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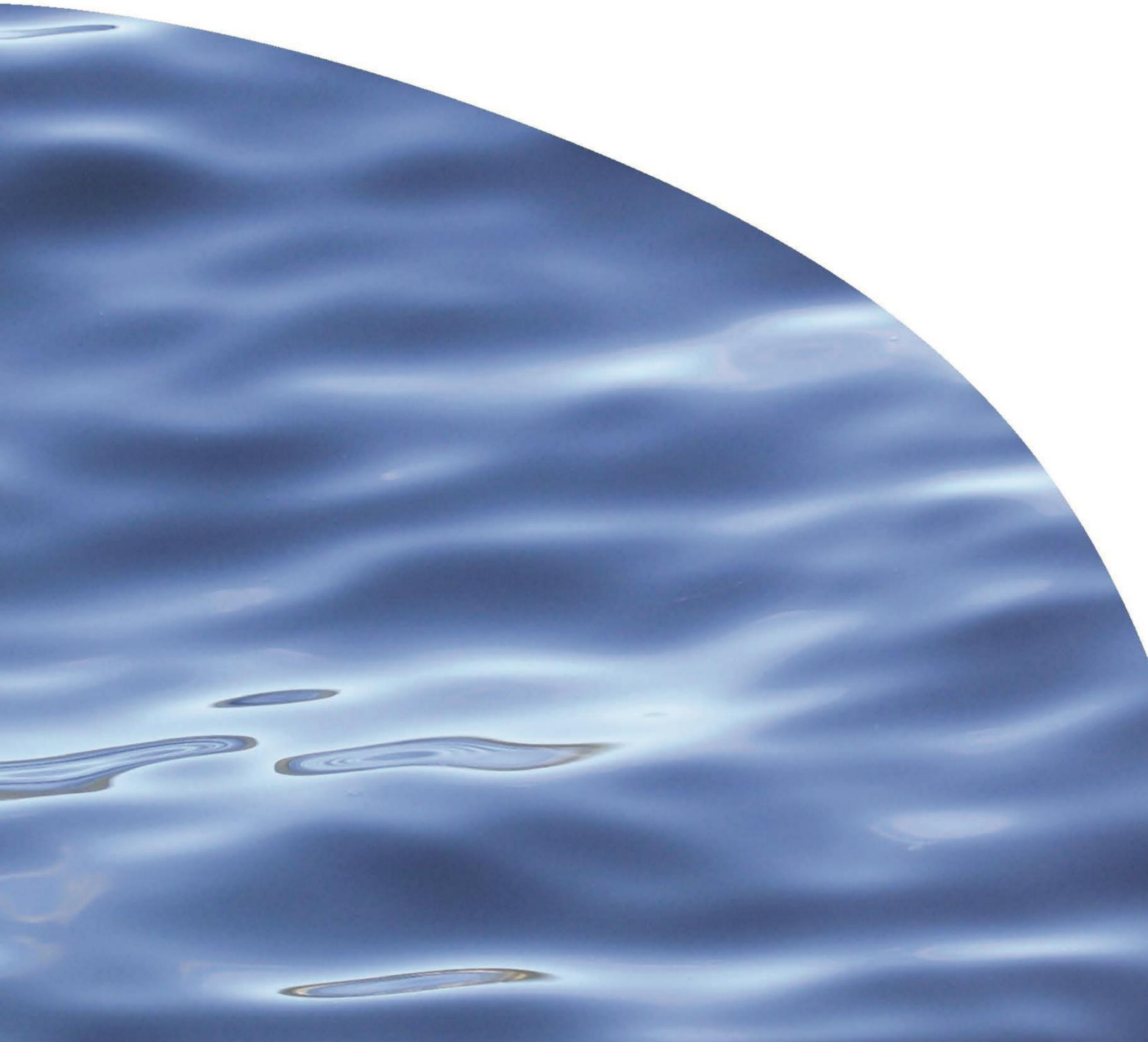
REPORT NO. 3633

CONTEXT FOR SEABED PROTECTION IN TASMAN BAY / TE TAI-O-AORERE AND GOLDEN BAY / MOHUA



CONTEXT FOR SEABED PROTECTION IN TASMAN BAY / TE TAI-O-AORERE AND GOLDEN BAY / MOHUA

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Envirolink advice grant 2131-NLCC115

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ISSUE DATE: 4 May 2021

RECOMMENDED CITATION: Newcombe E 2021. Context for seabed protection in Tasman Bay / Te Tai-o-Aorere and Golden Bay / Mohua. Prepared for Nelson City Council. Cawthron Report No. 3633. 12 p.

