Davidson Environmental Limited

Peer review of selected significant marine sites surveyed in 2015-2016

Research, survey and monitoring report number 848

A report prepared for:
Marlborough District Council and Department of Conservation
C/o Seymour Square
Blenheim

By
Rob Davidson, Andrew Baxter, Clinton Duffy, Bruno Brosnan, Peter Gaze, Sam du Fresne, Shannel Courtney

February 2017

Bibliographic reference:

Davidson, R. J.[1]; Baxter, A. S.[2]; Duffy, C. A. J.[2]; Brosnan, B.[5]; Gaze, P.[4]; du Fresne, S.[3]; Courtney, S.[2] 2016. Peer review of selected significant marine sites surveyed in 2015-2016. Prepared by Davidson Environmental Limited for Marlborough District Council and Department of Conservation. Survey and monitoring report no. 848.

1. Davidson Environmental Limited
2. Department of Conservation
3. Environmental Protection Authority (NZ)
4. Independent ornithologist
5. Te Atiawa Trust

Coordinated by:
Davidson Environmental Limited
P.O. Box 958, Nelson 7040
Phone: 03 545 2600, Mobile: 027 4453 352
e-mail: davidson@xtra.co.nz

Table of Contents

Expert review panel

Rob Davidson has been involved in marine biology for over 30 years. Rob holds a Master of Science with First Class Honours from the University of Canterbury, 1987 and has presented 18 conference papers and published 12 papers in internationally peer reviewed scientific journals. He has worked for MAF and the Department of Conservation and since 1994 is the director of an independent science consultancy. During his time at DOC, he coordinated or was involved in many large scale ecological surveys of coastal areas throughout Nelson and Marlborough. Rob compiled this information into the Department's Coastal Resources Inventory which was later reproduced as reports for the Councils' coastal plans. He has implemented monitoring programmes spanning up to 25 years, relating to Cook Strait ferry impacts, marine farm recovery and marine reserve monitoring. As a consultant, Rob has provided scientific information for over 850 resource consent applications and impact assessments. His company has also coordinated a marine ecological database for the Marlborough District Council. Over his working career, he has conducted over 4000 dives throughout the Marlborough area and has an extensive knowledge of the underwater features and values of Marlborough.

Clinton Duffy is a marine scientist employed as a Technical Advisor (Marine) with the Department of Conservation's Marine Ecosystems Team. He holds a M.Sc. (Hons) in Zoology from the University of Canterbury, 1990, and worked as a marine and freshwater technical support officer for the Department's Nelson/Marlborough, East Coast Hawke's Bay and Wanganui Conservancies from 1990-1999, and as a Scientific Officer (marine ecology) in the Science & Research and Marine Conservation Units from 1999-2012. He is a member of the New Zealand Marine Sciences Society, Oceania Chondrichthyan Society and the IUCN Shark Specialist Group – Australia and Oceania. Clinton has authored over 80 scientific publications and reports. His areas of expertise include marine survey and monitoring; biogeography of New Zealand reef fishes, algae and invertebrates; and the conservation biology, taxonomy and behaviour of sharks and rays. He has dived, either in a professional or private capacity, around much of New Zealand's coastline from the Kermadec Islands to Stewart Island, including co-ordination of a dive survey of shallow subtidal habitats of the Marlborough Sounds in 1989-90.

Peter Gaze worked for many years with Ecology Division of DSIR, involved with research into the distribution, conservation and economic value of birdlife in New Zealand. This included a study of forest bird ecology, in particular rifleman, kereru and mohua. Peter is a co-author of the first atlas of bird distribution in New Zealand. Various research projects took him to the sub-Antarctic, the Kermadecs, Cook Islands and Tahiti. He then moved to the Department of Conservation where his role was primarily to provide technical advice on fauna conservation work in Nelson and Marlborough. This role enabled him to bring a national perspective to the local matters. Related fields of interest include the impact and control of mammalian predators as well as reptile conservation including leading the department's recovery of tuatara for the last ten years. Both roles have included projects working on the islands and wildlife of the Marlborough Sounds. A plan written for the management of these islands continues to guide the work of the Department. He has a long association with bird research and conservation throughout the country and was for some time the secretary for the Ornithological Society of NZ. Peter has now works for charitable trusts committed to conservation in Abel Tasman National Park and the outer Marlborough Sounds.

Andrew Baxter has over 30 years' experience in coastal and marine management, specialising in marine ecology including marine mammals. He graduated from the University of Canterbury in 1981 with a BSc with First Class Honours in Zoology. Following two years working for the Taranaki Catchment Commission as a marine biologist, Andrew worked as a fisheries management scientist for MAF Fisheries based in Wellington from 1984 to 1987. He has been employed as a marine ecologist for the Department of Conservation in Nelson since October 1987. Andrew is currently a Technical Advisor in DOC's Marine Species and Threats Team.

Sam du Fresne has over 15 years of experience studying marine mammals, beginning with his master's thesis in 1998. He has conducted several dolphin surveys in New Zealand focussed mainly on Hector's dolphins and has worked in places as diverse as Far East Russia, Hawaii and Western Australia. After graduating with a PhD from the University of Otago in 2005, Sam worked as an independent consultant, specialising in marine mammals. As a consultant, Sam worked closely with DoC, MFish, NIWA, Cawthron, various regional councils and several industry clients, providing expert advice and research services on a range of species and issues. Sam also spent time at SMRU Ltd in St Andrews (Scotland) where he worked as a senior research scientist, focussing mainly on marine mammals and renewable energy projects. Recently, after working for more than three years in Western Australia on mega-projects such as the Gorgon and Wheatstone LNG developments, Sam returned to New Zealand to join the EEZ Compliance team at the Environmental Protection Authority in Wellington.

