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Additional information on a proposed marine farm located west of Grant Bay, Pelorus Sound

Research, Survey and Monitoring Report Number 344

A report prepared for:

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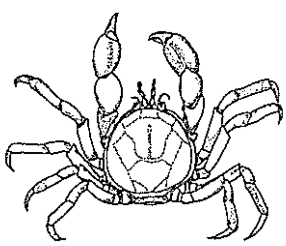

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1.0 Introduction

The present report provides additional information in response to particular issues raised in the Ministry of Fisheries Evaluation Report – A. King and S. King, west of Grant Bay, Crail Bay, Pelorus Sound C18-640 (U990657) dated 29 April 2000.

This information is supplementary to the biological report produced by Davidson Environmental Ltd entitled "Biological report on a proposed marine farm located immediately west of Grant Bay, Pelorus Sound Survey and Monitoring Report no 227" (Davidson and Brown 1999).

2.0 Methods

2.1 Reef fish presence/absence

The presence of reef fish and their relative abundance was assessed by divers from three areas: Grant Bay eastern reef, Grant Bay western reef (adjacent to the proposed marine farm) and from the shoreline from Licence 157 to the tip of the promontory at the western side of Grant Bay (bay side habitat)(Figure 1). The Grant Bay eastern reef was investigated on the 10 th March 2000, while the Grant Bay western reef and bay sides were investigated on 18th May 1999 and 6 th June 2000.

