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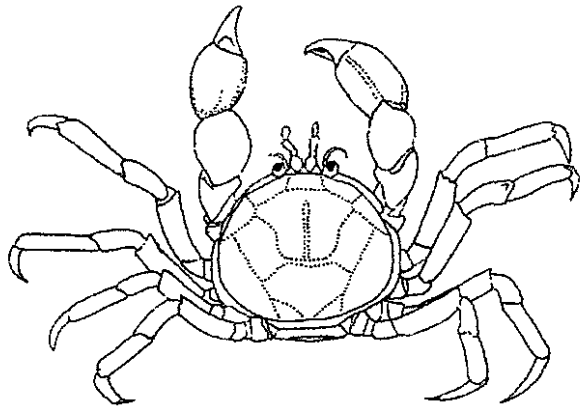
Research, survey and monitoring report number 121

Description of the subtidal substrata and associated macrobenthic communities from a proposed marine farm extension in north-western Beatrix Bay, Pelorus Sound

A report prepared for:
Marlborough Mussel Company



June, 1996

1.0 INTRODUCTION

This report presents a biological description of habitats and associated conspicuous macrobenthic communities from an area proposed as a marine farm extension in Western Beatrix Bay, Pelorus Sound (Figure 1).

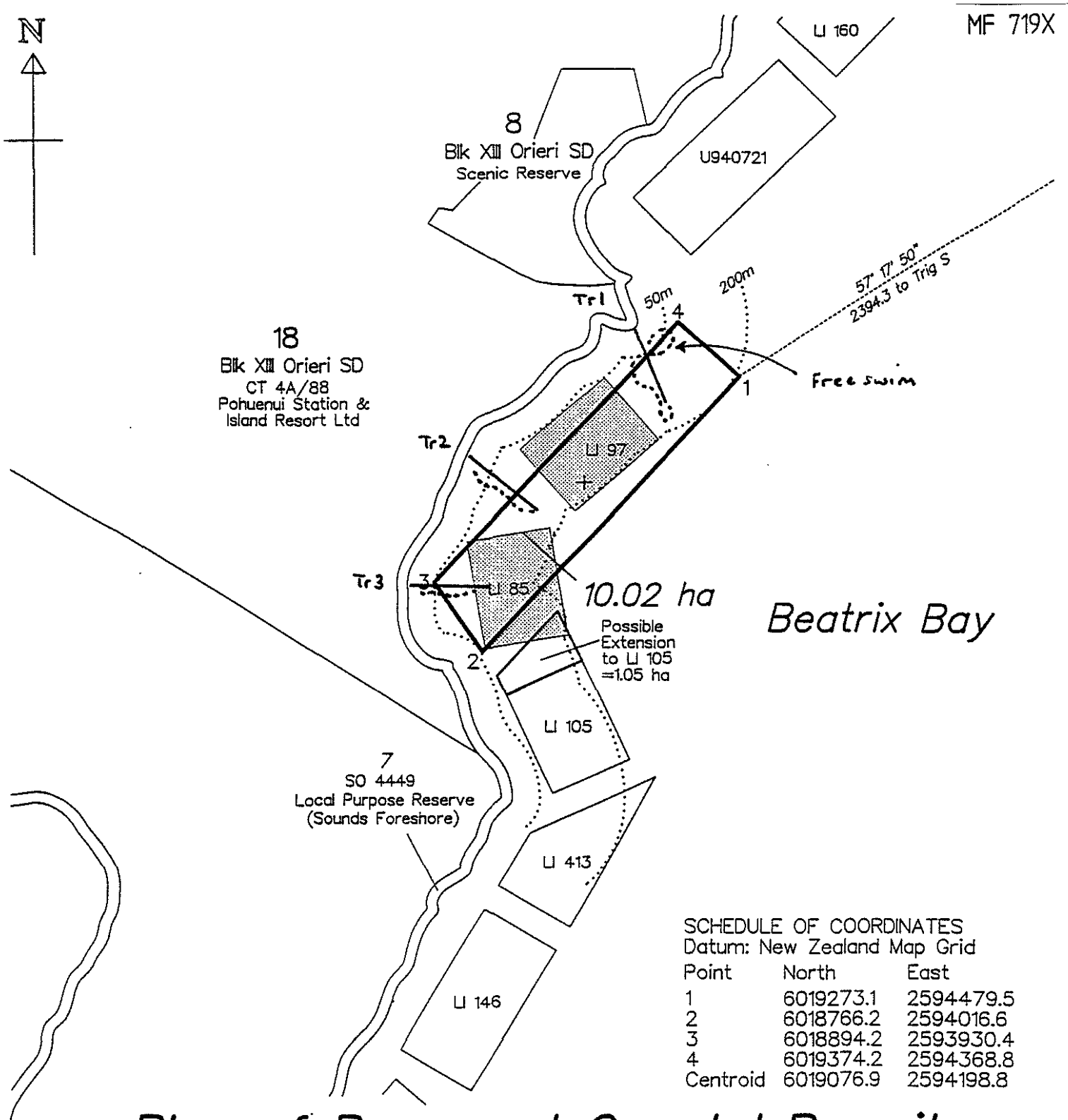
Beatrix Bay is a large bay (approximately 5 km in long and up to 4 km wide), located in central Pelorus Sound. Depths in most of the offshore areas of the bay are between 30 m to 33 m but rise to considerably shallower depths in the numerous small bays around its edges (see Navy Chart NZ 615). The shoreline of Beatrix Bay is dominated by cobble, pebble and substrata with beaches at the heads of many small bays and rock headlands located at prominent locations around the bay. The terrestrial environment of most of Beatrix Bay is dominated by reverting pasture and scrub with isolated areas of pasture.