Shannel Courtney is a Nelson-based plant ecologist with the Department of Conservation, working as a Technical Advisor in the Terrestrial Ecosystems Unit. In 1983 he attained a Master of Science in plant ecology at Canterbury University and before DOC has worked for the NZ Wildlife Service, NZ Department of Lands and Survey and NZ Forest Service on management issues. For much of the earlier part of his career, he has been involved in the assessment of natural areas for ecological significance and has led various ecological surveys of the East Cape, Taranaki, Marlborough and Nelson regions. Relevant publications and co-authorships include Protected Natural Area reports for North Taranaki, Motu and Pukeamaru Ecological Districts and for Molesworth Station, habitat restoration guides for Nelson City and Tasman District, and several publications on the development of a natural character framework for the Marlborough Sounds. For the last 20 years, he has specialised in threatened plant conservation and co-ordinates the recovery of nationally threatened and at-risk species in the Nelson region and Marlborough Sounds. He is currently on the National Threatened Plant Panel and on the committee of the NZ Plant Conservation Network. In 2008 he was awarded the Loder Cup in recognition of his services to plant conservation.

Bruno Brosnan presently works for Te Atiawa o Te Waka-a-Maui as Rohe Manager and was formerly a Coastal Planner at the Marlborough District Council. His qualifications include a Bachelor's of Science in Zoology and Psychology from Massey University, a postgraduate diploma in Marine Science from Otago University, a Master of Science in Marine Science from Otago University investigating recovery and succession of benthic environments after large scale disturbance, a post graduate diploma in Environmental Management from the University of Waikato, a Master of Management Studies from the University of Waikato, and a Master of Planning from Massey University. Bruno is also a qualified diver instructor.

1.0 Summary

Davidson *et al.* (2011) described a total of 129 significant marine sites in Marlborough. The Marlborough District Council (MDC) and Department of Conservation (DOC) have embarked on an ongoing survey and monitoring programme aimed at updating and improving this information and to collect data that can be used to monitor selected sites. Davidson *et al.* (2014) provided a detailed range of survey protocols including techniques suited for rapid reconnaissance (i.e. qualitative descriptions) and techniques suitable for monitoring (i.e. quantitative and certain qualitative data).

Two follow-up surveys have been undertaken to date. The first was conducted in summer 2014/2015 and targeted 21 sites and sub-sites in the eastern Marlborough Sounds. The second survey was conducted in the summer of 2015-2016 and targeted 15 sites and sub-sites in the Croisilles Harbour and D'Urville Island areas. Sites selection was guided by:

- Sites identified as having limited or old biological information (Davidson *et al.,* 2011).
- Sites where additional information was needed (Davidson *et al.,* 2014).
- Recommended sites suitable for monitoring (Davidson *et al.,* 2014).
- New potential sites based on new information received since 2011.

Results from those two surveys were summarized in Davidson and Richards (2015, 2016); raw data were lodged with MDC. The authors also provided comment on site boundary alterations and recommendations for their reassessment based on the new data.

The present report outlines the peer review of sites surveyed in the summer of 2016 and is based on the new information provided in Davidson and Richards (2016). The peer review provides an updated assessment using the seven criteria originally developed by Davidson *et al.* (2011) and modified by the expert panel in 2015 (Davidson *et. al.,* 2015).

The present report also assesses site sensitivity to a range of anthropogenic threats including physical disturbance.

Overall, the peer review panel accepted all but one boundary modification proposed by Davidson and Richards (2016). The peer review panel recommended that the Chetwode significant site (2.20) remain unchanged from that defined in Davidson *et al*. (2011) and not be enlarged until further data are collected to support the proposed increase.

2.0 Background

In 2011, a report outlining Marlborough's known ecologically significant marine sites was produced for MDC and DOC (Davidson *et al*. 2011). The assembled group of expert authors ("expert panel") developed a set of criteria to assess the relative biological importance of each site. Sites that received a medium or high score were termed "significant". A total of 129 significant sites were recognized and described during this process.

The authors stated that their assessment of significance was based on existing data or information; however, they noted that many sites had limited or old information. Some marine sites had not been surveyed or the information available was incomplete, patchy or potentially not reflective of the current state of the sites. The authors stated that more investigation was required to better assess the status of many significant sites.

The authors also stated that many of the sites not assessed as "significant" had the potential to be ranked higher in the future as more information became available. Further, they recognized that the quality of some existing significant sites may decline over time due to natural or human related events or activities. The authors therefore acknowledged that their assessments would require updating on a regular basis.

Davidson *et al*. (2013) produced a protocol for receiving information for new candidate sites and for reassessing existing ecologically significant marine sites. The goal of that protocol was to establish consistency and to ensure a rigorous and consistent process for site identification, data collection and assessment. The aims of that report were to establish:

- The level of information required for new candidate sites.
- The process for assessing new sites and reassessing existing sites.
- A protocol for record keeping, selection of experts and publication of updated reports.

Davidson *et al.* (2014) provided guidance on the collection, storage and publication of biophysical data from potential new significant sites as well as existing sites. The biological investigation process was separated into three main elements:

- Survey of new sites;
- Collection of additional information from existing significant sites or sites that previously were not ranked as being ecologically significant; and
- Status monitoring of existing significant sites (i.e. site health checks).

Davidson *et al.* (2014) also detailed a range of candidate sites for survey and monitoring. The authors also provided comment on survey protocols including techniques suited for rapid

reconnaissance (i.e. qualitative descriptions) and techniques suitable for monitoring (i.e. combinations of both qualitative and quantitative data collection).

Follow-up surveys were undertaken in the summers of 2014-2015 (21 sites and sub-sites in eastern Marlborough Sounds) and 2015-2016, (15 sites and sub-sites in the Croisilles Harbour and D'Urville Island areas). Davidson and Richards (2015, 2016) summarised the new biological data; raw data were provided to MDC for storage. The authors also commented on site boundary alterations and recommended any necessary changes to the assessments of significance. On both occasions, the expert panel was reconvened to reassess the new information and make recommendations.

The present report presents the peer review assessment of the 2015-2016 survey season reported in Davidson and Richards (2016). It also comments on anthropogenic threats to significant sites.

