Survey and Monitoring Report No. 11

Description of the macrobenthic community from a proposed mussel spat catching area in Whakitenga Bay, Squally Cove, Marlborough Sounds

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1.0 INTRODUCTION

This report presents a biological description of the macrobenthic communities from a proposed 6.75 ha mussel spat catching area in Whakitenga Bay, Squally Cove, Croisilles Harbour (Figure 1). Whakitenga Bay is the southern of the two bays at the head of Squally Cove. Whakitenga Bay is located some 11 km from the sea entrance to Tasman Bay. Whakitenga Bay itself is approximately 1.9 km in length and between 400 to 900 metres in width. The Bay is relatively shallow, reaching depths not much greater than 13 m near the mouth where it becomes Squally Cove proper. From a maximum of approximately 13 m depth it grades into an intertidal cobble/pebble shoreline particularly at the head of the bay where large intertidal flat exists. Water residence times in this area have not been studied, however, are probably the longest in the Croisilles Harbour. Most of the Harbour has relatively strong tidal currents particularly in the outer and central Croisilles Harbour (Davidson and Duffy 1992).

The study area is a north facing coastline near the mouth of Whakitenga Bay (Fig. 1). The inner boundary of the proposed mussel spat catching farm is located between 50 to 70 metres distance from shore. The proposed spat catching farm stretches 450 m in length on both the inside and outside boundaries and is 150 m wide (Figure 1). This represents a total distance from shore of between 200 to 220 m distance. Depths on the inside boundary were approximately 11.5 (Point 1) to 7.8 m (Point 4), while depths on the outside boundary ranged between approximately 12 m (Point 3) to 13 m (Point 2). The proposed activity is green-lipped mussel (*Perna canaliculus*) spat catching. Details of farm structure and management practices are outlined in a report by the applicant.

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 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 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.

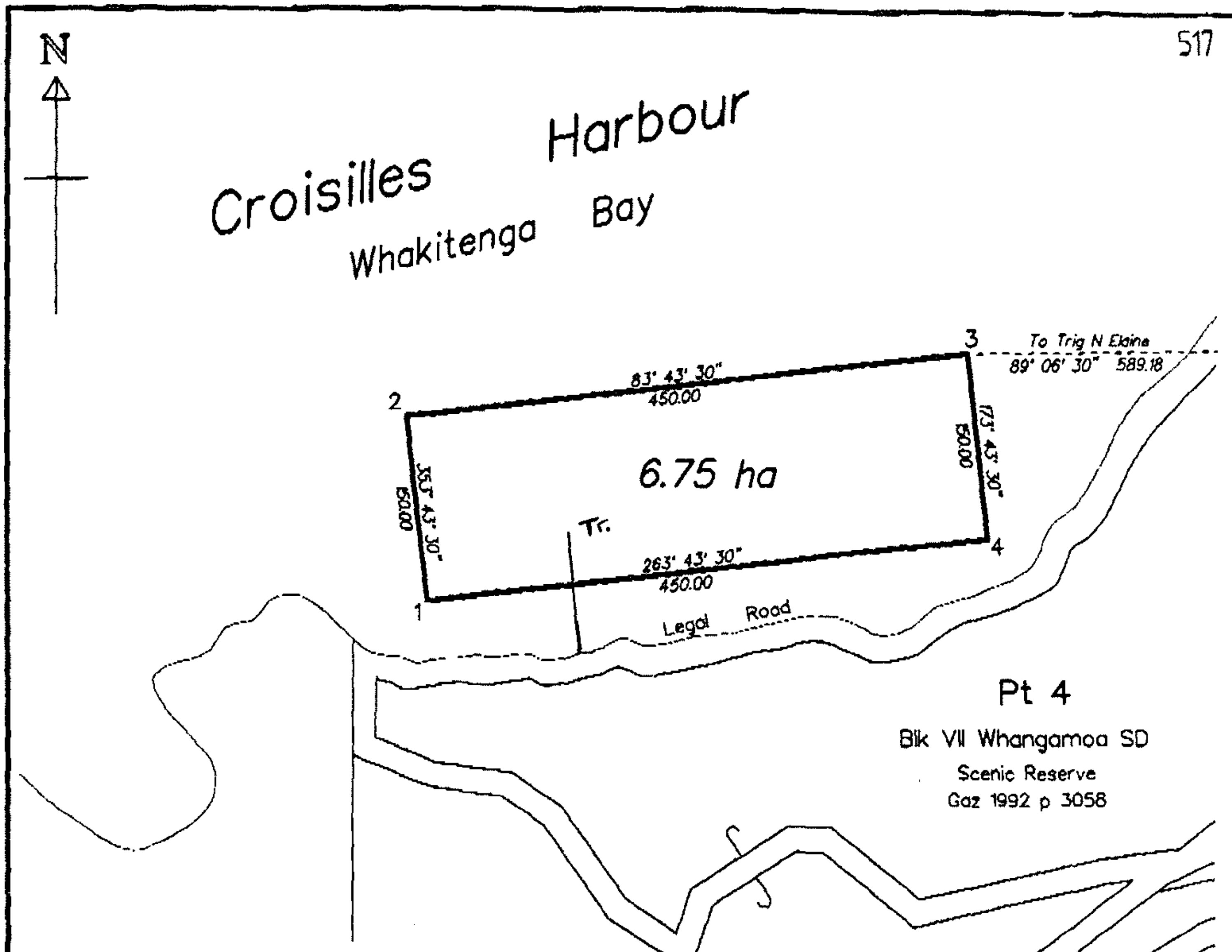
Multiple use (marine farming, fishing, boating, housing, waste water disposal, port development, forestry, agriculture) have the potential to degrade the environment of the Sounds. Marine farming for example, can have considerable impact on the environment through habitat modification or lowering water 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 spat catching activity.

