NIWA
Taihoro Nukurangi

Survey of the benthic ecology in an area for a proposed coastal permit, Orchard Bay, outer Pelorus Sound

Russell Cole
Ken Grange
Niki Alcock

prepared for

Sanford South Island Ltd.
Havelock

NIWA Client Report: MUS00410
August 1999

National Institute of Water & Atmospheric Research Ltd
PO Box 893, Nelson
New Zealand
Tel: 03 548 1715
Fax: 03 548 1716

CONTENTS

Reviewed by:

R. Cole

Approved for release by:

K R Grange

INTRODUCTION

Orchard Bay is a north-eastern extension of Forsyth Bay, in outer Pelorus Sound (Fig. 1). It is largely sheltered from the open sea to the north by part of Forsyth Island, and Duffers Reef and the longest wave fetch is from the south. Both Forsyth Island and Duffers Reef are wildlife sanctuaries. The coast of Forsyth Bay has numerous marine farms around its edge, and the present proposal is for a 49 ha site offshore in Orchard Bay (Fig. 1).

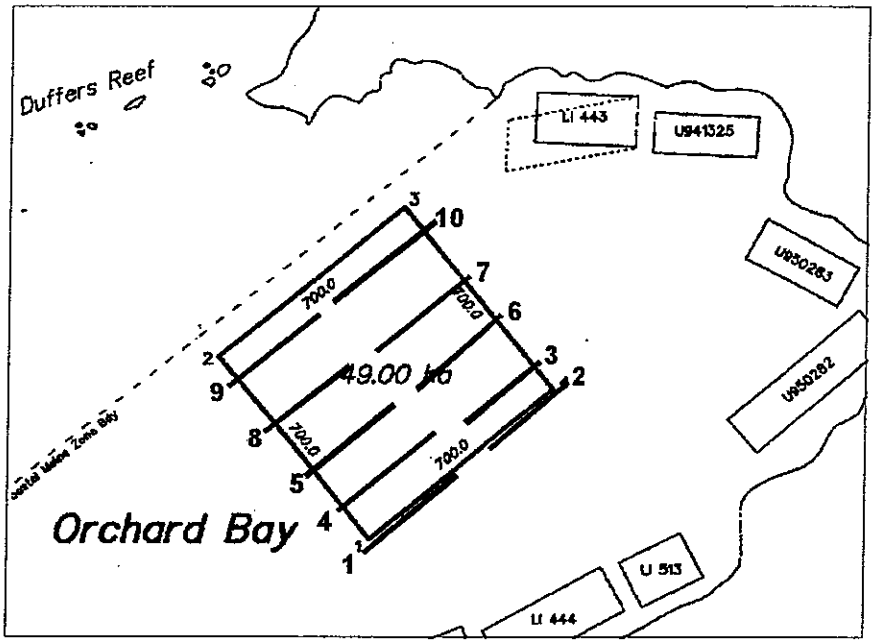

Figure 1. Site of proposed offshore marine farm in Orchards Bay. Lines 1-10 indicate positions and directions of dredge samples.

Nautical chart NZ615 shows the area under consideration to have a substratum of mud and broken shell, and the 30 m contour is relatively close to shore, indicating that the coast drops steeply. There is a broad shallow area running east – northeast off East Entry Point which rises to 16 m, but the area proposed for marine farming in this application lies entirely over water between 28 and 35 m deep.

There is little published information regarding the benthic fauna of outer Pelorus Sound.

METHODS

Although the depths of the entire area were not specifically surveyed for this part of the application, a series of spot depth recordings were taken as well as depths at the beginning and end of each dredge tow.

The depth and size of the area meant that it could not be readily sampled by divers, so a naturalist's dredge was used to obtain samples of the benthic communities. This dredge has a 600 mm x 260 mm opening, and is covered with 2 mm mesh. It was dragged an estimated distance of 300 m to obtain a sample. A total of 10 dredge samples were taken in the configuration shown in Figure 1. Tows 1 and 2 were conducted just seaward of the area to be occupied by the proposed marine farm to identify whether similar benthic species occurred outside the area. We are confident that the dredge was sampling adequately because of the large volumes of sediments obtained.

