Ministry for Primary Industries Manatū Ahu Matua



Marine high-risk site surveillance Annual report for all ports and marinas 2013–2014 (Project 12099)

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Prepared for the Ministry for Primary Industries by Donald Morrisey, Kimberley Seaward and Graeme Inglis

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Email: <u>brand@mpi.govt.nz</u> Telephone: 0800 00 83 33 Facsimile: 04-894 0300

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Executive Summary

The Marine High-Risk Site Surveillance programme of targeted surveillance for marine nonindigenous species (NIS), delivered by NIWA under contract to the Ministry for Primary Industries (MPI), is designed to detect the presence of a group of five primary and four secondary target non-indigenous or potentially invasive marine animals and plants that MPI have identified as presenting a significant risk of arriving and establishing in New Zealand. It also aims to monitor changes in the distribution of established marine non-indigenous or pest species.

This annual report details the targeted surveillance surveys in the 11 ports and marinas covered by the programme during the periods May–September 2013 (the Winter 2013 round of surveys) and November 2013–March 2014 (the Summer 2013–2014 round).

Numbers of locations sampled met the target on all surveys apart from the summer survey of Otago Harbour, when severe weather caused the loss of several trap lines and reduced the number of trap deployments.

Numbers of specimens sent to the Marine Invasives Taxonomic Service (MITS) per survey ranged from none to nine, and the total numbers of specimens sent were 26 for the Winter 2013 round and 33 for the Summer 2013–2014 round.

No primary target species were detected, but all four secondary target species were:

- *Arcuatula (Musculista) senhousia* was recorded during the following surveys: Auckland (Winter 2013, Summer 2013–2014), Whangarei (Winter 2013, Summer 2013–2014).
- *Eudistoma elongatum* was recorded during the following surveys: Opua (Winter 2013, Summer 2013–2014), Whangarei (Winter 2013, Summer 2013–2014).
- *Sabella spallanzanii* was recorded during the following surveys: Auckland (Winter 2013, Summer 2013–2014), Lyttelton (Winter 2013), Nelson (Summer 2013–2014 range extension), Whangarei (Winter 2013, Summer 2013–2014).
- Styela clava was recorded during the following surveys: Auckland (Winter 2013, Summer 2013–2014), Lyttelton (Winter 2013, Summer 2013–2014), Nelson (Winter 2013, Summer 2013–2014), Opua (Winter 2013, Summer 2013–2014), Otago Harbour (Winter 2013, Summer 2013-2014), Picton (Winter 2013 – range extension), Whangarei (Winter 2013, Summer 2013–2014).

Eight of the specimens sent to MITS from the Winter 2013 survey were NIS, including:

- the red alga *Grateloupia turuturu* (Tauranga the first record from this location during a MHRSS survey);
- the sponge *Halisarca dujardini* (Wellington);
- the phoronid worm *Phoronis ijimai* (Whangarei **new record for New Zealand**)
- Sabella spallanzanii (Whangarei);
- *Styela clava* (Picton range extension and Whangarei).

Ten of the specimens sent to MITS from the Summer 2013–2014 survey were NIS including:

- the colonial ascidian *Botrylloides giganteum* (Whangarei **new record for New Zealand**);
- the bryozoan *Celleporaria umbonatoidea* (Opua);
- the crab *Pyromaia tuberculata* (Port Taranaki range extension);
- the solitary ascidian *Pyura doppelgangera* (Opua range extension);

• Sabella spallanzanii (Nelson – range extension and Whangarei).

MPI were informed of the range extensions and new-to-New Zealand species at the time of collection or the time that identity was confirmed.

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Introduction

The Marine High-Risk Site Surveillance programme of targeted surveillance for nonindigenous marine species is part of the Ministry for Primary Industries' (MPI) wider marine biosecurity programme. The targeted surveillance programme, currently delivered by NIWA under contract to MPI, repeats surveillance work developed and undertaken in 2002–2004, 2005–2006 and 2008-present, also by NIWA, at 11 major ports and marinas around the country (Figure 1). The surveillance is designed to detect the presence of a group of nonindigenous and potentially invasive marine flora and fauna that MPI have identified as presenting a significant risk of arriving and establishing in New Zealand. It also aims to allow changes in the distribution of established marine non-indigenous or pest species to be monitored. The majority of marine pests targeted by the surveillance programme are listed on the New Zealand register of Unwanted Organisms under the Biosecurity Act 1993.

This annual report details the targeted surveillance in the 11 ports and marinas covered by the programme in the winter of 2013 and summer of 2013–2014.



Figure 1 Locations of the 11 ports and marinas covered by the targeted surveillance programme.

OBJECTIVES OF THE MARINE HIGH-RISK SITE SURVEILLANCE PROGRAMME

The primary objective of the targeted surveillance programme is to detect incursions of five primary target marine species (see below).

The secondary objectives are to:

- detect incursions of non-target non-indigenous or cryptogenic species not previously recorded in New Zealand;
- detect incursions of established non-indigenous or cryptogenic species which are exhibiting invasive characteristics (i.e. range extensions of established organisms).

TARGET SPECIES

MPI has identified five **primary target species** which are listed on the Unwanted Organisms register. These are:

- 1. the northern Pacific seastar Asterias amurensis;
- 2. the European green crab *Carcinus maenas*;
- 3. the green alga Caulerpa taxifolia;
- 4. the Chinese mitten crab Eriocheir sinensis;
- 5. the Asian clam Potamocorbula amurensis.

Additionally, four **secondary target organisms**¹ are known to be established in New Zealand's coastal waters. These include:

- 1. the Australian droplet tunicate *Eudistoma elongatum*;
- 2. the Asian date mussel Arcuatula (Musculista) senhousia;
- 3. the Mediterranean fanworm Sabella spallanzanii;
- 4. the clubbed tunicate Styela clava.

Dates of surveys

The targeted surveillance surveys of the 11 ports and marinas covered by the programme took place during the periods May–September 2013 (the Winter 2013 round of surveys) and November 2013–March 2014 (the Summer 2013–2014 round). Dates for each survey are given in Table 1.

Sabella spallanzanii was discovered on vessels in Nelson and Opua in May and July 2013, respectively, and on a natural substratum in Tauranga Harbour in September 2013. By agreement between MPI, NIWA and the Top of the South Marine Biosecurity Partnership these three ports were kept at the start of the Winter 2013 and Summer 2013–2014 rounds of sampling (rather than rotating to the end of the sequence of ports as would normally have happened) to increase the chance of early detection if *S. spallanzanii* had recruited to structures in these ports. Similarly, the Picton Summer 2013–2014 survey was run in December 2013 following the detection of *Styela clava* in Picton Marina during the previous winter survey (see below).

MPI Biosecurity New Zealand: contacts

The targeted marine surveillance programme is administered and funded by MPI's Biosecurity Surveillance Group. Queries relating to this programme should be directed to MPI.

The MPI contact person for all marine surveillance activity is Tim Riding (daytime telephone 04 894 3462, fax 04 894 4973, email tim.riding@mpi.govt.nz). Alternatively, the Biosecurity Surveillance Group Manager can be contacted at the following email address: NZBiosecuritySurveillance@mpi.govt.nz.

¹ Didemnum sp. was removed from the list of secondary target species by MPI in December 2008 (email from Brendan Gould, MPIBNZ, to Don Morrisey, NIWA, 12 December 2008). Sabella spallanzanii was moved from the primary to the secondary list in June 2011 (MAF Statement of Work for Post Border Surveillance Programmes. National Marine High Risk Site Surveillance Programme – 12099 [10 June 2011])

The surveillance team: contact person and personnel

The surveillance programme was designed by Graeme Inglis (daytime telephone 03 348 8987, fax 03 348 5548, email g.inglis@niwa.co.nz) and Don Morrisey (daytime telephone 03 548 1715, fax 03 548 1716, email d.morrisey@niwa.co.nz), and implemented by the personnel listed in the *Communications logs and field team lists* submitted to MPI prior to each survey.

The contacts for each individual survey are shown in Table 1.