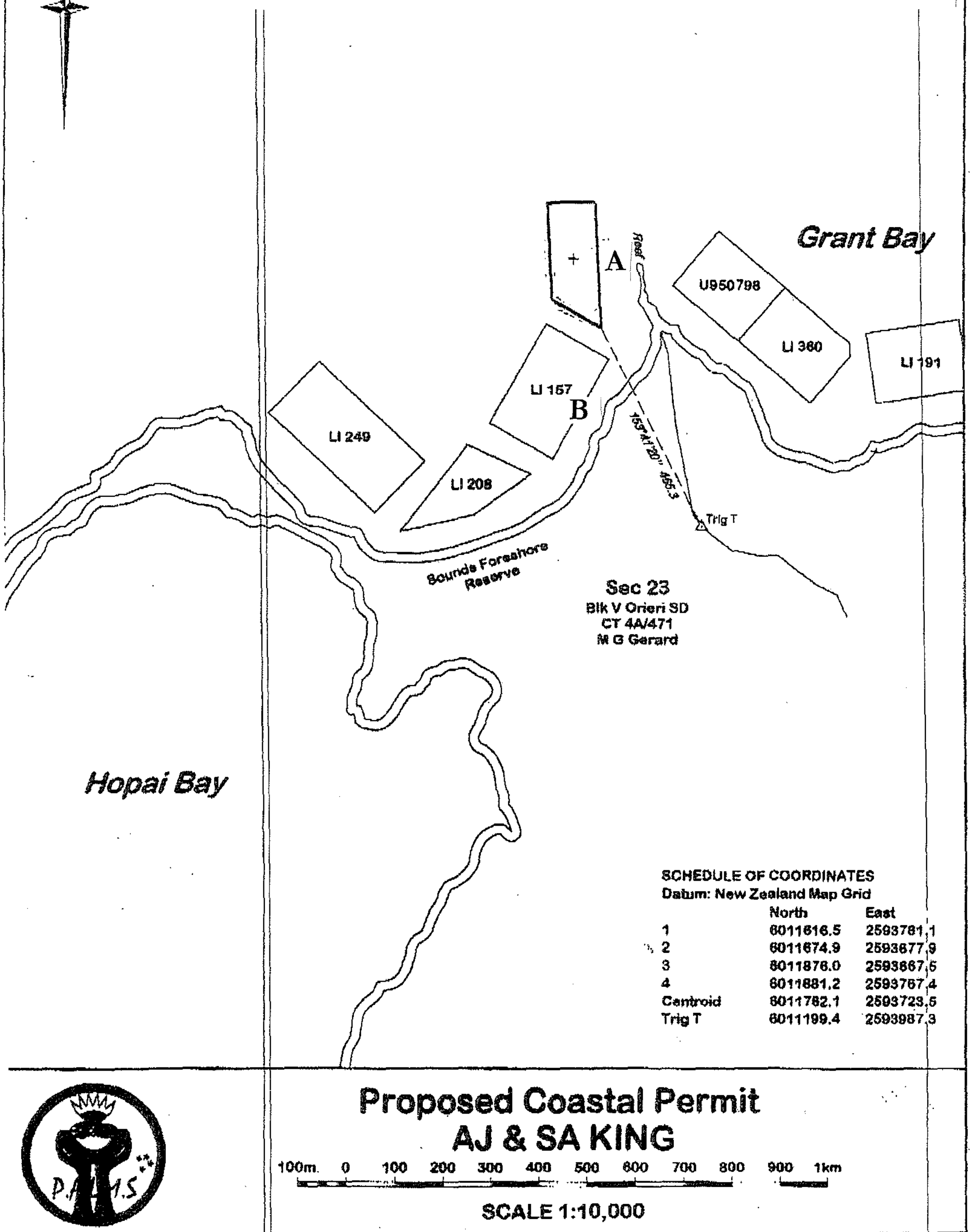
2.2 Reef fish abundance

Two sites were selected for study. One site was located centrally along the proposed marine farm (immediately west of the promontory) and the other located centrally along the existing marine farm (Li 157) located to the south of the proposed marine farm (Figure 1).

Fish density was investigated using traditional underwater strip transect methods (Bell 1983, McCormick & Choat 1987, Buxton & Smale 1989, Cole *et al.* 1990, Cole 1994). Transects were collected from three habitat types located at three depths at the two sites (Table 1, Figure 1). All transects were collected parallel to the shore. Blue cod were categoried by divers into three size groups (juvenile < 10 cm, sub-adult 10 to 30 cm and adult >30 cm). The same two divers sampled fish on the 6th June 2000. Diver estimation of blue cod size were standardised to recognise cod size using plastic fish underwater prior to field work. Transects were collected at slow constant swimming speed, but fast enough to ensure that spotty (*Notolabrus chelidotus*) and blue cod did not overtake divers. Triplefin density was not recorded during the present study.

At each station within each site, a lead weight at the start of the transect line was dropped onto the benthos within the designated habitat and depth range. The line automatically reeled off the spool as the diver holding the spool swam away from the lead weight. At a distance of five metres from the lead weight (as indicated by a squeezed metal marker on the line), divers started counting fish in a

Figure 1 Location of underwater fish transects at the two study sites. A = proposed marine farm, B = existing marine farm.



diver estimated two metre wide, two metre high, 30 metre long tunnel. A total of 36 counts were collected, 18 from each site. Six replicates were collected from each habitat at each site.

Table 1 Substrata, habitats and depth ranges sampled from each site (site 1 = proposed marine farm area, 2 = existing marine farm area).

Substrata	Habitat	Depth range (m)	Number replicates per site
Small boulder, cobble	Rubble bank	7 m to 9 m	6
Sorted broken shell, dead whole shell, fine sand	Sorted shell	17 m to 18 m	6
Broken and dead whole shell on a base of silt and clay	Shell/silt	21 m to 23	6

A wide ranging swim around the Grant Bay west reef extending northward from the promontory was also conducted. The range of fish species and their relative abundance was recorded from this reef and the other habitats investigated during the present study.

2.3 Fish feeding habitat

The number of holes that showed signs of recent fish grubbing activity were recorded from a total of eighteen 30 m x 2 m quadrats sampled from the three habitats outlined above. The same two study sites sample above were investigated. Recent fish activity was defined as a hole with either:

- Recently disturbed substrata suggesting very recent fish grubbing activity (possibly within the last week); and
- A hole with relatively steep sides suggesting activity (possibly within the last month).

