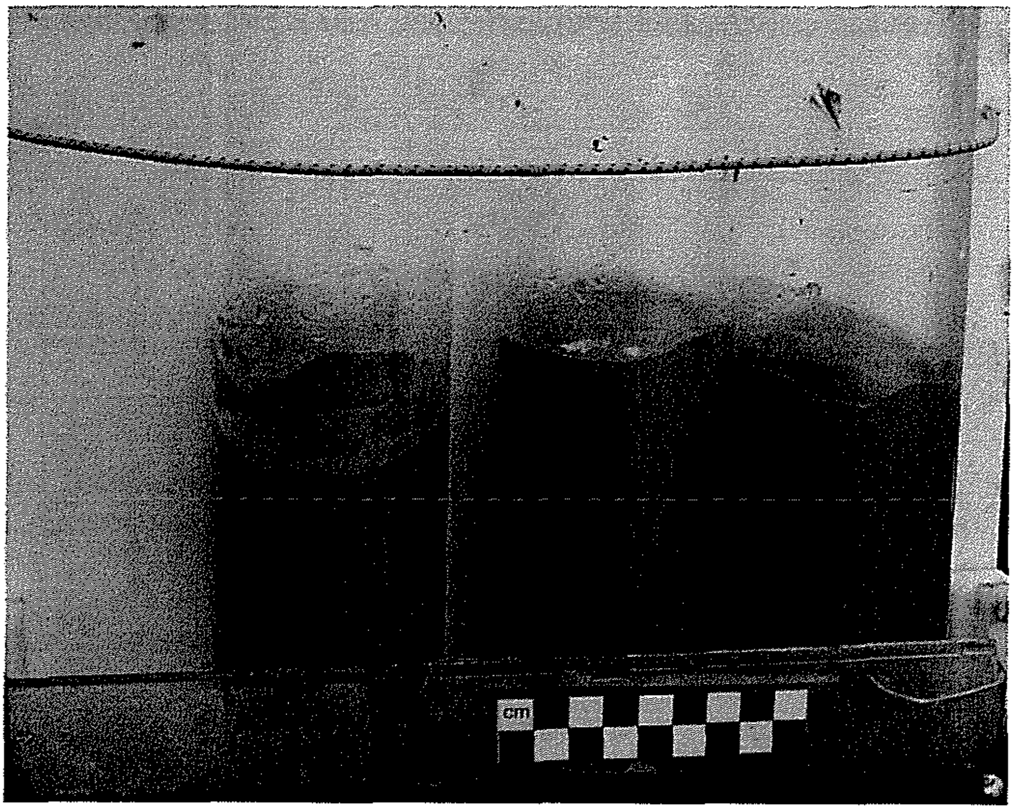

Figure 6. Representative cores collected from within the renewal site MPE 412. Left to right, Site A, Site B, and Site C.

4.3. Biological properties of the seabed

4.3.1. Epibiota

Epibiota beneath the existing marine farm were sparse with few distinct taxa. Observed species included: cushion stars (*Patiriella regularis*), and scallops (*Pecten novaezelandiae*). Epifaunal communities observed inshore of the existing marine farm were noticeably more diverse due to the change from deep soft mud habitat to a more complex cobble and reef structure. The shallow subtidal region of the shore consisted of bedrock, boulder and cobble with occasional macroalgal stands (*e.g. Carpophyllum* sp.). Cobble habitat extended offshore to the base of the slope at about 29 m where a silty mud habitat dominated.

The dive transect extended towards a major headland where the cobble reef met a rocky reef projecting down from the headland. The steep profile of the reef minimises the amount of mud which settles out on the cobble/rocky slope providing stability for colonisers. Dominant epibiota in this subtidal environment included; turfing algae (*Corallina* sp.), red algal sp., coralline paint, tube worm, ascidian, blue mussel (*Mytilus edulis*) , sea cucumber (*Stichopus mollis*), scallop, sea squirt (*Asterocarpa* sp.) starfish (*Coscinasterias calamaria*), sea anemone, ascidian, sponge (*Ancorina alata*), hydroids, kina (*Evechinus chloriticus*) and kelp (*Carpophyllum* sp.). Fish species observed included blue cod (*Parapercis colias)*, spotty (*Notolabrus celidotus*), butterfly perch (*Caesioperca Lepidoptera*) and triple fin (*Fosterygion* sp.). The community appeared naturally healthy and diverse with no obvious adverse impacts attributable to the neighbouring marine farm.