Port	Contact person/field team leader	Dates Winter 2013	Dates Summer 2013–2014
Auckland	Matt Smith	2–13 September 2013	10–21 March 2014
Bluff	Chris Woods	16–20 September 2013	31 March–4 April 2014
Lyttelton	Chris Woods	8–12 July 2013	17-21 February 2014
Nelson	Stephen Brown	27–31 May 2013	4-8 November 2013
Opua	Crispin Middleton	27–31 May 2013	18–22 November 2013
Otago Harbour	Kimberley Seaward	5–9 August 2013	3–7 March 2014
Picton/Havelock	Stephen Brown	10–14 June 2013	9–13 December 2013
Port Taranaki	Stephen Brown	19–23 August 2013	10-14 February 2014
Tauranga	Matt Smith	24–28 June 2013	16–20 December 2013
Wellington	Kate Neill	5–9 August 2013	24–28 February 2014
Whangarei	Crispin Middleton	22–26 July 2013	20–24 January 2014

Table 1 Dates and contact person/field tear	m leader for the Winter 20	13 and Summer 2013–2014 surveys.
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Results

SAMPLE COLLECTION

Sampling used a variety of techniques designed to sample a range of habitat types encompassing soft and hard surface habitats such as mud and gravel bottoms, intertidal rocky shores, and artificial structures, including marina pontoons, pilings, moorings, jetties and commercial vessel berths. The sampling techniques used were: crab condo lines; crab box traps; epibenthic sled tows; and diver and shore searches. The habitats and species targeted by each sampling technique are shown in Appendix 1.

Total numbers of locations surveyed in each survey round (Winter 2013 and Summer 2013–2014) in each port are shown in Table 2. Numbers of locations sampled met the target on all surveys apart from the summer survey of Otago Harbour, when severe weather caused the loss of several trap lines and reduced the number of trap deployments. Numbers of locations sampled with each method in each port are shown in Appendix 2, by sampling round. The sample locations for each technique are shown in Appendix 3.

Sample locations for crab box trap lines, epibenthic tows, and diver searches were preassigned prior to the survey by using a grid overlaid on the survey area in GIS. Where a preallocated sampling point was not accessible at the time the survey was done (for example, because a berth was occupied by a vessel), the sample was moved to a nearby location and the new coordinates recorded on the data sheet (or notepad computer, as appropriate). Field teams also noted any sampling locations that were not appropriate so that these could be removed from the grid of potential sampling locations for future surveys. Such locations included areas where high vessel traffic makes diving too hazardous or deployment of traps impossible, areas that are not suitable for trapping because they dry at low tide, and cable zones and other restricted areas.

Location	Sampling round	Target number of locations	Actual number of locations	% of target achieved
Auckland	Winter 2013	486	485	100
	Summer 2013–2014	486	491	101
Bluff	Winter 2013	243	240	99
	Summer 2013–2014	243	245	101
Lyttelton	Winter 2013	243	243	100
	Summer 2013–2014	243	242	100
Nelson	Winter 2013	243	244	100
	Summer 2013–2014	243	243	100
Opua	Winter 2013	243	251	103
	Summer 2013–2014	243	245	101
Otago Harbour	Winter 2013	243	243	100
	Summer 2013–2014	243	204	84
Picton / Havelock	Winter 2013	243	245	101
	Summer 2013–2014	243	245	101
Port Taranaki	Winter 2013	243	243	100
	Summer 2013–2014	243	248	102
Tauranga	Winter 2013	243	243	100
	Summer 2013–2014	243	243	100
Wellington	Winter 2013	243	243	100
	Summer 2013–2014	243	243	100
Whangarei	Winter 2013	243	243	100
	Summer 2013–2014	243	243	100

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TARGET SPECIES COLLECTION

Primary target species detected²: None

Secondary target species detected³: *Eudistoma elongatum, Arcuatula (Musculista)* senhousia, Sabella spallanzanii and Styela clava were recorded during both rounds of surveys (see below)

- *Arcuatula (Musculista) senhousia* was recorded during the following surveys: Auckland (Winter 2013, Summer 2013–2014), Whangarei (Winter 2013, Summer 2013–2014).
- *Eudistoma elongatum* was recorded during the following surveys: Opua (Winter 2013, Summer 2013–2014), Whangarei (Winter 2013, Summer 2013–2014).
- *Sabella spallanzanii* was recorded during the following surveys: Auckland (Winter 2013, Summer 2013–2014), Lyttelton (Winter 2013), Nelson (Summer 2013–2014 range extension), Whangarei (Winter 2013, Summer 2013–2014).
- *Styela clava* was recorded during the following surveys: Auckland (Winter 2013, Summer 2013–2014), Otago Harbour (Winter 2013, Summer 2013–2014), Lyttelton (Winter 2013, Summer 2013–2014), Nelson (Winter 2013, Summer 2013–2014),

 ² Asterias amurensis, Carcinus maenas, Caulerpa taxifolia, Eriocheir sinensis, Potamocorbula amurensis
³ Eudistoma elongatum, Arcuatula (Musculista) senhousia, Sabella spallanzanii, Styela clava

^{4 •} Marine High Risk Site Surveillance Annual Report 2013–2014

Opua (Winter 2013, Summer 2013–2014), Picton (Winter 2013 – range extension), Whangarei (Winter 2013, Summer 2013–2014).

NUMBER OF SPECIMENS COLLECTED AND SENT TO MITS

Numbers of specimens sent to the Marine Invasives Taxonomic Service (MITS) per survey ranged from none to nine, and the total numbers of specimens sent were 26 for the Winter 2013 round and 33 for the Summer 2013–2014 round (Table 3 and Table 4).

Eight of the specimens sent to MITS from the Winter 2013 survey were NIS (Table 5), including *Grateloupia turuturu* (Tauranga), the sponge *Halisarca dujardini* (Wellington), *Sabella spallanzanii* (Whangarei), *Styela clava* (Picton and Whangarei) and a new-to-New Zealand species, the phoronid worm *Phoronis ijimai* (Whangarei).

- The record of *G. turuturu* from Tauranga was the first from this location during a MHRSS survey. The first record from this location was made in April 2013 (MITS reference 70624).
- The record of *S. clava* in Picton represents a range extension and was notified to MPI at the time of discovery.
- The record of *P. ijimai* was communicated to MPI through the MITS reporting procedure.

Ten of the specimens sent to MITS from the Summer 2013–2014 survey were NIS (Table 6), including the colonial ascidian *Botrylloides giganteum* (Whangarei), the bryozoan *Celleporaria umbonatoidea* (Opua), the hydroid *Ectopleura crocea* (Bluff), the red alga *Griffithsia crassiuscula* (Bluff), the crab *Pyromaia tuberculata* (Port Taranaki), the solitary ascidian *Pyura doppelgangera* (Opua) and *Sabella spallanzanii* (Nelson and Whangarei). A specimen resembling *Grateloupia turuturu* from Bluff was also sent to MITS but was subsequently identified by molecular-taxonomic analysis in June 2014 as belonging to the genus *Pugetia*. The taxonomy of this genus is poorly known and no species name could be assigned.

- The specimen of a colonial ascidian of the genus *Botrylloides* from the Summer 2013–2014 survey of Whangarei (Marsden Cove) was initially identified (on morphological features) as *B*. cf. *leachii*. Subsequent molecular taxonomic analysis, however, showed that it is not the cryptogenic *B*. *leachii* but the non-indigenous species *B*. *giganteum* (Carmela Gissi, University of Milan, pers. comm. to Graeme Inglis and Mike Page, NIWA). Further information is given below. MPI were informed of this reidentification as soon as the information became available (10 June 2014).
- The discovery of *P. tuberculata* in Port Taranaki represents a range extension and was communicated to MPI through the MITS reporting procedure on 21 February 2014.
- The record of the solitary ascidian *P. doppelgangera* sp. nov. from Opua represents a southern extension of the known range of this species (Ruis and Teske 2013). MPI were informed at the time the final identification was confirmed.
- The record of *S. spallanzanii* from Nelson also represents a range extension and was notified to MPI at the time of discovery.