2.0 Croisilles Harbour

The Croisilles Harbour is located 43 kilometres 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.

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



SCHEDULE OF COORDINATES
Datum: New Zealand Map Grid

Point	North	East
1	6016632.1	2572855.9
2	6016781.2	2572839.5
3	6016830.4	2573286.8
4	6016681.3	2573303.2
Trig N (Elaine)	6016839.57	2573875.92

Plan of Proposed Marine Farming Licence

N.Z. Marine Farming Assoc.

No survey marks along the coast are able to be adopted

Bearing variation Geodetic Datum 1949 to NZMG +3'l'30"

SCALE 1:5000

50 0 50 100 150 200 250 300 350 400 450 metres

LOCAL AUTHORITY: MARLBOROUGH DISTRICT

NELSON LAND DISTRICT

Approved for internal reproduction by;
N.Z. Marine Farming Assoc.

Department of Survey & Land Information
Te Puna Korero Whenua

Prep. By RAS	Date 30.8.94	Job No 726570	File 6475/01/02	Reference P26/1.4

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). No data is available on recreational pursuits or the value of recreational activities in the Croisilles, however, it is not uncommon to see 30-40 boats at the scallop beds in the Harbour. In the summer months as many as 60-70 boats per day launch from Okiwi Bay (L. Holland, pers. comm.).

A total seven major substrate types have been recorded in the Croisilles Harbour area (Davidson & Duffy 1992). Substrate types are sometimes recorded as large homogeneous areas, but more often, a site is most often characterised by a variety of substrata. A total of 10 major habitats based on substrate or dominant cover of flora and fauna have been recognised (see Appendix 1).

3.0 MATERIALS AND METHODS

The proposed site was qualitatively investigated on the 9th September 1994, using two rapid subtidal survey techniques. All of the inshore boundary and randomly selected parts of the proposed spat catching area and adjacent coast between 1.5 to 12 metres depth were investigated using an Apollo scooter. Results from this preliminary investigation were recorded on waterproof paper. Based on these findings a representative area was selected and a 150 m lead-lined transect line marked at 5 m intervals was installed perpendicular to the shore (Fig. 1). The transect site was considered representative of the substrata, habitats and flora and fauna found over the proposed farm during the scooter run.

