Survey and Monitoring Report No. 36

Description of the macrobenthic community from a proposed marine farm in Oyster Bay, Croisilles Harbour, Marlborough Sounds

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A report prepared for

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January

1995

1.0 INTRODUCTION

This report presents a biological description of the conspicuous macrobenthic communities from a proposed 5.724 ha marine farm in Oyster Bay, Squally Cove, Croisilles Harbour (Figure 1). This report presents information on the ecological aspects of the benthos directly below and on the shore adjacent to the proposed marine farm.

Oyster Bay is the first large bay on the northern coast of Squally Cove, Croisilles Harbour. Squally Cove itself is approximately 7 km in length and between 1.3 to 1.5 km wide. Oyster Bay is relatively shallow, reaching depths not much greater than 12 to 13 m near the mouth where it enters Squally Cove proper. Oyster Bay grades into an intertidal cobble/pebble shoreline around its edges and at the head of the bay. Water residence times in this area have not been studied.

The study area is located on the western shore of Oyster Bay where it becomes Squally Cove, approximately 800 m south-west from the head of Oyster Bay. The inner boundary of the proposed marine farm is located between 50 to 60 metres distance from shore (Figure 1). The proposed farm stretches 340 metres along the inshore boundary and 423.2 m along the offshore boundary (Figure 1). The proposed marine farm is 150 m distance along its entire length. This represents a total distance from shore of between 200 to 210 m distance. Depths on the inside boundary were approximately 6.7 m (Point 1), 6.2 m (Point 2), 5 m (Point 3), while depths on the outside boundary were approximately 10 m (Point 4), 10 m (Point 5) and 11 m (Point 6). The proposed activity, details of farm structure and species are outlined in a report by R. Sutherland on behalf of the applicant (M. J. Hebberd).

Croisilles Harbour and the Marlborough Sounds lie at the northern end of the South Island, with Cook Strait to the north and east and Tasman Bay in the west. Formed by submergence of river valleys, the Sounds consist of approximately 1450 km of bays, passages, peninsulas, headlands, estuaries and beaches, often with an adjacent steep terrestrial topography. The Sounds are a resource of major environmental importance. In a nationwide report by the Department of

Conservation, the Marlborough Sounds was identified as being of national conservation importance. The Sounds was also identified as having areas of international biological importance (Davidson et al ., 1990; Davidson et al., in press). These values will be important consideration in the soon to be produced Marlborough District Council Coastal Plan and District Plan.

Multiple use (marine farming, fishing, boating, housing, waste water disposal, port development, forestry, agriculture) have the potential to degrade the environment of the Sounds. Marine farming for example, can have considerable impact on the environment through habitat modification or lowering water quality (Kaspar et al., 1985; Gowan and Bradbury, 1987; Kaspar et al., 1988; Gowan et al., 1990; Silvert, 1992). It is therefore important that all new marine farm proposals adequately identify natural values within and adjacent to a proposed marine farm.

The aim of this study was therefore to provide environmental information on the proposed site and to identify features of biological value which could be threatened by the establishment of the proposed marine farming activity.

2.0 Croisilles Harbour

The Croisilles Harbour is located 43 km north-east of Nelson. The harbour is traditionally regarded as the western-most component of the Marlborough Sounds ecological area. The Croisilles Harbour includes all the tidal and permanent water enclosed by a line from Cape Soucis around the seaward side of Motuanauru and Otuhaereroa Islands to Kakaho Point. The total intertidal and subtidal area encompassed within these boundaries is 4771 ha. The Croisilles Harbour area encompasses a variety of ecological values including: three main islands, Motuanaura (9 ha), Otuhaereroa (19 ha), Moukirikiri (0.8 ha); one barrier enclosed estuary, Whangarae Estuary; one lagoon, Pakiaka Point Lagoon; one cuspate foreland, Matarau Point; and numerous intertidal and subtidal boulder banks, beaches, tidal flats, rocky headlands, and a variety of subtidal environments.