The samples were then preserved in formalin, and returned to the laboratory where species were removed from the sediment, identified and the relative abundance of each estimated for each dredge tow.

The samples were then analysed for consistency of species occurrences and to objectively describe the dominant species by multivariate analysis. The samples were analysed by Multi-Dimensional Scaling techniques (MDS) (SAS Institute Inc, 1989) to identify if any samples were different from any others. The data were also analysed by hierarchical analyses followed by a community score analysis to rank the dominant species, comparable to McKnight & Grange (1991).

RESULTS

The depths within the proposed area lay between 28 m and 35 m. The sediments retained by the dredge were largely muds with shell gravel. The dredge samples contained a total of 23 species, including bivalve molluscs (clams), gastropods (snails), sea cucumbers, brittle stars, amphipods, isopods, and several polychaete worms (Table 1).

Table 1. Organisms found in dredge survey and their distribution among the 10 dredge samples.

Group	Species	Common name	% dredge occurrence
Bivalvia	*Nemocardium pulchellum*	Strawberry cockle	100
Bivalvia	*Nucula strangei*	Nutshell	100
Bivalvia	*Neilo australis*	-	100
Bivalvia	*Theora lubrica*	Japanese bivalve	100
Bivalvia	*Tellina charlottae*	-	10
Bivalvia	*Thracia vegrandis*	-	10
Gastropoda	*Amalda novaezelandiae*	Olive shell	70
Gastropoda	*Maoricolpus roseus*	Turret shell	20
Gastropoda	*Philine angasi*	Shelled slug	50
Gastropoda	*Struthiolaria vermis*	Ostrich shell	10
Echinodermata	*Echinocardium cordatum*	Heart urchin	100
Echinodermata	*Heterothyone alba*	Burrowing sea cucumber	100
Echinodermata	*Pentadactyla longidentis*	Burrowing sea cucumber	40
Echinodermata	*Amphiura rosea*	Small brittle star	100
Echinodermata	*Amphiura correcta*	Large brittle star	70
Crustacea	*Halicarcinus sp.*	Small crab	30
Crustacea	Unidentified isopoda	Sea lice	50
Crustacea	Unidentified amphipoda	Sea hoppers	10
Cnidaria	*Edwardsia sp.*	Burrowing anemone	20
Polychaeta	*Lumbrinereis sp.*	Uncased worm	100
Polychaeta	Unidentified polychaeta	Cased worm	90
Polychaeta	*Lepidonotus sp.*	Sea mouse	40
Polychaeta	*Aglaophamus* sp.	-	10

The most widespread species, those that occurred in all dredge samples, were the bivalves *Nemocardium pulchellum, Nucula strangei, Neilo australis* and *Theora lubrica*, the heart urchin *Echinocardium cordatum*, a burrowing sea cucumber, *Heterothyone alba*, a burrowing brittle star, *Amphiura rosea*, and a worm, *Lumbrinereis*. The samples were noteworthy for the generally similar numbers and types of animals in most samples.

Quantitative analysis suggested that within the proposed marine farm area, the only outlying sample came from dredge tow 10, in the inner corner of the proposed marine farm area (Fig. 2). During sampling it was noted that samples 9 and 10 were smaller than the others.

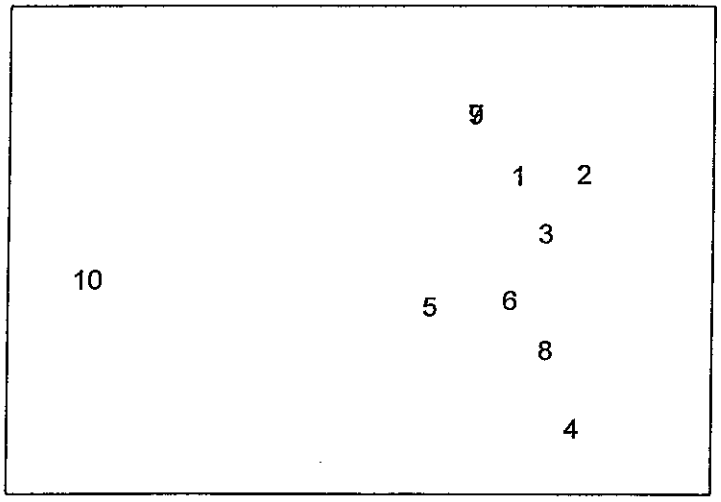

Figure 2. Clustering of dredge samples using multi-dimensional scaling. Dredge samples that contained similar numbers and types of species cluster together in the plot.