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 150 m from the low tide mark and at a depth of 12.5 metres. The abundance of macroinvertebrates, macroalgae and fish were estimated on a scale of 1 = uncommon, 2 = occasional, and 3 = common.

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 muddy sand, mud, Pebbles and cobbles, shallow hard-shore and deep hard-shore habitats were recorded from the present site;

2) one small area of bedrock was located 75-90 metres distance from shore and at a depth of approximately 11-12 metres. No other bedrock or rubble areas were recorded along the length of the proposed area. In most areas rubble habitat extended approximately < 30 m 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) a sponge and ascidian zone was consistently located between 5 to 9 m depth; and

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

4.2 Profile

The intertidal shore adjacent to the proposed spat catching area was dominated by a relatively small and low gradient rubble/cobble bank with small beach areas of pebble, dead shell and coarse sands. All of the coast was bordered by steeply rising hill side clad in coastal forest. The subtidal shore was initially an extension of the intertidal shore but quickly graded into a rubble sand/dead and broken shell mix approximately 15-30 m distance from the low tide mark and at depths between 2.5-3.0 m. Further from shore the benthos was dominated by soft sediments which graded from pebbles/sands/dead and broken shell through to fine sands/silts further from shore (Figure 2). Between 30 to 60 metres from shore and in depths of 5 to 10 metres numerous sponges and ascidians were recorded along most of the proposed farm boundary.

From the transect and scooter run a total of 19 species of invertebrate, 4 algae, 5 ascidians and 3 species of bony fish were recorded. A list of species is presented in Table 1, while the shore profile is plotted in Figure 2.

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

Relatively few species of fish were recorded from the transect, with spotty (*Notolabrus celidotus*) being numerically the most abundant. No blue cod (*Parapercis colias*) were recorded. Common triplefin (*Forsterygion lapillum*) were recorded from the rock at 11-12 metres depth.

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

Considerable numbers of living green-lipped mussels (*Perna canaliculus*) were recorded from 12.5 metres depth and 150 metres from shore (Figure 1). The extent of these mussels further from shore was not determined.

4.3 Sponge and Ascidian Zone

A zone of sponges and ascidians were consistently recorded along the length of the proposed marine farm between 5 to 10 m depth and 30 to 60 metres offshore from the low tide mark (Figure 2). Sponges were dominated by the encrusting sponge (*Crella encrustans*) and an unidentified species of purple sponge (Table 1). Ascidians were represented by five species, two on hard substrata and the remaining on soft shores.

