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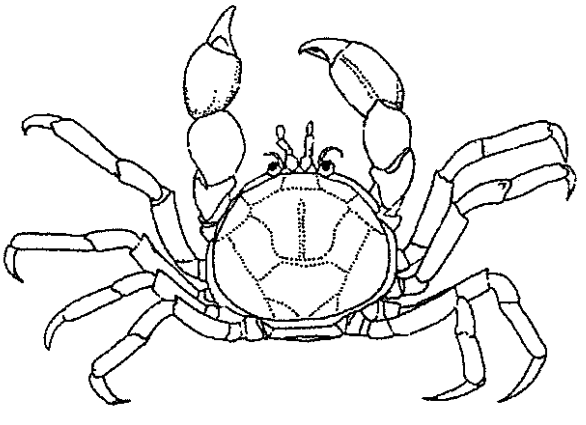
Research, survey and monitoring report number 114

Description of the subtidal macrobenthic substratum and associated communities from a proposed marine farm in Anakoha Bay

A report prepared for:
Marlborough Mussel Co.



May, 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 in Anakoha Bay, Pelorus Sound (Figure 1).

Anakoha Bay is an approximately 7 km long, north-west orientated dead-end bay, in the outer Marlborough Sounds. The mouth of the bay is approximately 2.5 km wide (measured between Allen Strait in the west and Tawaroa Point in the east. Anakoha Bay itself probably receives oceanic water directly from Cook Strait and it is expected that the bay would have relatively short water residence times compared to those calculated for bays within Pelorus Sound (Gibbs et al., 1991). Water clarity in the outer Marlborough Sounds including Anakoha Bay is not subject to the influx of a surface fresh water layer of turbid water prevalent in Pelorus Sound following heavy rain (Gibbs 1991, Gibbs et al. 1991). The shoreline of Anakoha Bay is either pasture, or scrub in various stages of regeneration. An area of native forest is located within the reserve at the eastern head of Anakoha Bay (Tararoa Point).

The application area is located along the western shore of Anakoha Bay (Figure 1). The boundaries of the proposed 3.9 ha area are shown in Figure 1. Depths along the inshore boundary were approximately 7 m (Point 1) and 21 (Point 4), while depths along the offshore boundary were approximately 24 m (Point 2) and 27 m (Point 3). 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.

2.0 MATERIALS AND METHODS

The proposed 3.9 ha site was investigated on the 13 th April 1996, using three subtidal survey techniques. Firstly, the inshore and offshore boundaries of the proposed area were remotely sensed