1. INTRODUCTION

A recent call to rebuild marine life globally put the case that 'rebuilding of depleted populations and ecosystems must replace the goal of conserving and sustaining the status quo, taking swift action to avoid tipping points beyond which collapse may be irreversible'[1] The authors also recognised that restorations of marine environments is both an urgent, and a largely achievable goal.

The seabed of Tasman Bay / Te Tai-o-Aorere and Golden Bay / Mohua is in poor health, and valuable shellfish fisheries have collapsed[2]. Sediment input and seabed disturbance are identified as key drivers of marine environmental degradation nationally[3], and specifically with respect to Tasman Bay and Golden Bay[4].

The aim of this report is to identify case studies where near-shore seabed protection has been achieved and to provide examples of approaches that have been successful internationally. The report considers examples of biodiversity protection and restoration, and wider effects on the associated human communities. The intention is to support informed community input to decision-making processes and provide councils (and other parties) with guidance for management. I focus on seabed protection from bottom-contact fishing, rather than on full-protection marine reserves.

1.1. Research approach and information availability

My approach was to search both formal (published articles and reports) and informal sources (including websites and news articles) to find information about the process and results of seabed protection. Initial searches pointed to a range of likely case studies, but on further investigation it proved difficult to find detailed information about the process leading up to protection. Attempts to contact individuals for more information were unsuccessful. I noticed that many scientific papers referred to large-scale protection from fisheries effects used grey literature, that is, research not published in peer-reviewed scientific journals[5,6].

Many existing protected areas and calls for further seabed protection are focussed on deep-water areas[7] (presumably because these are not yet as damaged as the long-disturbed inshore areas). However, this report focuses on nearshore areas to contribute to the discussion about how the health of Tasman Bay and Golden Bay could be improved.

This report does not propose specific areas or strategies for protection. Rather, the intention is to provide some context for the possibility of further protection. Protection for fisheries management purposes is not a focus of this report. Similarly, neither legal pathways nor guidance on Māori cultural perspectives and appropriate community engagement (the need for participatory processes) are within the scope of this report.

2. GUIDANCE ON SEABED STATE AND PROTECTION

International and national guidance is increasingly highlighting the needs and ways of changing the way we manage our seas. Some examples include:

- The Environment Aotearoa 2019 report[8] recognises that one of our highest priority environmental issues is that '**The way we fish is affecting the health of our ocean environment**', and that parts of the seabed are 'profoundly modified' by fishing practices. It also recognises that 'QMS stock assessments…do not fully account for…interactions with the broader marine environment'[a].
- UN Global Sustainable Development Goal 14 included an **end to destructive fishing practices** (Goal 14.4), and a goal of protection of at least 10% of coastal and marine areas by 2020 (Goal 14.5)[9].
- **Much more than 10% protection is recommended** to fulfil the intended purpose of protection in most cases[10,11,].
- Te Mana o te Taiao, the NZ Biodiversity Strategy, has as a goal for 2050 'An interconnected series of **marine and coastal ecosystems have been protected and restored to a 'healthy functioning' state** and are connected to indigenous land, wetland and freshwater ecosystems'[12].

[a] I would suggest that they do not account for these interactions in any meaningful way, as they were not intended to assess ecosystem effects.

3. IMPACTS AND RECOVERY FROM SEABED DISTURBANCE

Concerns about the negative effects on seabed communities from bottom-contact fishing were first raised many hundreds of years ago[13], and are now widely recognised[14,15]. Seabed disturbance from bottom contact fishing can have a range of effects on the seabed community beyond the extraction of target and by-catch species. These effects include:

- **Destruction of complex habitats** and prevention of their re-establishment. This effect occurs on
  - biogenic habitats[16,17] – which are created by the bodies, tubes or shells of organisms such as seaweeds, shellfish, sponges, and bryozoans ('moss animals'), and provide habitat for a range of other species. Species that sit on or emerge above the sediment surface are particularly affected by disturbance[18]. Remnant mussel beds in northern New Zealand[19] had nearly four times more invertebrates and 14 times more small fishes than surrounding sediments, which demonstrates the value of these habitats.
  - non-biogenic / inanimate habitat – by mixing up patches or layers of different kinds of sediments[20].
- Community shift to smaller-bodied[21] and shorter-lived species [22,23]
- Resuspension of sediments which increases sediment transport and re-deposition (increasing the risk of smothering when they re-settle), increases in turbidity, and changes other characteristics of the water column[24].