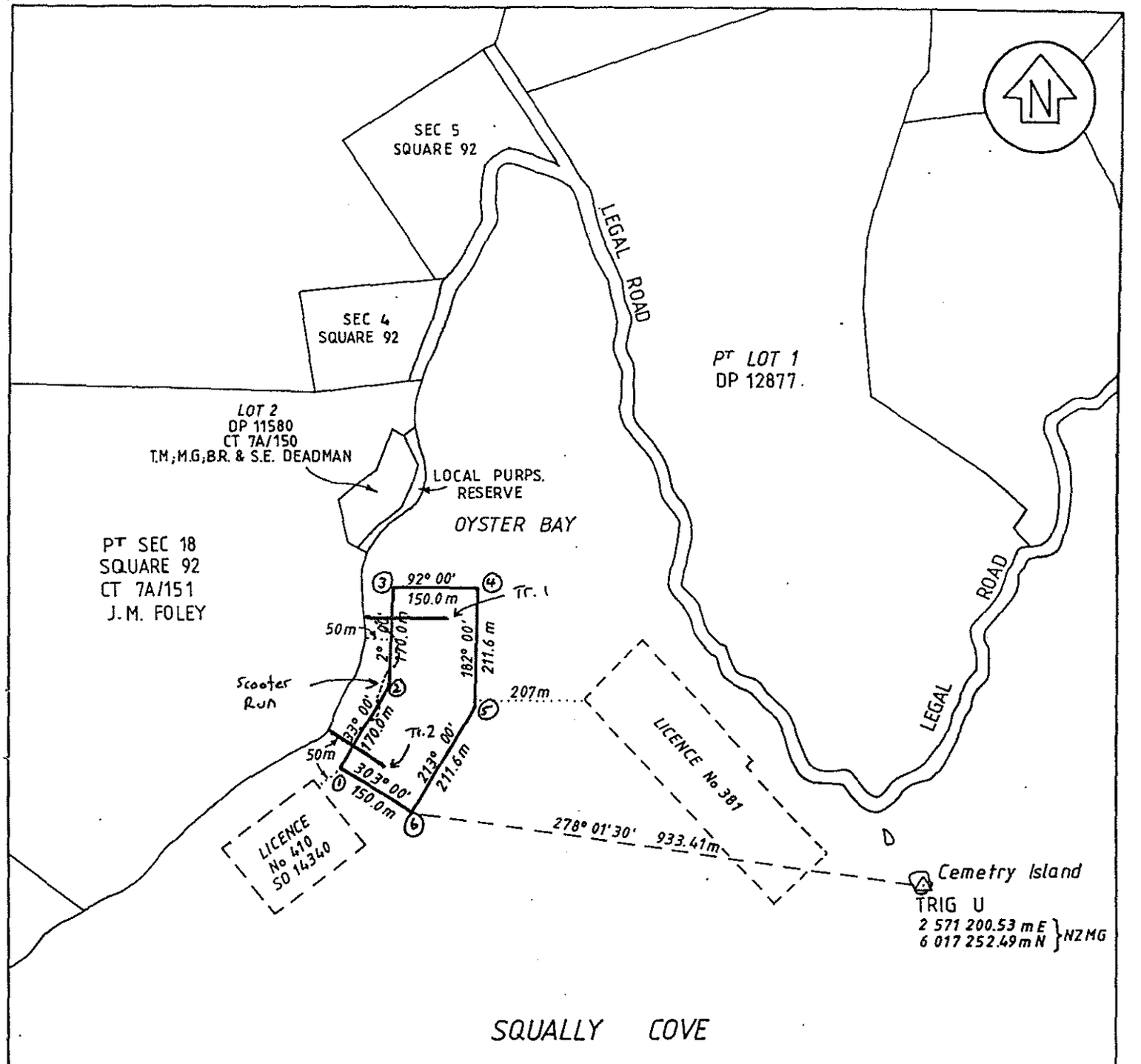

Figure 1. Location of transects and scooter run.

PLAN OF PROPOSED COASTAL PERMIT APPLICATION
M.J. HEBBERD

TOTAL AREA: 5.7240 ha

NOTE: THE POSITION OF THIS APPLICATION HAS NOT BEEN SURVEYED, THEREFORE IS APPROXIMATE ONLY.