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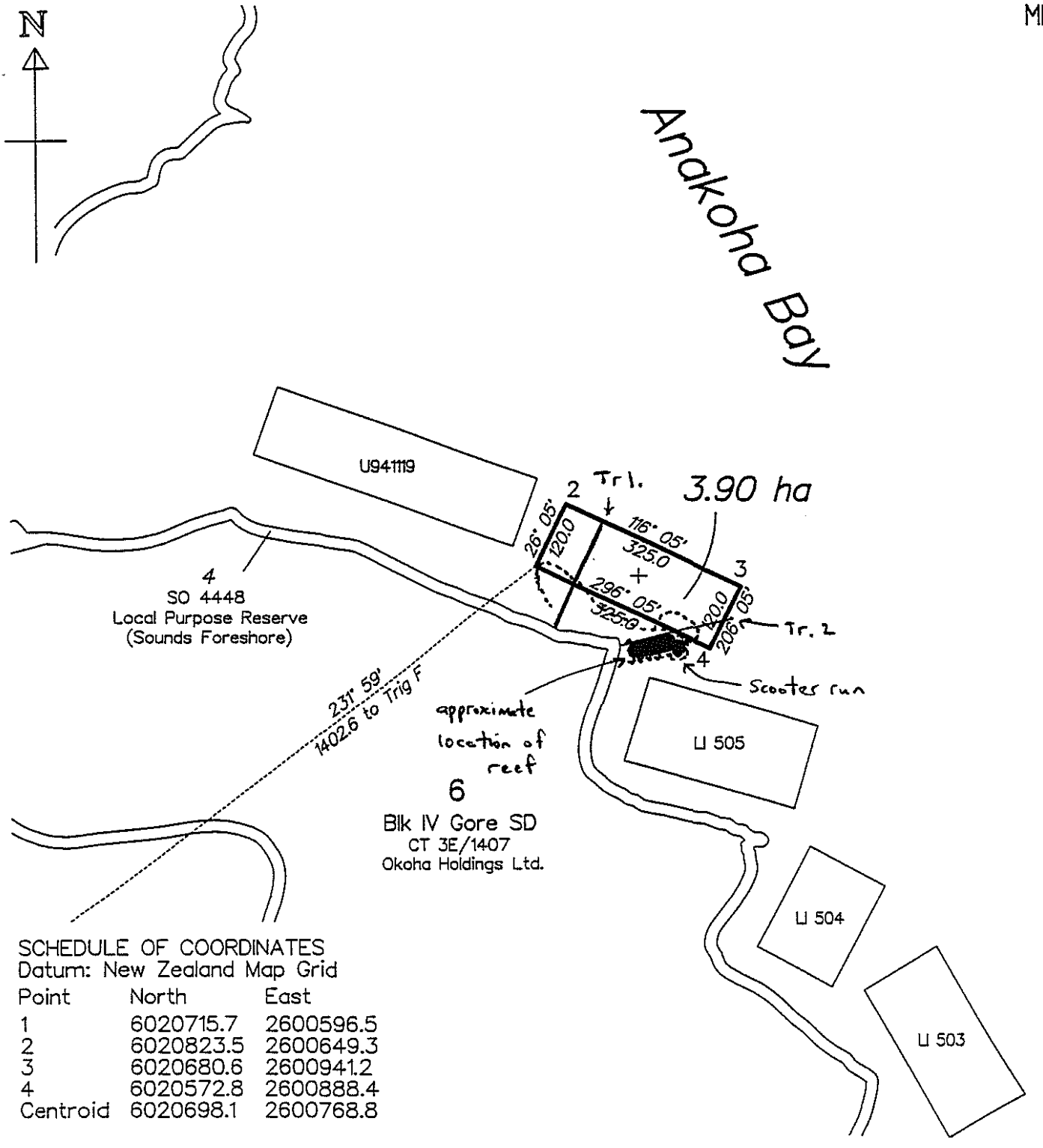

SCHEDULE OF COORDINATES
Datum: New Zealand Map Grid

Point	North	East
1	6020715.7	2600596.5
2	6020823.5	2600649.3
3	6020680.6	2600941.2
4	6020572.8	2600888.4
Centroid	6020698.1	2600768.8

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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Prepared by JB	Date 25/1/96	Job No 726823	File 6475/01/02	Reference P26/7.3

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Te Puna Korero Whenua

Figure 1. Transects and scooter run and location of reef.

using a colour scrolling Furuno depth sounder. Depths and any abnormalities along the sea bottom were noted for later diver inspection. In addition, the inshore boundary and randomly selected parts of the proposed marine farm area and adjacent coast between 4 to 15 metres depth were investigated by a diver assisted by a motorised subtidal Apollo scooter. Results from sounding and scooter investigations were recorded on waterproof paper.

Based on findings from these techniques, two 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 considered either representative of the substrata, habitats and flora and fauna observed during the free swim or targeted abnormalities in bottom topography or reef structures.

Scallop (*Pecten novaezelandiae),* and brachiopod (*Magasella sanguinea*) densities were not collected due to either their low abundance or absence from the study area. Horse mussel (*Atrina zelandica*) densities were collected from a total of 13 quadrats of 10 x 1 m^2 size.

Notes were collected on water current direction and relative speed at 9.30 am. These observations were collected at approximately low tide.

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).

3.0 RESULTS AND DISCUSSION

3.1 Scooter Run, Depth Soundings and Water Currents

Results from depth soundings and the scooter swim across random parts of the proposed farm and along the inshore area of the proposed marine farm suggested that:

1) substrata present were bedrock, small boulders, medium and fine sand, broken and dead whole shell and silt;

2) bedrock, cobble and boulder substrata were recorded within the boundaries of the proposed marine farm towards the eastern end of the study area;

3) tube worm mounds were observed within the boundaries of the proposed marine farm;

4) a reef structure was located by the depth sounder and the extent of the reef determined by radar/soundings, compass bearings and transect line;

5) apart from the eastern reef area, areas beyond 20 m distance from shore were dominated by soft bottoms;

6) large brown macroalgae were widely distributed on hard substratum; and

7) horse mussels were relatively common in a particular depth zone, while scallops were uncommon and brachiopods were not observed during the study.

