4. Biological and Shoreline Monitoring of Ship-Wake Effects

(also refer separate attachments)

(Clr Hope) (Report prepared by Dr Steve Urlich and Neil Morris) **E325-001-001, E325-007-002-01-03**

Purpose

1. To provide the Committee with an outcome of 20 years of monitoring the effects of ship wake on shoreline erosion and biological communities in Kura Te Au/Tory Channel and Tōtaranui/Queen Charlotte Sound.

2. Separate **attachments**: **1**. Shoreline Monitoring in Tory Channel and Queen Charlotte Sound. Dr Kevin Parnell. **2**. Biological monitoring of the ferry route in Tory Channel and Queen Charlotte Sound: 1995-2017. Davidson Environmental Ltd.

3.	**Rob Davidson, marine biologist, will give a presentation summarising the biological monitoring report (10 minutes).**

Background

4. The introduction of fast ferries in the mid-1990s resulted in significant effects in Kura Te Au/Tory Channel and Tōtaranui/Queen Charlotte Sound. The high energy waves caused concern for public safety (Figure 1), and resulted in environmental changes to shorelines from erosion and accretion, and to the ecology of inshore biological communities as marine invertebrate species were thrown out of the water.

Figure 1 - Examples of wave energy from fast ferries.

5. Council implemented long-term monitoring to examine the effects on beach and shoreline morphology (erosion and accretion), and to the habitats of marine invertebrates (eg; paua, kina). The monitoring has continued to the present. Over the course of the 20 years, there have been multiple changes to vessels on the ferry route between Picton and Wellington (Figure 2).

6. The speed of the fast ferries was effectively slowed by the implementation of the Navigation Bylaw in December 2000. This reduced the intensity of the wave profiles. As a result, monitoring has shown associated changes in shoreline profiles and general recovery of biological communities.

7. Given the length of time to monitoring, it was determined that each scientist should review the respective monitoring in its entirety and make recommendations for future monitoring. The same lead scientists have been involved over the duration of each study.

