



Marine High Risk Site Surveillance Programme

**Annual Synopsis Report for all High Risk Sites 2016–17
(SOW18048)**

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Prepared for the Ministry for Primary Industries
by Chris Woods, Kimberley Seaward, Graeme Inglis and Lily Pryor
Rodgers

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Publications Logistics Officer
Ministry for Primary Industries
PO Box 2526
WELLINGTON 6140

Email: brand@mpi.govt.nz
Telephone: 0800 00 83 33
Facsimile: 04 894 0300

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Executive Summary

The Marine High Risk Site Surveillance (MHRSS) is a national programme of surveys targeted at the early detection of high risk marine non-indigenous species (NIS). The primary objective of the MHRSS programme is to detect incursions of New to New Zealand non-indigenous organisms listed on the Unwanted Organisms Register at ports and marinas throughout New Zealand previously identified as high risk for the introduction and establishment of marine NIS. The MHRSS programme also has two secondary objectives, which are: (i) to detect incursions of marine NIS or cryptogenic organisms not previously recorded in New Zealand, and; (ii) to detect range extensions by marine NIS or cryptogenic organisms that are already established in New Zealand waters. The MHRSS programme is designed to detect the presence of five primary (*Asterias amurensis*, *Carcinus maenas*, *Caulerpa taxifolia*, *Eriocheir sinensis* and *Potamocorbula amurensis*), and four secondary (*Arcuatula senhousia*, *Eudistoma elongatum*, *Sabella spallanzanii* and *Styela clava*) target NIS. Each High Risk Site is surveyed bi-annually (hereafter referred to as the winter and summer surveys).

This Annual Synopsis Report details the targeted surveillance surveys at the 11 High Risk Sites during the periods June–September 2016 (the Winter 2016 round of surveys) and November 2016–May 2017 (the Summer 2016–17 round of surveys).

The number of locations sampled generally met the overall MHRSS programme survey targets. A total of 2849 locations (98.1% of target 2903) were surveyed during the Winter 2016 surveys. A total of 2923 locations (100.7% of target 2903) were surveyed during the Summer 2016–17 surveys. No primary target species were detected, but all four secondary target species were detected at various locations and times:

- *Arcuatula senhousia* was recorded during the following surveys: Waitemata (Winter 2016, Summer 2016–17); and Whangarei (Winter 2016, Summer 2016–17).
- *Eudistoma elongatum* was recorded during the following surveys: Opuā (Winter 2016, Summer 2016–17); and Whangarei (Winter 2016, Summer 2016–17).
- *Sabella spallanzanii* was recorded during the following surveys: Lyttelton (Winter 2016); Nelson (Summer 2016–17); Picton (Winter 2016); Tauranga (Summer 2016–17); Waitemata (Winter 2016, Summer 2016–17); and Whangarei (Winter 2016, Summer 2016–17).
- *Styela clava* was recorded during the following surveys: Lyttelton (Winter 2016, Summer 2016–17); Nelson (Winter 2016, Summer 2016–17); Opuā (Winter 2016, Summer 2016–17); Otago (Winter 2016, Summer 2016–17); Picton (Winter 2016, Summer 2016–17); Tauranga (Winter 2016, Summer 2016–17); Waitemata (Winter 2016, Summer 2016–17); Wellington (Winter 2016); and Whangarei (Winter 2016, Summer 2016–17).

The number of specimens collected and sent to the Marine Invasives Taxonomic Service (MITS) for formal identification per survey ranged from none to 12. The total numbers of specimens sent to MITS were 24 for the Winter 2016 round and 47 for the Summer 2016–17 round.

Five of the 24 specimens sent to MITS from the Winter 2016 surveys were NIS, including the red alga *Grateloupia turuturu* (Lyttelton, and *G. cf. turuturu* from Nelson), the caprellid amphipod *Caprella cf. penantis* (Tauranga), the fish *Chironemus maculosus* (Port Taranaki) and the solitary ascidian *Styela clava* (Wellington).

- The record of *C. cf. penantis* from Tauranga Harbour represents a **New to New Zealand** record
- The record of *C. maculosus* from Port Taranaki represents a MHRSS programme **range extension**.

Ten of the 47 specimens sent to MITS from the Summer 2016–17 surveys were NIS, including the caprellid amphipod *Caprella scauroides* (Waitemata), the amphipod *Apocorophium acutum* (Waitemata) and the colonial ascidians *Botrylloides giganteum* (Whangarei), *Clavelina lepadiformis* (Wellington), *Polyandrocarpa zorritensis* (Whangarei) and *Symplegma brakenhielmi* (Waitemata and Whangarei).

- The record of *C. scauroides* from Waitemata Harbour represents a **New to New Zealand** record
- The record of *C. lepadiformis* from Wellington Harbour represents a MHRSS programme **range extension**.

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

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Introduction

The Marine High Risk Site Surveillance (MHRSS) is a national programme of surveys targeted at the early detection of High Risk marine non-indigenous marine species (NIS), and is part of the Ministry for Primary Industries' (MPI) wider marine biosecurity system. The MHRSS programme, delivered by NIWA under contract to MPI, repeats targeted surveillance surveys developed and undertaken by NIWA in 2002–04, 2005–06 and 2008–present at 11 major ports and marinas around the country deemed to be high risk for the introduction and establishment of marine NIS (Figure 1). Repeat surveys by an experienced team, the core of which includes observers who have surveyed the sites on multiple occasions, builds capability and increases the likelihood of detecting temporal changes in species assemblages. Each site is surveyed in winter and summer each year because some organisms have life cycles that prevent macroscopic detection during certain times of the year.

The 11 High Risk Sites^{1,2} for the MHRSS programme are (from north to south):

1. Opua Marina/Waikare Inlet (including waters to the south of Brampton Bank);
2. Whangarei Harbour;
3. Waitemata Harbour (Auckland; including the Viaduct Basin, Hobson West Marina area, Westhaven Marina, Bayswater Marina, Devonport and Kauri Point Defence Areas);
4. Tauranga Harbour;
5. Port Taranaki (New Plymouth);
6. Wellington Harbour;
7. Nelson Harbour (including Waimea Inlet);
8. Picton Harbour (including Shakespeare and Waikawa bays, and Havelock Marina);
9. Lyttelton Harbour/Whakaraupō;
10. Otago Harbour;
11. Bluff Harbour.

¹ High Risk Site is the terminology used in the Ministry for Primary Industries Statement of Work for the national Marine High Risk Site Surveillance programme.