No water currents were detected during the study as slack water coincided with the study. It is expected that strongest currents would occur across the eastern reef area in a northwest direction. Depths in this area increased rapidly into the main reach of Anakoha Bay and were colonised by a number of large filter feeding species which often inhabit areas with tidal flow (e.g. large *Ancorina* sponges).

3.2 Shore Profiles

The intertidal zone adjacent to the proposed marine farm area was dominated by isolated bedrock areas separated by cobble and pebble shores. The coast was bordered by a terrestrial environment dominated by pasture and bare bedrock cliffs.

Transects were terminated at 200 m distance from shore. Data from transect 1 confirmed that the benthos between 150 m and 200 m distance from shore was dominated by a homogeneous mud habitat. Depth soundings of areas offshore of transect 2 suggested that this area was also dominated by a homogenous soft bottom habitat.

Transect was installed perpendicular to the shore, while transect 2 was orientated in order that the eastern reef structure could be sampled and its relationship to the proposed marine farm area be determined.

Transect 1:

The subtidal shore profile was initially dominated by bedrock substrata covered in a canopy of brown macroalgae (*Carpophyllum maschalocarpum, C. flexuosum, Cystophora sp.*) which were relatively common. This zone terminated by 20 m distance from shore and was replaced by medium ripple sand (Figure 2). At 100 m distance from shore and a depth of 4 m the substrata was dominated by fine sand with a small component of broken shell. At 12 m depth and 150 m distance from shore this substratum was replaced by silts and clays. A zone of horse mussels, sunset shells and shell tube worms were observed between approximately 80 to 140 m distance offshore.

Transect 2:

The subtidal shore profile at transect 2 was dominated by bedrock substrata covered in brown and green macroalgae (*Carpophyllum maschalocarpum, C. flexuosum, Cystophora sp., Ecklonia radiata, Caulerpa sedoides*) which were relatively common. This reef zone had areas of sand and small and

large boulders and terminated at 110 m distance along the transect and was replaced by fine sand/broken shell/silt (Figure 3). By 20 m depth and 140 m along the transect, the benthos was dominated by silt and clay substrata.

From transects and scooter run, a total of 33 conspicuous species of invertebrate, 10 algae, 5 ascidians and 10 species of bony fish were observed. A list of species are presented in Table 1, while the profiles are plotted in Figures 2 and 3.

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

3.3 Fish

Ten species of bony fish were recorded during the investigation. Spotty (*Notolabrus celidotus*) were the most abundant reef fish observed during the investigation. Blue cod (*Parapercis colias*) were relatively common and almost entirely restricted to the eastern reef area and adjacent fine sand/shell benthos. No cod were observed from the mud bottoms further from shore. Opal fish were common from these mud areas. Occasional individuals of blue moki, tarakihi and banded wrasse were observed in association with the eastern reef area. Four species of triplefin were relatively common on this rock habitat.

3.4 Scallops (Pecten novaezelandiae)

Scallops were uncommon from the study area.

3.5 Horse mussels

Horse mussels were observed in a distinct zone between 80 m to 140 m distance from shore. Densities within this zone were mean = 0.25 per m^{-2}, SE = 0.067. These densities represent a horse mussel bed (see Department of Conservation guideline, 1995), but are well below dense beds which reach densities or 9 to 14 per m^{-2} in particular parts of the Sounds (author pers.obs.). Horse mussels were uncommon or absent outside this zone. Sunset shells (*Gari olivacea*) and tubeworms (*Owenia* sp.) were also observed living in this horse mussel zone.

3.6 Lampshells

Lampshells (*M. sanguinea*) were not recorded from the study area.