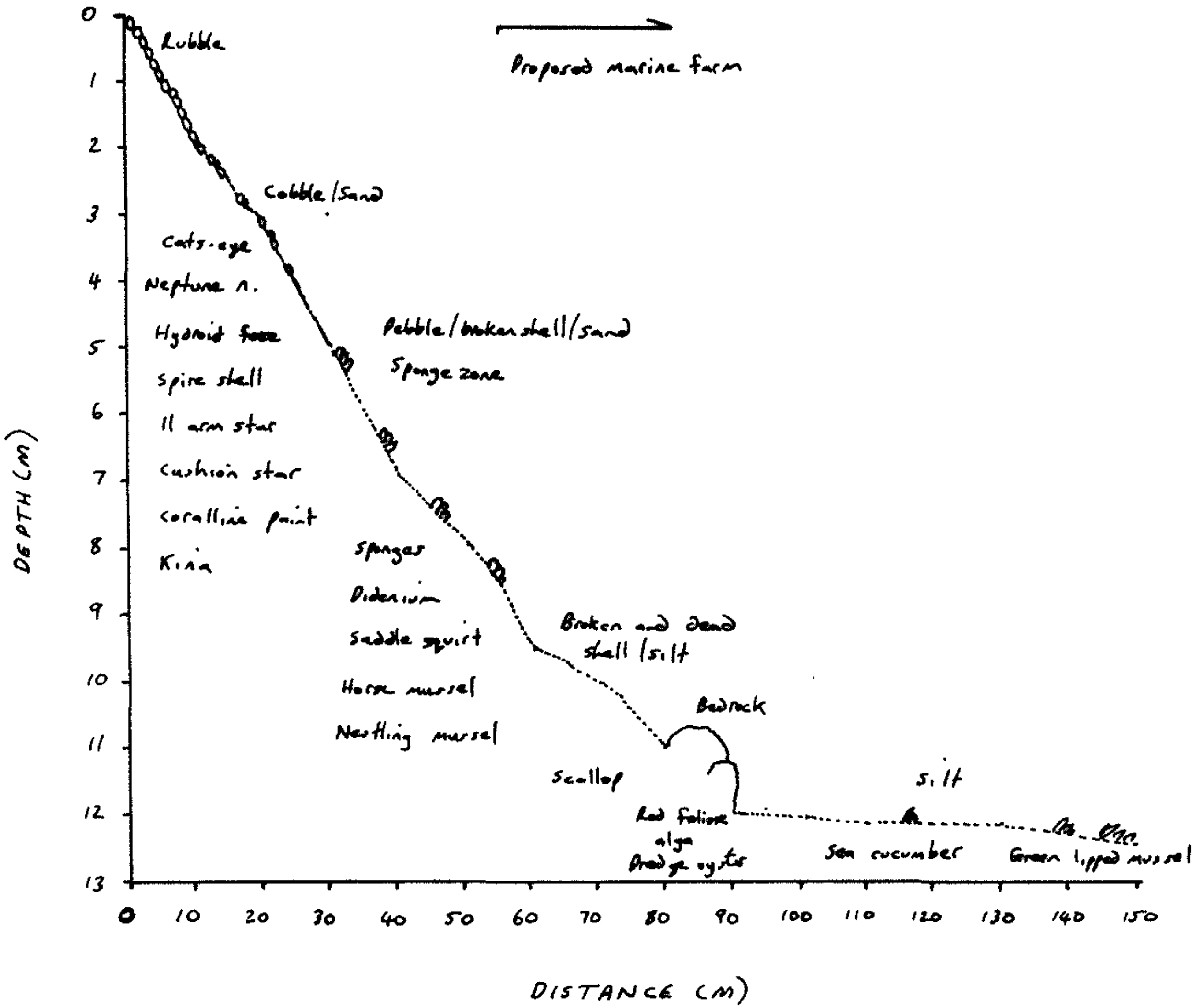


Figure 2. Shore profile of depths, habitats and associated flora and fauna from Whakitenga Bay, Croisilles Harbour.

Table 1 Species recorded from transect in Whakitenga Bay, Croisilles Harbour.				
Algae	**Common name**	**Invertebrates**	**Habitat**	**Common name**
Cystophora torulosa (1)		SPONGIA		
Corallina spp.(1)	paint	Crella encrustans (2)	encrusting	
Hormosira banksii (3)	Neptune's necklace	Purple glass sp. (2)	soft	
Red foliose alga (2)		COELENTERATA		
		Hydroid sp. (2)	rubble	hydroid fuzz
		MOLLUSCA		
		GASTROPODA		
		Maoricolpus roseus (2)	soft	spire shell
		Turbo smaragdus (3)	rubble	cats-eye
		BIVALVIA		
		Modiolarca impacta (1)	soft	nestling mussel
		Atrina zelandica (1)	soft	horse mussel
		Perna canaliculus (3)	soft	green mussel
		Pecten novaezelandica (1)	soft	scallop
		Triostrea lutaria (1)	rock	dredge oyster
		POLYCHAETA		
		Brachiomma sp.(1)	sand/rubble	fan worm
		Galeolaria hystix (1)	rubble	tube worm
		Pomatoceros caerulus (2)	rubble	tube worm
		Spirorbis sp. (2)	rubble	spiral worm
		CRUSTACEA		
		Pagurus spp (2)	soft	hermit crab
		ECHINODERMATA		
		Coscinasterias calamaria (2)	soft	11 arm star
		Evechinus choroticus (1)	soft	kina
		Patiriella regularis (1)	sand/rubble	cushion starfish
		Stichopus mollis (1)	soft	sea cucumber
		ASCIDEACEA		
		Cnemidocarpa sp. (1)	rubble	saddle squirt
		Didenium sp. (1)	rubble	white ascidean
		Unidentified sp. (3)	soft	purple species
		Unidentified sp. (2)	rock	saddle species
		Unidentified species (1)	soft	brown compound
		BONY FISHES		
		Notolabrus celidotus (2)	soft	spotty
		Hemercoetes monopterygius (1)	soft	opal fish
		Forsterygion lapilum (2)	rock	common triplefin