² Where appropriate, High Risk Site names follow official names listed in the New Zealand Gazetteer of place names: <http://www.linzi.govt.nz/regulatory/place-names/find-place-name/new-zealand-gazetteer-place-names>. Otherwise, High Risk Site names follow those listed in the Ministry for Primary Industries Statement of Work for the national Marine High Risk Site Surveillance programme.

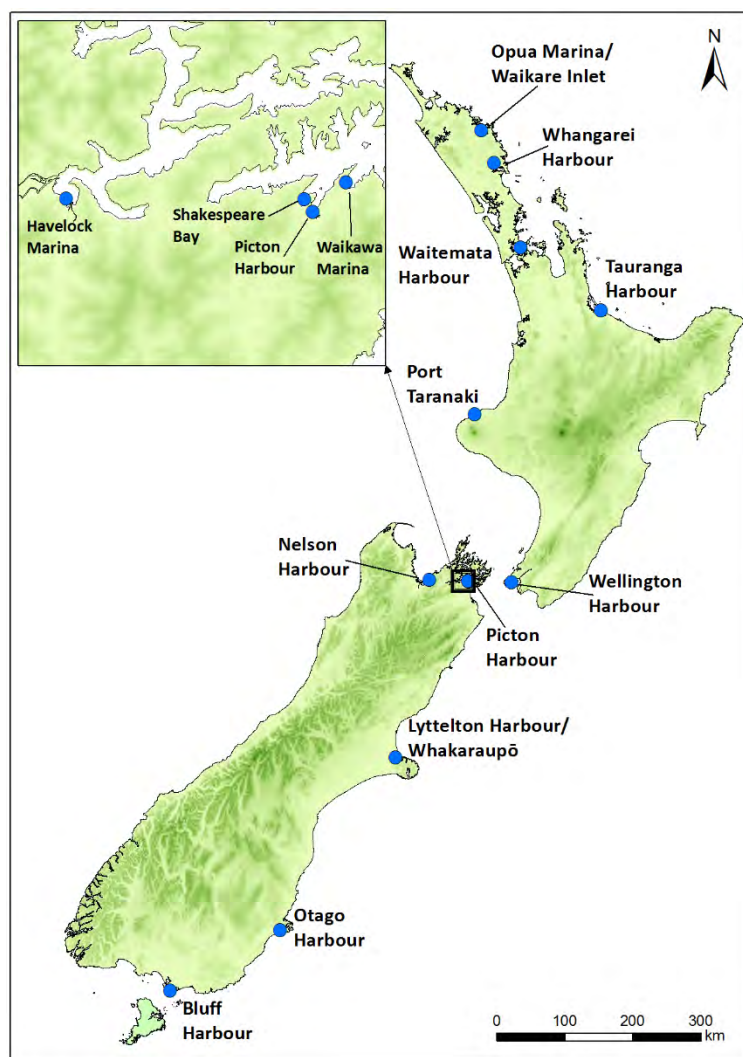


Figure 1: Locations of the 11 High Risk Sites covered by the Marine High Risk Site Surveillance (MHRSS) programme.

Objectives of the Marine High-Risk Site Surveillance programme

The primary objective of the MHRSS programme is:

- To detect incursions of New to New Zealand non-indigenous organisms listed on the Unwanted Organisms Register at High Risk Sites throughout New Zealand.

The secondary objectives of the MHRSS programme are:

- To detect incursions of New to New Zealand non-indigenous or cryptogenic organisms not listed on the Unwanted Organisms Register at High Risk Sites throughout New Zealand.
- To detect incursions (i.e., range extensions) of established non-indigenous or cryptogenic organisms that exhibit characteristics of Pests and Diseases.

Target species

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

1. The northern Pacific seastar *Asterias amurens*.*.
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 amurens*.*.

Additionally, four secondary target organisms³ are known to be established in New Zealand's coastal waters.

1. The Asian date mussel *Arcuatula senhousia*.
2. The Australian droplet tunicate *Eudistoma elongatum*.
3. The Mediterranean fanworm *Sabella spallanzanii*.*.
4. The clubbed tunicate *Styela clava*.

*Notifiable organism under Biosecurity (Notifiable Organisms) Order 2016

<http://www.legislation.govt.nz/regulation/public/2016/0073/9.0/whole.html>

This Annual Synopsis Report details the targeted surveillance in the 11 High Risk Sites covered by the MHRSS programme in the survey rounds of Winter 2016 and Summer 2016–17.

³ *Didemnum* sp. was removed from the list of secondary target species by MPI in December 2008 (Email from Brendan Gould, MPI/BNZ, to Don Morrissey, 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]).

Summary of Survey Activity/Methods

Dates of Marine High Risk Site Surveillance programme survey activity

The targeted surveillance surveys of the 11 High Risk Sites covered by the MHRSS programme took place during the periods June⁴–September 2016 (the Winter 2016 round of surveys) and November 2016–May⁵ 2017 (the Summer 2016–17 round of surveys). Dates for each survey are provided in Table 1.

Table 1: Dates for the Winter 2016 and Summer 2016–17 Marine High Risk Site Surveillance (MHRSS) programme surveys.

Port	Winter 2016 survey	Summer 2016–17 survey
Bluff Harbour	8–12 August 2016	30 January–3 February 2017
Lyttelton Harbour/Whakaraupō	20–24 June 2016	14–24 November and 12–13 December 2016 ^{*,**}
Nelson Harbour	22–26 August 2016	13–22 March 2017
Opuā Marina/Waikare Inlet	29 August–2 September 2016	27–31 March 2017
Otago Harbour	4–8 July 2016	28 November–2 December 2016
Picton Harbour	12–16 September 2016	13–17 March 2017
Port Taranaki	25–29 July 2016	28 November–2 December 2016
Tauranga Harbour	18–22 July 2016	21–25 November 2016
Waitemata Harbour	13–24 June 2016 ^{***}	13–24 March and 23–24 May 2017 ^{***}
Wellington Harbour	5–19 September 2016 [*]	20 February–16 March 2017 ^{****}
Whangarei Harbour	12–16 September 2016	27 January–2 February 2017

^{*}Survey interrupted by unfavourable weather

^{**}Survey interrupted by 14 November 2016 Kaikōura earthquake

^{***}Survey affected/interrupted by the presence of a large resident leopard seal

^{****}Survey interrupted by NIWA boating resources availability

Marine High Risk Site Surveillance programme survey techniques

Survey sampling for the MHRSS programme uses a variety of techniques designed to sample a range of soft and hard habitat types 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 condos; crab (box) traps; benthic sled tows; diver searches; and shore searches. The habitats and species targeted by each sampling technique are detailed in Appendix 1.