3.0 The assessment process

3.1 Data collation

All data collected by Davidson and Richards (2016) were compiled and made available to the expert panel during the review of study sites. Study sites were made up of 11 sites, however, two sites comprised 3 sub-sites each (i.e. a total of 15 sites and sub-sites). Data included: drop camera photographs, hand held still photography, hand held video, remote video, sonar images, and observations (note: all raw data is held by MDC).

Information relating to each original site surveyed by Davidson *et al.* (2011) was also compiled and made available including: site description, site boundaries, ecological assessment, and any data previously compiled or known for the site or sub-site.

3.2 Expert peer review panel

The original expert panel that was involved in the Davidson *et al*., (2011) report was reconvened, apart from Sam du Fresne (marine mammals) and Shannel Courtney (plants). Peter Hamill was also replaced by Bruno Brosnan. Peter Gaze reviewed new data for an existing king shag site located in Port Gore prior to the group assessment; this assessment was also reviewed by the other panel members to ensure consistency. Sam du Fresne and Shannel Courtney were not involved in the reassessment meeting as no new or resurveyed marine mammal or plant sites were under scrutiny; however, all experts reviewed and commented on the present report and are therefore included as authors.

4.0 Wording of the assessment criteria

During the previous peer review (Davidson *et al.* 2015), the panel members recognized a need to clarify some of the original assessment criteria used by Davidson *et al.* (2011) to avoid any possible misinterpretation. The expert panel applied the revised criteria during the reassessment of the 21 sites and sub-sites surveyed in the 2014-2015 survey year (Davidson and Richards 2014, Davidson *et al.* 2015). The review panel took care not to create inconsistency between the sites assessed in Davidson *et al.* (2011) and the 2015 reassessment.

The present review process adopted the same revised criteria (Davidson *et al.,* 2015) but with one small addition. Criteria 7 (adjacent catchment modification) was amended to include a "not applicable" option in recognition of sites located in areas little influenced by catchment effects.

The new rank is: **NA = The site is little influenced or is not influenced by catchment effects.**

5.0 Review of surveyed sites (2015-2016)

The review panel assessed all sites and sub-sites based on the information and proposed changes presented in Davidson and Richards (2016) (Table 1) and recommended:

- Accepting most adjustments to significant site boundaries proposed by Davidson and Richards (2016).
- Accepting new data for the Hunia king shag colony.
- Accepting a new significant site at Lone Rock, Croisilles Harbour.
- Rejecting the proposed enlargement of Site 2.20 (Chetwodes to The Haystack). The review panel considered there was insufficient evidence to support the change and recommended further field surveys before the site is reassessed.

The agreed boundary refinements lead to both increases and decreases to the size of individual significant sites surveyed by Davidson and Richards (2016) and an overall decline of -262.6 ha between 2011 and 2016 (Table 1).

Table 1. Summary of significant site assessment by review panel.

Site	Biological features	Review panel recommendations	Original data	New area (ha)	Change (ha)	Reason/s for change
Site 1.2 Croisilles Harbour Entrance	Physical structure, lancelets	Adjust boundary to encompass values	368	492	124.0	Improved detail of survey
Site 1.4 Motuanauru Is. Boulder Bank	Physical structure (subtidal boulder bank)	Adjust boundary to encompass values	39	29.3	-9.7	Improved detail of survey
Site 1.5 (A) Coppermine-Ponganui Bays	Rhodoliths	Adjust boundary to encompass values	0	1.13	1.1	New subsite
Site 1.5 (B) Coppermine-Ponganui Bays	Rhodoliths	Adjust boundary to encompass values	22.3	2.88	-19.4	Improved detail of survey
Site 1.5 (C) Coppermine-Ponganui Bays	Rhodoliths	Adjust boundary to encompass values	0	0.54	0.5	New subsite
Site 2.6 Rangitoto Passage	Biogenic structures	Adjust boundary to encompass values	429.8	111.6	-318.2	Improved detail of survey
Site 2.13 (A) Catherine Cove	Rhodoliths	Adjust boundary to encompass values	5.9	3.5	-2.4	Improved detail of survey
Site 2.13 (B) Catherine Cove	Rhodoliths	Adjust boundary to encompass values	6.8	5.06	-1.7	Improved detail of survey
Site 2.13 (C) Catherine Cove	Rhodoliths	Adjust boundary to encompass values	16	10.27	-5.7	Improved detail of survey
Site 2.15 Clay Point	Current swept reef	Adjust boundary to encompass values	33.5	4.3	-29.2	Improved detail of survey
Site 2.18 Paparoa	Current swept reef, biogenic structures	Adjust boundary to encompass values	12.6	6	-6.6	Improved detail of survey
Site 2.20 Chetwodes to The Haystack	Biogenic structures, high diversity reefs	Adjust boundary to encompass values	71.7	71.7	0.0	New data supports existing boundaries
Site 2.35 Hunia, Port Gore	King shag colony	No change	0.025	0.025	0.0	No change
Site 1.9 Lone Rock, Croisilles Harbour	Rhodoliths	Accept new site	0	4.68	4.7	New site
Site 2.37 Penguin Island Channel	Dog cockle bed, high diversity reef	Adjust boundary to encompass values	3.8	3.8	0.0	Site initially part of larger site
Totals			1009.425	746.785	-262.6	

5.2 Site summary

The following tables present a summary of the review for each site. Sub-sites have been presented as one Table where applicable.