Port	Auckland	Bluff	Lyttelton	Nelson	Opua	Otago	Picton/Havelock	Port Taranaki	Tauranga	Wellington	Whangarei	Total	% of total
Algae					1	1			1			3	11.5
Amphipods												0	0.0
Ascidians							3			2	3	8	30.8
Barnacles												0	0.0
Bivalves					1					1		2	7.7
Bryozoans												0	0.0
Crabs								3	1	1		5	19.2
Decapods												0	0.0
Echinoderms												0	0.0
Fish												0	0.0
Gastropods												0	0.0
Hydroids										1		1	3.8
Hard corals												0	0.0
Nudibranchs			1									1	3.8
Sea anemones												0	0.0
Sponges										1		1	3.8
Worms											5	5	19.2
Total	0	0	1	0	2	1	3	3	2	6	8	26	100.0

Table 3 Summary of numbers and types of specimens collected and sent to MITS during the Winter 2013 round of surveys.

Port	Auckland	Bluff	Lyttelton	Nelson	Opua	Otago	Picton/Havelock	Port Taranakai	Tauranga	Wellington	Whangarei	Total	% of total
Algae		8							2			10	3.3
Amphipods												0	0.0
Ascidians					1						1	2	6.1
Barnacles												0	0.0
Bivalves					2						1	3	9.1
Bryozoans					1							1	3.0
Crabs				1	1			2	2		1	7	21.2
Decapods												0	0.0
Echinoderms							1					1	3.0
Fish												0	0.0
Gastropods												0	0.0
Hydroids		1										1	3.0
Nudibranchs												0	0.0
Sea anemones												0	0.0
Sponges												0	0.0
Worms				1	1		2			2	2	8	24.2
Total	0	9	0	2	6	0	3	2	4	2	4	33	100.0

Table 4 Summary of numbers and types of specimens collected and sent to MITS during the Summer 2013–2014 round of surveys.

Table 5 Specimens collected and sent to MITS from each port during the Winter 2013 survey (non-indigenous species in bold type).

Taxonomic group	Species	Sample number	MITS code	Date	Location	Method
AUCKLAND						
None						
BLUFF						
None						
LYTTELTON						
Nudibranch	Hoplodoris nodulosa	LYT17202b	70722	09/07/2013	LYT17202	Diver search
NELSON						
None						
OPUA						
Alga	Pterocladiella capillacea	OPX17100	70630	27/05/2013	OPX17100	Benthic sled
Bivalve	Corbula zelandica	OPX17094	70631	30/05/2013	OPX17094	Benthic sled
OTAGO HARBOUR						
Alga	Schizoseris griffithsia	DUD17188a	70797	5/08/2013	DUD17188	Diver search
PICTON						
Ascidian	Microcosmus squamiger	PCN17051 PCN17200	70632	12/06/2013	PCN17051	Benthic sled
Ascidian	Styela clava	BNZ(TAR)10122 PCN17199	70633	11/06/2013	PCN17200	Diver search
Ascidian	Styela clava	BNZ(TAR)10122	70634	11/06/2013	PCN17199	Diver search
PORT TARANAKI		, ,				
Crab	Liocarcinus corrugatus	NPL17123	70806	23/08/2013	NPL17123	Crab trap
Crab	Ovalipes catharus	NPL17008	70807	23/08/2013	NPL17008	Benthic sled
Crab	Neommatocarcinus huttoni	NPL17032	70808	23/08/2013	NPL17032	Benthic sled
TAURANGA						
Crab	Nepinnotheres atrinicola	TRG17024	70759	25/06/2013	TRG17024	Benthic sled
Alga	Grateloupia turuturu	TRG17325	70760	26/06/2013	TRG17325	Shore search
WELLINGTON						
Bivalve	Aulacomya maoriana	WLG17220	70761	05/08/2013	WLG17220	Shore search
Hard coral	Culicia rubeola	WLG17203	70762	07/08/2013	WLG17203	Diver search
Crab	Ebalia laevis	WLG17044	70763	08/08/2013	WLG17044	Benthic sled
Sponge	Halisarca dujardini	WLG17206	70794	05/08/2013	WLG17206	Diver search
Ascidian	Alcyonium	WLG17186	70795	05/08/2013	WLG17186	Diver search
Ascidian	Didemnum vexillum	WLG17202	70796	07/08/2013	WLG17202	Diver search
WHANGAREI						
Ascidian	Styela clava	WRE17207	70756	25/07/2013	WRE17207	Diver search
Ascidian	Styela plicata	WRE1/20/	/0/91	25/07/2013	WRE1/20/	Diver search
Ascidian	Microcosmus squamiger	WRE1/20/	/0/92	25/07/2013	WRE1/20/	Diver search
Worm	Sabella spallanzanii	WRE1/207	/0/51	25/07/2013	WRE17207	Diver search
Worm	Branchiomma curtum	WRE1/210	/0/52	25/07/2013	WRE1/210	Diver search
Worm (phoropid)	Phoronis iiimai	WKE1/200 RN7/DEM/2022	70753	25/07/2012		Diver soarch
Worm	Filoronis ijinai Branchiomma curtum	M/DE172023	70754	25/07/2013	WRE1/200	Diver search
Worm	Branchiomma curtum	WRE17202	70755	25/07/2013	WRE17202	Diver search
WOITH		WILL 17200	10133	2010112010	WILL I / ZUJ	Diver search

Taxonomic group	Species	Sample number	MITS code	Date	Location	Method
AUCKLAND						
None						
BLUFF						
DEGIT	Pugetia sp. (originally identified					
Alga	as Grateloupia cf. turuturu)	BI U18184a	70896	01/04/2014	BI U18184	Diver search
Alga	Griffithsia crassiuscula	BLU18206a	70897	01/04/2014	BLU18206	Diver search
Alga	Polysinhonia sn	BLU18219a	70898	31/03/2014	BLU18219	Shore search
Alga	Echinothamnion hystrix	BLU18220a	70800	31/03/2017	BLU18220	Shore search
Hydroid		BLU18200a Candalf	70000	01/04/2014	BLU18200	Diver search
	Seutosiphon Iomontaria	DLU10200a_Gariuali	70900	01/04/2014	DLU 10200	Shore search
Alga		DLU10222a	70901	01/04/2014		
Alga	Bryopsis vesilia	BLU 182068	70907	01/04/2014	BLU 18208	Diver search
Alga	Callophyllis variegata	BLU18183a	70908	01/04/2014	BLU18183	Diver search
Alga	Pugetia sp.	BLU18183a	70909	01/04/2014	BLU18183	Diver search
None						
NELSON						
Worm	Sabella spallanzanii	NSN18190	70827	04/11/2013	NSN18190	Diver search
Crah	Hemiaransus crenulatus	NSN18091	70828	04/11/2013	NSN18091	Benthic sled
OPUA	rieniigiupsus cienululus	Nontroost	10020	04/11/2010	NONTOUST	Dentine Sied
Bivalve	Crassostrea gigas	OPX18250	70834	21/11/2013	OPX18250	Diver search
Bivalve	Limnoperna pulex	OPX18193	70835	20/11/2013	OPX18193	Diver search
Worm	Polydora haswelli	OPX18002	70836	20/11/2013	OPX18002	Benthic sled
Ascidian	Pyura doppelgangera	OPX18234	70837	20/11/2013	OPX18234	Shore search
Brvozoan	Celleporaria umbonatoidea	OPX18230 OPX18002	70838	20/11/2013	OPX18230 OPX18002	Benthic sled
OTAGO HARBOUR	· · · · · · · · · · · · · · · · · · ·					
None						
PICTON						
Echinoid	Pseudechinus albocinctus	PCN18024	70841	02/12/2013	PCN18024	Benthic sled
Worm	Chaetopterus chaetopterus - B	PCN18061 PCN18061	70842	04/12/2013	PCN18061 PCN18061	Benthic sled
PORT TARANAKI	Lopidonotus banksi		10042	04/12/2010		Dentine Sied
Crab	Nectocarcinus antarcticus	NPL18068	70860	11/02/2014	NPL18068	Benthic sled
Crab	Pyromaia tuberculata	NPL18072	70861	11/02/2014	NPL18072	Benthic sled
TAURANGA						
Alga	Anotrichium crinitum	TRG18246	70844	18/12/2013	TRG18246	Shore search
Alga	Plocamium cartilagineum	TRG18168	70845	16/12/2013	TRG18168	Crab trap
Crab	Liocarcinus corrugatus	TRG18010	70846	17/12/2013	TRG18010	Benthic sled
Crab	Liocarcinus corrugatus	TRG18021	70847	17/12/2013	TRG18021	Benthic sled
WELLINGTON						
Worm	Galeolaria hystrix	WLG18006	70859	17/02/2014	WLG18006	Benthic sled
VVorm	Pseudopotamilia laciniosa	WLG18006	70862	17/02/2014	WLG18006	Benthic sled
Bivalve	Corbula zelandica	WRE18060	70851	21/01/2014	WRF18060	Benthic sled
Crab	Liocarcinus corrugatus	WRE18071	70850	22/01/2014	WRE18071	Benthic sled
Worm	Polychaeta (no worm in tube)	WRE18201	70849	23/01/2014	WRE18201	Diver search
Ascidian	Botrylloides giganteum	WRE18204	70853	23/01/2014	WRE18204	Diver search
vvorm	Sabella spallanzanii	WREI0191	10852	29/01/2014	WRE18191	Diver search

Table 6 Specimens collected and sent to MITS from each port during the Summer 2013–2014 survey (non-indigenous species in **bold** type).