Table 1 Species observed from an area in Anakoha Bay.				
Algae	**Common name**	**Invertebrates**	**Habitat**	**Common name**
Corallina spp.(3)	paint	SPONGIA		
Colpomenia sp. (2)	bubble weed	Aplysilla sulphurea (2)	rock	sulphur sponge
Hormosira banksii (1)	Neptune's necklace	Ancorina alata (2)	rubble	grey sponge
Halopteris sp. (2)		COELENTERATA		
Carpophyllum maschalocarpum (2)	narrow flap-jack	Actinothoe albocincta (1)	rubble/bedrock	anemone
Carpophyllum flexuosum (2)	wide flapjack	Culicea rubeola (2)	rock	box anemone
Caulerpa sediodes (3)	grape weed	Obelia sp. (1)	rubble/rock	hydroid fuzz
Cystophora sp. (2)		Phlyctenactis tuberculosa (2)	soft	wandering anemone
Ecklonia radiata (1)	paddle weed	Isocradactis magna (2)	sand	sand anemone
Asparagopsis armata (3)	red cling weed	GASTROPODA		
		Cellana spp. (3)	rubble	limpet
		Cookia sulcata (1)	rock	Cook's turban
		Cominella adspersa (2)	soft	whelk
		Haliotis iris (3)	rock	black paua
		Maoricolpus roseus (2)	sand/shell	spire shell
		Thias orbita (1)	rock	white rock shell
		Trochus viridus (2)	rubble	
		Turbo smaragdus (3)	rock/rubble	cats eye
		BIVALVIA		
		Atrina zelandica (2)	soft	horse mussel
		Gari olivacea (3)	soft	sunset shell
		Modilarca impacta (3)	rubble	Nestling mussel
		Monia zelandica (2)	rock/rubble	window oyster
		Mytilus edulis (3)	rock	blue mussel
		Perna canaliculus (1)	rock	green mussel
		Pecten novaezelandiae (1)	soft	scallop
		POLYCHAETA		
		Brachiomma sp.(2)	sand/rubble	fan worm
		Galeolaria hystrix (3)	sand/rubble	tube worm
		Owenia sp. (3)	soft	shell tubeworm
		Serpulid sp. (1)	soft	tube worm
		CRUSTACEA		
		Pagurus spp (2)	sand	hermit crab
		ECHINODERMATA		
		Coscinasterias calamaris (2)	sand/shell	11 arm star
FISH		Evechinus choroticus (3)	rock/rubble	kina
Notolabrus fucicola (1)	banded wrasse	Patiriella regularis (2)	sand/rubble	cushion starfish
Latridopsis ciliaris (1)	blue moki	Pectinura maculata (1)	rubble	snake star
Notolabrus celidotus (3)	Spotty	Echinocardium australe (2)	soft	heart urchin
Hemercoetes monopterygius (2)	Opalfish	Stichopus mollis (2)	sand/silt	cucumber
Forsterygion varium (2)	variable trip.	ASCIDEACEA		
Parapercis colias (2)	blue cod	Aplidium adamsii (2)	rubble	orange ascidian
Forsterygion sp. (2)	yellow/black trip	Cnemidocarpa sp. (3)	rubble	saddle squirt
Forsterygion lapillum (2)	common trip.	Didemnium sp. (2)	rubble	cream ascidian
Forsterygion malcolmi (1)	mottled trip.	Pyura sp. (1)	rock	sea tulip
Nemadactylus macropterus (1)	tarakihi	Leptoclinides sp. ? (2)	rubble	purple colonial