The application area is located along the western shore of Beatrix Bay (Figure 1). The total area of the application is 10.02 ha, however, the present study was restricted to three areas located outside the two current licences which exist within and adjacent to the 10.02 ha application area (Licence 85 and 97, Figure 1). The benthos under the existing farms was not investigated. Depths along the inshore boundary were approximately 8 m (Point 3) and 22 m (Point 4), while depths along the offshore boundary were approximately 30 m (Point 1) and 21 m (Point 2). A reef system was located near the north-west end of the inshore boundary. The benthos in this area rose to approximately 8 m depth. The proposed activity, details of farm structure and proposed species are outlined by a report by Resource Management Consulting on behalf of the applicant Marlborough Mussel Company.

The Marlborough Sounds lie at the northern end of the South Island, with Cook Strait to the north and east and Golden Bay and the West Coast to the west. The Marlborough Sounds were formed by a submergence of river valleys. The Sounds consist of approximately 1500 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 having national conservation importance. The Sounds has areas of international biological importance (Davidson et al., 1990; Davidson et al., in press). These values will be important consideration in the Marlborough District and Coastal Plans.

Multiple use (marine farming, fishing, boating, housing, waste water disposal, port development, forestry, agriculture) has 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 of 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 that could be threatened by the establishment of the proposed marine farming activity.



SCHEDULE OF COORDINATES
Datum: New Zealand Map Grid

Point	North	East
1	6019273.1	2594479.5
2	6018766.2	2594016.6
3	6018894.2	2593930.4
4	6019374.2	2594368.8
Centroid	6019076.9	2594198.8

Plan of Proposed Coastal Permit

Marlborough Mussel Co.

Coastline is MHWM from DOSLI DCDB

Bearing variation Geodetic Datum 1949 to NZMG +31° 30"

SCALE 1:10,000

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

LOCAL AUTHORITY: MARLBOROUGH DISTRICT	MARLBOROUGH LAND DISTRICT
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Prep. By JB	Date 22/11/95	Job No 726789	File 6475/01/02	Reference P26/5.3

Department of Survey & Land Information
Te Puna Korero Whenua

Figure 1. Transects and free swims.

2.0 MATERIALS AND METHODS

The proposed 10.02 ha site was investigated on the 9 th May 1996, using three subtidal survey techniques. Firstly, the inshore, center line and offshore boundaries of the proposed area were remotely sensed using a colour scrolling Furuno depth sounder. Depths and any abnormalities along the sea bottom were noted for later diver inspection. In addition, selected parts of the inshore boundary of the proposed marine farm and areas outside the existing licenses were investigated by a free swimming diver on the return trip from each transect.

Based on depth soundings, three areas were selected and a lead-lined transect line marked at 5 m intervals installed perpendicular to the shore (Figure 1). These transect sites were located in either representative parts of the areas outside the existing marine farms or targeted bottom abnormalities.

Brachiopod (*Magasella sanguinea*) were observed in relatively low abundances from the study area. Estimates of their maximum density were collected from each transect. Scallop (*Pecten novaezelandiae*) and horse mussel (*Atrina zelandica*) densities were collected from a total of 23 quadrats of 10 x 1 m^2 size.