DISTRIBUTION OF TARGET AND NON-TARGET SPECIES

Distribution maps were plotted for target species and for non-target species in the following categories: new records for New Zealand; those that have expanded their ranges; and those that currently have a restricted distribution (Appendix 4). The maps show locations where each species was recorded (as red dots) and also locations where it was absent, based on appropriate sampling methods for each species (see Appendix 1).

Species plotted (and the methods by which they might be collected) are: *Acentrogobius bifrenatus* (crab trap, epibenthic sled, diver search); *Arcuatula (Musculista) senhousia* (epibenthic sled, crab trap, shore search); *Botrylloides* sp. (unidentified, new-to-New Zealand; epibenthic sled, diver search, shore search); *Charybdis japonica* (epibenthic sled, crab trap, crab condos, diver search, shore search); *Clavelina lepadiformis* (diver search, shore search); *Eudistoma elongatum* (epibenthic sled, diver search, shore search); *Limaria orientalis* (epibenthic sled); *Metapenaeus bennettae* (epibenthic sled, crab trap, diver search: this species may possibly be sampled by crab condos but this has not occurred to date); *Nassarius burchardi* (epibenthic sled, diver search, shore search); *Pyromaia tuberculata* (epibenthic sled, crab trap, diver search, shore search); *Sabella spallanzanii* (epibenthic sled, crab trap, diver search, shore search); *Styela clava* (epibenthic sled, diver search); *Theora lubrica* (epibenthic sled); and *Undaria pinnatifida* (epibenthic sled, crab trap, diver search). Records are shown for the Winter 2013 and Summer 2013–2014 surveys.

Secondary target species

Arcuatula (Musculista) senhousia

A. senhousia was recorded in both surveys of Auckland (Waitemata) and Whangarei Harbours. It was not recorded in Tauranga Harbour during either survey. Distributions within each harbour were as follows:

- Auckland Harbour: recorded at three sites, two in the upper and one in the lower harbour during the winter survey, and at two sites in the upper harbour in the summer survey. This reflects a continued limited distribution compared to earlier surveys.
- Whangarei Harbour: as in previous surveys, recorded throughout the harbour, from the Town Basin to Marsden Cove Marina, including the Portland Arm.

Eudistoma elongatum

E. elongatum was recorded in both surveys of Opua and Whangarei Harbour. Distributions within each harbour were as follows:

- Opua: present at numerous locations on the wharf and in the marina, and at three locations at Okiato on the opposite shore of the Veronica Channel, in the winter survey. Present at the same locations, and also along the shore north towards Paihia, during the summer survey.
- Whangarei Harbour: as in the 2011–2012 and 2012–2013 surveys, *Eudistoma* was found in the Portland Arm and on Limestone Island during both surveys.

Sabella spallanzanii

S. spallanzanii was found during both surveys of Auckland (Waitemata) and Whangarei Harbours, the winter survey of Lyttelton Harbour and the summer survey of Nelson.

• Auckland Harbour: throughout the port, Bayswater, Orakei, Westhaven and Westpark Marinas, Devonport, the channel between the Harbour Bridge and Kauri Point and in the upper harbour. During the winter survey *S. spallanzanii* was recorded in 57 of the

60 dive searches, 17 benthic sled and 30 shore search sites. During the summer survey it was recorded in 59 dive sites, 14 benthic sleds and 35 shore searches. Population densities in Westhaven Marina up to 1000 per m^2 and in the Viaduct Basin up to 200 per m^2 . It was abundant at all locations where it occurred, and several sites had tubes with estimated length in excess of 350 mm.

- Lyttelton Harbour: as in previous surveys, and in stark contrast to Auckland Harbour, only three individuals were detected during the winter survey and none during the summer survey. One of the worms (with a tube length of 80 cm) was on the hull of a local yacht in Dampier Marina and two were on Z-berth.
- Nelson Harbour: a single specimen was found on E Berth in the marina during the summer survey.
- Whangarei Harbour: four mature worms were collected by diver searches during the winter survey; two in Marsden Cove Marina and two at Port Nikau. A large number of individuals (estimated at 1000) were also detected on the heavily-fouled hull of a vessel on Main Wharf One. These worms were not removed, but Northland Regional Council were informed of the find. During the summer survey, *S. spallanzanii* was found on all six dives from Port Nikau to Kissing Point, and four of eight dives in Marsden Cove Marina. A large specimen was also found on the old wharf structure at the Portland/Golden Bay Cement wharf.

Styela clava

S. clava was found during both surveys of Auckland, Lyttelton, Nelson, Opua, Otago Harbour and Whangarei, and during the winter survey of Picton Harbour.

- Auckland Harbour: throughout the port, Bayswater, Orakei, Westhaven and Westpark Marinas (only in the winter survey in the case of Westpark), Devonport, the channel between the Harbour Bridge and Kauri Point and in the upper harbour. During the winter survey, *S. clava* was found in 33 of the dive searches, in five benthic sleds, and in 15 of the shore searches. During the summer survey, it was found in 32 of the dive searches, in five benthic sled, and in 23 of the shore searches throughout the harbour.
- Lyttelton Harbour: at locations throughout the port and at Magazine Bay Marina, and at Governors Bay during the summer survey.
- Nelson: collected on Main Wharf, the Slipway Basin, the inner marina, off Haulashore Island, and (for the first time) in that part of the main channel north of the port/marina area during the winter survey. During the summer survey, individuals were collected from Main Wharf, the Slipway Basin, the inner and outer marina and off Haulashore Island.
- Opua: present at numerous locations on the wharf and in the marina, at three locations at Okiato on the opposite shore of the Veronica Channel, and at three sites off Paihia and Waitangi in the winter survey. Present at Opua wharf and marina, Okiato, off Paihia and off Russell during the summer survey.
- Otago Harbour: specimens were again recorded in Port Otago, but at more locations (13 in the winter survey, nine in the summer survey) than in previous years.
- Picton: four individuals were collected by divers at two sites in Picton Marina during the winter survey. Although a single specimen had previously been recorded on the hull of a vessel recently arrived in Waikawa Marina from the Waitemata Harbour in September 2005, this represents a range extension and MPI were informed at the time of the discovery. A subsequent delimitation survey (23–24 June) commissioned by Marlborough District Council and MPI collected a further 98 specimens from the inner marina and one from the outer marina. No further individuals were found during the summer survey.
- Whangarei Harbour: Marsden Cove Marina (both surveys), Parua Bay (both surveys) and the western end of North Port, Marsden Point (summer survey). During the winter

survey, large numbers (> 100 individuals) of *S. clava* were also found on the hulls of two heavily-fouled vessels, one in Marsden Cove Marina and the other on a swing-mooring in Urquarts Bay.

Non-target, non-indigenous species

Acentrogobius pflaumii

Recorded in Auckland Harbour at one location in the port during the winter survey, and one location in the port, one in Westhaven Marina and one in the Devonport Naval Base in the summer survey. It was also detected at two locations at Port Nikau during the winter survey of Whangarei Harbour.