The total sampling effort at each High Risk Site and for each survey is governed by a fixed contracted cost. A documented process for the selection of sampling methods and allocation of sampling effort for the target species was developed at the start of a previous phase of the MHRSS programme (Inglis et al. 2006) and included information on the biology and behaviour of the target organisms and sampling methods used for the same or similar species in other parts of their range. Sensitivity (efficiency of the survey method), cost-effectiveness, impacts on native species and environments, feasibility and consistency with safe field-working practice were also evaluated in selecting sampling methods. Information on species-habitat relationships and hydrodynamic modelling of dispersal of larvae was used to identify sites around introduction nodes where target species incursions were most likely to occur. Stochastic scenario tree (SST) modelling has also been used to evaluate and optimise

⁴ The typical winter MHRSS survey period is May–September, but renegotiation of MHRSS contract delayed the start of the 2016 winter survey until June 2016.

⁵ The typical summer MHRSS survey period is November–March, but a significant health and safety issue relating to the presence of a large leopard seal resident in the Waitemata Harbour delayed the completion of this High Risk Site's summer survey until May 2017

confidence of target species detection and identify the resources needed to achieve the required detection outcomes (Morrissey et al. 2012a,b).

Sampling locations for crab (box) trap lines, benthic sled tows, and diver searches were pre-allocated prior to each survey by using a grid overlaid on the survey area in Geographic Information Systems (GIS). Where a pre-allocated sampling point was not accessible at the time of the survey (e.g., berth was occupied by a vessel, port operations etc.), the sample was relocated to a nearby location and the new coordinates recorded on the data sheet (or tablet computer, as appropriate). Field teams also noted any sampling locations that were not appropriate or unsafe 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 are dry at low tide, or are seafloor cable zones or other restricted areas.

Environmental data collection

Environmental data were recorded at sampling locations during each survey (the principal aim of these records is to develop a database of environmental conditions for each location in the MHRSS programme, rather than conditions associated with each individual sample). The following parameters were measured: water depth; salinity; temperature; water clarity (secchi disk depth); wind direction and speed; time of sampling (to allow determination of tidal stage); and sediment type (for benthic sled sampling).

MPI Marine High Risk Site Surveillance programme team: contacts

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

The MPI Operational Liaison for all marine surveillance activity from June 2016 to February 2017 was Tim Riding, Senior Advisor, Marine Surveillance and Incursion Investigation. From February to April 2017, the interim MPI contact was Dr Michael Taylor, Team Manager, Biosecurity Surveillance and Incursion Investigation (Aquatic & Environmental Health). From April 2017 to the present, the MPI Operational Liaison for all marine surveillance activity is Abraham Growcott, Senior Advisor, Biosecurity Surveillance and Incursion Investigation (Aquatic & Environmental Health) (tel: 04 894 2433, email: Abraham.Growcott@mpi.govt.nz).

NIWA Marine High Risk Site Surveillance programme survey team: contacts

The MHRSS programme surveys were designed by Drs Graeme Inglis (tel: 03 348 8987, email: Graeme.Inglis@niwa.co.nz) and Don Morrissey (now employed by Cawthron Institute), and implemented by the personnel listed in the *Stakeholder communications logs and field team lists* submitted to MPI prior to each MHRSS programme survey. The NIWA Project Manager for the MHRSS programme is Dr Chris Woods (tel: 03 348 8987, email: Chris.Woods@niwa.co.nz).

Results

Sample collection

Total numbers of locations surveyed in each MHRSS programme survey round (Winter 2016 and Summer 2016–17) at each High Risk Site are shown in Table 2. Numbers of locations sampled generally met the overall survey targets. A total of 2849 locations (98.1% of target 2903) were surveyed during the Winter 2016 surveys; the inability to conduct the diver search component to the winter Waitemata Harbour survey (88.3% survey target achieved, refer to *Problems encountered during sampling section*) was the cause of not meeting the overall winter survey target. A total of 2923 locations (100.7% of target 2903) were surveyed during the Summer 2016–17 surveys. Numbers of locations sampled with each method at each High Risk Site are shown in Appendix 2, by sampling round. The achieved sample locations for each sampling technique at each High Risk Site are shown in Appendix 3, by sampling round.

Table 2: Summary of target and achieved numbers of locations sampled at each Marine High Risk Site Surveillance (MHRSS) programme High Risk Site.

High Risk Site	Sampling round	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
Bluff Harbour*	Winter 2016	225	228	101.3
	Summer 2016–17	225	226	100.4
Lyttelton Harbour/Whakaraupō	Winter 2016	243	244	100.4
	Summer 2016–17	243	242	99.6
Nelson Harbour	Winter 2016	243	243	100.0
	Summer 2016–17	243	245	100.8
Opuā Marina/Waikare Inlet	Winter 2016	248	249	100.4
	Summer 2016–17	248	249	100.4
Otago Harbour	Winter 2016	243	244	100.4
	Summer 2016–17	243	248	102.1
Picton Harbour	Winter 2016	243	244	100.4
	Summer 2016–17	243	244	100.4
Port Taranaki	Winter 2016	243	241	99.2
	Summer 2016–17	243	243	100.0
Tauranga Harbour	Winter 2016	243	246	101.2
	Summer 2016–17	243	246	101.2
Waitemata Harbour	Winter 2016	486	429	88.3
	Summer 2016–17	486	491	101.0
Wellington Harbour	Winter 2016	243	239	98.4
	Summer 2016–17	243	243	100.0
Whangarei Harbour	Winter 2016	243	242	99.6
	Summer 2016–17	243	246	101.2
All sites	Winter 2016	2903	2849	98.1
All sites	Summer 2016–17	2903	2923	100.7

* By agreement with MPI, the total target number of sampling locations in Bluff Harbour have been reduced compared to earlier surveys (from 243 down to 225), due to the presence of a sub-surface oyster farm lease to the north of Tikore Island which has resulted in the immediate area being inaccessible for sampling using crab traps and benthic sled tows. The total number of crab traps and benthic sled locations have been reduced (from 80 to 68, and from 100 to 84, respectively), but the total number of dive locations increased (from 30 to 40), with several of those dives allocated to the oyster farming lease area.

Target species collection

Primary target species detected⁶: None.

Secondary target species detected⁷: *Arcuatula senhousia*, *Eudistoma elongatum*, *Sabella spallanzanii* and *Styela clava* were recorded during both rounds of surveys (see below).