All depths presented in this report are adjusted to datum.

Data collected during the study follow the Department of Conservation guideline on procedures for the investigation of marine farm areas in the Marlborough Sounds (Department of Conservation, 1995).

Notes were collected on water current direction and relative speed at 10.30 am and 11.30 am. These observations were approximately 2 hours before low tide.

3.0 RESULTS AND DISCUSSION

3.1 Water Currents, Free Swims and Depth Soundings

Results from depth soundings and the free swims across random parts of the proposed farm extension areas and in the inshore area of the extension suggested that:

1) substrata present were cobbles, pebbles, outcropping rock, small and large boulders, and various combinations of fine sand, broken shell and dead whole shell, shell debris and silt;

2) outcropping rock, cobble and boulder substrata were recorded within the boundaries of the proposed marine farm at the north-western end of the proposal;

3) tube worm mounds (*Galeolaria hystrix*) were observed within the boundaries of the proposed marine farm at the north-western end of the proposal;

4) a reef structure was located during the soundings and free swims at the north-western end of the proposed marine farm extension;

5) all areas offshore of 50 m to 80 m distance from shore were dominated by soft bottoms;

6) a zone of macroalgae were observed on the reef structure and at transect 2; and

7) shell debris presumably originating from the overlying mussel farm was recorded in offshore areas at transect 3.

Water currents velocities were estimated at approximately 12 m depth and 22 m depth. At 12 m depth, water current was observed was very light current along the shore in a southerly direction. At 22 m depth, no current was observed. Species and communities observed from this site were not representative of communities which prefer areas swept by strong or moderate currents.

3.2 Shore Profiles

The intertidal zone adjacent to the proposed marine farm area was dominated by boulder/cobble/pebble shoreline with small areas of bedrock located towards the northern end of the study area. The coast was bordered by a terrestrial environment dominated by early regeneration broardleaf scrub and an occasional wilding pine.

Subtidal transects were terminated at 150 m distance from shore. All transects showed a consistent change to a mud dominated benthos in the outer parts of each transect. Verification that no further changes occurred was tested by a free swim for a further approximately 40 m distance at transect 1. No bottom abnormalities were observed during sounding runs.

Subtidal shore profiles were initially dominated by hard substrata. At transect 1, the transect targeted a reef structure detected during the inshore sounding run. This structure extended to approximately 80 m distance from shore (Figure 2). The reef consisted of relatively large outcrops of rock surrounded by various sized boulders and cobble material with a component of shell and fine sand. Brown macroalgae dominated by *Carpophyllum flexuosum, C maschalocarpum* and *Cystophora* sp. extended in intermittent patches the full extent of the reef. Beyond the reef, the benthos was dominated by dead whole shell overlying a shell and silt base and by 120 m distance from shore and 28 m depth, the benthos was dominated by silt and clay.

At transects 2 and 3, the hard shore zone was dominated by small and medium boulders, cobbles and pebbles. Hard shores terminated at 50 m from shore at these transects. The bottom material was replaced by a zone of relatively clean broken shell, fine sand and dead shell (Figures 2, 3). This broken shell/fine sand zone was colonised at transect 2 by a bed of the green alga (*Caulerpa sediodes*) which disappeared by approximately 70 m distance from shore. By 80 m distance from shore and depths of 12 m to 18 m, the benthos graded into dead shell overlying a base of silt and clay. At approximately 130 m distance at transect 2, the benthos was dominated by silts and clay. Silts and

clay also dominated the benthos at transect 3 but also had a mussel shell debris layer from approximately 120 m distance from shore.

From transects and free swims, a total of 28 conspicuous species of invertebrate, 8 algae, 2 ascidians and 12 species of bony fish were observed. A list of species are presented in Table 1, while the profiles are plotted in Figures 2, 3 and 4.

Green-lipped mussel (*Perna canaliculus*) and blue mussel (*Mytilus edulis*) were both observed during the study.