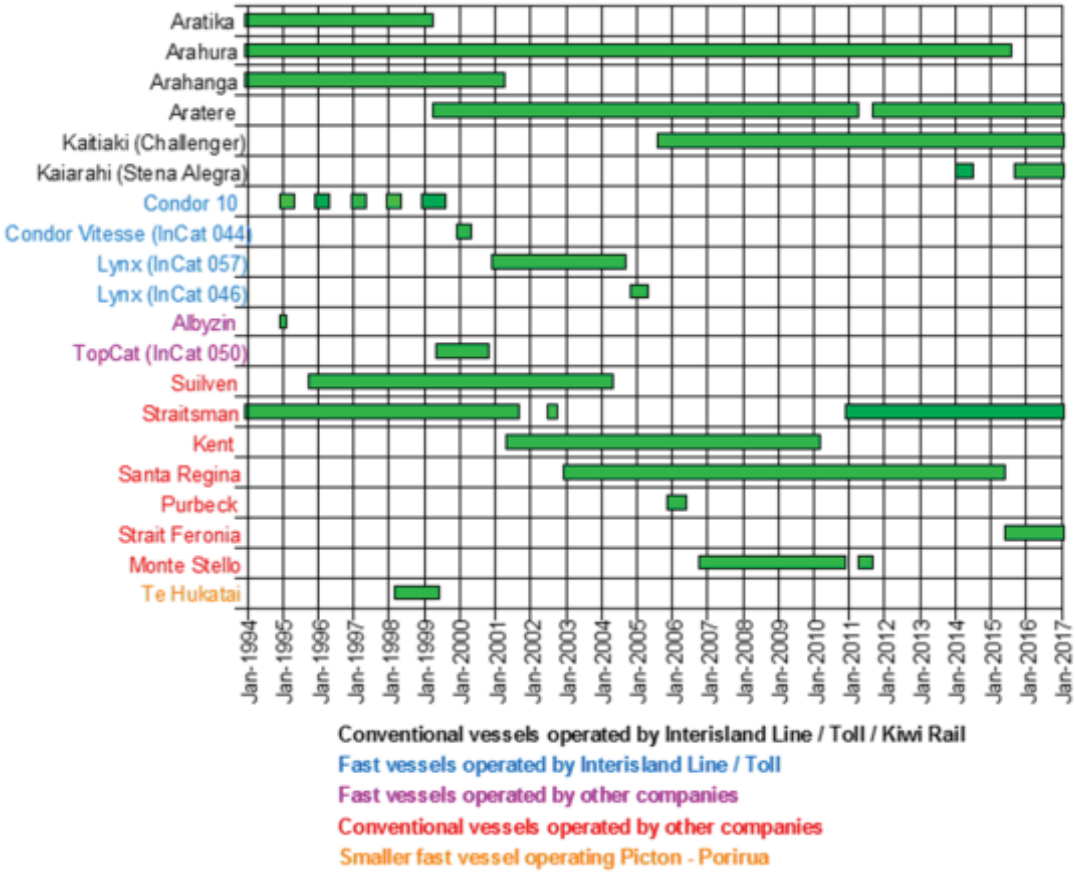

Figure 2 - List of ferries in service on the Cook Strait route since 1994

Shoreline erosion

8. Twenty-one monitoring locations were established along the ferry route and in the Outer Queen Charlotte Sound as reference sites (Figure 3). Cross-sections were taken by registered surveyors (Figure 4) at each site at six month intervals until 2012, when the frequency was reduced to annually.

9. The reference sites in the outer Queen Charlotte Sound have been generally stable, with some minor and slow erosion at some sites, and fluctuating erosion and accretion (expansion) at others. By contrast, there have been a range of impacts at the sites along the ferry route.

10. Blackmore's at Waikawa (site 5) had the sediment stripped down to bedrock by the fast ferries (Figure 3). The sand has not replenished due to insufficient wave energy to return the sediment. Bob's Bay (site 8) has shown a trend of consistent erosion to the present time, which may be related to the high numbers of boats of all types passing the site.

11. For other sites along the ferry route, the report states that the Navigation Bylaw restricting speeds to 18 knots has resulted in changes to sediment dynamics. "*Although a definitive conclusion may never be possible, the results support the understanding that the fast ferry wakes resulted in rapid sediment build-up at the top of the beach on most beaches along the ferry route. However, it is now clear that under the current vessel operational regimes, either stability (with the newly inherited morphology remaining) or a return to pre fast ferry morphology is occurring or has occurred. This conclusion was first reached in 2009 and has been reinforced by surveys since that time*".

12. Dr Parnell concludes that the monitoring programme has been effective in demonstrating the effects of fast ferry operation on beaches, and the increased sediment availability along the route. He advises that an equilibrium state exists with respect to beach morphology and drivers of coastal processes, with the current vessels operating the route.