Botrylloides giganteum

This colonial ascidian was collected from Marsden Cove Marina in the summer survey. Initial molecular-taxonomic analysis was inconclusive, suggesting possibly a new species in the genus *Botrylloides*. The current consensus, based on very close matching of COI genetic sequences and morphology, is that it is *Botrylloides giganteum*, previously known from California, Brazil, Italy and Senegal (Carmela Gissi, University of Milan, pers. comm. to Graeme Inglis and Mike Page, NIWA). This is a new record for New Zealand.

Charybdis japonica

Recorded during the winter and summer surveys of Auckland and Whangarei Harbours (but not in Opua, where a single specimen was recorded in the Winter 2012 survey). All specimens were destroyed.

- Auckland: throughout the port, at Devonport, in Orakei, Bayswater, Westhaven and Westpark Marinas, and in the channels in the upper, middle and lower harbour. A single specimen of the native paddle crab, *Ovalipes catharus*, was captured at Devonport during the winter survey but none during the summer survey.
- Whangarei Harbour: around the Town Wharf, Limestone Island, Portland Arm, Parua and Munro Bays and Marsden Cove Marina. Highest population densities were around Port Nikau, Limestone Island and Portland Reach.

Celleporaria umbonatoidea (not mapped)

This species was recorded at a single location in the marina during the summer survey of Opua, representing a range extension from Whangarei Harbour where it was first recorded in New Zealand during the Summer 2009–2010 survey (this was also the first record outside its native range of eastern Asia). The Opua specimen had the known introduced spionid polychaete *Polydora haswelli* living epifaunally on it. *P. haswelli* usually lives by boring into the shells of molluscs so this behaviour is unusual (Geoff Read, NIWA, pers. comm.).

Clavelina lepadiformis

The known distribution of this species in New Zealand continues to be restricted to Nelson Marina and Dickson Basin, where it was first noted in November 2008. It was recorded at three of nine dive locations in the winter survey and five of 14 locations in the summer surveys.

Grateloupia turuturu

Specimens resembling *Grateloupia turuturu* were collected during the Winter 2013 surveys of Nelson (marina), Picton (south of the ferry terminal), Tauranga (Tauranga Bridge Marina) and Wellington (Seaview) and the Summer 2013–2014 surveys of Taranaki (Lee Breakwater), Picton (outer marina) and Wellington (Lambton Harbour). The specimen from Bluff was subsequently identified, by molecular-genetic analysis, as *Pugetia* sp., a genus that contains a

native species but whose taxonomy is poorly understood. Another specimen was collected from Tauranga during the summer survey, but was identified by MITS as the indigenous *Plocamium cartilagineum*.

As noted in previous reports, the identification of some of the specimens sent to MITS proved to be difficult and a review of the Genus *Grateloupia* and molecular information is required to confirm some of them (Roberta D'Archino, NIWA, pers. comm. to Serena Wilkens, MITS). The current status of these and previously-collected specimens indicates that *G. turuturu* is present in Lyttelton, Nelson, Port Taranaki and Wellington.

Limaria orientalis

Recorded in Auckland Harbour during the winter and summer surveys, where it occurs in the main channel in the outer and middle harbours, including the port and Devonport, and the upper harbour off Beach Haven.

Metapenaeus bennettae

This species was first recorded in New Zealand during the Winter 2009 survey of Auckland Harbour (outside Bayswater Marina) and in Whangarei Harbour (Port Nikau) in February 2012.

- *M. bennettae* was recorded at Devonport, the port and at three locations in the upper harbour during the winter survey of Auckland Harbour. In the summer survey it was recorded only at three locations in the port.
- In Whangarei Harbour it was recorded off Limestone Island, at Port Nikau and in the Town Basin during the winter survey. In the summer survey it was recorded at the same locations and also in the lower harbour, in the channel off Snake Bank.

Nassarius burchardi

This species was originally reported from the Waitemata Harbour in 2009. It was recorded at Port Nikau and the Town Basin during the summer survey of Whangarei Harbour, but not during the winter survey.

Phoronis ijimai

The collection of this species of Phoronida (horseshoe worms) in Whangarei Harbour during the winter survey is the first record in New Zealand. It was collected from a wharf piling in Marsden Cover Marina. It is native to the north Pacific (Japan, China, Russia and the western coast of North America) and has been found on the east coast of North America and in Botany Bay, New South Wales.

Pyromaia tuberculata

Recorded in Auckland Harbour during both surveys, Opua (four locations around Hermione Rock) and a first record for Port Taranaki (the port) during the summer surveys, and Whangarei Harbour (Limestone Island and the middle harbour channel) during the winter survey. In Auckland Harbour it occurred in the main channel of the upper, middle and outer harbour and the port. The record from Port Taranaki represents a range extension.

Pyura doppelgangera

This solitary ascidian was collected from Okiato during the summer survey of Opua and represents a southern extension of its known range. This species has been recently described from specimens from southeast Australia and northern New Zealand (Ruis and Teske 2013).

Theora lubrica

This species occurs in soft, muddy sediments throughout Auckland, Lyttelton, Nelson, Opua, Picton and Havelock, Port Taranaki, Tauranga, Wellington and Whangarei. *T. lubrica* appears to have been much less widely distributed in the winter survey of Port Taranaki than in the summer survey.

Undaria pinnatifida

Widespread in Auckland, Bluff, Lyttelton, Nelson, Otago Harbour, Picton, Port Taranaki and Wellington. Also present, but less widespread, in Tauranga Harbour.

- Auckland: the port, Viaduct, Bayswater, Orakei and Westhaven Marinas, Devonport, the upper harbour off Hobsonville, and the outer harbour.
- Bluff: western side of the harbour, including the port, and Tiwai Wharf.
- Lyttelton: throughout the harbour.
- Nelson: marina, port and inside the Boulder Bank.
- Otago Harbour: throughout the harbour.
- Picton: throughout the port, Waimahana Wharf (Shakespeare Bay) and Waikawa Marina. Not present in Havelock.
- Port Taranaki: throughout the port, the reclamation and inside the Lee Breakwater.
- Tauranga: at the base of Mount Maunganui facing the harbour, the port and Tauranga Bridge Marina.
- Wellington: throughout the harbour.

ENVIRONMENTAL DATA COLLECTION

Environmental data were recorded at most survey locations (the principal aim of these records is to develop a database of environmental conditions for each port in the surveillance programme, rather than conditions associated with each individual sample). The following parameters were measured: water depth; salinity; temperature; secchi depth; wind direction and speed; and time of sampling (to allow determination of tidal stage). Wind direction was allocated to one of eight compass directions (north, northeast, east, etc.). It should also be noted that the wind speed measured at a given sampling location (for example, against a sheltered wharf) may not be representative of general conditions prevailing at the time of the survey.

Conclusions

The Winter 2013 and Summer 2013–2014 rounds of marine high-risk site surveillance surveys met the project objectives in terms of the target numbers of locations sampled apart from the summer survey of Otago Harbour, when severe weather caused the loss of several trap lines and reduced the number of trap deployments. Fifty-nine specimens were collected and sent to MITS for identification. No primary target species were detected during the survey, but the four secondary target species were all recorded: *Arcuatula (Musculista) senhousia* (Auckland and Whangarei); *Eudistoma elongatum* (Opua and Whangarei); *Sabella spallanzanii* (Auckland, Lyttelton, Nelson and Whangarei); and *Styela clava* (Auckland, Lyttelton, Nelson, Opua, Otago Harbour, Picton and Whangarei).

All of these target species have been recorded at the respective locations during previous surveys apart from *S. spallanzanii* in Nelson and *S. clava* in Picton. The last two records represent range extensions, although a vessel heavily infested with *S. spallanzanii* arrived in Nelson in March 2013 and a specimen of *S. clava* was found on the hull of a vessel in Waikawa Marina in 2005. Both vessels were slipped and cleaned after arrival, though not until more than a month later in the case of the first vessel in 2013.

Non-target, non-indigenous species recorded during the surveys included: Acentrogobius pflaumii; Botrylloides giganteum; Celleporaria umbonatoidea; Charybdis japonica; Clavelina lepadiformis; Grateloupia turuturu/Grateloupia sp.; Limaria orientalis; Metapenaeus bennettae; Nassarius burchardi; Phoronis ijimai; Pyromaia tuberculata; Pyura doppelgangera; Theora lubrica; and Undaria pinnatifida.