The question of how and when seabed communities change or recover once disturbance is reduced is more difficult to answer. There is more information available about destruction associated with bottom-contact fishing than about recovery. This is understandable because destruction occurs quickly and is easily measured. Recovery, while possible, can take many years[25], and the trajectory of recovery is influenced by a range of factors[26]. These include the coverage and intensity of historical trawling, the size of the area protected, and the range of other stressors present. Nonetheless, studies show that seabed communities do respond to protection from seabed disturbance[27,28]. Documented recovery may be only partial, for example, limited to the abundance of a particular group of species (at least in the timeframe of the study). Effects on habitat are much less commonly studied than effects on target or other mobile species. For example, in an international assessment of recovery of seabed invertebrate communities from trawling effects[29], none of the 70 studies included in a meta-analysis examined effects of trawling on biogenic habitat. Where studies find that seabed protection does not result in recovery of species of interest, this is often ascribed, at least in part, to ineffective enforcement and/or insufficient protection from other kinds of fishing [30] i.e., lack of real-world protection to allow for recovery. An additional limitation in demonstrating seabed recovery is that timeframes of studies are often shorter than the likely recovery time[31].

4. THE SEABED IN TASMAN BAY AND GOLDEN BAY

Effects of seabed disturbance have been demonstrated with reference to Tasman Bay[32,33,34]. It is widely acknowledged that the seabed in Tasman Bay and Golden Bay supported extensive beds of scallops, green-lipped mussels, and dredge oysters[35] (the last two being habitat-forming species). Populations declined in response to fisheries pressures over the years, although sometimes recovering for a period of time[36]. However, it is acknowledged that a range of factors, including land-based activity, have contributed to the decline in seabed health[37]. At present, all three shellfish species are nearly or totally absent in all areas of the subtidal seabed, despite efforts to promote recovery of scallops. Numerous studies of the seabed for research or monitoring purposes describe a largely featureless seabed dominated by soft surface sediments, and fine sediments suspended in the water column [38,39,40].

All areas of Tasman Bay and Golden Bay, except those expressly protected or inaccessible, are trawled[41,42]. Data from MPI up to 2013[43] shows that most areas are trawled (either mid-water or bottom trawled) several times a year and much of the bay is trawled many times a year. A recent study at Separation Point[44] has shown that from the time of the arrival of humans, an increase in sedimentation (associated with modification of the land) was important in structuring marine communities. However, in the last 60 years or so, the strongest factor structuring soft sediment seabed communities has been seabed disturbance. Interestingly, one of the few remnant areas of scallops in Tasman Bay is associated with horse mussels[45], indicating the importance of the relationship between habitat-forming species and valuable fisheries species.

Including the part of the bays that falls outside of the 12 nautical mile limit of council control, approximately 3.5% of Tasman Bay / Golden Bay is formally protected from seabed disturbance, although some informal protection is also in place:

- There are two marine reserves in Tasman Bay, Tonga Island (in the TDC area) and Horoirangi (NCC area). Marine reserves constitute about 1% of Tasman Bay in the TDC and NCC Coastal Marine Areas.
- The Separation Point no-trawl zone covers less than 6% of the TDC Coastal Marine Area.
- There is no protection in the Marlborough District Council area of Tasman Bay.
- The Wakapuaka / Delaware Bay Taiapure was established in 2002[46], and an informal agreement was reached with commercial fisheries to avoid some areas of the Taiapure (Andrew Stephens, Wakapuaka Taiapure Komiti, pers. comm.).
- Voluntary and legislated seasonal closures to trawling are in place along the inshore areas of both bays, and these have apparently been well-supported by fishers. The purpose of these closures is for fisheries management; namely to protect juvenile snapper[47].

5. SEABED PROTECTION FROM BOTTOM-CONTACT FISHING

Many marine reserves have been set up around the world for the protection of the marine environment from human activities. The purposes and sizes of marine reserves can vary widely. Although small reserves are common internationally and in New Zealand, many countries have instituted large areas where certain kinds of fishing are not permitted. These are often to protect surviving high-value areas, such as the Great Barrier Reef in Australia.