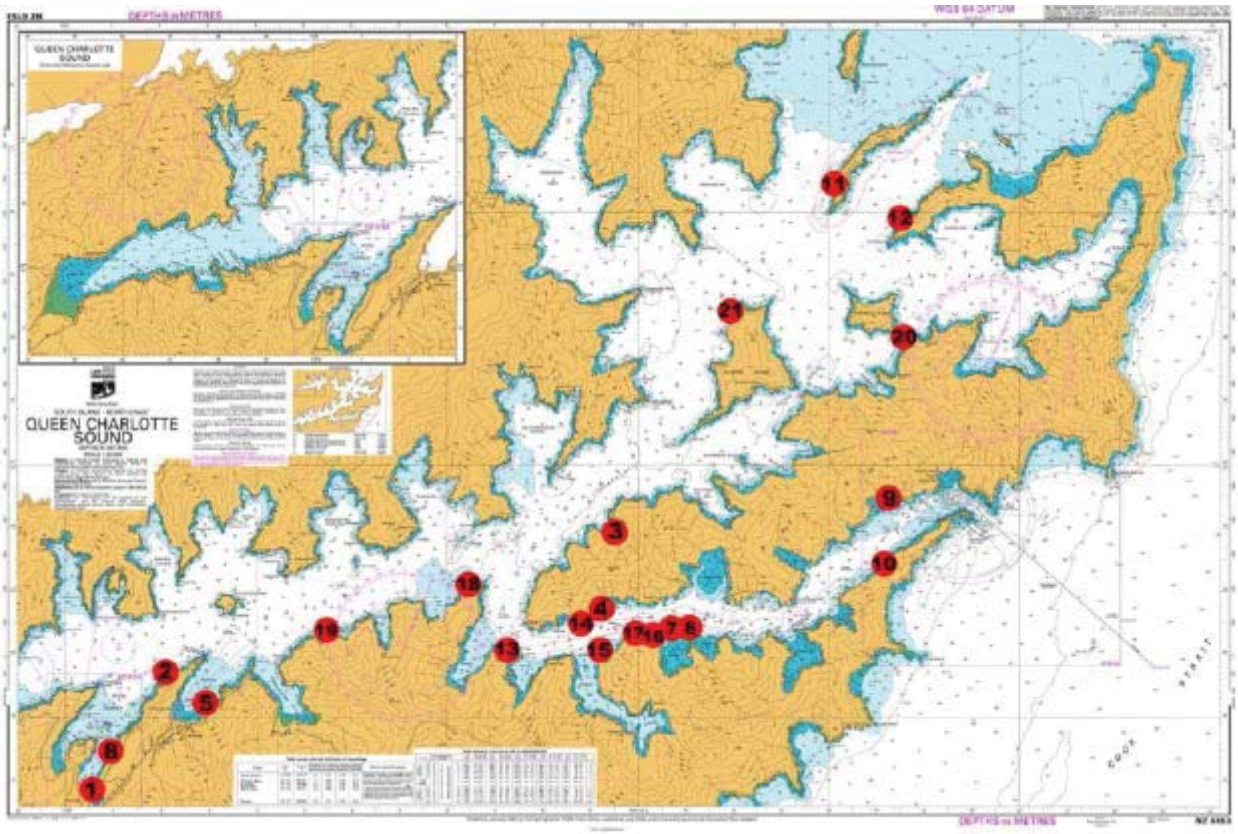

Figure 3 - Shoreline erosion sites monitored since 1997

13. In that light, he suggests that if the purpose of the monitoring programme remains as it was when it was established, to determine the impacts of vessel-wakes, then it can be suspended. This is on the proviso that it could be reactivated should there be a need based on changes in vessel operation. This is because the survey marks at each site were benchmarked to a common datum in 2013.

14. If the purpose of the monitoring programme is for a more general state of the environment purpose, then he suggests it should continue, perhaps at a reduced frequency. The number of sites could be reduced by a third for those sites which Dr Parnell sees little value in continuing monitoring.

15. Given the relatively low cost of the shore line erosion monitoring (~$10K per annum), a change to biennial (two-yearly) monitoring is favoured. This retains the value of the long-term data-set for state of the environment purposes, and safeguards the investment in monitoring made over the past 20 years.

Figure 4 - (*Left*) Shoreline survey assessment at Bob's Bay (site 8); (*Right*) Blackmore's in Waikawa (site 5)

Biological monitoring

16. Monitoring sites were also established on rocky shore and subtidal habitats in the mid 1990s. These have been monitored annually up to 2013 by Davidson Environmental Ltd, when the monitoring of the cobble and bedrock communities was shifted to alternate years until 2017.

17. The monitoring included reference sites in outer Queen Charlotte Sound and impact sites on the ferry route in Tory Channel and inner Queen Charlotte Sound. The monitoring occurred during the period when fast ferries were operating, and following the 2000 Navigation Bylaw. The monitoring design therefore enables inferences to be drawn about changes as consequence of the bylaw.