Holes with rounds sides or partially filled in suggesting old activity were not included in counts.

2.4 Tidal currents and direction

Diver observations of water currents and their relative strength and direction were collected from the proposed marine farm site and adjacent reef from 11.30 am to 3 pm and from 2 pm to 3.30 pm from the vicinity of Licence 157.

In addition a 1.5 litre container 90 % filled with water was released at 11.30 on the eastern site of the reef. This container was retrieved at 3 pm and its relative location estimated.

3.0 Results

3.1 Reef fish abundance

A total of 10 fish inhabiting the three study areas were recorded on three sample occasions (Table 2). Of note was the presence of blue maomao from the Grant Bay east reef site. This species is near its southern New Zealand limit in the Marlborough Sounds (Francis 1988). Spotty was the most common reef fish at all study sites and was most abundant from the reef areas compared to the bay side habitat. Blue cod were relatively uncommon from all sites (Table 2).

The range of species present at the reef habitat was higher than the bay side habitat. More species were recorded from the eastern reef compared to the western reef but it is probable that both reef areas support the same range of species. It is probable that all areas support snapper, but this species is seldom observed by divers outside marine reserves.

Table 2 Relative abundance of reef fish observed by divers from Grant Bay eastern and western reef areas and the bay sides (1 = occasional, 2 = common, 3 = abundant).

Common name	Scientific name	Relative abundance		
		Bay side	Grant Bay (west reef)	Grant Bay (east reef)
Blue cod	*Parapercis colias*	1	1	1
Spotty	*Notolabrus celidotus*	2	3	3
Leatherjacket	*Parika scaber*		3	2
Tarakihi	*Nemadactylus macropterus*			1
Conger eel	*Conger verreauxi*		1	1
Blue maomao	*Scorpis violaceus*			1
Common triplefin	*Forsterygion lapillum*	1	2	3
Variable triplefin	*Forsterygion varium*	2	2	2
Mottled triplefin	*Forsterygion malcolmi*	1	1	1
Yellow black triplefin	*Forsterygion flavonigrum*	1	1	1
Total no. species		**6**	**8**	**10**

3.2 Reef fish density and depth/habitat distribution

Reef fish abundance were collected form three stations (habitats and depths) from two sites (existing marine farm site and proposed marine farm site) during the present study.

Two species of reef fish were recorded from transects (Table 3). Spotty was recorded from all depths, but were most abundant from the rubble bank and bedrock outcrops sampled between 7 m to 9 m depth (Table 3). The density of spotty from the rubble habitat was highest adjacent to the proposed marine farm site due to the large numbers of spotty recorded from transect adjacent to the reef. An occasional spotty was recorded from the sorted shell zone at both the proposed and existing marine farm sites. Occasional spotty individuals were recorded from the silt/shell habitat but only within the existing marine farm area (Table 3).

Blue cod were not recorded from the silt shell habitat at either the existing or proposed marine farm site. One blue cod was recorded from the sorted shell habitat at the proposed marine farm site (Table 3). All other blue cod were recorded or observed within the rubble bank habitat. One blue cod was > 300 mm length was recorded with the remainder from 100 mm to 300 mm length.

Table 3 Density of blue cod, spotty and fish holes from three habitats at two sites west of Grant Bay.