- *Arcuatula senhousia* was recorded during the following surveys: Waitemata (Winter 2016, Summer 2016–17); and Whangarei (Winter 2016, Summer 2016–17).
- *Eudistoma elongatum* was recorded during the following surveys: Opuia (Winter 2016, Summer 2016–17); and Whangarei (Winter 2016, Summer 2016–17).
- *Sabella spallanzanii* was recorded during the following surveys: Lyttelton (Winter 2016); Nelson (Summer 2016–17); Picton (Winter 2016); Tauranga (Summer 2016–17); Waitemata (Winter 2016, Summer 2016–17); and Whangarei (Winter 2016, Summer 2016–17).
- *Styela clava* was recorded during the following surveys: Lyttelton (Winter 2016, Summer 2016–17); Nelson (Winter 2016, Summer 2016–17); Opuia (Winter 2016, Summer 2016–17); Otago (Winter 2016, Summer 2016–17); Picton (Winter 2016, Summer 2016–17); Tauranga (Winter 2016, Summer 2016–17); Waitemata (Winter 2016, Summer 2016–17); Wellington (Winter 2016); and Whangarei (Winter 2016, Summer 2016–17).

Number of specimens collected and sent to MITS

The numbers of specimens sent to the Marine Invasives Taxonomic Service (MITS) for formal identification per survey ranged from none to 12. The total numbers of specimens sent were 24 for the Winter 2016 round and 47 for the Summer 2016–17 round (Table 3 and Table 4).

Five of the 24 specimens sent to MITS from the Winter 2016 surveys were NIS (Table 5), including the red alga *Grateloupia turuturu* (Lyttelton, and *G. cf.*⁸ *turuturu* from Nelson), the caprellid amphipod *Caprella cf. penantis* (Tauranga), the fish *Chironemus maculosus* and the solitary ascidian *Styela clava* (Wellington).

- The record of *C. cf. penantis* from Tauranga Harbour represents a **New to New Zealand** record, and was communicated to MPI through the MITS reporting procedure.
- The record of *C. maculosus* from Port Taranaki represents a MHRSS programme **range extension** (previously known from Cook Strait), and was communicated to MPI through the MITS reporting procedure.

Ten of the 47 specimens sent to MITS from the Summer 2016–17 surveys were NIS (Table 6), including the amphipod *Apocorophium acutum* (Waitemata), the caprellid amphipod *Caprella scauroides* (Waitemata) and the colonial ascidians *Botrylloides giganteum* (Whangarei), *Clavelina lepadiformis* (Wellington), *Polyandrocarpa zorritensis* (Whangarei) and *Symplegma brakenhielmi* (Waitemata and Whangarei).

- The record of *C. scauroides* from Waitemata Harbour represents a **New to New Zealand** record, and was communicated to MPI through the MITS reporting procedure.

⁶ *Asterias amurensis*, *Carcinus maenas*, *Caulerpa taxifolia*, *Eriocheir sinensis*, *Potamocorbula amurensis*

⁷ *Arcuatula senhousia*, *Eudistoma elongatum*, *Sabella spallanzanii*, *Styela clava*

⁸ cf. (Latin for *confer* = compares with) is a taxonomic terminology used to indicate that a specimen resembles the named species very closely, but has certain minor features not found on the type specimen(s). Whether it is a different population of the named species or a different species altogether would require more research into the species' population variations.

- The record of *C. lepadiformis* from Wellington Harbour represents a MHRSS programme **range extension** (previously known from Nelson and Picton), and was communicated to MPI through the MITS reporting procedure.

Table 3: Summary of numbers and types of specimens collected from each Marine High Risk Site Surveillance (MHRSS) programme High Risk Site and sent to the Marine Invasives Taxonomic Service (MITS) for formal identification during the Winter 2016 round of surveys.

Organism type	Bluff Harbour	Lyttelton Harbour/Whakaraupō	Nelson Harbour	Opuā Marina/Waikare Inlet	Otago Harbour	Picton Harbour	Port Taranaki	Tauranga Harbour	Waitemata Harbour	Wellington Harbour	Whangarei Harbour	Total	% of total
Algae		1	1							2		4	16.7
Annelid						1						1	4.2
Amphipod								1				1	4.2
Anthozoan										1		1	4.2
Ascidian		2						2		2		6	25
Barnacle												0	0
Bivalve							1			1		2	8.3
Bryozoan					2							2	8.3
Crab												0	0
Decapod												0	0
Echinoderm										1		1	4.2
Fish			1			1	1			1		4	16.7
Gastropod												0	0
Hydroid												0	0
Nudibranch					1							1	4.2
Sponge												0	0
Scleractinian												0	0
Other										1		1	4.2
Total	0	3	2	0	3	2	2	3	0	9	0	24	100

Table 4: Summary of numbers and types of specimens collected from each Marine High Risk Site Surveillance (MHRSS) programme High Risk Site and sent to the Marine Invasives Taxonomic Service (MITS) for formal identification during the Summer 2016–17 round of surveys.

Organism type	Bluff Harbour	Lyttelton Harbour/Whakaraupō	Nelson Harbour	Opuā Marina/Waikare Inlet	Otago Harbour	Picton Harbour	Port Taranaki	Tauranga Harbour	Waitemata Harbour	Wellington Harbour	Whangarei Harbour	Total	% of total
Algae									1	2		3	6.4
Annelid			1			2		1				4	8.5
Amphipod									4			4	8.5
Anthozoan											1	1	2.1
Ascidian				1	1			6	4	2	8	22	46.8
Barnacle												0	0.0
Bivalve		1								3	1	5	10.6
Bryozoan												0	0.0
Crab									2		2	4	8.5
Decapod										1		1	2.1
Echinoderm												0	0.0
Fish							1					1	2.1
Gastropod												0	0.0
Hydroid												0	0.0
Nudibranch										1		1	2.1
Sponge								1				1	2.1
Scleractinian												0	0.0
Other												0	0.0
Total	0	1	1	1	1	2	1	8	11	9	12	47	100

Table 5: Specimens collected and sent to the Marine Invasives Taxonomic Service (MITS) for formal identification from each Marine High Risk Site Surveillance (MHRSS) programme High Risk Site during the Winter 2016 round of surveys.