18. The slowing of the fast ferries reduced the intensity of disturbance to intertidal and shallow subtidal communities. This resulted in the ecological recovery at most, but not all, impact sites. As similar changes were not recorded at reference sites, the most plausible explanation is the reduction in wave energy from slowing vessel speed.

19. This is supported by the measured increase in invertebrate species numbers and density at impact sites following the bylaw. Prior to the bylaw, regular strong wave action resulted in a jumbled, loosely packed intertidal shore. In these conditions, the biota living on and under cobbles was rare or absent. In contrast, at reference sites where the cobbles were usually stable and surrounded by fine substrata such as pebbles, sand and broken shell, there was a variety of intertidal organisms.

20. There was also a reduction in numbers of invertebrates cast up onto the shore by wave action along the ferry route. The numbers of invertebrates cast ashore at impact sites was highest at the beginning of the fast ferry operation (eg; Figure 5), but declined after the initial months. This reflected the effects on invertebrate survival from the frequent buffeting of high energy waves.

Figure 5 - Kina (sea urchins) cast up at the high tide line at Te Weuweu Bay, Tory Channel in 1995 (red arrows). Note: spines and flesh are intact for most individuals suggesting recent relocation from the subtidal zone.

21. The limited recovery at some intertidal bedrock and cobble sites is attributed to the continued waves from conventional vessels. This is because the recovery of some species metrics levelled out, or declined, coincident with the introduction of the Kaitaki in late 2005. According to the report, regular waves from conventional ferries suppress recovery at certain locations and tidal heights.

22. Davidson Environmental recommend that monitoring of shoreline communities continues to ensure that any further changes in the Cook Strait ferry fleet can be properly assessed. They suggested

that the intertidal and shallow subtidal sampling intensity could be reduced to every second summer, given the long-term data-set and amount of variation detected. They recommend that the deep subtidal bedrock monitoring can be dropped as these are not sensitive to ship wake effects.

23. Given the relatively low cost of the biological monitoring (~$15K per annum), a change to biennial (two-yearly) monitoring is favoured. This retains the value of the long-term data-set for state of the environment purposes, and safeguards the investment in monitoring made over the past 20 years

Summary

24. The ongoing shoreline and biological monitoring has been effective in demonstrating the effects of fast ferry operation on beaches. For the *shoreline monitoring*, measurements of wake characteristics showed that the fast ferries generated sufficient energy to transport sediment in both alongshore and cross-shore directions. It has also demonstrated the importance of sediment supply, and how fast ferries contributed to increased sediment availability along the route. The monitoring has also shown that the beach profiles in the outer Queen Charlotte Sound, not affected by regular large vessel traffic, are generally very stable. The stability of these reference sites is also evident in the *biological monitoring*. At most impact sites, ecological recovery was documented following the implementation of the 2000 Navigational Bylaw. As similar changes were not recorded at reference sites, the most plausible explanation is that the bylaw was not only effective in reducing wave energy for public safety, but also alleviated the disturbance to intertidal and shallow subtidal biological communities. The scientists that have undertaken each study have made recommendations for reducing the frequency of monitoring and rationalising sites. These are supported by Council staff for the continuation of state of the environment monitoring. The relatively minor cost savings will be reallocated into other priority coastal monitoring projects.

RECOMMENDED

1. That the report be received.

2. That both the shoreline monitoring and biological monitoring programmes be reduced to bi-annual programmes.

5. Ecologically Significant Marine Site Monitoring 2017
(also refer to separate attachment)

(Clr Hope) (Report prepared by Dr Steve Urlich) **E325-002-004-01**

Purpose

1. To provide the Committee with the results from the survey and monitoring of ecologically significant marine sites in the outer Marlborough Sounds over the 2016/2017 summer season.

2. **Separate attachment:** Significant marine site survey and monitoring programme (survey 3): Summary report 2016-2017. Davidson Environmental Limited, Nelson.