Site	Species	Mean density per m^2 (standard error)		
		Rubble	Sorted shell	Shell/silt
Proposed marine farm	Blue cod <10 cm	0	0	0
	Blue cod 10-30 cm	0.17 (0.17)	0.17 (0.17)	0
	Blue cod > 30 cm	0	0	0
	Spotty	14.8 (4.35)	1.0 (0.68)	0
	Holes	0	12.3 (0.88)	3.0 (0.58)
Established marine farm	Blue cod <10 cm	0	0	0
	Blue cod 10-30 cm	0.17 (0.17)	0	0
	Blue cod > 30 cm	0.17 (0.17)	0	0
	Spotty	5.5 (1.18)	0.17 (0.17)	0.83 (0.54)
	Holes	0	13.7 (1.9)	1.0 (0.37)

3.3 Fish feeding habitat

The sorted shell/fine sand habitat was recognised by Davidson and Brown (1999) as a fish feeding habitat. The authors concluded that holes were made by foraging fish.

No fish grubbing holes were recorded from the rubble habitat at 7 m to 9 m depth (Table 3). Holes were recorded from the other two habitats, but were dramatically more abundant in the sorted shell/fine sand habitat. The mean density of holes in the sorted shell zone was relatively consistent between the proposed marine farm and existing marine farm treatments (Table 3). The density of holes from the deeper silt/shell zone was lower for both the existing marine farm and the proposed marine farm area (Table 3). For this habitat, lower numbers of holes were recorded from immediately below the mussel droppers.

3.4 Tidal flow and direction

The high tide at the study area was approximately 12.30 pm and relatively large (i.e. 4 m at French Pass). Tidal current observations were made on the late part of the incoming tide and early part of the outgoing tide. The sea conditions during these observations were calm with no wind apparent.

On both the late incoming and early outgoing tides a light tidal stream was observed flowing across the reef from an east to west direction. On both the incoming and outgoing tides a light northward along shore tidal flow was observed from areas south of the promontory tip (Figure 2). These tidal currents were apparent at greater depths on the outgoing tide.