SCALE 1:10,000

200 100 0 100 200 300 400 500 600 700 800 900 1000 metres

LOCAL AUTHORITY: MARLBOROUGH DISTRICT	NELSON LAND DISTRICT
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Te Puna Korero Whenua

Many of the Croisilles Harbour catchments are covered with regenerating native bush, but there are significant areas of land which have been extensively modified by farming, forestry and fire. In a study by Lands and Survey (1981), the Croisilles Harbour was recognised as having 'outstanding' to 'distinguished' landscape values, especially the south-western faces and the Croisilles Islands. A more recent landscape study by Bennett (1990) recognised many areas in the Croisilles as having high landscape quality. The study considered that many areas were very vulnerable to a reduction of landscape values by inappropriate development. Notable features of the terrestrial environments of the Croisilles Harbour include: the regionally rare swamp maire *Syzygium maire* (one of only three South Island locations); the regionally rare sand-dune plant, *Spinifex sericeus*; geologically rare landform, Matarau Point; the nationally 'vulnerable' native sand spurge *Euphorbia glauca*; nationally 'rare' native mistletoe, *Tupeia antarctica*; regionally rare large-leaved milk tree *Streblus banksii*; coastal herb, *Scleranthus biflorus*; coastal fern, *Asplenium terrestre maritimum*; nationally 'threatened' land snail, *Powelliphanta hochstetteri obscura* and threatened reef heron, *Egretta sacra sacra*. The Croisilles Islands are gazetted as scenic reserves and have no mammalian predators, however, it is probable that stoats make occasional visits to the islands (I. Millar, pers. comm.).

The ecology of the subtidal environment of Croisilles Harbour is poorly known, but the general subtidal features of this area are well known by local and Nelson divers. The central and outer Croisilles Harbour is recognised as an important recreational diving area, providing good reef diving along its southern coast and scallops in most other places (Nelson Underwater Club Inc, 1985).

A total seven major substrate types have been recorded in the Croisilles Harbour area (Davidson & Duffy 1992). These authors recorded substratum types were either large homogeneous areas, but more often, a variety of substrata depending on environmental constraints. A total of 10 major habitats based on substrata or dominant cover of flora and fauna have been recognised (see Appendix 1).

3.0 MATERIALS AND METHODS

The proposed site was qualitatively investigated in December 1994, using two rapid subtidal survey techniques. All of the inshore boundary and randomly selected parts of the proposed marine farm area and adjacent coast between 0 to 10 metres depth were investigated by a free diver assisted by an Apollo scooter. Results from this preliminary investigation were recorded on waterproof paper. Based on these findings two representative area at either ends of the proposed farm areas were selected and a 100 m lead-lined transect line marked at 5 m intervals was installed perpendicular to the shore (Fig. 1). These transect sites were considered representative of the substrata, habitats and flora and fauna found over the proposed farm during the free dive.

Using SCUBA, depth, distance, substrate, habitat and associated conspicuous surface dwelling flora and fauna were recorded using waterproof paper, clipboard and a pencil. This process was terminated at a distance of 115 to 135 m from the low tide mark and at a depths between 10 to 10.5 metres. The abundance of conspicuous macroinvertebrates, macroalgae and fish were estimated on a scale of 1 = uncommon, 2 = occasional, and 3 = common.

All depths presented in this report have been adjusted to chart datum.