Perhaps the most visually conspicuous seabed impact below a marine farm is the modification of the benthic habitat that occurs through accumulation of live and dead mussel material on the seafloor, produced primarily during harvesting and farm maintenance (Davidson 1998; Davidson & Brown 1999). Visual observations suggest that shell deposition within a farm can be patchy, ranging from rows of live mussel clumps and shell litter directly beneath long lines, to widespread coverage across the farm site (Forrest & Barter 1999, N. Keeley pers. obs.). At this site, the latter tends to be the case, with site depth and tidal movement of the mussel lines resulting in a relatively even dispersal of deposited material. Shell material observed beneath the existing farm site was patchy, variable, and of relatively low density. No obvious shell debris was observed outside the farm boundaries.

Mussel clumps and shell litter beneath a mussel farm can act as a substrate for the formation of reef-type communities (De Jong 1994; Davidson & Brown 1999). Kaspar *et al.*1985) described reef-like communities under an existing farm that included large epibiota such as tunicates, sponges, sea cucumbers, calcareous polychaetes, and mobile predatory species such as starfish, crabs and fish. In other situations, mussel clumps and shell litter can remain relatively barren of reef-type communities (Watson 1996) and if forming a blanket layer, could conceivably inhibit the vertical movement of errant (free moving) infauna species. No significant shell-based reef community was observed beneath the Forsyth Bay farm site.

5. CONCLUSIONS

Very few epibiota were observed below the farm due to the deep, silty/mud sediments, although a diverse range of infauna was observed, similar to unimpacted areas throughout the Marlborough Sounds in the deep muddy basins. Build up of shell deposits beneath the site was noticeable, but not excessive given the length of time the site has already been farmed (approximately eight years).

With respect to the renewal of this consent application, it is our assessment that the site continues to be ecologically healthy and functional and has not been 'adversely impacted' from recent activities. If the site continues to be managed in a similar manner it can be assumed that the rates of biodeposition and shell build-up beneath the site will remain unchanged. Further changes to the composition of the seabed, predator-prey interactions, nutrient dynamics, plankton communities, associated and dependent species (*e.g.* marine mammals and seabed) and risks associated with biofouling species and biosecurity issues should therefore be negligible. Thus, continuation of this consent should have no significant adverse ecological effects on the marine environment.

7. APPENDICES

Appendix 1. Taxonomic infaunal count data for MFE 412.

Taxa	Common Name	Forsyth, A	Forsyth, B	Forsyth, C	Forsyth average
GASTROPODA (WHITE RISSOID LIKE)	Unidentified gastropod	0	2	0	0.7
Arthritica bifurca	Small bivalve	0	0	2	0.7
Corbula zelandica		0	0	1	0.3
Limaria orientalis	File Shell	1	0	0	0.3
Melliteryx parva		0	1	2	1.0
Nemocardium pulchellum	strawberry cockle	1	0	1	0.7
Perna canaliculus	Green Lipped Mussel	1	0	0	0.3
Theora lubrica	Window shell	9	1	10	6.7
Scalibregma inflatum		1	0	0	0.3
Cossura consimilis		0	0	1	0.3
Maldanidae	Bamboo Worms	1	0	0	0.3
Orbinia papillosa		2	0	0	0.7
Paraonidae		4	0	5	3.0
Dorvilleidae		49	6	35	30.0
Lumbrineridae		3	1	2	2.0
Onuphis aucklandensis		0	1	0	0.3
Hesionidae		0	1	1	0.7
Syllidae		0	0	1	0.3
Sphaerosyllis sp.		2	0	1	1.0
Phyllochaetopterus socialis	Parchment worm	0	0	1	0.3
Prionospio sp.		4	1	9	4.7
Cirratulidae		1	0	2	1.0
Flabelligeridae		0	3	1	1.3
Terebellidae		1	0	2	1.0
Terebellides stroemi		7	7	19	11.0
Cumacea	Cumaceans	6	0	1	2.3
Amphipoda a	Amphipods	1	4	6	3.7
Amphipoda b	Amphipods	0	2	2	1.3
Amphipoda c	Amphipods	0	0	1	0.3
OSTRACODA	Ostracods	16	1	8	8.3
Echinocardium cordatum	Heart Urchin	1	0	0	0.3
Ophiuroidea	Brittle stars	2	1	2	1.7
Total No. of individuals		**113**	**32**	**116**	**87**
Total No. of taxa		**20**	**14**	**24**	**32**