Site 1.2: Croisilles Entrance

SIGNIFICANT SITE SUMMARY	Existing and present survey information	Expert panel assessment
Original area of significant site (ha)	368	
Recommended area of significant site (ha)	492	
Change to original site	Increase	
Change (ha)	124	
Percentage change from original area (%)	33.7	
Anthropogenic disturbance	High intensity during season (recreational dredging frequent event during scallop season)	Moderate disturbance (light equipment).
Vulnerability assessment	Low (due to historic dredging it is probable the benthos has adjusted to the impacts over time)	Resilient
Assessment criteria scores (original)		**Assessment criteria scores (revised)**
1. Representativeness	H (high)	H (high)
2. Rarity	M (medium)	H (high)
3. Diversity and pattern	M (medium)	L (low)
4. Distinctiveness	M (medium)	H (high)
5. Size	H (high)	H (high)
6. Connectivity	L (low)	M (medium)
7. Catchment	L (low)	NA
Comments	The area supports three main soft substratum types (A) rippled mobile sand and shell, (B) sand, fine sand and shell and (C) silt. There are indications this shallow area may have a base of cobble material. Mobile rippled sand and shell supports lancelets. It is unknown how much of the significant sites supports this species and only one site has been quantitatively surveyed. The numbers of lancelet reported place this site as the highest density known from the Marlborough Sounds.	One of a low number of sites known in Tasman/Marlborough (3 sites in Marlborough, 5 sites in Tasman Bay). Potentially more widespread. Classified as sparse (naturally uncommon). Therefore likely to be reassessed as an at risk taxa. Diversity unknown and ranked as low until data becomes available to properly assess the site (we expect it will be medium). Distinctive habitat and lancelet species in Sounds area.
Recommendations	A widespread quantitative survey of lancelet abundance and distribution over this significant site is suggested.	Recommend sampling a small number of additional haphazardly selected sites over the wider area to confirm presence and abundance.

Site 1.4: Motuanauru Boulder Bank

SIGNIFICANT SITE SUMMARY	Existing and present survey information	Expert panel assessment
Original area of significant site (ha)	39	
Recommended area of significant site (ha)	29.3	
Change to original site	Decrease	
Change (ha)	9.7	
Percentage change from original area (%)	24.9	
Anthropogenic disturbance	Low	Low
Vulnerability assessment	Low	Resilient
Assessment criteria scores	**Assessment criteria scores (revised)**	**Assessment criteria scores (original)**
1. Representativeness	H (high)	M (medium)
2. Rarity	L (low)	L (low)
3. Diversity and pattern	M (medium)	M (medium)
4. Distinctiveness	H (high)	M (medium)
5. Size	H (high)	H (high)
6. Connectivity	L (low)	M (medium)
7. Catchment	L (low)	NA
Comments	Decline in site size due to more accurate mapping techniques.	
Recommendations	Include only the boulder bank in this site. The adjacent soft substratum habitats that support lancelets as part of Site 1.2.	Representativeness medium (one of two examples if its kind in biogeographic area. Connected to Croisilles Entrance sand habitat.

Site 1.5: Coppermine and Ponganui Bays (A,B,C)

SIGNIFICANT SITE SUMMARY	Existing and present survey information	Expert panel assessment
Original area of significant site (ha)	22.3	
Recommended area of significant site (ha)	4.55	
Change to original site	Decrease	
Change (ha)	17.75	
Percentage change from original area (%)	79.6	
Anthropogenic disturbance	Moderate	Moderate (anchoring disturbance, well managed catchment).
Vulnerability assessment	High	Extremely sensitive
Assessment criteria scores	**Assessment criteria scores (original)**	**Assessment criteria scores (revised)**
1. Representativeness	H (high)	H (high)
2. Rarity	M (medium)	H (high)
3. Diversity and pattern	M (medium)	M (medium)
4. Distinctiveness	H (high)	H (high)
5. Size	L (low)	H (high)
6. Connectivity	L (low)	L (low)
7. Catchment	M (medium)	M (medium)
Comments	The smaller size of this site is likely due to the increased intensity of sampling compared to the original survey that was based on a smaller number of drop camera stations.	
Recommendations	Redefine the site as 3 subsites (A= north, B = middle, C = south). Relocated moorings to locations adjacent to rhodolith beds. Adjust original boundary to fit areas occupied by rhodoliths. Protect areas from all forms of bottom disturbance.	Representativeness: best site (3 separate polygons with larger overall size). Rare nationally. Connectivity: one site with 3 parts, therefore low as no other significant sites nearby.

Site 1.9: Lone Rock, Croisilles Harbour

SIGNIFICANT SITE SUMMARY	Existing and present survey information	Expert panel assessment
Original area of significant site (ha)	NA	
Recommended area of significant site (ha)	4.68	
Change to original site		
Change (ha)	NA	
Percentage change from original area (%)	NA	
Anthropogenic disturbance	Low	Low
Vulnerability assessment	High	Extremely sensitive (vulnerable to physical disturbance)
Assessment criteria scores	**Assessment criteria scores (original)**	**Assessment criteria scores (revised)**
1. Representativeness		M (medium)
2. Rarity		H (high)
3. Diversity and pattern		M (medium)
4. Distinctiveness		M (medium)
5. Size		H (high)
6. Connectivity		L (low)
7. Catchment		M (medium)
Comments	Rob Murdock of NIWA advised that a rhodolith bed existed along the north-eastern coastline of Okiwi Bay. The present survey located and mapped the abundance and distribution of this bed.	Large site compared with other beds. One of only two rhodolith beds in biogeographic region. Adjacent land DOC or private but steep and unlikely to be planted in forestry or farmed.
Recommendations	Protect site from all forms of physical disturbance.	