4.0 RESULTS AND DISCUSSION

4.1 Scooter Run

Results from the scooter run across random parts of the proposed farm and along the entire length of the proposed marine farm and adjacent coast suggested that:

1) of habitats identified from the Croisilles by Davidson and Duffy (1992), only mud, pebbles and cobbles, and shallow hard-shore habitats and substrata were recorded from

the present site;

2) no bedrock or rubble areas were recorded within the proposed farm area. In most adjacent coastal areas rubble habitat extended approximately < 30 to 50 m distance from the low tide mark;

3) the changes in substrata and associated communities in the proposed farm and adjacent shores showed similar trends in depth/distribution down the shore for the entire length of the inshore farm boundary;

4) soft sediments dominated by mud were widespread over all of the proposed marine farm area; and

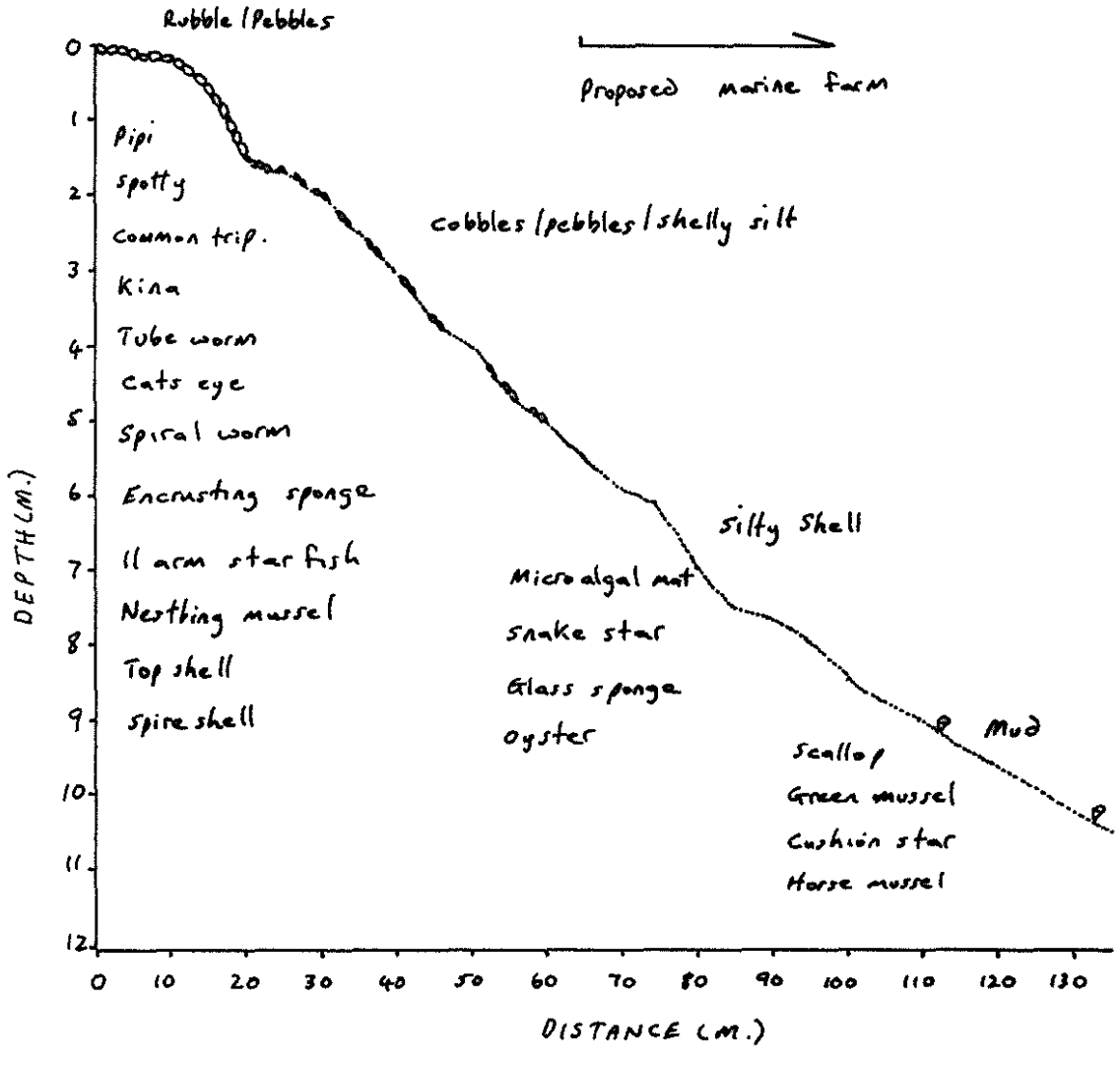
5) of 51 species of fish recorded by Davidson and Duffy (1992) only four species were recorded in the present study and were present in relatively low densities.