3.	**Rob Davidson, Marine Biologist, will give a presentation summarising the report (20 minutes).**

Background

4. In 2011, the Council and the Department of Conservation commissioned Davidson Environmental Limited to lead an expert group to collate information about marine sites which were known to be important ecologically and as habitat for threatened species. These sites were then assessed against a number of criteria for significance. 129 sites considered significant were identified.

5. This information was published and is available on the Council's website (Figure 6).

6. Significant marine sites are protected by a prohibition on dredging and bottom-trawling in the Marlborough Environment Plan, notified on 9 June 2016. This is because the Council has a statutory responsibility under sections 6 and 30 of the Resource Management Act 1991 to protect the habitats of significance to indigenous fauna and to maintain indigenous biological diversity. The extent of these powers is currently the subject of judicial proceedings in the Court of Appeal.

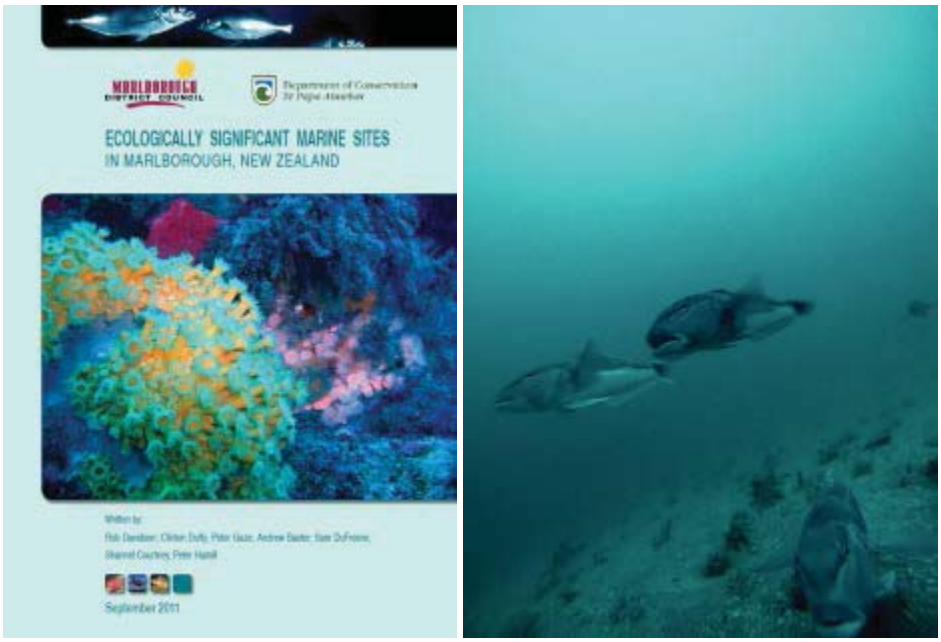

Figure 6: Ecologically significant marine sites publication

https://www.marlborough.govt.nz/environment/coastal/coastal-ecosystems/significant-marine-sites

7. A survey and monitoring protocol for these significant sites has been developed. All sites are planned to be visited at least once every ten years. A subset of sensitive biogenic (living) habitats is being monitored more frequently. Estuaries are monitored in a separate project.

8. The protocol includes surveying sites which are poorly known, such that an assessment of significance could not be undertaken in 2011. New or candidate sites will also be progressively visited. The 2011 report is planned to be revised once sufficient information has been gathered.

9. The Council and the Department of Conservation are co-funding the annual survey and monitoring programme, and jointly set the priority areas for monitoring. The Committee will recall that the first year of survey and monitoring in 2015 was focused on Tōtaranui/Queen Charlotte Sound, Kura Te Au/Tory Channel and Te Anamahanga/Port Gore; and the 2016 monitoring focused on Croisilles Harbour and off eastern D'Urville Island/Rangitoto ki te Tonga.

10. Davidson Environmental will present the findings of the third year's monitoring, conducted last summer. This includes information on better defining the boundaries of each area (spatial extent) along with a comparison with previous information and data on the condition of each site.