3.3 Fish

Twelve species of bony fish were recorded during the investigation. This is a relatively high number of fish species for the sheltered central Pelorus Sound. Six of these species were exclusively observed from the reef located at the north-western part of the proposed extension. At this reef, spotty (*Notolabrus celidotus*) and tarakihi (*Nemadactylus macropterus*) were the most abundant reef fish observed. A large school of tarakihi were observed during diver descending and ascending trips. Blue cod (*Parapercis colias*) were relatively common from this area. Conger eel (*Conger verreauxi*) and rock cod (*Lotella* sp.) were observed under an anchor block located near the base of the reef. A single goat fish (*Upeneicthys lineatus*) was also observed from this reef area.

Fish observed from transects 2 and 3 were typical of the sheltered central Pelorus Sound. Reef fish in these areas were dominated by spotty, blue cod and triplefins. Most blue cod were observed from the rubble bank and adjacent soft shores. Opal fish were observed from offshore mud areas. Two species of triplefin were observed from these transects (common and variable triplefin).

3.4 Scallops (Pecten novaezelandiae)

Most scallops were observed from inshore soft bottom substrata between 40 m to 110 m distance from shore. Densities from all quadrats were mean = 0.082 per m^{-2}, SE = 0.023. These densities are generally below those considered as recreationally acceptable.

3.5 Horse mussels (Atrina zelandica)

Horse mussels were observed during the study but were patchy and generally recorded in very low densities (mean = 0.045 per m^{-2}, SE = 0.021). These densities are well below those considered as constituting a horse mussel bed (Department of Conservation guidelines).

3.6 Lampshells

Lampshells (*Magasella sanguinea*) were recorded in low abundances between 110 m to 150 m distance from transects 2 and 3. Estimated densities from areas where lampshells were most common were < 5 per m^{-2}. These densities are low compared to lampshell beds in central Pelorus Sound

Table 1 Species observed from an area in western Beatrix Bay, Pelorus Sound.				
Algae	**Common name**	**Invertebrates**	**Habitat**	**Common name**
Corallina spp.(3)	paint	SPONGIA		
Colpomenia sp. (3)	bubble weed	Ancorina alata (2)	rubble	grey sponge
Hormosira banksii (3)	Neptune's necklace	Crella incrustans (1)	rubble	encrusting sponge
Carpophyllum flexuosum (2)	wide flapjack	Aplysilla sulphurea (2)	rock	sulphur sponge
Caulerpa sedoides (3)	grape weed	COELENTERATA		
Cystophora sp. (1)		GASTROPODA		
Carpophyllum maschalocarpum (2)	narrow flapjack	Eudoxochiton nobilus (1)	rock	noble chiton
Unidentified red alga (2)	red alga	Cellana spp. (2)	rubble	limpet
		Cookia sulcata (2)	rock	Cook's tuban
		Maoricolpus roseus (2)	sand/shell	spire shell
		Penion sp. (1)	soft	whelk
		Trochus viridus (3)	rubble	
		Turbo smaragdus (3)	rock/rubble	cats eye
		BIVALVIA		
		Atrina zelandica (2)	soft	horse mussel
		Crassostrea gigas (2)	rock	Pacific oyster
		Chlamys sp. (1)	rock	queen scallop
		Modilarca impacta (2)	rubble	Nestling mussel
		Monia zelandica (2)	rock/rubble	window oyster
		Mytilus edulis (3)	rock	blue mussel
		Pecten novaezelandiae (2)	soft	scallop
		Perna canaliculus (3)	rock	green mussel
		POLYCHAETA		
		Brachiomma sp.(2)	sand/rubble	fan worm
		Galeolaria hystrix (3)	sand/rubble	tube worm
		Spirorbis sp. (3)	rubble/rock	
		Maldanidae (2)	soft	tube worm
Conger verreauxi (1)	conger eel	CRUSTACEA		
Notolabrus celidotus (3)	Spotty	Pagurus spp (2)	sand	hermit crab
Hemercoetes monopterygius (2)	Opalfish	ECHINODERMATA		
Forsterygion lapillum (3)	common trip.	Coscinasterias calamaris (2)	sand/shell	11 arm star
Forsterygion varium (3)	variable trip.	Evechinus choroticus (2)	rock/rubble	kina
Forsterygion malcolmi (2)	mottled trip.	Patiriella regularis (2)	sand/rubble	cushion starfish
Parapercis colias (2)	blue cod	Stichopus mollis (2)	sand/silt	cucumber
Upeneichthys lineatus (1)	goat fish	BRACHIOPODA		
Notoclinops segmentatus	blue eye trip.	Magasella sanguinea (2)	shell	lamp shell
Nemadactylus macropterus (3)	tarakihi	ASCIDEACEA		
Latridopsis ciliaris (1)	blue moki	Cnemidocarpa sp. (2)	rubble	saddle squirt
Parika scaber (1)	leatherjacket	Didemnium sp. (2)	rubble	cream ascidian