4.0 Conclusions

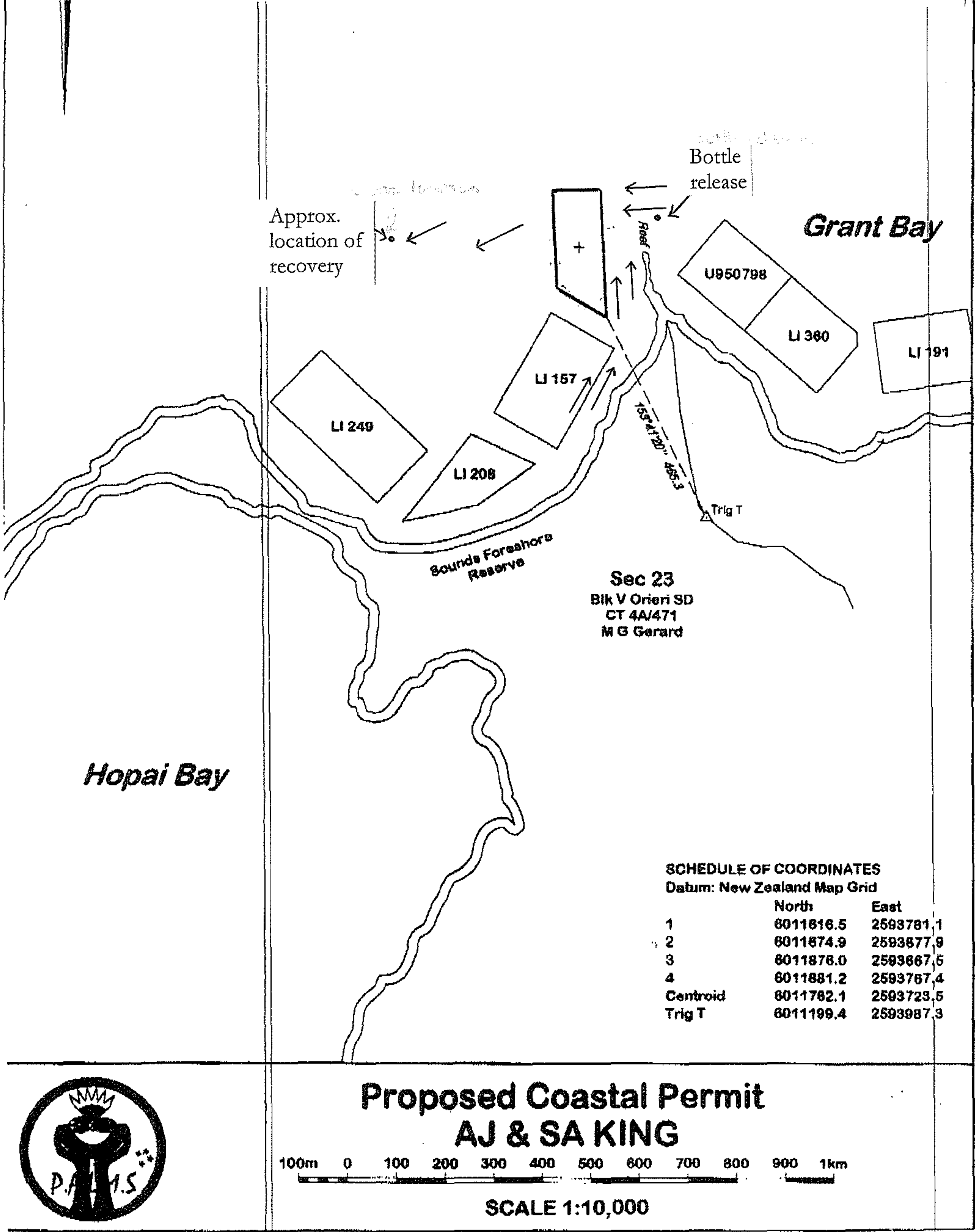
Fish species and their abundance

The range of species and their abundance recorded from the two reef and the bay side habitats were low compared to reef areas in the sheltered and exposed outer Pelorus Sound area (Davidson and Brown 1994), but representative of reef areas within the sheltered Marlborough Sounds (Davidson 1995). The range of species and their abundance was comparable to reefs known to the author west of Rams Head, Picnic Bay and in Waitata Bay.

Blue cod habitat, movement and feeding

Blue cod are known primarily as a reef fish (Francis 1988). They have however, been recorded from offshore habitats in the Sounds, particularly in areas where bryozoans or horse mussel exist (author pers. obs.). Within the Sounds, adult blue cod are most abundant from the rubble/reef substrata found most often as a relatively narrow strip <80 m from mean low water. Blue cod appear as juvenile < 5 cm at depths > 10 m most often in combinations of sand/silt/shell and cobbles. In particular areas in

Figure 2 Tidal current observations and location of bottle release and recovery. Arrows indicate direction of currents during all stages of late incoming and early outgoing tides.



the outer Sounds they can be observed from fine sand shell areas with dead whole dog cockles present on the surface.

Blue cod feed on a variety of organisms (Cole et al. in prep., Villouta in prep.) most of which are found in the rubble bank zone of the Sounds. Cod often become most abundant at dusk and dawn when they may feed on animals that move out from under cobbles and thereby become available to cod (e.g. virgin paua).

A proportion of the adult blue cod population move little during their lives (Cole et al. in prep.). This means that the number of takable fish available to fishers in any one area is limited. In response, fishers of blue cod often move to take advantage of cod in adjacent areas by drift fishing or moving regularly. As most cod inhabit the rubble bank and to a lesser extent the sorted shell zone it is probable that most cod would be captured in distance < 80 m distance from shore. Any cod captured offshore of 80 m distance may have been attracted offshore by the bait or burly.

Fish feeding habitat

The presence of holes caused by fish grubbing presumably for food from the sorted shell zone suggest this habitat is regularly utilised by fish. The lack of holes from 7 m to 9 m from the rubble habitat was due to the lack of soft substrata. The deeper shell silt zone appears to be occasionally used by fish as indicated by occasional holes.