11. The 2017 summer survey continued the monitoring in Croisilles Harbour and off eastern D'Urville Island, and included sites in outer Pelorus Sound and Port Gore. A number of fragile biogenic communities, including rhodolith (calcified algae) beds, tubeworm mounds, sponge gardens and bryozoan (coral-like) communities, were identified (Figure 7)

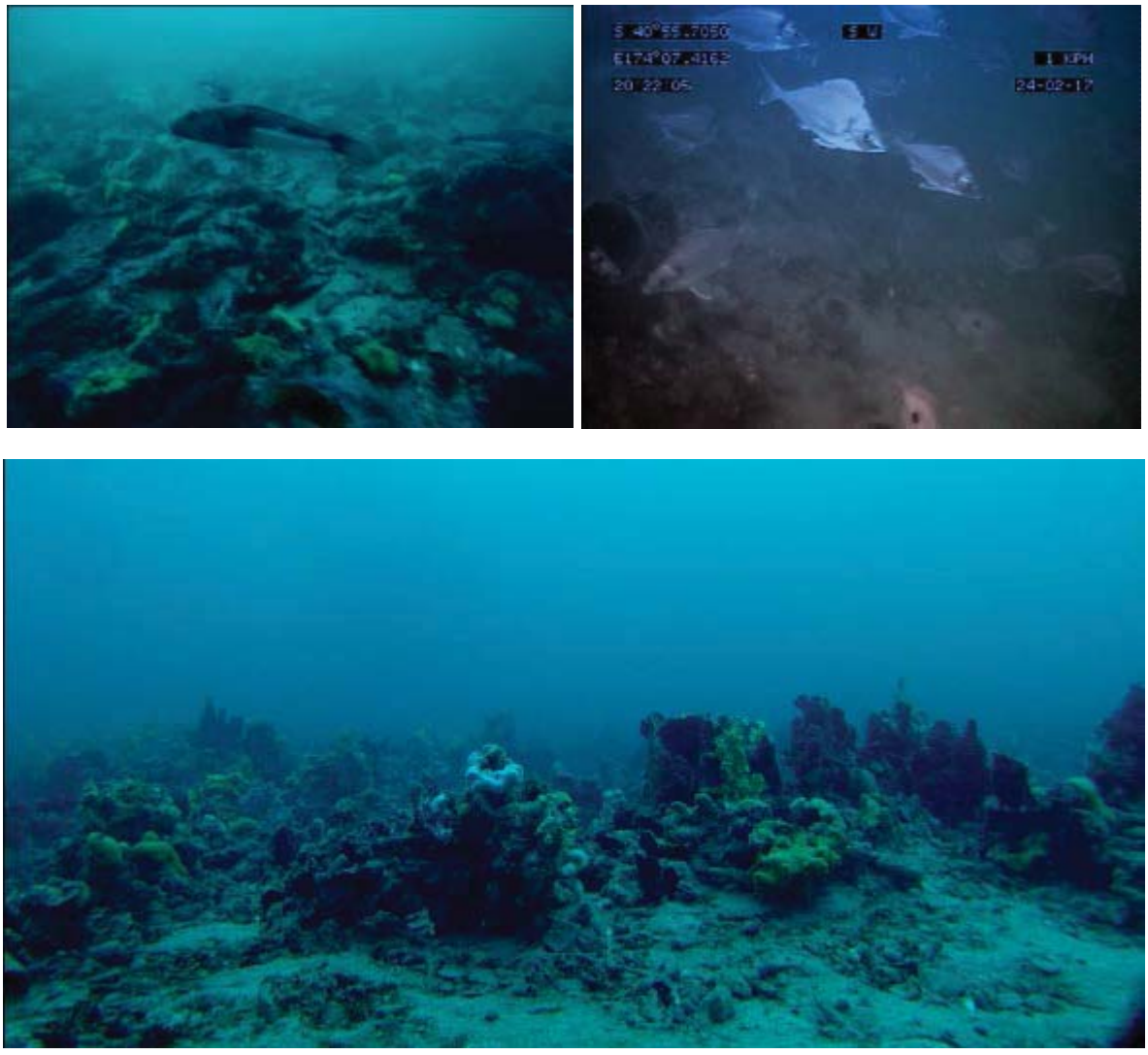

Figure 7: Examples of habitats and species from the year three significant marine sites study