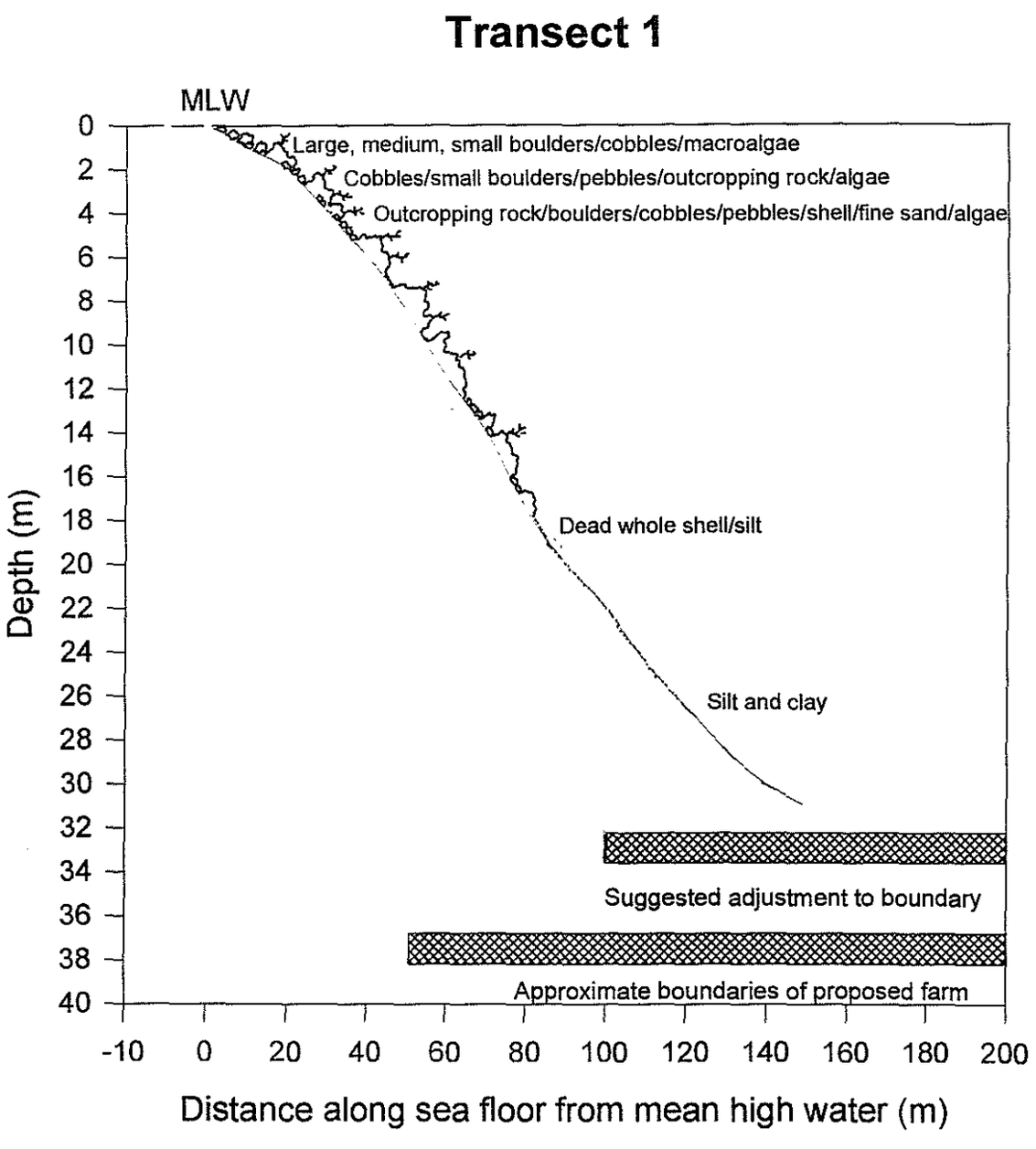

Figure 2 Subtidal shore profile and substratum from an area proposed as a marine farm extension in western Beatrix Bay, Pelorus Sound.