Site 2.6: Rangitoto: Passage

SIGNIFICANT SITE SUMMARY	Existing and present survey information	Expert panel assessment
Original area of significant site (ha)	429.8	
Recommended area of significant site (ha)	111.6	
Change to original site	Decrease	
Change (ha)	318.2	
Percentage change from original area (%)	74.0	
Anthropogenic disturbance	Moderate (trawling occurs periodically)	High (intermittent heavy equipment used)
Vulnerability assessment	Sensitive (biogenic mounds sensitive)	Very sensitive
Assessment criteria scores (original)		**Assessment criteria scores (revised)**
1. Representativeness	H (high)	M (medium)
2. Rarity	L (low)	H (high)
3. Diversity and pattern	M (medium)	H (high)
4. Distinctiveness	H (high)	M (medium)
5. Size	M (medium)	H (high)
6. Connectivity	L (low)	M (medium)
7. Catchment	L (low)	NA
Comments	Sonar and depth soundings of much of the deep areas of the original significant area showed a low likelihood of biogenic habitats. The survey concentrated in areas where sonar and previous studies have detected biogenic habitats. The reduction in the area between 2011 and the present study is likely due to more accurate survey methods. Data form Davidson and Brown (1994) showed that biogenic habitats are located on the eastern side of Wakaterepapanui Island. This area as well as the remainder of the coast of the three Islands should be surveyed for biogenic habitats. A horse mussel bed on the eastern side of Puangiangi Island was also discussed by Davidson and Brown (1994) and should also be investigated.	Representativeness: medium as comparable to Trios biogenic habitats. Category may elevate to high when more data collected. Habitat type now rare (i.e. biogenic bryozoan mounds). Distinctiveness: three types of major biogenic habitat (cobble/boulder, deep rocky reef, bryozoans and sponges on mud) = medium, but may elevate as more data is collected. Given the size of the site and the current and wave action it is likely to be connected to other comparable biogenic habitats e.g.. larval transport.
Recommendations	Adjust boundaries to fit the biogenic habitats. Conduct more surveys to confirm the existing significant site and to investigated more of the islands coastal habitats. Include significant sites (2.5 Rangitoto Channels) into this significant site. Protect habitats from all physical disturbance.	Prioritize completion of survey in the near future.

Site 2.13 (A, B, C): Catherine Cove

SIGNIFICANT SITE SUMMARY	Existing and present survey information	Expert panel assessment
Original area of significant site (ha)	28.7	
Recommended area of significant site (ha)	18.8	
Change to original site	Decrease	
Change (ha)	9.9	
Percentage change from original area (%)	31.7	
Anthropogenic disturbance	Moderate	High: A marine farm is located immediately adjacent. It is probable the farm has impacted the rhodoliths that were likely located under the farming structures.
Vulnerability assessment	High	Extremely sensitive
Assessment criteria scores	**Assessment criteria scores (original)**	**Assessment criteria scores (revised)**
1. Representativeness	H (high)	H (high)
2. Rarity	M (medium)	H (high)
3. Diversity and pattern	M (medium)	M (medium)
4. Distinctiveness	M (medium)	H (high)
5. Size	M (medium)	H (high)
6. Connectivity	L (low)	L (low)
7. Catchment	M (medium)	M (medium)
Comments	Decline in area is due to the higher intensity of survey and not a loss due to damage.	Representativeness: only site in biogeographic region and best and biggest site in Marlborough Sounds (3 separate polygons and overall largest rhodolith area). Rare nationally. Connectivity: one site with 3 parts, therefore low as no other significant sites located nearby. Catchment DOC and private but stable.
Recommendations	Protect all sites from all forms of physical damage.	Reposition marine farm further from shore to avoid rhodoliths habitat. Recovery of rhodoliths may then occur.

Site 2.15: Clay Point

SIGNIFICANT SITE SUMMARY	Existing and present survey information	Expert panel assessment
Original area of significant site (ha)	33.5	
Recommended area of significant site (ha)	4.3	
Change to original site	Decrease	
Change (ha)	29.2	
Percentage change from original area (%)	87.2	
Anthropogenic disturbance	Low (no impacts observed)	Moderate (light commercial devices (pots))
Vulnerability assessment	Low (no impacts observed)	Resilient (rocky substrata, current swept and exposed)
Assessment criteria scores	**Assessment criteria scores (original)**	**Assessment criteria scores (revised)**
1. Representativeness	M (medium)	M (medium)
2. Rarity	L (low)	L (low)
3. Diversity and pattern	M (medium)	M (medium)
4. Distinctiveness	M (medium)	M (medium)
5. Size	L (low)	M (medium)
6. Connectivity	L (low)	L (low)
7. Catchment	L (low)	NA
Comments	The rocky reef structure is a combination of shallow upright reef and deeper low topography reef comprising rock, boulder, cobble and sand and shell. Reduction in area is due to improved survey techniques.	Area boundary based on sonar data. Photos are representative examples of habitats. Further deeper water survey may discover higher valued habitat types.
Recommendations	Repeat sonar run at slack water to improve resolution.	Repeat sonar run at slack water to improve resolution.

Site 2.18: Paparoa

SIGNIFICANT SITE SUMMARY	Existing and present survey information	Expert panel assessment
Original area of significant site (ha)	12.9	
Recommended area of significant site (ha)	6	
Change to original site	Decrease	
Change (ha)	6.9	
Percentage change from original area (%)	53.5	
Anthropogenic disturbance	Commercial potting observed (no impacts observed)	Moderate (light commercial devices (pots)
Vulnerability assessment	Low (no impacts observed)	Resilient (rocky substrata, current swept and exposed)
Assessment criteria scores	Assessment criteria scores (original)	**Assessment criteria scores (revised)**
1. Representativeness	M (medium)	M (medium)
2. Rarity	L (low)	L (low)
3. Diversity and pattern	M (medium)	M (medium)
4. Distinctiveness	M (medium)	M (medium)
5. Size	L (low)	M (medium)
6. Connectivity	L (low)	M (medium)
7. Catchment	L (low)	NA
Comments	Most reef structure is deep. Reduction in significant site area is due to improved survey techniques.	Deeper offshore areas that are current swept may also support biogenic habitats.
Recommendations	Repeat sonar run at slack water to improve resolution.	Repeat sonar run at slack water to improve resolution.