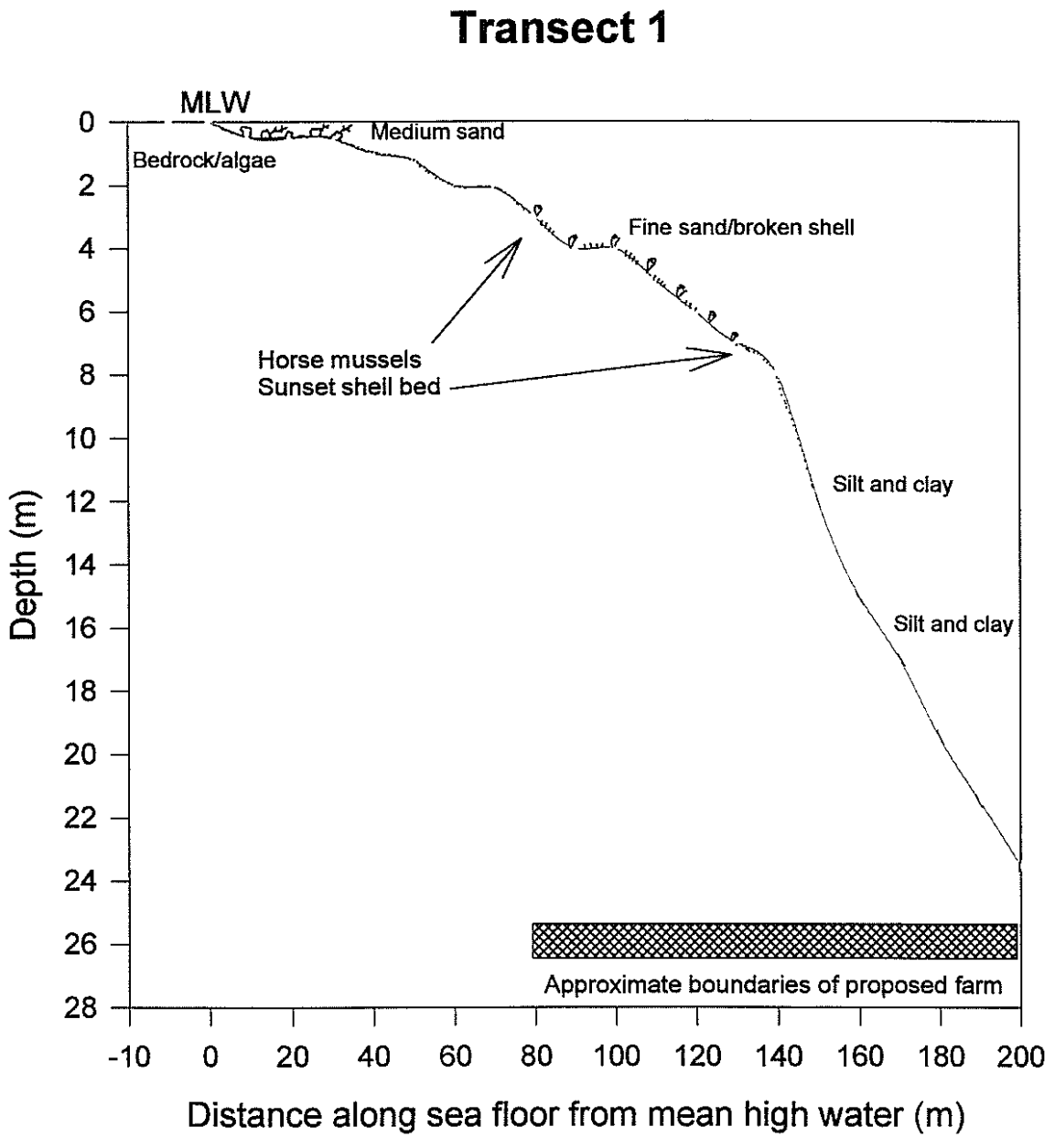

Figure 2 Subtidal shore profile and substratum from an area proposed as a marine farm in Anakoha Bay.