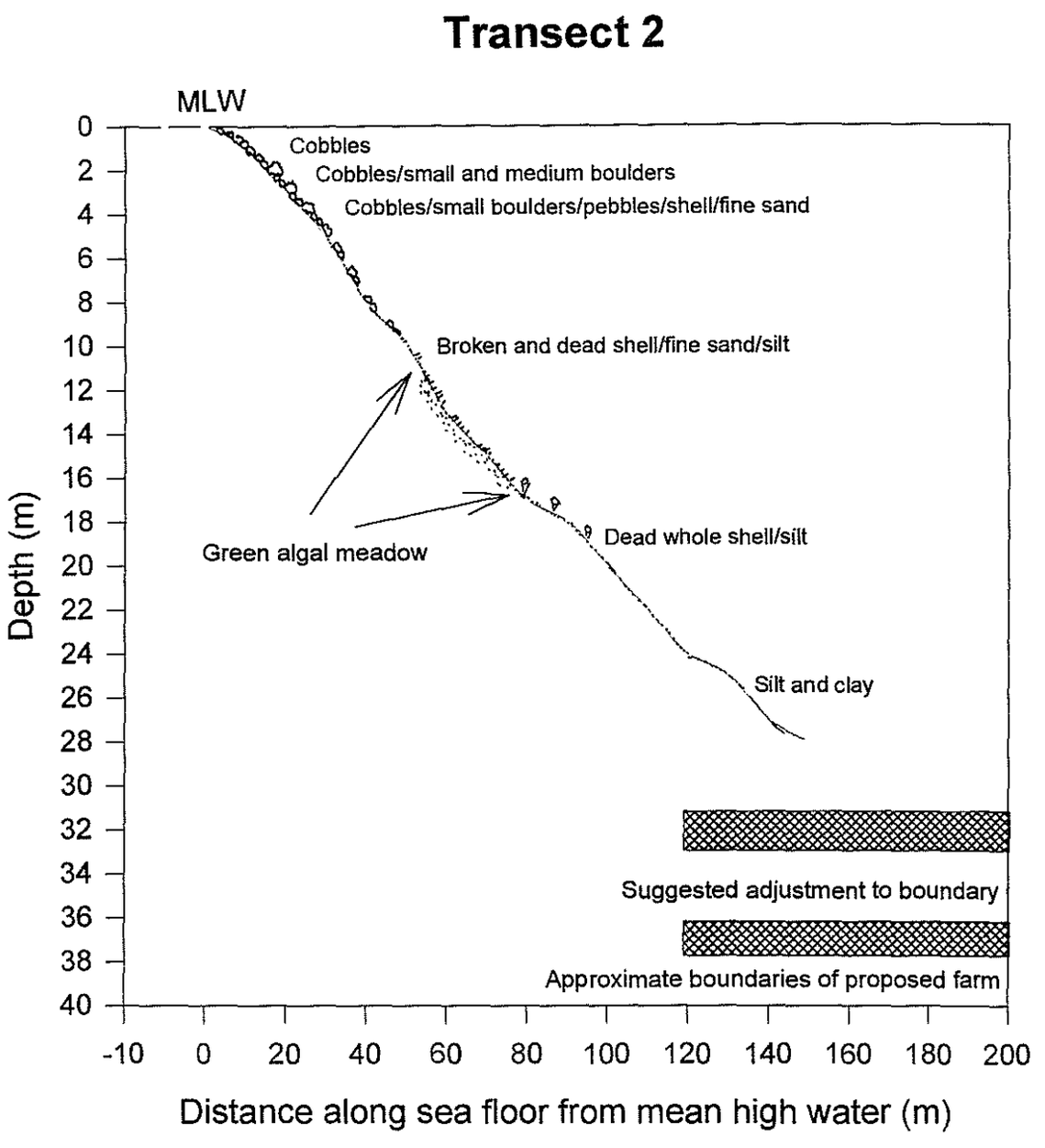

Figure 3 Subtidal shore profile and substratum from an area proposed as a marine farm extension in western Beatrix Bay, Pelorus Sound.