Site 2.20: Chetwodes to The Haystack

SIGNIFICANT SITE SUMMARY	Existing and present survey information	Expert panel assessment
Original area of significant site (ha)	71.7	71.7
Recommended area of significant site (ha)	119.7	71.7
Change to original site	Increase	No change
Change (ha)	48	0
Percentage change from original area (%)	66.9	0.0
Anthropogenic disturbance	High	High
Vulnerability assessment	High	Very sensitive (bryozoan mounds)
Assessment criteria scores	Assessment criteria scores (original)	**Assessment criteria scores (revised)**
1. Representativeness	M (medium)	M (medium)
2. Rarity	L (low)	M (medium)
3. Diversity and pattern	M (medium)	M (medium)
4. Distinctiveness	M (medium)	M (medium)
5. Size	M (medium)	H (high)
6. Connectivity	L (low)	M (medium)
7. Catchment	H (high)	NA
Comments	The area supports low density biogenic habitats and occasional isolated rocks. The Passage is an example of a high flow rocky reef supporting abundant sponges and anemones.	Insufficient data to include additional area. Photographs suggest the area has been impacted by physical damage.
Recommendations	Survey areas the east and south of the Haystack.	No change to original boundary suggested.

Site 2.35: Hunia, Port Gore

SIGNIFICANT SITE SUMMARY	Existing and present survey information	Expert panel assessment
Original area of significant site (ha)	0.025	
Recommended area of significant site (ha)	0.025	
Change to original site	No change	
Change (ha)	0	
Percentage change from original area (%)	0.0	
Anthropogenic disturbance	Low	Low (no disturbance observed)
	High	Extremely sensitive (vulnerable to human disturbance, predators,
Vulnerability assessment		disease)
Assessment criteria scores	Assessment criteria scores (original)	**Assessment criteria scores (revised)**
1. Representativeness	M (medium)	M (medium)
2. Rarity	H (high)	H (high)
3. Diversity and pattern	L (low)	L (low)
4. Distinctiveness	M (medium)	M (medium)
5. Size	L (low)	L (low)
6. Connectivity	M (medium)	M (medium)
7. Catchment	L (low)	NA
Comments	The site is part of the ingoing aerial survey commissioned by King Salmon as part of the Consent monitoring programme.	
Recommendations		

Site 2.37 Penguin Island Channel

SIGNIFICANT SITE SUMMARY	Existing and present survey information	Expert panel assessment
Original area of significant site (ha)	180.5 (Note: part of a larger area recognised for its stable catchment).	
Recommended area of significant site (ha)	3.8 (subtidal), 0.75 (terrestrial)	
Change to original site	No change	
Change (ha)	NA	
Percentage change from original area (%)	NA	
Anthropogenic disturbance	Low	Low (no disturbance observed).
Vulnerability assessment	Moderate	Sensitive (shellfish beds and shell rubble biogenic habitat vulnerable to smothering or disturbance).
Assessment criteria scores (original)	Assessment criteria scores (original)	**Assessment criteria scores (revised)**
1. Representativeness	L (low)	H (high)
2. Rarity	L (low)	M (medium)
3. Diversity and pattern	L (low)	H (high)
4. Distinctiveness	M (medium)	M (medium)
5. Size	M (medium)	L (low)
6. Connectivity	M (medium)	H (high)
7. Catchment	H (high)	H (high)
Comments	The Penguin Island Channel surveyed in the present study was originally included as part of a larger area (site 2.12) recognised for its stable catchment. The small channel that separates Penguin Island from D'Urville Island was surveyed in the present study.	Size: it is likely there are more and larger dog cockle beds in the Marlborough Sounds. Criteria scores have changed dramatically due to the formation and description of the new significant site.
Recommendations	Create a separate significant site to 2.12. Call the new site Penguin Island Channel. Also create a new site for Penguin Island (terrestrial).	New site recommended.

6.0 Significant site sensitivity and anthropogenic disturbance

6.1 Anthropogenic disturbance

Many of Marlborough's significant marine sites contain biological features considered uncommon and remnants of habitats and communities that were likely once more widespread (Davidson *et al*. 2011; Davidson and Richards 2015; Handley 2015, 2016). This situation reflects a global trend of declining biogenic habitats (area and quality) with consequential effects on wider ecological values (Thrush *et al.,* 2006a, 2006b; Gray *et al.,* 2006; Lotz *et al*., 2006; Airoldi *et al.,* 2008; McCauley *et al.,* 2015). For example, in New Zealand, a decline in biogenic habitats has been linked to declining juvenile fish habitats and, therefore, a decline in fish abundance and biomass (see Morrison *et al*. 2014 for review).

The site assessment criteria used by Davidson *et al*. (2011) relied heavily on identifying the best or better sites remaining in each biogeographic area. In certain cases, the biological values represented the last of their kind based on existing knowledge. Their existence was often due to environmental factors such as topography or substratum that provided some level of natural protection from anthropogenic impacts.

Loss and degradation of marine biological values around New Zealand and internationally has been linked to anthropogenic activities (Lauder 1987, Stead 1991, Cranfield *et al.* 1999, Cranfield *et al.* 2003, Morrison *et al.,* 2009; Davidson *et al.,* 2011; Paul 2012; Morrison *et al.,* 2014, 2014a; Handley 2015, 2016). Direct physical disturbance, for example, has been assessed as one of the main causes of damage to marine benthic biological values (MacDiarmid *et al.*, 2012; MfE, 2016). It is likely that without protection or strong management, Marlborough's less resilient significant marine sites will continue to be lost or degraded. Davidson and Richards (2015) highlighted the decline of biological attributes at several significant sites identified by Davidson *et al.* (2011), including sites becoming smaller and some being functionally lost. In contrast, Davidson and Richards (2016) did not document loss that could be directly attributed to human activities; rather site boundaries were adjusted based on improved information and data.

Various significant marine sites are vulnerable to physical damage from activities such as dredging, trawling and anchoring, as well at catchment effects such as excess sedimentation. An assessment of each significant site's sensitivity to anthropogenic effects provides a guide to the type and level of protection is required.

6.2 Threat assessment process

For each significant site, the peer review panel assessed anthropogenic threats based on (i)the level of anthropogenic disturbance, and (ii) the site's vulnerability (Table 3). This assessment was based on the review panel's knowledge of the biophysical characteristics of each significant site (e.g. personal knowledge and/or from the literature).