4.2 Profiles

The intertidal shore adjacent to the proposed marine farm area was dominated by a relatively low gradient rubble/cobble bank with isolated areas of larger boulders towards the south-western end of the proposed marine farm. All of the coast was bordered by short bluffs/banks and steeply rising hill side clad in kanuka/scrub and gorse. The subtidal shore was initially an extension of the intertidal shore with larger boulders towards the southern parts of the area and rubble/cobbles towards the norther end of the proposed farm. The boulder or rubble substrata quickly graded through to soft sediments of shelly silt/pebble and ultimately silts and clays (mud) at approximately 80 to 100 metres from shore and in depths of approximately 9 m depth. Further from shore the benthos was a continuation of this mud substrata (Figure 2).

From the transect and scooter run a total of 24 species of invertebrate, 4 algae, 2 ascidians and 4 species of bony fish were recorded. A list of species is presented in Table 1, while transects

Table 1 Conspicuous species recorded from transects in Oyster Bay, Croisilles Harbour.				
Algae	Common name	Invertebrates	Habitat	Common name
Red alga (2)		SPONGIA		
Corallina spp.(1)	paint	Tethia sp. (1)	rubble	golf ball
Hormosira banksii (1)	Neptune's necklace	Crella encrustans (2)	encrusting	sponge
Microalgal mat (2)		Callyspongia sp. (3)	soft	purple glass
		MOLLUSCA		
		GASTROPODA		
		Cellana sp. (2)	rubble	limpet
		Maoricolpus roseus (2)	rubble	spire shell
		Trochus viridus (1)	rubble	top shell
		Turbo smaragdus (3)	rubble	cats-eye
		BIVALVIA		
		Atrina zelandica (1)	soft	horse mussel
		Modiolarca impacta (2)	rubble	nestling mussel
		Mytilus edulis (1)	rubble	blue mussel
		Paphies australis (3)	rubble	pipi
		Pecten novaezelandiae (1)	soft	scallop
		Perna canaliculus (1)	soft	green mussel
		Triostrea sp.	soft	dredge oyster
		POLYCHAETA		
		Brachiomma sp.(1)	sand/rubble	fan worm
		Galeolaria hystix (2)	rubble	tube worm
		Pomatoceros caerulus (2)	rubble	tube worm
		Spirorbis sp. (3)	rubble	spiral worm
		CRUSTACEA		
		Pagurus spp (1)	soft	hermit crab
		ECHINODERMATA		
		Coscinasterias calamaria (2)	soft	11 arm star
		Evechinus choroticus (2)	soft	kina
		Patiriella regularis (1)	sand/rubble	cushion starfish
		Pectinura maculata (1)	soft	snake star
		Stichopus mollis (1)	soft	sea cucumber
		ASCIDEACEA		
		Cnemidocarpa sp. (1)	rubble	saddle squirt
		Leptoclinides sp.?	soft	purple species
		BONY FISHES		
		Notolabrus celidotus (2)	soft	spotty
		Hemercoetes monopterygius (1)	soft	opal fish
		Forsterygion lapilum (2)	rubble	common triplefin
		Unidentified species (2)	rubble	