In several countries, larger areas of seabed have been protected from disturbance by bottom contact fishing. While it has proven difficult to find detailed information about most of these cases (studies of fully-protected areas are much more common), some relevant near-shore examples protection are given below:

- Australia – in the 1,930 km^2 Port Phillip Bay, Victoria, Australia, scallop dredging has been banned since 1996[48]. Snapper numbers were observed by recreational fishers (surveyed in 2009) to have greatly increased (although this was still considered only a partial recovery) after seabed protection was instituted, but sizes were possibly smaller[49]. Recreational fishers and divers believed that an 'increase in snapper, an increase in marine life in general and an overall improvement of fishing was directly attributed to the end of scallop dredging'. However spatial differences in improvements and declines were identified. Changes in the bay unrelated to seabed protection were also identified, such as reductions in other finfish species, and effects of invasive species. Divers identified some areas of improvement in habitat and fish populations from the conditions of the 1980s, but in the longer term the environment was considered worse (fewer species and lower abundance of particular fished species) than approximately 60 years prior. Shellfish reef restoration is being undertaken[50]. I was not able to find a lot of information on the process of protection, although it seems that dredging ceased when industry was bought out by the government[51].
- United Kingdom – in 2008, 206 km^2 in Lyme Bay, on the south coast of England, was protected from dredging and trawling[52]. This area included reef and sediment habitats. Increases in several indicator taxa were apparent within a few years, including on the coarse sediment areas. Recreational users and tourist operators increased their use of the area in the first 3 years. This is a complex fishery with fishers targeting a range of species with a range of gear. Economic and well-being effects were positive for fishers using static gear, but some negative effects were experienced by fishers using mobile fishing gear. Landings weight and value increased for scallops from both inside the protected area (where they were diver-caught) and outside (where they were dredged) the protected area.
- Hong Kong – a trawling ban was implemented in 2012 for the 1,651 km^2 territorial seas. Crustacean fisheries had been depleted following an increase in bottom-trawling. The ban on bottom trawling was to promote recovery of the seabed and fisheries resources, which included the valuable crustacean fisheries. A study of

relatively short-term recovery (3.5 years) showed varying degrees of change in fished species in the territorial seas—both positive and negative[53]. The study's authors recognised that other factors were likely affecting crustacean populations, and that longer-term studies were needed. Water quality had improved 2.5 years after the trawling ban (reduction in suspended solids[54]), as did several other physical and biological seabed characteristics. Biogenic habitat changes were not investigated in these studies.

- Venezuela – a prohibition on industrial trawling came into effect in inshore waters in 2001, and all Venezuelan seas in 2009[55] to protect fish stocks, including by protecting the seabed from damage[56]. However, artisanal fishers can apparently continue to use a range of gear types[57]. I have not found information about habitat effects of this partial seabed protection, but catch of the artisanal fleet (which dominated the fishery) increased[58].
- Palau – a ban on bottom trawling was enacted in 2006 in all territorial waters[59]. Palau has since extended protection, establishing large areas of no-take marine reserves[60]. Artisanal fisheries are protected, as are the majority of the coral reefs that are very important to Palau's tourism industry. The extension to marine protection may be why it is difficult to find information on the trawl ban only. Also, sources also note that there has always been a strong conservation ethic in Palau[61], such that their marine resources have remained healthy relative to many other regions. Protection, rather than recovery, was apparently the motive for the ban.

Many other countries have instituted large-scale bans on bottom-contact fishing in near-shore areas; these include: Qatar, where bottom-trawling ceased in 1993 (and the number of artisanal fishers and the catch both subsequently increased) [62]; Croatia, where trawling is prohibited within one nautical mile of the coast[63]; Italy, where trawling was banned in the Gulf of Castellammare in the 1990s (artisanal fisheries using low-impact gear experienced increased catches, although subsequently conflicts with recreational fishers arose[64,65]); Madeira, the Azores and Canary Islands where bottom trawling around the coasts was banned in 2005; Belize; the Solomon Islands; Malaysia; Namibia[66].

In New Zealand, the undesirable effects of bottom contact fishing were recognised in the protection of offshore areas[67], although it is acknowledged that these areas were not highly valued fishing areas and the protection, while still important, was not instituted in response to likely fishing activity. Trawling has been banned from some inshore areas, such as large parts of the Marlborough Sounds[68], but in this case the persistence of dredging in many other areas[69] demonstrates the focus on fisheries management rather than wider environmental outcomes.

From the above examples we can see that limitation of fisheries activity, and associated seabed protection, is by no means uncommon globally or even nationally.

5.1. Effects of seabed protection beyond biodiversity

From a council perspective, protection of the seabed would have the purpose of protecting or rebuilding regional biodiversity. However, resistance to the idea may come from a range of differing perspectives. Protection of the marine environment can have costs (particularly in the short term) or benefits for not only fisheries activities (e.g., changes in catch rate, quality, and composition) but can also influence the wellbeing of fishers and the wider community[70]. The 'triple bottom line' is a widely recognised framework, where economic development, environmental sustainability, and social inclusion[71], are used to assess costs and benefits of management decisions.