All *Charybdis* specimens caught in crab traps were euthanized. All *Sabella spallanzanii* found in Lyttelton, Nelson and Whangarei were enclosed in bags, removed and disposed of to landfill (or sent to MITS in the case of the Nelson specimen). All *Styela clava* found in Nelson, Picton and Port Otago were collected, and either preserved and sent to MITS or disposed of to landfill.

Problems encountered:

Problems during sampling

Winter surveys

Large amounts of sea lettuce (*Ulva* spp.) were present during the winter survey of Otago Harbour, making retrieval of traps difficult, and one trap line was lost. Strong winds and busy shipping activity required the movement of diving and trapping sites around Port Taranaki.

Summer surveys

Gale-force winds at the beginning of the Otago Harbour survey caused problems with the crab trapping; this is reflected in the reduced number of deployments achieved. Traps were deployed in the more sheltered Port Chalmers area on the Monday, but on the Tuesday winds increased and were too severe to allow recovery. The traps were retrieved on the Wednesday, but six lines were lost. The harbour master, Port Otago pilots and harbour control were informed of the loss and the last known locations of the traps. The remaining traps were redeployed in the more sheltered town basin area on the Wednesday and were retrieved successfully the following day. However, continued strong winds in the channel prevented a third deployment during the week.

The farm manager of New Zealand's Bluff Oyster Company (NZBO) came on board the dive boat during the survey of Bluff Harbour and showed the field team the approximate extent of his active marine-farming lease at low tide near Green Point. There are many sub-surface lines running through NZBO's lease area which are not marked, and which will be likely snagged by any trapping/sledding activity. The immediate area surrounding NZBO's lease area is very shallow, with occasional unmarked wrecks/submerged structures, such that safe navigation is difficult for conducting any sampling outside the lease area. Therefore, preallocated crab trap and benthic sled sites within the aquaculture lease area of New Zealand's Bluff Oyster Company near Green Point were relocated to the main shipping areas of Bluff. Two dives were conducted within NZBO's lease area on farm structures with NZBO's permission.

Sea lettuce was prolific throughout Tauranga Harbour following a summer bloom, making retrieval of crab traps very difficult. Drag-induced movement of several anchored traps occurred in the western arm of the harbour, up to half a nautical mile in one example.

Difficulties encountered in meeting minimum monitoring requirements

See comments above re difficulties with deploying and recovering traps during the summer survey of Otago Harbour.

Problems encountered in reporting surveillance results None.

Management actions taken to reduce problems

Where pre-assigned sampling locations could not be accessed because of, for example, the presence of a vessel alongside the wharf, the sample was taken as close as possible to the pre-assigned location and GPS coordinates were recorded.

A working solution to sampling within the marine-farming area in Bluff Harbour has been arrived at with the farm's owner. As in the summer survey, future surveys will not trap or sled in the area, but diver searches will be allocated there.

Stakeholder engagement, public awareness and media contact:

The response from stakeholders contacted prior to the survey to inform them and obtain permission was generally rapid, and no problems were encountered with regard to access to sample sites.

A stakeholder meeting was conducted during the summer survey of Otago Harbour with Lincoln Coe from Port Otago, Brian Stewart from Ryder Consulting and Rachel from Dive Otago, at the NIWA Dunedin office. The notes from the meeting, as prepared by Lincoln Coe, were attached to the Post-sampling Report sent to MPI after the survey.

MPI and regional council staff joined the field teams for surveys of Wellington and Whangarei Harbours.

Casual enquiries from members of the public and marina operators/owners were responded to by the field-team leader as per the short-term communications policy between MPI and NIWA.

Recommendations

- Electronic data recording is still being trialled whenever possible but problems of reliability of the tablet computers continue.
- A set of models of the primary target species (excluding *Potamocorbula amurensis*) have been purchased. We have also compiled a set of preserved specimens of target and selected non-target, non-indigenous species and native species that appear similar to them. The models and specimens have been circulated around all the field teams to refresh members' recognition skills for the target species. This will be done periodically prior to future surveys.
- The distribution of sampling effort in Opua, as proposed in the revised design report and based on stochastic scenario tree modelling, will be used in future rounds of surveys. This optimisation approach may be applied to other ports in the future, pending decisions on potential review of target ports and species by MPI.

Acknowledgements

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Appendix 1. Summary of sampling methods, target species and habitats.

Underlined species have been collected using this method during the present or previous target-species surveillance programmes.

Method	Target species	Non-target species	Habitat	Spatial coverage	Effectiveness	Cost effectiveness	Feasibility	Previous surveillance in NZ?	Previous surveillance overseas?
Epibenthic sled tows	Asterias amurensis <u>Eudistoma</u> <u>elongatum</u> <u>Arcuatula senhousia</u> Potamocorbula amurensis <u>Sabella spallanzanii</u> Styela clava	<u>Acentrogobius</u> <u>pflaumii</u> <u>Chaetopterus</u> <u>sp.</u> Charybdis japonica Didemnum sp. Grateloupia turuturu Hypnea sp. <u>Pyromaia</u> <u>tuberculata</u> <u>Theora lubrica</u>	Subtidal soft sediments. Particular focus on known shellfish beds (for <i>Asterias</i>) and areas next to public access (e.g. wharves, boat ramps, marinas, etc. <i>Caulerpa</i> , <i>Sabella</i>).	Narrow width but 50 m tow length and high replication (100+ per location) enables a reasonably large area to be sampled (ca 2500m ² per location).	Reliable sample collection including asteroids, infaunal and epifaunal bivalves and polychaetes and macroalgae.	Processing of sled contents can be time consuming.	Feasible on all soft-sediment habitats under reasonable weather conditions. Can be limited by the presence of large amounts of benthic macroalgae or soft mud that fill mouth of sled.	Yes	Yes

Method	Target species	Non-target species	Habitat	Spatial coverage	Effectiveness	Cost effectiveness	Feasibility	Previous surveillance in NZ?	Previous surveillance overseas?
Box (crab) traps	Asterias amurensis Carcinus maenas Eriocheir sinensis	Acentrogobius pflaumii <u>Charybdis</u> <u>japonica</u> <u>Pyromaia</u> <u>tuberculata</u>	Adjacent to wharf pilings and other artificial habitats. Intertidal and shallow subtidal rocky shores, breakwalls and saltmarsh. Particular focus on habitats with complex physical structure (e.g. mussel beds, seagrass beds)	Sampled area is dependent on dispersion of bait odour. High replication possible.	Effectively sample other species of crabs (<i>Ovalipes</i> , <i>Hemiplax</i> , <i>Charybdis</i>).	Quick to deploy and recover, so high replication possible.	Most locations and weather conditions.	Yes	Yes (Hewitt & Martin 2001, May & Brown, 2001 Thresher et al. 2003, Yamada et al. 2001)
Crab condos	Carcinus maenas Eriocheir sinensis	Acentrogobius pflaumii <u>Charybdis</u> japonica Pyromaia tuberculata	Intertidal and shallow subtidal banks of rivers. Particular focus on brackish water habitats with complex physical structure (e.g. saltmarsh or fringing vegetation).	High replication possible. Availability of suitable estuarine habitat may limit deployment.	Effectively sample other species of crabs (<i>Helice</i> , <i>Hemiplax</i>). Higher rates of detection of crabs than bated traps in muddy river banks (Veldhuizen 2000).	Quick to deploy and recover, so high replication possible.	High – access problems at some sites (shallow water, deep mud, private land).	Yes	Yes (Veldhuizen 2000)