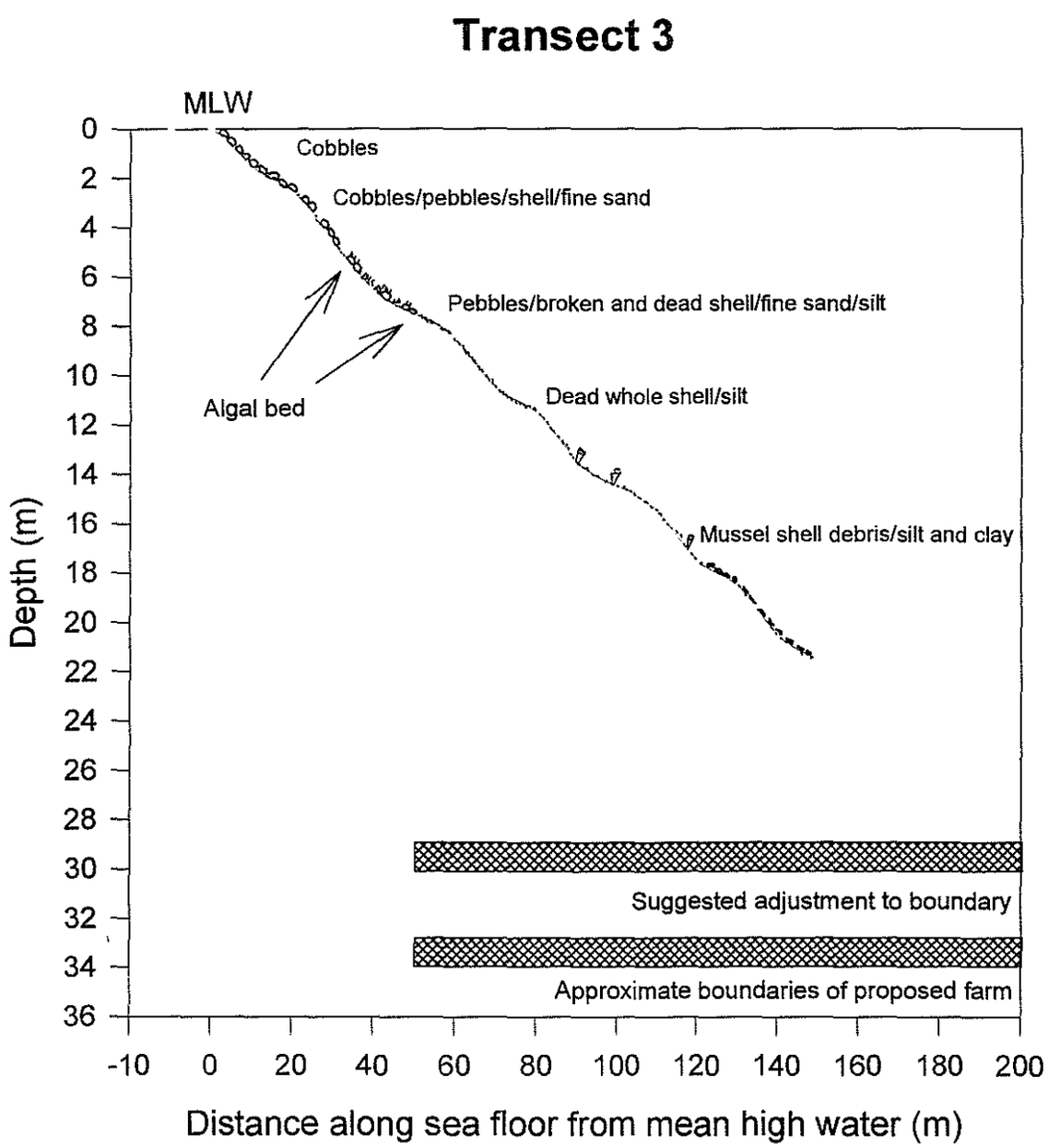

Figure 4 Subtidal shore profile and substratum from an area proposed as a marine farm extension in western Beatrix Bay, Pelorus Sound.

(Chadderton and Davidson in prep.) and well below the Department of Conservation guideline threshold.

3.7 Hydroids

No large hydroid species or hydroid zones were recorded during the present study.

4.0 POTENTIAL IMPACT OF A BIVALVE MARINE FARM

The impact of shell and sediment deposition on the benthos under a mussel marine farm results is a shift from the initial state to a new state. The degree of change depends on the habitat type and communities present prior to mussel material deposition. In general, a build up of mussel shell on a mud bottom will result in an increased diversity of species living on the surface and a decrease of infaunal species due to increased sedimentation (Kaspar et al. 1985). On a rocky bottom, a decrease in species diversity as a result of shell and sediment deposition would be expected.