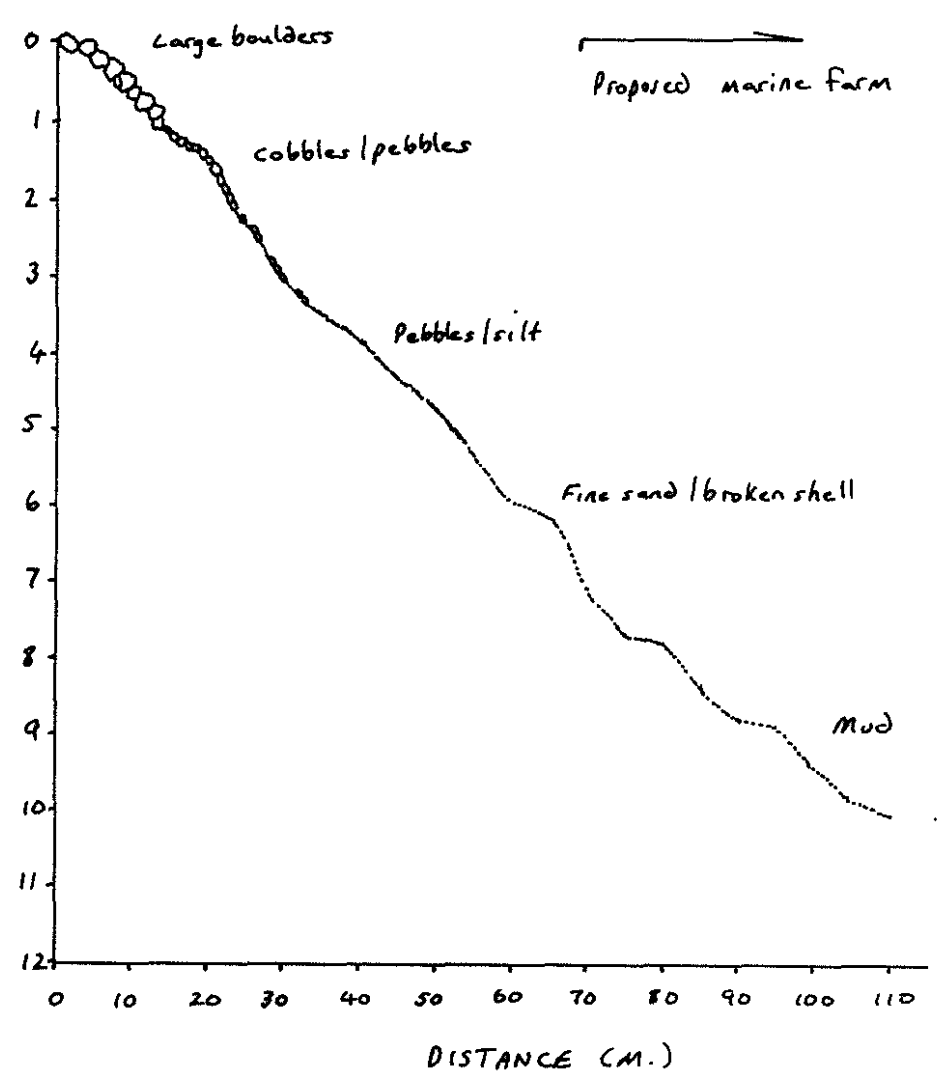


Figure 2. Shore profiles from proposed marine farm site in Oyster Bay, Croisilles Harbour.

are plotted in Figure 2.

Although tube worms *Galeolaria hystrix* were recorded on rubble habitat in the present study, but no tube worm mounds were observed.

Only four species of fish were recorded from the transect, with spotty (*Notolabrus celidotus*) being numerically the most abundant. No blue cod (*Parapercis colias*) were recorded. Opal fish *Hemercoates monopterygius* were recorded on the silt habitat at 9 to 10 m depth.

The brachiopod *Magasella sanguinea* was not recorded from the study area. No other species of brachiopod were recorded from the study site.

Green-lipped mussels (*Perna canaliculus*) were recorded from the soft substrata.

Scallops and oysters were recorded from soft substrata but in relatively low numbers.

5.0 DISCUSSION OF POTENTIAL IMPACTS OF BIVALVE MARINE FARMS

In a study on the effects of mussel aquaculture, it was recognised that build-up of shell debris and increased sedimentation rates directly below mussel farms strongly influenced benthic communities (Kaspar et al., 1985). No data was sourced on the impact of stick culture of Pacific oysters (*Crassostrea gigas*) on the benthos.

All of the benthos below the proposed marine farm was dominated by soft substrata, with the majority dominated by mud habitat with relatively few epibenthic species being present (horse mussel, cushion star, microalgae, straw worm, opal fish). Sessile species would be probably smothered by any shell debris originating from a farm, while the opal fish would probably be displaced preferring to inhabit mud substrata.