Method	Target species	Non-target species	Habitat	Spatial coverage	Effectiveness	Cost effectiveness	Feasibility	Previous surveillance in NZ?	Previous surveillance overseas?
Shoreline searches	Carcinus maenas Eriocheir sinensis <u>Eudistoma</u> <u>elongatum</u> <u>Arcuatula senhousia</u> <u>Sabella spallanzanii</u> <u>Styela clava</u>	<u>Chaetopterus</u> <u>sp.</u> <u>Charybdis</u> <u>japonica</u> <u>Clavelina</u> <u>lepadiformis</u> <u>Didemnum sp.</u> <u>Grateloupia</u> <u>turuturu</u> <u>Hypnea sp.</u> Pyromaia tuberculata	Sloping sandy shorelines, intertidal rocky reefs and areas where drift material is likely to accumulate. Prevailing winds on preceding days are a useful guide to where material may accumulate.	Wide – can cover long stretches of intertidal habitat quickly.	Used effectively in delimitation studies of <i>Styela</i> .	High	High – access to intertidal areas may be limiting.	Yes	Yes
Diver searches	Asterias amurensis Carcinus maenas <u>Eudistoma</u> <u>elongatum</u> <u>Sabella spallanzanii</u> <u>Styela clava</u>	<u>Chaetopterus</u> <u>sp.</u> <u>Charybdis</u> <u>japonica</u> <u>Clavelina</u> <u>lepadiformis</u> <u>Didemnum sp.</u> <u>Grateloupia</u> <u>turuturu</u> Hypnea sp. Pyromaia tuberculata	Wharf piles, marina piles and pontoons and other artificial structures, intertidal and shallow subtidal reefs.	Good – large numbers of piles or lengths of hard substratum can be searched in detail.	Dependent on water clarity and level of biofouling.	Cost effective in reasonable water clarity, can be time- consuming under poor conditions.	Feasibility dependent on water currents, weather, water clarity and safety issues for divers.	Yes	Yes

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Appendix 2. Summaries of achieved versus target sample numbers for Winter 2013 and Summer 2013–2014.

AUCKLAND

Sampling method	Target number of locations	Actual number of locations	% of target achieved
ALL AUCKLAND WINTER 2013			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	16 160 200 60 50 486	15 160 200 60 50 485	94 100 100 100 100 100
WAITEMATA WINTER 2013			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	8 32 91 4 20 155	7 25 93 1 20 146	88 78 102 25 100 94.2
PORT OF AUCKLAND WINTER 2013			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	0 28 37 15 0 80	37 37 15 3 92	132 100 100 300 115
VIADUCT/HOBSON WEST WINTER 2013			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	0 13 15 15 10 53	18 14 12 6 50	139 93 80 60 94
WESTHAVEN WINTER 2013			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	0 11 24 15 9 59	20 25 13 7 65	182 104 87 78 110
BAYSWATER MARINA WINTER 2013			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	0 13 12 5 6 36	13 12 4 6 35	100 100 80 100 97
WESTPARK MARINA WINTER 2013			
Crab condo lines Crab (box) trap lines	0	10	77

Sampling method	Target number of locations	Actual number of locations	% of target achieved
Epibenthic sled tows Diver searches Shore searches Sample total	1 3 3 20	3 2 15	100 67 75
ORAKEI/HOBSON MARINA WINTER 2013			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total DEVONPORT NAVAL BASE AND PUBLIC	8 10 5 3 2 28	8 22 3 6 41	100 220 40 100 300 146
WHARF WINTER 2013	0		
Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches	11 12 6	13 14 7	118 116 116
	29	34	117
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	0 3 3 2 8	2 3 2 7	67 100 100 88
ALL AUCKLAND SUMMER 2013-2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	16 160 200 60 50 486	16 160 199 60 56 491	100 100 100 100 112 101
WAITEMATA SUMMER 2013–2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	8 27 83 1 8 127	8 27 82 1 14 132	100 100 99 100 175 104
PORT OF AUCKLAND SUMMER 2013–2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	34 41 15 90	34 41 15 90	100 100 100 100
VIADUCT/HOBSON WEST SUMMER 2013-2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches	19 15 12 10	19 15 12 10	100 100 100 100

Sampling method	Target number of locations	Actual number of locations	% of target achieved
Sample total	56	56	100
WESTHAVEN SUMMER 2013–2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	19 25 13 12 69	19 25 13 12 69	100 100 100 100 100
BAYSWATER MARINA SUMMER 2013-2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	12 12 4 6 34	12 12 4 6 34	100 100 100 100 100
WESTPARK MARINA SUMMER 2013-2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches	10 3 2	10 3 2	100 100 100
Sample total	15	15	100
ORAKEI/HOBSON MARINA SUMMER 2013– 2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	8 25 4 4 10 51	8 25 4 4 10 51	100 100 100 100 100 100
DEVONPORT NAVAL BASE AND PUBLIC WHARF SUMMER 2013–2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	11 16 6 2 35	11 16 6 2 35	100 100 100 100 100
KAURI POINT SUMMER 2013–2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	3 4 2 9	3 4 2 9	100 100 100
	5	J	100

BLUFF

Sampling method	Target number of locations	Actual number of locations	% of target achieved
WINTER 2013			
Crab condo lines	8	8	100
Crab (box) trap lines	80	77	96
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
Sample total	243	240	99
SUMMER 2013–2014			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	32	107
Shore searches	25	25	100
Sample total	243	245	101

LYTTELTON

Sampling method	Target number of locations	Actual number of locations	% of target achieved
WINTER 2013			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
Sample total	243	243	100
SUMMER 2013–2014			
Crab condo lines	8	7	88
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
Sample total	243	242	100

NELSON

Sampling method	Target number of locations	Actual number of locations	% of target achieved
WINTER 2013			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	31	103
Shore searches	25	25	100
Sample total	243	244	100
SUMMER 2013–2014			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
Sample total	243	243	100

OPUA

Sampling method	Target number of locations	Actual number of locations	% of target achieved
WINTER 2013			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	105	105
Diver searches	30	30	100
Shore searches	25	28	112
Sample total	243	251	103
SUMMER 2013-2014			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	32	107
Shore searches	25	25	100
Sample total	243	245	101

OTAGO HARBOUR

Sampling method	Target number of locations	Actual number of locations	% of target achieved
WINTER 2013			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
Sample total	243	243	100
SUMMER 2013–2014			
Crab condo lines	8	8	100
Crab (box) trap lines	80	41	51
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
Sample total	243	204	84

PICTON/HAVELOCK

Sampling method	Target number of locations	Actual number of locations	% of target achieved
TOTAL PICTON/HAVELOCK WINTER 2013			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	8 80 100 30 25 243	8 80 100 32 25 245	100 100 100 107 100 101
PICTON/SHAKESPEARE BAY WINTER 2013			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	0 35 60 15 9 119	34 60 16 10 120	97 100 107 111 101
WAIKAWA WINTER 2013			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	0 20 20 7 8 55	20 20 8 8 56	100 100 114 100 102
HAVELOCK WINTER 2013			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	8 25 20 8 8 69	8 26 20 8 7 69	100 104 100 100 88 100
TOTAL PICTON/HAVELOCK SUMMER 2013– 2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	8 80 100 30 25 243	8 80 100 32 25 245	100 100 100 107 100 101
PICTON/SHAKESPEARE BAY SUMMER 2013– 2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	0 34 60 15 9 118	34 60 16 9 119	100 100 107 100 101
WAIKAWA SUMMER 2013–2014			
Crab condo lines Crab (box) trap lines Epibenthic sled tows Diver searches Shore searches Sample total	0 20 20 7 8 55	20 20 8 8 56	100 100 114 100 102
Sampling method	Target number of locations	Actual number of locations	% of target achieved
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HAVELOCK 2013-2014			
Crab condo lines	8	8	100
Crab (box) trap lines	26	26	100
Epibenthic sled tows	20	20	100
Diver searches	8	8	100
Shore searches	8	8	100
Sample total	70	70	100

PORT TARANAKI

Sampling method	Target number of locations	Actual number of locations	% of target achieved
WINTER 2013			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	26	100
Sample total	243	244	100
SUMMER 2013–2014			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	103	103
Diver searches	30	30	100
Shore searches	25	27	108
Sample total	243	248	102

TAURANGA

Sampling method	Target number of locations	Actual number of locations	% of target achieved
WINTER 2013			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	30	120
Sample total	243	248	102
SUMMER 2013–2014			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	30	120
Sample total	243	248	102

WELLINGTON

Sampling method	Target number of locations	Actual number of locations	% of target achieved

Sampling method	Target number of locations	Actual number of locations	% of target achieved
WINTER 2013			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
Sample total	243	243	100
SUMMER 2013–2014			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
Sample total	243	243	100

WHANGAREI

Sampling method	Target number of locations	Actual number of locations	% of target achieved
WINTER 2013			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	101	100
Diver searches	30	31	100
Shore searches	25	25	100
Sample total	243	245	100
SUMMER 2013–2014			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
Sample total	243	243	100

Appendix 3. Maps showing locations sampled in Winter 2013 and Summer 2013–2014.