Non-indigenous species are in bold type. Specimens are ordered alphabetically by High Risk Site, then by organism type, taxon and (field) sample number. C1 = cryptogenic species category 1. Species previously recorded from New Zealand whose identity as either native or non-indigenous is ambiguous. Also included in this category are newly described species that have exhibited invasive behaviour in New Zealand, but for which there are no known records outside the New Zealand region; Indeterminate = specimens that could not be reliably identified to species level. This group includes: (1) organisms that were damaged or juvenile and lacked morphological characteristics necessary for identification, and; (2) taxa for which there is not sufficient taxonomic or systematic information available to allow identification to species level; NIS = non-indigenous species. Species range extensions for the MHRSS programme are highlighted in blue and marked with an asterisk (*). Species that are New to New Zealand are highlighted in purple and marked with a double asterisk (**).

High Risk Site	Organism type	Taxon	Biosecurity status	Sample number	MITS code	Survey method
Lyttelton Harbour/Whakaraupō	Algae	<i>Grateloupia turuturu</i>	NIS	LYT23222	72016	Shore search
Lyttelton Harbour/Whakaraupō	Ascidian	<i>Polyzoa reticulata</i>	Native	LYT23185b	72036	Diver search
Lyttelton Harbour/Whakaraupō	Ascidian	<i>Pyura pulla</i>	Native	LYT23185b	72017	Diver search
Otago Harbour	Bryozoan	<i>Celleporina proximalis</i>	Native	DUD23009	72035	Benthic sled
Otago Harbour	Bryozoan	<i>Sertularella robusta</i>	Native	DUD23009	72037	Benthic sled
Otago Harbour	Nudibranch	<i>Aphelodoris luctuosa</i>	Native	DUD23009	72034	Benthic sled
Nelson Harbour	Algae	<i>Grateloupia cf. turuturu</i>	NIS	NSN23241	72050	Shore search
Nelson Harbour	Fish	<i>Trachelochismus</i> sp.	Native	NSN23099	72049	Benthic sled
Picton Harbour	Fish	<i>Gobiomorphus gobioides</i>	Native	PCN23125a	72061	Crab trap
Picton Harbour	Annelid	<i>Megalomma suspiciens</i>	Native	PCN23208a	72060	Diver search
Port Taranaki	Bivalve	<i>Linucula hartvigiana</i>	Native	NPL23071	72039	Benthic sled
Port Taranaki	Fish	<i>Chironemus maculosus</i>*	NIS	NPL23102	72038	Crab trap
Tauranga Harbour	Amphipod	<i>Caprella cf. penantis</i>**	NIS	TRG23229	72042	Shore search
Tauranga Harbour	Ascidian	<i>Botrylloides</i> sp.	Indeterminate	TRG23210	72041	Diver search
Tauranga Harbour	Ascidian	<i>Styela plicata</i>	C1	TRG23196	72040	Diver search
Wellington Harbour	Algae	<i>Galene meridionalis</i>	Native	WLG23188	72059	Diver search
Wellington Harbour	Algae	Gigartinaceae	Indeterminate	WLG23207	72058	Diver search
Wellington Harbour	Anthozoan	<i>Alcyonium</i> sp.	Native	WLG23185	72057	Diver search
Wellington Harbour	Ascidian	<i>Botrylloides leachii</i>	C1	WLG23239	72056	Shore search
Wellington Harbour	Ascidian	<i>Styela clava</i>	NIS	WLG23107a	72054	Crab trap
Wellington Harbour	Bivalve	<i>Bartschicoma edgari</i>	Native	WLG23090	72062	Benthic sled
Wellington Harbour	Echinoderm	<i>Allostichaster insignis</i>	Native	WLG23144a	72052	Crab trap
Wellington Harbour	Fish	<i>Pseudophycis breviuscula</i>	Native	WLG23116c	72053	Crab trap
Wellington Harbour	Other	Terrestrial plant material	Indeterminate	WLG23231	72055	Shore search

* MHRSS programme range extension

** New to New Zealand

Table 6: Specimens collected and sent to the Marine Invasives Taxonomic Service (MITS) for formal identification from each Marine High Risk Site Surveillance (MHRSS) programme High Risk Site during the Summer 2016–17 round of surveys.

Non-indigenous species are in bold type. Specimens are ordered alphabetically by High Risk Site, then by organism type, taxon and (field) sample number. C1 = cryptogenic species category 1. Species previously recorded from New Zealand whose identity as either native or non-indigenous is ambiguous. Also included in this category are newly described species that exhibited invasive behaviour in New Zealand, but for which there are no known records outside the New Zealand region; Indeterminate = specimens that could not be reliably identified to species level. This group includes: (1) organisms that were damaged or juvenile and lacked morphological characteristics necessary for identification, and; (2) taxa for which there is not sufficient taxonomic or systematic information available to allow identification to species level; NIS = non-indigenous species. Species range extensions for the MHRSS programme are highlighted in blue and marked with an asterisk (*). Species that are New to New Zealand are highlighted in purple and marked with a double asterisk (**).

High Risk Site	Organism type	Taxon	Biosecurity status	Sample number	MITS code	Survey method
Lyttelton Harbour/Whakaraupō	Bivalve	<i>Mytilus galloprovincialis</i>	Native	LYT24221	72072	Shore search
Nelson Harbour	Annelid	<i>Parasabella aberrans</i>	Native	NSN24221	73123	Shore search
Opuā Marina/Waikare Inlet	Ascidian	<i>Hypsistozoa fasmeriana</i>	Native	OPX24036	73545	Benthic sled
Otago Harbour	Ascidian	<i>Botryllus stewartensis</i>	Native	DUD24181b	72074	Diver search
Picton Harbour	Annelid	<i>Chaetopterus chaetopterus-B</i>	C1	PCN24026	73172	Benthic sled
Picton Harbour	Annelid	<i>Pista pegma</i>	Native	PCN24026	73170	Benthic sled
Port Taranaki	Fish	<i>Acanthoclinus fuscus</i>	Native	NPL24123	72073	Crab trap
Tauranga Harbour	Annelid	<i>Salmacina australis</i>	Native	TRG24192	72078	Diver search
Tauranga Harbour	Ascidian	<i>Aplidium phortax</i>	C1	TRG24195	72077	Diver search
Tauranga Harbour	Ascidian	<i>Asterocarpa humilis</i>	C1	TRG24185	72080	Diver search
Tauranga Harbour	Ascidian	<i>Botrylloides leachii</i>	C1	TRG24210	72081	Diver search
Tauranga Harbour	Ascidian	<i>Corella eumyota</i>	Native	TRG24198(1)	72082	Diver search
Tauranga Harbour	Ascidian	<i>Corella eumyota</i>	Native	TRG24198(2)	72076	Diver search
Tauranga Harbour	Ascidian	<i>Pyura rugata</i>	Native	TRG24198(1)	72075	Diver search
Tauranga Harbour	Sponge	Unidentifiable	Unknown	TRG24181	72079	Diver search
Waitemata Harbour	Algae	<i>Cladostephus spongiosus</i>	Native	AKL24106	73539	Benthic sled
Waitemata Harbour	Amphipod	<i>Apocorophium acutum</i>	NIS	AKL24ExtraDive1	73675	Diver search
Waitemata Harbour	Amphipod	<i>Caprella</i> cf. <i>equilibraria</i>	C1	AKL24ExtraDive1	73674	Diver search
Waitemata Harbour	Amphipod	<i>Caprella scauroides</i>**	NIS	AKL24ExtraDive1	73604	Diver search
Waitemata Harbour	Amphipod	<i>Jassa</i> cf. <i>marmorata</i>	C1	AKL24ExtraDive1	73676	Diver search
Waitemata Harbour	Ascidian	<i>Botrylloides leachii</i>	C1	AKL24391	73645	Diver search
Waitemata Harbour	Ascidian	<i>Symplegma brakenhielmi</i>	NIS	AKL24114	73541	Benthic sled
Waitemata Harbour	Ascidian	<i>Symplegma brakenhielmi</i>	NIS	AKL24114	73542	Benthic sled
Waitemata Harbour	Ascidian	<i>Synoicum haurakiensis</i>	Native	AKL24154	73543	Benthic sled
Waitemata Harbour	Crab	<i>Pilumnus novaezealandiae</i>	Native	AKL24107	73540	Benthic sled
Waitemata Harbour	Crab	<i>Pilumnus novaezealandiae</i>	Native	AKL24346	73544	Crab trap