5.0 DISCUSSION OF POTENTIAL IMPACTS OF MUSSEL SPAT CATCHING

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). Little is known, however, about the impact of mussel spat catching on benthic rocky or soft bottom communities in New Zealand. It is probable, however, that mussel spat collection would not result in an appreciable level of shell debris deposited on the benthos.

Over most of the proposed marine farm site there was little opportunity for mussels to naturally settle (ie. soft sediments), however, large beds of adult green-lipped mussel were observed living in deeper areas of the proposed farm. These had possibly been deposited from an earlier attempt to farm mussels on the site as a farm structure was in place at the time of investigation. The substrata around the edges and immediately adjacent to the proposed site were dominated by substrata which may provide suitable attachment to mussels, but it is unlikely that a spat catching activity would result in an increased level of settlement unless spat were allowed to grow to sexual maturity prior to their relocation.

Studies on the impacts of dredging on marine environments has suggested that benthic communities can be either destroyed or modified into a different state of community structure (de Groot 1984; Poiner and Kennedy, 1984; Jones, 1992). The establishment of marine farms effectively precludes this activity from the area directly beneath and adjacent to any farm. This advantage to the benthic community is outweighed under many types of marine farms as the benthos is modified by material falling from the farm (Kaspar et al., 1985). In the case of a spat catching marine farm, the impact on the benthos may be minimal (depending on management practices) and therefore the advantage of dredge cessation could potentially be realized. This could be an advantage to communities which are sensitive to dredging as the proximity of a marine farm may provide some level of protection. The sponge zone located in the present study would be destroyed by dredging.

6.0 CONCLUSION

The aims of the study were to provide a biological description of the benthos under and adjacent to a proposed mussel spat catching marine farm in the head of Squally Cove in Whakitenga Bay and to identify potential threats to any conservation values posed by the proposed activity.

All of the hard shore and most of the soft shore benthic communities recorded from the present study contained species that are widespread and common throughout the subtidal shores of 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 Davidson, 1994a; Duffy et al. in prep; Chadderton et al., in prep, Chadderton and Davidson in prep). The sponge and ascidian zone recorded between 5 to 10 metres depth and between 30 and 60 metres offshore from the low tide mark contained a species assemblage which may be characteristic on inner Squally Cove. The extent and distribution of this community in the Marlborough Sounds is unknown and may be relatively localized. It is therefore suggested that any marine farm avoid this community. It is suggested that any farm be situated greater than 70 metres offshore from the low tide mark.

No other rare or threatened species or communities were recorded in the present study. Other than the sponges, a relatively low diversity of species were recorded from this part of the Croisilles Harbour compared to a study of the outer and central harbour by Davidson and Duffy (1992). This was primarily due to the narrow depth range of rock substratum and the shallow and sheltered nature of the site.

Potentially, the proximity of a mussel spat catching farm may afford some level of protection to benthic communities directly below and immediately adjacent to the proposed farm from impacts such as dredging. This is provided, however, that the impact of such a farm did not itself threaten the benthic communities themselves. The common practice of cutting free the plastic mesh bags which weigh down spat catching lines results in two environmental impacts. Firstly it introduces long-lasting plastic pollution into the environment and secondly, the bags and small cobbles act to smother benthic communities such as horse mussels and sponges which may occur directly below back-bone lines (author, pers. obs.). The impacts of green-lipped spat catching should therefore be the focus of a rigorous study on the impacts on the environment.

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Appendix 1. Description of habitats and substrata from Croisilles Harbour.

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*.