Similar approaches have been adopted by Halpern *et al.* (2007) and further adapted for the assessment

of New Zealand's marine environment by MacDiarmid *et al.* (2012). Robertson and Stevens (2012) described an ecological vulnerability assessment (originally developed by UNESCO (2000)) for use at estuarine sites in Tasman and Golden Bays. The UNESCO methodology was designed to be used by experts to represent how coastline ecosystems were likely to react to the effects of potential "stressors".

Anthropogenic disturbance is the known or expected (based on experts' experience) level of impact associated with human-related activities. Disturbance levels range from little or no disturbance (low score) to sites regularly subjected to disturbance (high score). Impacts range from direct physical disturbance to indirect effects, including from the adjacent catchments.

Vulnerability is the sensitivity of habitats, species and communities to disturbance and damage. Scores ranged from extremely sensitive biological features such as lace corals and brittle tubeworm mounds (high vulnerability score) to relatively robust species or habitats such as coarse substrate/mobile shores and high energy kelp forests (low vulnerability score).

Table 2. Selected environmental variables used to assess the vulnerability of significant sites to benthic damage from physical disturbance.

Variables	Descriptions, definitions and examples
Anthropogenic disturbance	
Low	Little or no known human associated physical disturbance. Catchment effects low (vegetated).
Moderate	Light equipment and/or anchoring disturbance. Well managed catchment.
High	Subjected to regular or heavy equipment seabed disturbance, and/or catchments modified and poorly managed.
Vulnerability	
Extremely sensitive (very high)	Lace or fragile bryozoan colonies, tubeworm mounds, rhodoliths.
Very sensitive (high)	Massive bryozoans, sponges, hydroids, burrowing anemone.
Sensitive (moderate)	Horse mussels, soft tubeworms, shellfish beds, red algae bed.
Resilient (low or unlikely)	Algae forest, coarse substrata, reefs, boulder banks, high energy shore, short-lived species.

6.3 Assessment summary

Site 1.4 was ranked as both resilient and subject to a low level of human impact (Table 3). This site is a boulder dominated habitat that is both robust and likely avoided by bottom towed devices. All other sites were ranked as being adversely affected at a variety of levels and/or sensitive to disturbance. Site 1.9 (Lone Rock), for example, was ranked as having a low level of impact, but was regarded as extremely sensitive to events such as physical disturbance or smothering. Site 2.6 (Rangitoto Passage) was subjected to human impacts, but these are patchy. Some habitats present at the Rangitoto site remained free of disturbance, but were regarded as very sensitive. Two sites that supported rhodoliths had been adversely affected by either moorings or a marine farm. The panel supports the suggestions by Davidson and Richards (2016) that alternative mooring technology be used to reduce impacts on Rhodoliths in Ponganui Bay(Site 1.5). The panel also suggests consideration be given to relocating a mussel farm further from

shore to allow rhodoliths in Catherine Cove to recover (Site 2.13).

The peer review panel recommends that all sites vulnerable to anthropogenic disturbance be given a level of protection that ensures their biological values are not degraded.

Acknowledgements

The project was funded and supported by the Marlborough District Council and the Department of Conservation. Constructive and detailed comments on this report were gratefully received from Steve Urlich (MDC). Lancelet records from Te Papa were provided by Carl Struthers.

Table 3. Summary of threat assessment scores.

	Site 1.2 Croisilles Entrance	Site 1.4 Motuanauru Is. Boulder Bank	Site 1.5 (A, B, C) Coppermine-Ponganui Bays	Site 1.9 Lone Rock, Croisilles	Site 2.6 Rangitoto Passage	Site 2.13 (A, B, C) Catherine Cove	Site 2.15 Clay Point	Site 2.18 Paparoa	Site 2.20 Chetwodes to The Haystack	Site 2.35 Hunia, Port Gore	Site 2.37 Penguin Is Channel
Anthropogenic disturbance	Moderate	Low	Moderate	Low	High	High	Moderate	Moderate	High	Low	Low
Vulnerability assessment	Resilient	Resilient	Extremely sensitive	Extremely sensitive	Very sensitive	Extremely sensitive	Resilient	Resilient	Very sensitive	Extremely sensitive	Sensitive

References

Airoldi L, Balata D, Beck MW. 2008. The Gray Zone: Relationships between habitat loss and marine diversity and their applications in conservation. Journal of Experimental Marine Biology and Ecology 366: 8–15.

Bloomfield, H.J.; Sweetling, C.J.; Mill, A.C.; Stead, S.M; Polunin, N.V.C. 2012. No-trawl area impacts: perceptions, compliance and fish abundances. Environmental Conservation 39 (3): 237–247.

Cranfield, H.J.; Manighetti, B.; Michael, K.P.; Hill, A. 2003. Effects of oyster dredging on the distribution of bryozoan biogenic reefs and associated sediments in Foveaux Strait, southern New Zealand. Continental Shelf Research 23: 1337–1357.

Cranfield, H.J.; Michael, K.P.; Doonan, I.J. 1999. Changes in the distribution of epifaunal reefs and oysters during 130 years of dredging for oysters in Foveaux Strait, southern New Zealand. Aquatic Conservation: Marine and Freshwater Ecosystems I: 461–483.

Davidson, R.J. and Richards, L.A. 2016. Significant marine site survey and monitoring programme: Summary report 2015-2016. Prepared by Davidson Environmental Limited for Marlborough District Council. Survey and monitoring report number 836.

Davidson, R.J. and Richards, L.A. 2015. Significant marine site survey and monitoring programme: Summary 2014-2015. Prepared by Davidson Environmental Limited for Marlborough District Council. Survey and monitoring report number 819.

Davidson, R. J.; Baxter, A. S.; Duffy, C. A. J.; Gaze, P.; du Fresne, S.; Courtney, S.; Brosnan, B. 2015. Reassessment of selected significant marine sites (2014-2015) and evaluation of protection requirements for significant sites with benthic values. Prepared by Davidson Environmental Limited for Marlborough District Council and Department of Conservation. Survey and monitoring report no. 824.