High Risk Site	Organism type	Taxon	Biosecurity status	Sample number	MITS code	Survey method
Wellington Harbour	Algae	<i>Codium fragile</i>	Native	WLG24186	73141	Diver search
Wellington Harbour	Algae	<i>Polysiphonia strictissima</i>	Native	WLG24015	73142	Benthic sled
Wellington Harbour	Ascidian	<i>Clavelina lepadiformis</i>*	NIS	WLG24207	73129	Diver search
Wellington Harbour	Ascidian	<i>Pyura subuculata</i>	Native	WLG24207	73143	Diver search
Wellington Harbour	Bivalve	<i>Aulacomya maoriana</i>	Native	WLG24221	73126	Shore search
Wellington Harbour	Bivalve	<i>Corbula zelandica</i>	Native	WLG24001	73154	Benthic sled
Wellington Harbour	Bivalve	<i>Corbula zelandica</i>	Native	WLG24056	73155	Benthic sled
Wellington Harbour	Decapod	<i>Phylladiorhynchus pusillus</i>	Native	WLG24051	73153	Benthic sled
Wellington Harbour	Nudibranch	<i>Pleurobranchaea maculata</i>	Native	WLG24206	73127	Diver search
Whangarei Harbour	Anthozoan	<i>Actinothoe albocincta</i>	Native	WRE24205	73152	Diver search
Whangarei Harbour	Ascidian	<i>Botrylloides giganteum</i>	NIS	WRE24067	73146	Benthic sled
Whangarei Harbour	Ascidian	<i>Botrylloides giganteum</i>	NIS	WRE24197	73148	Diver search
Whangarei Harbour	Ascidian	<i>Cnemidocarpa nisetis</i>	Native	WRE24191	73524	Diver search
Whangarei Harbour	Ascidian	<i>Microcosmus squamiger</i>	C1	WRE24191	73145	Diver search
Whangarei Harbour	Ascidian	<i>Polyandrocarpa zorritensis</i>	NIS	WRE24209	73147	Diver search
Whangarei Harbour	Ascidian	<i>Styela plicata</i>	C1	WRE24191	73535	Diver search
Whangarei Harbour	Ascidian	<i>Symplegma brakenhielmi</i>	NIS	WRE24191	73523	Diver search
Whangarei Harbour	Ascidian	<i>Symplegma brakenhielmi</i>	NIS	WRE24209	73144	Diver search
Whangarei Harbour	Bivalve	<i>Corbula zelandica</i>	Native	WRE24068	73151	Benthic sled
Whangarei Harbour	Crab	<i>Metadromia wilsoni</i>	Native	WRE24081	73149	Benthic sled
Whangarei Harbour	Crab	<i>Metadromia wilsoni</i>	Native	WRE24097	73150	Diver search

* MHRSS programme range extension

** New to New Zealand

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 (within MHRSS programme records); and those that currently have a restricted distribution. The maps show locations where each species was recorded (as red dots) and also locations where it was absent (Appendix 4), 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* (benthic sled, crab trap, diver search); *Amathia verticillata* (benthic sled, diver search, shore search); *Apocorophium acutum* (diver search); *Arcuatula senhousia* (benthic sled, diver search); *Arenigobius bifrenatus* (benthic sled, crab trap, diver search); *Botrylloides giganteum* (benthic sled, diver search, shore search); *Caprella mutica* (diver search); *Caprella* cf. *penantis* (shore search); *Caprella scauroides* (diver search); *Charybdis* (*Charybdis*) *japonica* (benthic sled, crab trap, crab condo, diver search, shore search); *Chironemus*

maculosus (crab trap); *Ciona* spp.⁹ (benthic sled, diver search, shore search); *Clavelina lepadiformis* (benthic sled, diver search, shore search); *Eudistoma elongatum* (benthic sled, diver search, shore search); *Ectopleura* spp.¹⁰ (benthic sled, diver search, shore search); *Ficopomatus enigmaticus* (benthic sled, diver search, shore search); *Grateloupia turuturu* (benthic sled, diver search, shore search); *Limaria orientalis* (benthic sled); *Metapenaeus bennettiae* (benthic sled, crab condo, crab trap); *Polyandrocarpa zorritensis* (benthic sled, diver search, shore search); *Pyromaia tuberculata* (benthic sled, crab trap); *Tritia burchardi*¹¹ (benthic sled, crab trap, crab condo, diver search, shore search); *Sabella spallanzanii* (benthic sled, crab trap, diver search, shore search); *Styela clava* (benthic sled, crab trap, diver search, shore search); *Symplegma brakenhielmi* (benthic sled, diver search, shore search); *Theora lubrica* (benthic sled); and *Undaria pinnatifida* (benthic sled, crab trap, diver search, shore search). Records are shown for both the Winter 2016 and Summer 2016–17 survey rounds.