Improved recreational fishery and benefits for local community have been shown in Port Philip Bay, while countries such as Palau benefit from marine resources in ways other than purely from commercial harvest. In Lyme Bay, United Kingdom, the value of scallop fisheries increased both inside and outside of the area protected from bottom contact fishing. While there are clearly some risks or negative effects for some sectors of society in changing the use of marine space[72,73], a review of marine protected areas (largely from examples in Asia and Europe) found more positive (51%) than negative (31%) outcomes for human wellbeing[74]. Negative impacts of marine protection can be related more to attitudes to protection (e.g., fear and uncertainty), rather than the actual effects[75]. While most studies of economic gain are limited to artisanal fisheries, it is clear that economic benefits of marine protection to other types of fisheries also frequently occur[76].

In Tasman Bay and Golden Bay, large scale seabed protection is likely to contribute to the rebuilding of scallop fisheries—which along with scallops and oysters were worth up to $90M p/a in the best year. A reduction in the amount of resuspended sediment and an increase in biogenic habitats are likely outcomes that, in turn, are expected to improve scallop survival. There is also the potential for positive effects on other fisheries species, such as snapper, which benefit from the presence of biogenic or complex habitats for the survival of juveniles[77,78].

Moreover, protection of the seabed need not be considered as an all-or-nothing proposition. It may be that partial protection in Tasman Bay and Golden Bay is appropriate, such that protection and recovery of marine communities can begin in the short term at least in some areas. The fisheries industry and researchers are working to reduce a range of negative impacts of fishing[79]. As new fishing technologies are developed, and changes in practice occur in the medium-term, larger-scale recovery could occur in Tasman Bay and Golden Bays. It is likely that future recovery would be accelerated in those areas adjacent to habitat that is already recovering.

6. CONSIDERATIONS FOR SEABED PROTECTION IN TASMAN BAY AND GOLDEN BAY

Sediment deposition and physical damage has turned the seabed in Tasman Bay and Golden Bay into a largely featureless muddy place now incapable of supporting healthy populations of many important species. The benefits of seabed protection from disturbance are widely recognised[80] but although large areas of New Zealand seabed away from the coast have been protected, **little nearshore habitat has been.**

We have never given the seabed of Tasman and Golden bays the opportunity to recover from disturbance and existing protected areas are small. Voluntary inshore protections are seasonal, and are not intended to protect habitat.

Recovery will be impossible if widespread seabed disturbance continues. Numerous countries have instituted bans on bottom-contact fishing over large areas. Moreover, national and international guidance is raising expectations for the degree and extent of protection that we should be aiming for. Recovery is likely to take a long time, but the likely benefits for natural communities, and for fisheries, are substantial.

Factors other than fisheries disturbance can have negative effects on seabed communities, particularly those near shore. In many cases **seabed protection is not, in itself, enough to ensure recovery**. Measures to limit sediment input are in place for many activities[81], and there is increasing acceptance that sediment should be better managed (however, legacy or cumulative effects of sediment inputs on shellfish populations may be stronger than more recent, relatively low inputs[82]). Restoration may also be appropriate[83,84] (e.g., dumping of shell or creation of artificial habitat).

We need to protect larger areas to have any chance of seeing recovery. International information suggest we should be aiming for 30% or more[85, 86]. Responses to changes in seabed disturbance vary in different places, and a sufficiently large area needs to be protected so that areas with different environmental characteristics are included. When identifying areas for protection, current flow should be considered in terms of both the loading of the water column in Tasman Bay and Golden Bay with suspended sediments, and the likely connectivity between recovering populations.

Some horse mussel beds have been recently identified near the Boulder Bank[87], and horse mussels also occur in the Nelson Haven (pers. obs.). These give some indication of the kind of seabed and water column conditions that may permit the recovery of biogenic habitat. However, given the state of large areas of the bays, areas that currently have high-value species are few and small. Accordingly, it may be that protection of areas of currently featureless seabed is needed to provide the opportunity for long-term recovery.

7. ACKNOWLEDGEMENTS

Thanks to Fraenzi Furigo for sharing documents from her literature search on this topic. Thanks also Carol Scott (Southern Inshore Fisheries) for pointing me to information on voluntary fisheries closures. Thanks to Lisa Floerl (Cawthron Institute) for the mapping to calculate the proportion of the bay protected from disturbance.

8. NOTES

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