Based on observations made throughout much of the Marlborough Sounds the likely fish species include snapper, blue moki, blue moki, eagle ray and skate. Very large holes > 0.5 m across were clearly made by eagle ray or skate. Where this activity was recent, the outline of the rays wings could be observed on the substrata.

Sorted shell habitat is not widespread in the Marlborough Sounds or where present is often relatively narrow. It appears widespread and up to 120 m wide in particular parts of the Beatrix, Crail, Clova Bays complex and in particular areas in Tawhitinui Reach, Garne, Saville and Hallam Cove areas. When present this habitat appears to be an important fish feeding area as indicated by the presence of foraging holes.

The impact of a mussel farm on the sorted shell fish feeding zone

Davidson and Brown (1999) recommended that the north-western inshore boundary of the proposed marine farm be located no closer than 90 m distance to shore. These adjustments were to avoid cobble habitat and thereby provided a separation distance between farm structures and hard substrata of some 45 m to 70 m distance based on the contour of the coastline. Fish feeding habitats in the vicinity of transect 2 of their report were separated from the farm structures by 15 m distance. In the area of transect 1, a separation distance between farm structures and fish feeding habitat from 5 m to 25 m would be established. The authors concluded that based on their observations made on marine farms in close proximity of the sorted shell/fine sand habitat used by fish to feed that it was unlikely that the fish feeding habitat would be negatively impacted by a mussel farm.

The Ministry of Fisheries has stated that a buffer zone of 20 m distance between the sorted shell zone and the droppers should be 20 m distance. . The Ministry's buffer zone of 20 m has been based on the concern that fish feeding habitat would be negatively impacted. Counts of holes from the sorted shell zone immediately adjacent to the existing marine farm as part of the present study (i.e. within 20 m distance of the structures) suggested that the presence of a mussel farm had not reduced fish feeding activity

The need for a 20 m buffer zone to protect fish habitat may therefore require further investigation before it can be implemented with proper scientific justification. The distance between the sorted shell habitat and the first droppers on the existing marine farm (Li 157) was approximately 10 m to 15 m distance. The existing literature reports a detectable impact distance from mussel farm growing structure of 20 m. This impact has often been based on infaunal and epibenthic invertebrate sampling, and sampling of the redox layers (DeJong 1994). I am unaware of any study that reports a negative impact to fish feeding habitat or activity. A separation of 10 m to 15 m between fish feeding habitat and droppers at the existing marine farm (Li 157) showed that there was no difference in the number of holes and therefore fish feeding activity compared to the site with no marine farm to the north. There is therefore a lack of scientific evidence either form observation from fish abundance or fish feeding holes to support a need for a buffer zone of 20 m from the sorted shell zone at this locality.

Based on observations and data collected during the present study it is concluded that: (a) there is insufficient data to show that a mussel farm adversely impacts fish feeding habitat (i.e. the sorted shell zone) and (b) data collected as part of this study suggests that 10 m to 15 m separation distance from droppers was sufficient to ensure no adverse impacts on fish feeding activity. At the proposed marine farm site adjacent to the western promontory to Grant Bay the distance between the inshore droppers and the sorted shell zone is 10 m in the south and 20 m in the north. Should the Ministry of Fisheries require a buffer zone of 20 m despite the findings of this report, a maximum reduction of 10m distance from the inshore northern boundary corner would be required to achieve this separation.

Tidal currents and direction

Observation collected from two visits and on both the incoming and outgoing tides suggest that tidal flow is: (a) light, (b) travels across the reef from an east to west direction, and (c) travels along the bay edge in an along-shore northward direction. Based on these observations, it appears unlikely that water flowing through the proposed marine farm site would travel towards the marine farms located to the south-west. It is probable, however, the water flowing through the existing marine farms located to the southwest will enter the proposed marine farm area south of the promontory tip. The proposed marine farm site will also receive water flowing across the reef from Grant Bay. As such, the proposed marine farm site would be flushed to a greater extent than farms located within the bay proper.

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