Secondary target non-indigenous species

Arcuatula senhousia

Arcuatula senhousia was recorded (predominantly in benthic sled tows) during both surveys of Waitemata and Whangarei harbours. Distributions within each High Risk Site were as follows:

- Waitemata: recorded off Kauri Point and in Henderson Creek channel during the winter survey, and off Kauri Point in the Whau River channel during the summer survey. Recorded at a total of two out of 429 (0.5%) sampling locations during the winter survey, and at two out of 491 (0.4%) sampling locations during the summer survey. This reflects a continued sparse distribution and abundance.
- Whangarei: recorded in the Hatea River channel, around Limestone Island and the Portland, Wellington and Tamaterau reaches, and in Marsden Cove Marina during both surveys. Recorded at a total of 15 out of 242 (6.2%) sampling locations during the winter survey, and at 10 out of 246 (4.1%) sampling locations during the summer survey. This reflects a similar distribution and abundance to other recent surveys, apart from the more limited distribution recorded in the Winter 2014 and Summer 2014–15 survey rounds, when there were no detections in the lower harbour or Marsden Cove Marina.

Eudistoma elongatum

Eudistoma elongatum was recorded (predominantly during diver and shore searches) during both surveys of Opua Marina/Waikare Inlet and Whangarei Harbour. Distributions within each High Risk Site were as follows:

- Opua: recorded at Okiato Point, Opua Wharf and in and around the Opua Marina during both surveys, but more widespread during the summer survey with detections at Kaiaraara and Toretore islands, near the Paihia jetties and at Te Waihapu Point. Recorded at a total of 11 out of 249 (4.4%) sampling locations during the winter survey, and at 35 out of 249 (14.1%) sampling locations during the summer survey. This reflects a similar distribution and abundance to other recent surveys.
- Whangarei: recorded near Kaiwaka Point during both surveys, and Portland Wharf, Limestone Island and Wellington Reach during the summer survey. Recorded at a total of five out of 242 (2.1%) sampling locations during the winter survey, and at 18

⁹ Includes *Ciona intestinalis* and *C. savignyi*. Both are NIS that have been recorded previously in New Zealand. There are no native *Ciona* spp. in New Zealand. Further differentiation as to the extent of the presence of both NIS at MHRSS High Risk Sites is required.

¹⁰ Includes *Ectopleura crocea* and *E. larynx*. Both are NIS that have been recorded previously in New Zealand. There are native *Ectopleura* spp. in New Zealand, but their polyp colouration is markedly different, allowing *E. crocea* and *E. larynx* to be differentiated from the natives. Further differentiation as to the extent of the presence of both NIS at MHRSS High Risk Sites is required.

¹¹ Formerly referred to as *Nassarius burchardi*.

out of 246 (7.3%) sampling locations during the summer survey. This reflects a slightly expanded distribution compared to earlier surveys, but similar to the last winter and summer survey rounds (2015–16).

Sabella spallanzanii

Sabella spallanzanii was recorded (predominantly during diver and shore searches) during both surveys of Waitemata and Whangarei harbours, the winter surveys of Lyttelton and Picton harbours, and the summer surveys of Nelson and Tauranga harbours. Distributions within each High Risk Site were as follows:

- Lyttelton: recorded at the No. 1 Breastworks as a single specimen. Recorded at a total of one site out of 244 (0.4%) sampling locations. This reflects a continued sparse distribution and abundance after a delimitation and removal programme commissioned by MPI for this species in 2008–09 following its detection here as a New to New Zealand NIS during the Lyttelton Summer 2008 MHRSS programme survey.
- Nelson: recorded on pontoons in the Nelson Marina. Recorded at a total of three out of 245 (1.2%) sampling locations. This reflects a continued sparse distribution and abundance in the marina.
- Picton: recorded on a pontoon at the water taxi berth in the Picton Marina as a single specimen. This reflects a continued sparse distribution and abundance at this site's marinas. This species has been subject to delimitation and removal surveys by Marlborough District Council and the Top of the South Biosecurity Partnership.
- Tauranga: recorded at the swing moorings near Mount Maunganui. Recorded at a total of one out of 246 (0.4%) sampling locations during the summer survey. This reflects a similar sparse distribution and abundance to other recent surveys. This species is subject to ongoing delimitation and removal surveys by Bay of Plenty Regional Council.
- Waitemata: recorded in the main channels in the upper and lower harbour, West Park, Bayswater, Westhaven and Orakei marinas, Viaduct and Hobson West Marina, Port of Auckland, Devonport Naval Base and Whakatakataka Bay. Recorded at a total of 60 out of 429 (14.0%) sampling locations during the winter survey, and at 190 out of 491 (38.7%) sampling locations during the summer survey. This reflects a similar distribution and abundance for the winter survey to other recent surveys, but the summer survey's distribution appears increased.
- Whangarei: recorded at Kissing Point Marina, Port Nikau and Marsden Cove Marina during both surveys, and near Limestone Island, Parua Bay, Shell Cut Reach and Marsden Point during the summer survey. Recorded at a total of eight out of 242 (3.3%) sampling locations during the winter survey, and at 40 out of 246 (16.3%) sampling locations during the summer survey. This reflects a similar distribution and abundance to other recent surveys.

Styela clava

Styela clava was recorded (predominantly during diver and shore searches) during both surveys of Lyttelton, Nelson, Otago, Picton, Tauranga, Waitemata and Whangarei harbours, Opuia Marina/Waikare Inlet, and during the winter survey of Wellington Harbour. Several instances of *S. clava* being recorded from crab traps attached to masking crabs (*Notomithrax* spp.) were noted. Distributions within each High Risk Site were as follows:

- Lyttelton: recorded throughout the Port of Lyttelton, at Cashin Quay, and Magazine Bay Marina during both surveys, Governors Bay during the winter survey, and Quail Island, Charteris Bay and Diamond Harbour during the summer survey. Recorded at a total of 42 out of 244 (17.2%) sampling locations during the winter survey, and at 48

out of 242 (19.8%) sampling locations during the summer survey. This reflects a similar abundance to other recent surveys, but increased distribution.