Dredge 10 differed from the other samples (Fig. 2). To determine whether this was biologically significant, the data were analysed using a Community Score Analysis (Grange, 1979) to show which species were dominant in each of the 2 clusters shown in Figure 2. The results are presented in Table 2. Group 1, which contained most of the samples both within and seaward of the proposed marine farm boundaries, was dominated by the brittle star, *Amphiura rosea*, the heart urchin, *Echinocardium cordatum*, and the nut shell, *Nucula strangei*. Dredge sample 10 also contained all of these species, but it was dominated by an amphipod (that was not recorded in the other 9 samples), the sea mouse, *Lepidonotus*, and the snail, *Philine*. This sample also contained relatively fewer individuals of 2 common bivalves (*Neilo australis* and *Theora lubrica*), and the heart urchin *Echinocardium cordatum*.

Table 2. Dominant species recorded from dredge samples, Orchard Bay, as ranked by community score analysis.

GROUP NUMBER 1 (Dredge sample nos 1, 2, 3, 4, 5, 6, 7, 8, 9)

Dominant Species

Amphiura rosea
Echinocardium cordatum
Nucula strangei

Subdominant Species

Nemocardium pulchellum
Neilo australis
Theora lubrica
Heterothyone alba
Lumbrinereis sp
Amphiura-correcta (Endemic)
Unidentified Polychaeta
Amalda novaezelandiae (Endemic)
Isopoda (Endemic)

Secondary Species

Tellina charlottae (Endemic)
Thracia vegrandis (Endemic)
Maoricolpus roseus (Endemic)
Philine angasi
Struthiolaria vermis (Endemic)
Pentadactyla longidentis (Endemic)
Halicarcinus sp (Endemic)
Edwardsia sp (Endemic)
Lepidonotus sp
Aglaophamus sp (Endemic)

GROUP NUMBER 2 (Dredge sample no 10)

Dominant Species

Unidentified Amphipoda (Endemic)
Lepidonotus sp
Philine angasi

Subdominant Species

Unidentified Polychaeta
Amphiura rosea
Nucula strangei
Heterothyone alba
Nemocardium pulchellum
Lumbrinereis sp
Echinocardium cordatum
Theora lubrica
Neilo australis

CONCLUSIONS

The smaller volumes of samples collected in dredge tows 9 and 10 appeared to legitimately reflect the benthos at that end of the site; several repeats of the samples were initially made to clarify whether the dredge had actually sampled adequately, and all samples appeared similar.

The organisms found are typical of dredge samples collected throughout the Marlborough Sounds, being very similar to those recorded by McKnight & Grange (1994). The entire site and the area seaward support widespread and common species, and all dredge samples collected were very similar. One dredge sample, from the deeper end of the site, showed a different species dominance, but most of the same species were also collected from this dredge tow. This sample was separated from the others by the presence of an amphipod, but also by fewer of the common species. No species regarded as rare or unusually susceptible to marine farming activities were recorded from these dredge samples. The only dominant species that was recorded during this study and not by McKnight & Grange (1991) was *Theora lubrica*. This is an introduced Japanese bivalve that is now abundant on muddy sediments throughout New Zealand. In all other respects, these dredge samples contain the same benthic community as those reported by McKnight & Grange (1991) from the same area.

REFERENCES

Grange, K.R. 1979. Soft-bottom macrobenthic communities of Manukau Harbour, New Zealand. *NZ Journal of Marine and Freshwater Research 13(3)*: 315-329.

McKnight, D.G.; Grange, K.R. 1991. Macrobenthos-sediment-depth relationships in Marlborough Sounds. *DSIR Division of Water Sciences Report 1991/4, prepared for Department of Conservation, Wellington.*