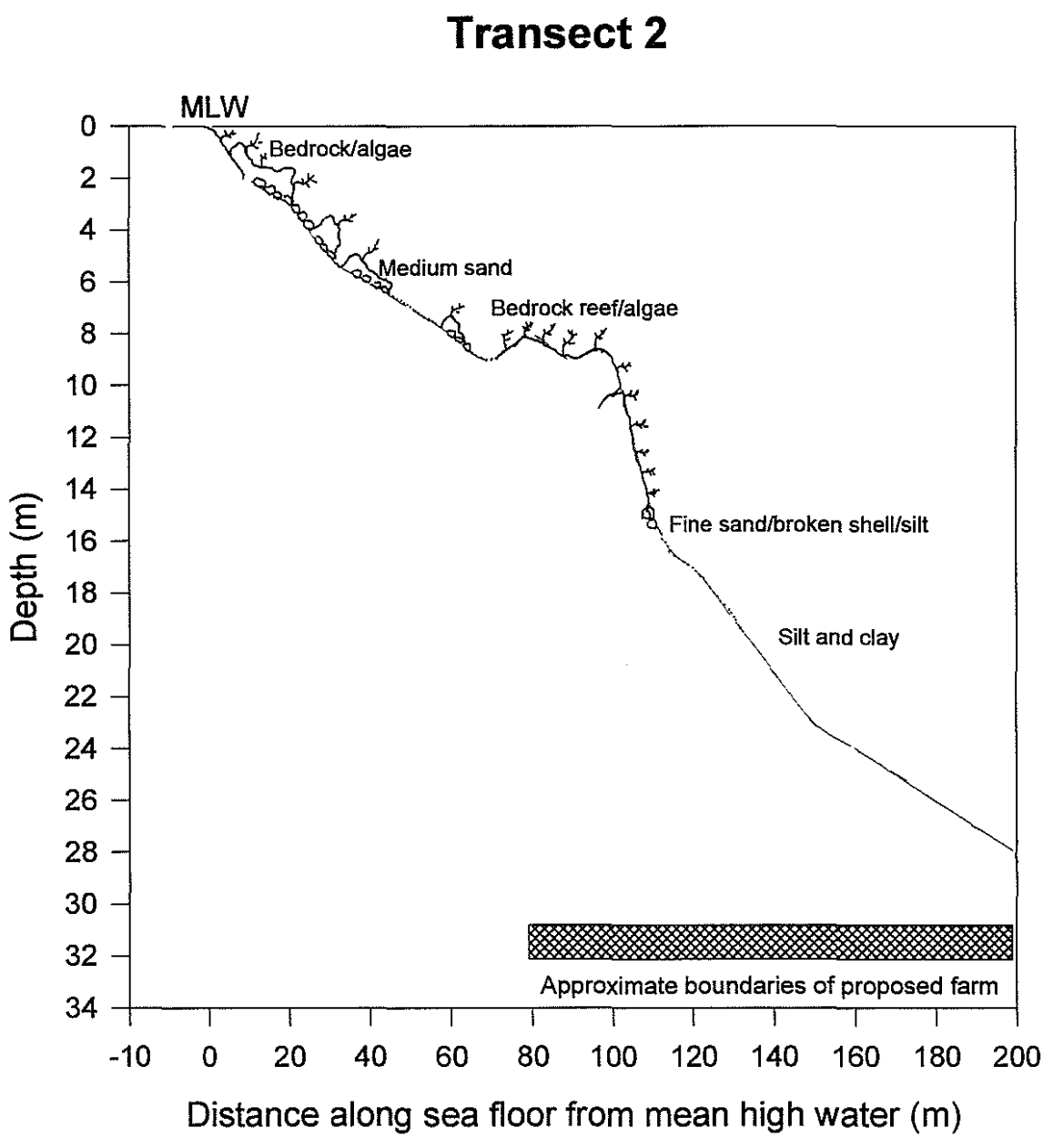

Figure 3 Subtidal shore profile and substratum from an area proposed as a marine farm in Anakoha Bay.

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

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). Deposition of shell debris can ultimately smother natural benthic communities (author pers. obs.).

Substrata and communities observed 140 m distance from shore and beyond were characterised by silt and clay sediments with a low variety of species in low abundances. Silt and clay areas represent the habitat which appears to be least impacted by mussel farms and is the most common subtidal substratum in the Marlborough Sounds.

In contrast, the eastern reef structure extending to 110 m distance along the transect and the horse mussel community observed between 80 m to 140 m distance offshore were represented by a relatively high number of species in often high abundances compared to offshore mud shores in the present study. The reef and horse mussel communities would probably be impacted by a deposition of shell material originating from a mussel farm.

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 in Anakoha Bay, 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 outer 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 were uncommon from the study area, while brachiopods were not observed from this site.

Substrata and communities observed 140 m distance from shore and beyond were characterised by silt and clay sediments with a low variety of species in low abundances. Silt and clay areas represent the

habitat which appears to be least impacted by mussel farms and is the most common subtidal substratum in the Marlborough Sounds.

In contrast, a reef structure extending to 110 m distance along the eastern transect and the horse mussel community observed between 80 m to 140 m distance offshore at transect 1 and also observed along the shore during the scooter run were represented by a relatively high number of species in often high abundances compared to offshore mud shores in the present study. The reef and horse mussel communities would probably be impacted by a deposition of shell material originating from a mussel farm.

Considering ecological data collected during the present study in Anakoha Bay, an offshore relocation of the inshore boundary between Points 1 and 4 is suggested. In order that the horse mussel, sunset shell, tubeworm bed be avoided a shift of 50 m offshore would be required. In order that the eastern reef be avoided a shift of 10 m shift would be required. It is therefore suggested that a 50 m offshore relocation of the inshore boundary be adopted. This shift would mean that backbones would not be located over horse mussels and associated species and a 40 m buffer zone between the reef and backbones would be established.

It is expected that tidal currents in this area are not strong and would be most influential on the outgoing tide. This would tend to carry sediment and shell material offshore and to some extent along shore, resulting in little threat of mussels smothering the reef community once the farm has been relocated.

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