6.0 CONCLUSION

The aims of the study were to provide a biological description of the benthos under and adjacent to a proposed mussel farm in Oyster Bay, Croisilles Harbour and to identify potential threats to any conservation values posed by the proposed activity.

The soft and hard shore communities recorded from the present study contained species that are widespread and common throughout the subtidal shores of Croisilles Harbour and the Marlborough Sounds (Dell 1951; Estcourt 1967; McKnight 1969, 1974; Roberts and Asher 1993; McKnight and Grange 1991; Davidson and Duffy, 1992; Davidson, 1994; Davidson and Brown, 1994; Duffy et al. in prep; Chadderton et al., in prep, Chadderton and Davidson in prep). No rare or threatened species were recorded from this area.

The substrata and associated flora and fauna under all of the proposed marine farm was soft substrata, dominated by mud (silts and clays). A relatively low diversity of marine biota was recorded from these substrata, particularly mud. These habitats and their associated species are widespread in Croisilles Harbour and the Marlborough Sounds. This habitat has a relatively low diversity of species compared to many rich and diverse habitats and communities recorded from particular parts of the Sounds. The establishment of a marine farm over this benthos would probably mean the ultimate modification of this mud benthos and its associated community. This impact would, however, represent a small fraction of this habitat type in the Marlborough Sounds.

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Appendix 1. Description of habitats and substrata recorded from Croisilles Harbour (from: Davidson and Duffy 1992).

Coarse Sand-Broken Shell

Coarse sand was characterised by sand particles between 0.5 and 2.0 mm diameter. In the Croisilles Harbour, coarse sand was always found with a proportion of clean broken shell. Two colours of this sand habitat were recognised, brown/fawn and grey. Both coarse sand types were located in depths < 9 m. The grey sands appear alien to the Croisilles and probably originate from outside the harbour. Characteristic species of the coarse sand habitat vary considerably. The grey, current swept sand near the entrance, is characterised by a virtual absence of species. The fawn/brown coarse sands were characterised by the presence of the lancelet, *Epigonichthys hectori*; scallop, *Pecten novaezelandiae*; cushion star *Patiriella regularis*; horse mussel, *Atrina zelandica*; urchin, *Evechinus chloroticus*; 11 arm star, *Coscinasterias calamaria*; *Apatopygus recens*; dog cockle, *Glycymeris laticostata*; modest dog cockle, *Glycymeris modesta; Cominella virgata*; and hermit crabs.

Clean Sand-Broken Shell

Clean sand substrate is characterised by sand particles between 0.065 and 0.5 mm in diameter. Clean sand in the Croisilles Harbour was encountered in depths < 4 m. Clean sand bottoms in the Croisilles Harbour were mixed with a component of broken shell. Characteristic species included the horse mussel, *A. zelandica*; tube worm, *Branchiomma* sp.; scallop, *P. novaezelandiae*; hermit crabs; and cushion star, *P. regularis*. A total of 17 species were recorded from clean sand areas in the Croisilles Harbour.

Muddy Sand

Muddy sand was dominated by sand particles with a significant proportion of silts and clays. This sediment had a granular texture and clouded the water when disturbed. Muddy sand was encountered at a variety of depths with varying proportions of mud. Generally, the greater the depth, the greater the mud content. Muddy sand substrate was encountered from 4-17 m depth. Characteristic species included the scallop, *P. novaezelandiae*; urchin, *E. chloroticus*; hermit crabs; snake star, *Pectinura maculata*; sea cucumber, *Stichopus mollis*; horse mussel, *Atrina zelandica; Trochus tiaratus; Cominella adspersa;* and 11 arm starfish, *C. calamaria*.

Mud

Mud is defined as sediments made up of silts and clays <0.063 mm in diameter. Common species included: *Echinocardium australe, Austrofusus glans, Amalda* spp., *Alcithoe arabica, Poirieria zelandica, Struthiolaria papulosa* and *Pecten novaezelandiae*. The presence of scrub

and regenerating forest on most of the catchments, lack of a large river and strong tidal currents act against the formation of mud dominated areas.