12. A total of 15 sites and sub sites were investigated (Figure 8). Three sites increased in size by a total of 583 hectares as a result of an improved level of sampling. Four sites declined by a combined total of 459 hectares. This was due to a combination of improved information and, in two cases, a loss of habitat due to physical damage.

13. The sensitivity of sites to physical contact from dredging and bottom-trawling can result in severe damage and destruction, with consequent loss of biodiversity. The ecosystem value of these habitats is highlighted by the invertebrates and fish that congregate at these sites. These habitats are relatively old and slow growing, which means they take a long time to recover, if at all.

14. Davidson Environmental advises that these habitats are now relatively scarce, meaning those that remain are even more important. The Committee has received previous reports on the reduction in size and distribution of habitats in Marlborough's coastal waters over the last 150 years, due to direct damage from fishing and smothering by sedimentation, including very recently.

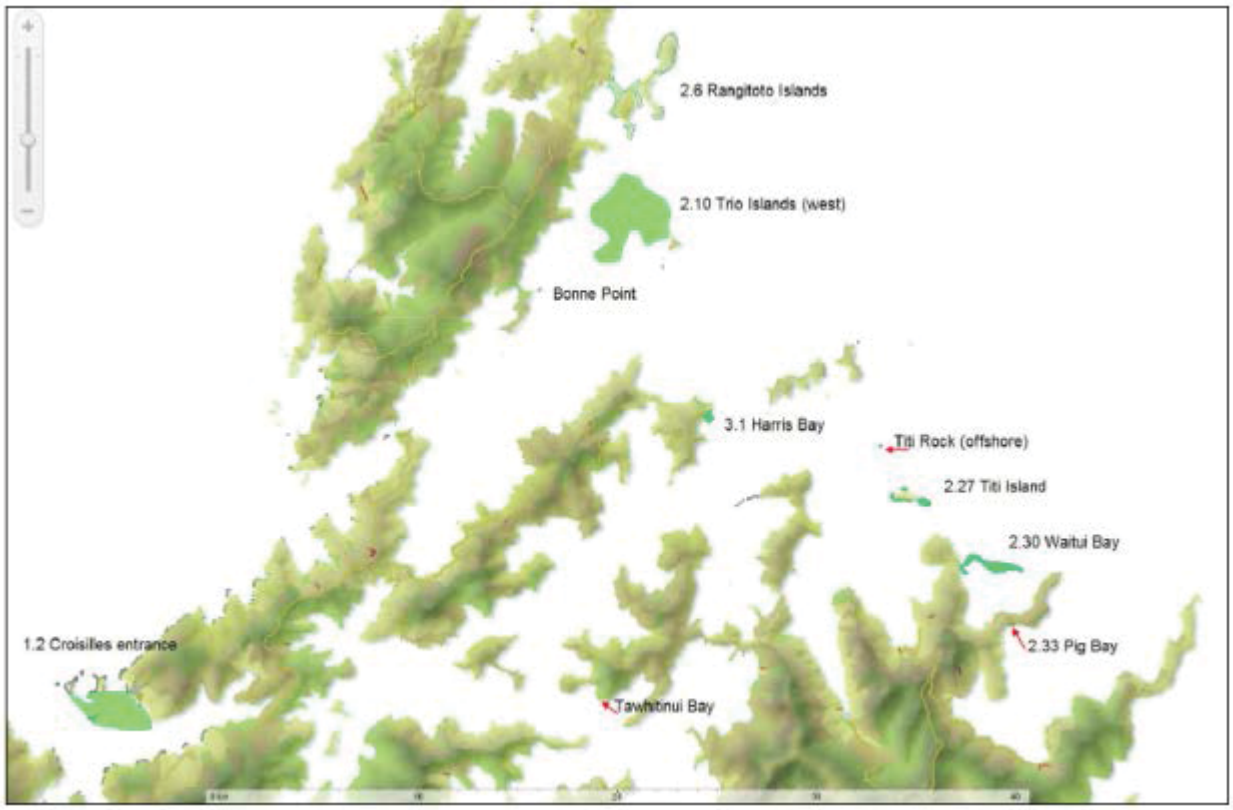

Figure 8: Habitats surveyed by Davidson Environmental in early 2017

15. Davidson Environmental makes a number of recommendations to protect the sites surveyed in the **separately attached** report (set out in Table 1 below). These include protection from dredging and bottom-trawling at most sites, to protection from all forms of disturbance, including preventing anchoring at some sites.

16. These recommendations are consistent with those made after the first and second year's monitoring by the Significant Marine Sites Expert Panel (Expert Panel). The two Expert Panel reports have also been considered by the Environment Committee.

17. The Expert Panel identified different categories of sites based on their susceptibility to different types of disturbance, and the degree of risk to those sites. Some sites can withstand anchoring and recreational dredging, others are not resilient to any forms of dredging and the most fragile cannot tolerate even light boat anchors, such as tubeworm mounds, rhodolith beds and bryozoans.

18. The Expert Panel report also called for buffers to be established around significant sites to prevent accidental incursions caused by GPS errors or strong currents dragging dredges and trawls equipment over habitats. That report was referred to the Council's Regional Planning and Development Committee to consider in 2016.