Most soft bottom substrata and associated communities located within the proposed marine farm extension area were dominated by dead and broken shell overlying silt and clay sediments or further from shore, silts and clays. A low variety of species in low abundances were observed from these offshore soft bottom habitats. Horse mussels, scallops and brachiopods were recorded from these areas and would probably be smothered by the deposition of shell and sediment from a marine mussel farm. The densities of these species were, however, very low. In general, offshore silt and clay areas represent the habitat least impacted by mussel shell deposition and is the most common subtidal substratum in the Marlborough Sounds.

Soft shore communities of note were recorded inshore of the farm boundary at transect 2. The green alga bed was located some 40 m to 70 m distance away from the inshore boundary of the proposed extension. It would be unlikely that this community would be adversely influenced by a mussel marine farm. It is worth noting that this community type may have existed under the inshore parts of Licence 97. If this farm was removed as part of this process, this algal community may re-establish over time.

Substrata and communities observed from the inshore 30 m at transect 3 (southern end) were dominated by coarser soft shore substrata supporting a greater variety of species in higher abundances than were recorded from deeper soft shores. This area would be located under warps structures and have anchors along the inshore zone. The impact of warps is expected to be minor while the impact of blocks is localised. No species or communities were observed in this area that would warrant diver supervised placement of anchors.

The reef structure located near the north-western end of the proposed extension was located within the proposed extension. The reef was colonised by a variety of encrusting species in often high abundances. The reef attracted a wide variety of fish also often in high abundances. This reef would be adversely impacted by a mussel farm situated over this subtidal feature. The distance required between a mussel farm and a reef structure to ensure no adverse impact is unknown. No strong or moderate currents were observed during the investigation, nor were current dependent species observed from the reef.

5.0 CONCLUSION

The aims of the study were to provide a biological description of the benthos under and adjacent to a proposed marine farm area in western Beatrix Bay, Pelorus Sound and to identify potential threats to any subtidal ecological values posed by the proposed activity.

The soft and hard shore communities recorded from the present study were dominated by species that occur on subtidal shores in the sheltered Marlborough Sounds (Dell 1951; Estcourt 1967; McKnight 1969, 1974; Roberts and Asher 1993; McKnight and Grange 1991; Davidson and Duffy, 1992; Davidson, 1995; Davidson and Brown 1994; Duffy et al. in prep; Chadderton et al., in prep, Chadderton and Davidson in prep). Scallops, horse mussels and brachiopods were relatively uncommon from the study area.

Substrata and communities observed from most of the proposed area were characterised by dead whole shell and silt and clay sediments with a low variety of species in low abundances. These silt and clay areas represent the habitat least impacted by mussel farms and is the most common subtidal substratum in the Marlborough Sounds.

Substrata from inshore area of transect 3 were characterised by coarser soft sediments with a higher number of species in higher abundances than were observed from offshore soft bottom areas. This soft shore would be located under warp structures and be subjected to a localised impact from anchor structures. No rare or important species of communities were observed from this approximately 30 m wide area.

Soft shore communities of note were recorded inshore of the farm boundary at transect 2. A green algal bed was located some 40 m to 70 m distance away from the boundary of the proposed extension and would be unlikely to be adversely influenced by a mussel marine farm. It is worth noting that this community type may have existed under the inshore parts of Licence 97. If this farm was removed this community type may re-establish over time.

A reef structure recorded near the north-western end of the proposed extension was located within the proposed marine farm extension. The reef was colonised by a variety of encrusting species in often high abundances. The reef attracted a wide variety of fish also often in high abundances. It is probable that this reef would be adversely impact by a mussel farm situated over this subtidal feature. The distance between a mussel farm and a reef structure required to ensure that no adverse impact occurs is unknown. No strong or moderate currents that would result in sediment being carried considerable distances away from a mussel farm were observed during the investigation, nor were current dependent species observed from the reef.

Considering ecological data collected during the present study from the areas between Licences 85 and 97 in western Beatrix Bay, a modification to the north-western end to avoid the reef and allow a buffer zone is suggested. It is recommended that the inshore boundary for a distance of no less than 230 m from Point 4 be relocated to 100 m distance offshore from the tip of the small promontory. This would allow a 20 m offshore buffer zone and a 100 m along shore buffer zone between the reef and marine farm. The extensive along shore buffer zone is suggested as most current action in the sheltered Sounds appears to travel along the shore, and not in an inshore direction.

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