Pebbles and Cobbles (Hard-shore Habitat)

Pebbles are defined as a hard substrate ranging in size between 4 and 64 mm diameter. Cobbles are in the size range 64 to 256 mm in diameter.

Boulders (Hard-shore Habitat)

Boulders are characterised by rock substrate greater than 256 mm in diameter. Boulders may be further distinguished into a small or large size classification.

Rock (Hard-shore Habitat)

Rock substrata may be solid as in the case of rock walls or platforms or appear as outcropping rock which emerges from the basement sediment layer as on isolated unit.

Shallow Hard-Shore Zone

The shallow hard-shore habitat is located in water depths of < 12 m. Substrata comprising of pebble, cobble, boulder and rock or combinations of these substrata are located throughout the Croisilles Harbour, particularly around the islands and harbour edges. Characteristic species of the shallow hard-shore zone include: barnacles *Epopella plicata, Chamaesipho columna; Serpulid* tubeworms, *Galeolaria hystrix;* box anemone , *Culicia rubeola; Actinothoe albocincta*; white rock shell, *Thias orbita*; cats eye, *Turbo smaragdus;* Cook's turban shell, *Cookia sulcata*; false oyster, *Anomia walteri*; butterfly chiton, *Cryptoconchus porosus*; nestling mussel, *Modiolarca impacta*; green top, *Trochus viridus*; limpet, *Cellana radians*; kina, *Evechinus chloroticus*; 11 arm starfish, *Coscinasterias calamaria*; inflated cushion star, *Stegnaster inflatus*; sea cucumber, *Stichopus mollis*; cushion star, *Patiriella regularis*; reef star, *Stichaster australis*; broach star, *Pentagonaster pulchellus*; and saddle ascidian, *Cnemidocarpa bicornuata.*

Deep Hard-Shore Zone

The deep hard-shore zone is restricted to depths > 12 m in the Croisilles. Hard shore zones in the Croisilles seldom reach depths > 22 m. Characteristic species of this zone include: the brachiopod, *Waltonia inconspicua*; sponges, *Ancorina alata, Aplysilla sulfurea, Callyspongia regularis, Iophon minor, Aaptos aaptos, Tethia aurantium, Tethia ingalli, Polymastia* spp.; bryozoan, *Celleporaria agglutinans*; kina, *Evechinus chloroticus*; sea cucumber, *Stichopus mollis*; inflated cushion star, *Stegnaster inflatus;* 11 arm starfish, *Coscinasterias calamaria*;

mitre shell, *Maoricolpus rosea*; false oyster, *Cheidothaerus albidus*; tiger top shell, *Maurea tigris;* spotted top shell, *Maurea punctulata*; and numerous encrusting bryozoans, ascidians and red algae species.

Brown Algal Zone

Three species of brown algae form a distinct zone in the Croisilles Harbour: *Carpophyllum flexuosum, C. maschalocarpum, Ecklonia radiata.* An algal zone is deemed to exist when the cover of plant material forms a canopy over the underlying substrate. In the Croisilles, the algal zones are restricted to a narrow strip at the low tide zone (*Carpophyllum maschalocarpum, C. flexuosum*) or form small patches in depths < 12 m (*C. flexuosum, E. radiata*).

Brachiopod Bed

Three species of brachiopods were recorded from the Croisilles, however, only one (*Waltonia inconspicua*) reached densities where the animals formed a recognisable zone. Large beds were located on bedrock walls on the seaward side of Otuhaereroa Island.

Zostera novazelandica (Eelgrass)

Eelgrass or seagrass in New Zealand is an intertidal vascular species of grass. Eelgrass has been recorded from Whangarae Estuary.

Native Rushes, Sedges and Herbfields

Detailed investigation of these areas in the Croisilles is yet to be carried out. Rush species recorded to date are the sea rush *Juncus maritimus* and the jointed wire rush *Leptocarpus similis.*