19. The recommendations and data presented in the **separately attached** Davidson monitoring report are also to go before the Expert Panel. The Expert Panel will report back to the Council and the Department of Conservation by November 2017. That information will then be presented to Council's Environment Committee for consideration.

Attribute	Values
Area based on 2011 and 2015 (ha)	1742.2
Area in 2017 (ha) *	1872.64
Potential new sites*	3
Potential site removed*	0
Increase in area (ha) *	589.34
Decrease in area (ha) *	-458.9
Overall change (ha) *	130.44
Sites	Work conducted/recommendations
Site 1.2 Croisilles Harbour Entrance	Quantitative survey of lancelet abundance to investigate impacts of recreational dredging
Site 2.6 Rangitoto Passage	Adjust boundaries, protect significant sites from all forms of physical disturbance
Site 2.10 Trio Islands (west) (biogenic community)	Adjust boundaries, protect significant sites from all forms of physical disturbance
Site 2.27 Titi Island (biogenic community)	Adjust boundaries, protect significant sites from all forms of physical disturbance
Site 2.30 Waitui Bay (biogenic community)	Adjust boundaries, protect significant sites from all forms of physical disturbance
Site 2.33 Hunia Coast (tubeworms)	Adjust boundaries, protect significant sites from all forms of physical disturbance
Site 3.1 Harris Bay (algae)	Adjust boundaries, protect significant sites from all forms of physical disturbance
Titi Island Rock (biogenic community)	Establish significant site and protect from all forms of disturbance
Bonne Point (rhodolith bed)	Establish significant site and protect from all forms of disturbance
Tawhitinui Bay (king shag)	Establish a new site and establish an approach distance guideline for colony

*Recommended but subject to expert peer review

Table 1: Summary of sites and sub-sites investigated during the present study and main recommendations

Summary

20. The Council has an inventory of significant marine sites as part of its statutory responsibility for protecting and maintaining biodiversity. These are being progressively monitored and surveyed. The third year of the monitoring programme has been completed. Davidson Environmental has produced a report outlining the extent and condition of the sites visited. A number of high value ecological habitats were identified. The Davidson report will be referred to the Expert Panel for confirmation of the site assessments and recommendations.

RECOMMENDED

1. That the report be received.

2. That the Committee note that a Significant Marine Sites Expert Panel report on the year three monitoring results will be presented in the near future.