NOTE THAT NUMBERS OF LOCATIONS PLOTTED MAY APPEAR SMALLER THAN THOSE SHOWN IN APPENDIX 2 DUE TO POINTS PLOTTING ON TOP OF EACH OTHER AS A RESULT OF THE SPATIAL RESOLUTION OF THESE MAPS

AUCKLAND (WAITEMATA HARBOUR)

Winter 2013

Crab (box) trapping locations



Crab condo locations



Sledding locations



Dive search locations





Summer 2013-2014

Crab (box) trapping locations











BLUFF HARBOUR

Winter 2013

Crab (box) trapping locations











Summer 2013–2014

Crab (box) trapping locations











LYTTELTON HARBOUR

Winter 2013

Crab (box) trapping locations











Summer 2013-2014

Crab (box) trapping locations











NELSON

Winter 2013

Crab (box) trapping locations











Summer 2013–2014

Crab (box) trapping locations











OPUA

Note: grey crosses indicate navigational markers

Winter 2013

Crab (box) trapping locations











Summer 2013–2014

Crab (box) trapping locations











OTAGO HARBOUR

Winter 2013

Crab (box) trapping locations











Summer 2013–2014

Crab (box) trapping locations








Shore search locations



PICTON/HAVELOCK

Winter 2013

Crab (box) trapping locations (Picton Harbour)



Crab (box) trapping locations (Waikawa Marina)



Crab (box) trapping locations (Havelock Harbour)



Crab condo locations (Havelock Harbour)



Sledding locations (Picton Harbour)



Sledding locations (Waikawa Marina)



Sledding locations (Havelock Marina)



Dive search locations (Picton Harbour)



Dive search locations (Waikawa Marina)



Dive search locations (Havelock Harbour)



Shore search locations (Picton Harbour)



Shore search locations (Waikawa Marina)



Shore search locations (Havelock Harbour)



Summer 2013-2014





Crab (box) trapping locations (Waikawa Marina)



Crab (box) trapping locations (Havelock Harbour)



Crab condo locations (Havelock Harbour)



Sledding locations (Picton Harbour)



Sledding locations (Waikawa Marina)



Sledding locations (Havelock Marina)



Dive search locations (Picton Harbour)



Dive search locations (Waikawa Marina)



Dive search locations (Havelock Harbour)



Shore search locations (Picton Harbour)



Shore search locations (Waikawa Marina)



Shore search locations (Havelock Harbour)



PORT TARANAKI

Winter 2013

Crab (box) trapping locations



Crab condo locations







Shore search locations



Summer 2013-2014

Crab (box) trapping locations



Crab condo locations







Shore search locations



TAURANGA HARBOUR

Winter 2013

Crab (box) trapping locations



Crab condo locations







Shore search locations



Summer 2013-2014

Crab (box) trapping locations



Crab condo locations







Shore search locations



WELLINGTON HARBOUR

Winter 2013

Crab (box) trapping locations



Crab condo locations







Shore search locations



Summer 2013-2014

Crab (box) trapping locations



Crab condo locations







Shore search locations



WHANGAREI HARBOUR

Winter 2013

Crab (box) trapping locations



Crab condo locations






Shore search locations



Summer 2013–2014

Crab (box) trapping locations



Crab condo locations



Sledding locations



Dive search locations



Shore search locations



Appendix 4. Distribution maps for target and selected non-target species in Winter 2013 and Summer 2013-2014.

ACENTROGOBIUS PFLAUMII

Auckland (Waitemata Harbour) Winter 2013



Auckland (Waitemata Harbour) Summer 2013–2014





ARCUATULA (MUSCULISTA) SENHOUSIA

Auckland (Waitemata Harbour) Winter 2013



Auckland (Waitemata Harbour) Summer 2013–2014





Whangarei Harbour Summer 2013–2014



BOTRYLLOIDES GIGANTEUM

Whangarei Harbour Summer 2013–2014



CHARYBDIS JAPONICA

Auckland (Waitemata Harbour) Winter 2013



Auckland (Waitemata Harbour) Summer 2013–2014





Whangarei Harbour Summer 2013–2014



CLAVELINA LEPADIFORMIS

Nelson Winter 2013



Nelson Summer 2013–2014



EUDISTOMA ELONGATUM

Opua Winter 2013



Opua Summer 2013–2014





Whangarei Harbour Summer 2013–2014



GRATELOUPIA TURUTURU/GRATELOUPIA SP.

Nelson Winter 2013



Picton/Havelock Winter 2013



Picton/Havelock Summer 2013–2014



Port Taranaki Summer 2013–2014



Tauranga Harbour Winter 2013



Wellington Harbour Winter 2013



Wellington Harbour Summer 2013–2014



LIMARIA ORIENTALIS

Auckland (Waitemata Harbour) Winter 2013



Auckland (Waitemata Harbour) Summer 2013–2014



METAPENAEUS BENNETTAE

Auckland (Waitemata Harbour) Winter 2013



Auckland (Waitemata Harbour) Summer 2013–2014





Whangarei Harbour Summer 2013–2014



NASSARIUS BURCHARDI

Whangarei Harbour Summer 2013–2014



PHORONIS IJIMAI



PYROMAIA TUBERCULATA

Auckland (Waitemata Harbour) Winter 2013



Auckland (Waitemata Harbour) Summer 2013–2014



Opua Summer 2013–2014



Port Taranaki Summer 2013–2014





PYURA DOPPELGANGERA

Opua Summer 2013–2014



SABELLA SPALLANZANII

Auckland (Waitemata Harbour) Winter 2013



Auckland (Waitemata Harbour) Summer 2013–2014



Lyttelton Harbour Winter 2013



Nelson Summer 2013–2014





Whangarei Harbour Summer 2013–2014



STYELA CLAVA

Auckland (Waitemata Harbour) Winter 2013



Auckland (Waitemata Harbour) Summer 2013–2014



Lyttelton Harbour Winter 2013



Lyttelton Harbour Summer 2013–2014



Nelson Winter 2013



Nelson Summer 2013–2014



Opua Winter 2013



Opua Summer 2013–2014



Otago Harbour Winter 2013



Otago Harbour Summer 2013–2014



Picton Harbour Winter 2013


Whangarei Harbour Winter 2013



Whangarei Harbour Summer 2013–2014



THEORA LUBRICA

Auckland (Waitemata Harbour) Winter 2013



Auckland (Waitemata Harbour) Summer 2013–2014



Lyttelton Harbour Winter 2013



Lyttelton Harbour Summer 2013–2014



Nelson Winter 2013



Nelson Summer 2013–2014



Opua Winter 2013



Opua Summer 2013–2014



Picton/Havelock Winter 2013



Picton/Havelock Summer 2013–2014



Port Taranaki Winter 2013



Port Taranaki Summer 2013–2014



Tauranga Harbour Winter 2013



Wellington Harbour Winter 2013



Wellington Harbour Summer 2013–2014



Whangarei Harbour Winter 2013



Whangarei Harbour Summer 2013–2014



UNDARIA PINNATIFIDA

Auckland (Waitemata Harbour) Winter 2013



Auckland (Waitemata Harbour) Summer 2013–2014



Bluff Harbour Winter 2013



Bluff Harbour Summer 2013–2014



Lyttelton Harbour Winter 2013



Lyttelton Harbour Summer 2013–2014



Nelson Winter 2013



Nelson Summer 2013–2014



Otago Harbour Winter 2013



Otago Harbour Summer 2013–2014



Picton/Havelock Winter 2013



Picton/Havelock Summer 2013–2014



Port Taranaki Winter 2013



Port Taranaki Summer 2013–2014



Tauranga Harbour Winter 2013



Tauranga Harbour Summer 2013–2014



Wellington Harbour Winter 2013



Wellington Harbour Summer 2013–2014