Davidson, R. J.; Duffy, C. A. J.; Gaze, P.; Baxter, A. S.; du Fresne, S.; Courtney, S.; Hamill, P. 2014. Ecologically significant marine sites in Marlborough: recommended protocols for survey and status monitoring. Prepared by Davidson Environmental Limited for Marlborough District Council and Department of Conservation. Survey and monitoring report no. 792.

Davidson, R. J.; Duffy, C. A. J.; Gaze, P.; Baxter, A. S.; du Fresene, S.; Courtney, S.; Hamill, P. 2013. Ecologically significant marine sites in Marlborough: protocol for receiving and assessing new sites and reassessing existing sites. Prepared by Davidson Environmental Limited for Marlborough District Council and Department of Conservation. Survey and monitoring report no. 768.

Davidson R. J.; Duffy C.A.J.; Gaze P.; Baxter, A.; du Fresne S.; Courtney S.; Hamill P. 2011. Ecologically significant marine sites in Marlborough, New Zealand. Co-ordinated by Davidson Environmental Limited for Marlborough District Council and Department of Conservation. Published by Marlborough District Council.

Grange, K.R.; Tovey, A.; Hill, A.F. 2003. The spatial extent and nature of the bryozoan communities at Separation Point, Tasman Bay. Marine Biodiversity Biosecurity Report No. 4. Prepared for Ministry of Fisheries by NIWA ISSN 1175-771X.

Gray, J.S., Dayton, P., Thrush, S., Kaiser, M.J., 2006. On effects of trawling, benthos and sampling design. Mar. Pollut. Bull. 52, 840–843.

Halpern, B.S., Selkoe, K.A., Micheli, F., Kappel, C.V. 2007. Evaluating and ranking the vulnerability of global marine ecosystems to anthropogenic threats. Conservation Biology 21: 1301–1315.

Handley, S. 2015. The history of benthic change in Pelorus Sound (Te Hoiere), Marlborough Prepared for Marlborough District Council. NIWA client report No: NEL2015-001

Hewlitt, J.E.; Lohrer, A.M. 2013. Impacts of sedimentation arising from mining on the Chatham Rise. Prepared for Chatham Rock Phosphate Ltd. NIWA Client Report HAM2012-132.

Lauder, G.A. 1987. Coastal landforms and sediment of the Marlborough Sounds. PhD thesis University of Canterbury.

Lotze, H.K., Lenihan, H.S., Bourque, B.J., Bradbury, R.H., Cooke, R.G., Kay, M.C., Kidwell, S.M., Kirby, M.X., Peterson, C.H., Jackson, J.B.C., 2006. Depletion, degradation, and recovery potential of estuaries and coastal seas. Science 312, 1806–1809.

MacDiarmid, A.; McKenzie, A.; Sturman, J.; Beaumont, J.; Mikaloff-Fletcher, S.; Dunne, J. 2012. Assessment of anthropogenic threats to New Zealand marine habitats New Zealand Aquatic Environment and Biodiversity Report No. 93.255 p.

Martino, D. 2001. Buffer Zones Around Protected Areas: A Brief Literature Review. Electronic Green Journal, 1(15), Pp 1-19. http://escholarship.org/uc/item/02n4v17n

McCauley DJ, Pinsky ML, Palumbi SR, Estes J a., Joyce FH, Warner RR. 2015. Marine defaunation: Animal loss in the global ocean. Science 347: 247–254.

Ministry for the Environment and Statistics New Zealand 2016. New Zealand's Environmental Reporting Series: Our marine environment 2016. Available from www.mfe.govt.nz and www.stats.govt.nz.

Morrison, M.A.; Jones, E.G.; Consalvey, M; Berkenbusch, K. 2014. Linking marine fisheries species to biogenic habitats in New Zealand: a review and synthesis of knowledge New Zealand Aquatic Environment and Biodiversity Report No. 130.

Morrison, M.A.; Jones, E.; Parsons, D.P.; Grant, C. 2014a. Habitats and areas of particular significance for coastal finfish fisheries management in New Zealand: A review of concepts and current knowledge, and suggestions for future research. New Zealand Aquatic Environment and Biodiversity Report 125.202 p.

Morrison, M.A.; Lowe, M.L.; Parsons, D.M.; Usmar, N.R.; McLeod, I.M. (2009). A review of land-based effects on coastal fisheries and supporting biodiversity in New Zealand. New Zealand Aquatic Environment and Biodiversity Report No. 37. 100 p.

Robertson, B.; Stevens, L. 2012. Waimea Inlet to Kahurangi Point Habitat Mapping, Ecological Risk Assessment, and Monitoring Recommendations. Prepared for Tasman District Council by Wriggle Ltd.

Stead, D.H. 1991. A preliminary survey of mussel stocks in Pelorus Sound. Fisheries Technical Report no. 61.

Paul, L.J. 2012. A history of the Firth of Thames dredge fishery for mussels: use and abuse of a coastal resource. New Zealand Aquatic Environment and Biodiversity Report No. 94. 27p.

Thrush, S.F., Gray, J,S., Hewittm J.E., Uglandm K.I. 2006. Predicting the effects of habitat homogenization on marine biodiversity. Ecological Applications 16: 1636–1642.

Thrush, S. A., Hewitt, J. E., Cummings, V. J., Dayton, P. K., Cryer, M., Turner, S. J., Funnell, G. A., Budd, R. G., Milburn, C.J., Wilkinson, M. R. 1998. Disturbance of the marine benthic habitat by commercial fishing: impacts at the scale of the fishery. Ecological applications, 8(3): 866-879.

Thrush, S.A., Hewitt, J.E., Funnell, G.A., Cummings, V.J., Ellis, J., Schultz, D., Talley, D.M., Norkko, A. 2001. Fishing disturbance and marine biodiversity: The role of habitat structure in simple soft-sediment systems. Marine Ecology Progress Series 223: 277-286.