- Nelson: recorded around Haulashore Island, throughout Port Nelson, the Slipway Basin, Nelson Marina and the Haven during both surveys. During both surveys, two locations involved *S. clava* attached to masking crabs (*Notomithrax* sp.) caught in crab traps. Recorded at a total of 57 out of 243 (23.5%) sampling locations during the winter survey, and at 40 out of 245 (16.3%) sampling locations during the summer survey. This reflects an increasing distribution and abundance relative to other recent surveys.
- Opuā: recorded throughout the Opuā Marina, at the Opuā Wharf, Ōkiato Point, Russell and Kaiaraa Island during both surveys, near Hermione Rock and at Toretore Island during the winter survey, and Paihia during the summer survey. Recorded at a total of 39 out of 249 (15.7%) sampling locations during the winter survey, and at 32 out of 249 (12.9%) sampling locations during the summer survey. This reflects a similar distribution and abundance to other recent surveys.
- Otago: recorded throughout Port Otago from the Town Basin up to the Leith Marina during both surveys, to the east of the Victoria Channel training wall and at Carey's Bay near Port Chalmers during the summer survey. Recorded at a total of 31 out of 244 (12.7%) sampling locations during the winter survey, and at 34 out of 248 (13.7%) sampling locations during the summer survey. This reflects an increasing distribution and abundance compared to other recent surveys, and the first time that *S. clava* has been detected in the lower harbour (Carey's Bay).
- Picton: recorded in the Waikawa Marina during the winter survey, and Shakespeare Bay, Picton Port and Picton Marina during the summer survey. Recorded at a total of one out of 244 (0.4%) sampling locations during the winter survey, and 10 out of 244 (4.1%) sampling locations during the summer survey. During the summer survey, eight of the 10 sampling locations involved *S. clava* attached to masking crabs (*Notomithrax* sp.) caught in crab traps. This reflects a similar distribution and abundance to other recent surveys following its first detection here as a range extension in the Winter 2014 survey, and a subsequent delimitation and removal survey in June 2014 commissioned by Marlborough District Council and MPI.
- Tauranga: recorded in the Port of Tauranga during both surveys. Recorded at a total of one out of 246 (0.4%) sampling locations during the winter survey, and at eight out of 246 (3.3%) sampling locations during the summer survey. This reflects a similar sparse distribution and abundance to other recent surveys. This species is subject to ongoing delimitation and removal surveys by Bay of Plenty Regional Council.
- Wellington: recorded attached to a masking crab (*Notomithrax* sp.) caught in a crab trap in Seaview Marina. Recorded at a total of one out of 239 (0.4%) sampling locations during the winter survey. This reflects the sporadic detection of this species in the harbour since its first detection here in 2013.
- Waitemata: recorded in Bayswater, Westhaven and Orakei marinas, Viaduct and Hobson West Marina, Port of Auckland, Devonport Naval Base and Whakatakataka Bay during both surveys, and the channel between the Harbour Bridge and Kauri Point and main lower harbour channel during the summer survey. Recorded at a total of nine out of 429 (2.1%) sampling locations during the winter survey, and at 93 out of 491 (32.0%) sampling locations during the summer survey. This reflects a similar distribution and abundance to other recent surveys.
- Whangarei: recorded in Marsden Cove Marina during both surveys, and Kissing Point Marina, Port Nikau, Parua Bay and Marsden Point during the summer survey. Recorded at a total of 12 out of 242 (5.0%) sampling locations during the winter survey, and at 22 out of 246 (8.9%) sampling locations during the summer survey. This reflects a similar distribution and abundance to other recent surveys.

Non-target, non-indigenous species

Acentrogobius pflaumii

Recorded in the Waitemata Harbour during both surveys, and Whangarei Harbour during the summer survey.

- Waitemata: Port of Auckland; and near Soldiers Bay.
- Whangarei: Port Nikau.

Amathia verticillata

Recorded in Waitemata and Whangarei harbours during both surveys, and Nelson Harbour, Opuā Marina/Waikare Inlet and Tauranga Harbour during the summer survey.

- Nelson: Port Nelson; and Nelson Marina.
- Opuā: Kaiaraa Island; Motuarahi Island; Toretore Island; Te Waihapu Point; Okiato Point; Tapu Point; Opuā Wharf; and Opuā Marina.
- Tauranga: Tauranga Marina.
- Waitemata: Bayswater Marina; Westhaven Marina; Orakei Marina; Viaduct and Hobson West Marina; and Port of Auckland.
- Whangarei: Town Basin; Parua Bay; Munro Bay; and Marsden Cove Marina.

Apocorophium acutum

Recorded in the Waitemata Harbour during the summer survey at Okahu Bay from a swing mooring.

Arenigobius bifrenatus

Recorded in the Waitemata Harbour during the winter survey, and Whangarei Harbour during the summer survey.

- Waitemata: Viaduct and Hobson West Marina.
- Whangarei: Town Basin; Marsden Cove Marina; and Marsden Point.

Botrylloides giganteum

Recorded in Waitemata and Whangarei harbours during both surveys, and Tauranga Harbour during the summer survey.

- Tauranga: Tauranga Bridge Marina.
- Waitemata: near Soldiers Bay; Viaduct and Hobson West Marina; and Port of Auckland.
- Whangarei: McLeod Bay; Marsden Cove Marina; and Marsden Point.

Caprella mutica

Recorded in Bluff Harbour during the winter survey on a moored yacht in the channel to the south of Green Point.

Caprella cf. penantis

Recorded in Tauranga Harbour during the winter survey on swing moorings near Mount Maunganui. This represents a **New to New Zealand** detection for this caprellid. Large numbers of this caprellid were observed on the swing moorings, and all life stages were present, with ovigerous females. This NIS can be regarded as being established in Tauranga Harbour.

C. penantis has historically been considered a cosmopolitan species, and is one of the most challenging caprellids to identify taxonomically because of marked intraspecific morphological variation. It has been recorded under several specific or sub-specific names

from temperate and tropical regions worldwide and further morphological and molecular studies are required to evaluate the respective status of this species around the world. The type locality for *C. penantis* is the Devonshire Coast, England. Its known distribution includes: Atlantic Ocean; Australia; Bay of Biscay; Bay of Fundy; Brazil; Caribbean Sea; Colombia; English Channel; France; Gulf of Mexico; Gulf of Saint Lawrence; Indian Ocean; Ireland; Japan Sea; Mediterranean Sea; Mexico; North Atlantic Ocean; Norway; Pacific Ocean; South Africa; Southern Ocean; Spain; Portugal; United Kingdom; United States; Venezuela; and Yellow Sea (Cabezas et al 2013). NIWA taxonomists are currently working on elucidating the taxonomic identity of the Tauranga Harbour detection.

Caprella scauroides

Recorded in the Waitemata Harbour during the summer survey in Okahu Bay from a swing mooring. This represents a **New to New Zealand** detection for this caprellid. All life stages were present, with ovigerous females. Separate samples of this species were also collected for a MPI response investigation from resident vessels being cleaned at The Landing haul-out facility in Okahu Bay (MITS sample 73603), also with large numbers of all life stages present. Several specimens were also observed on the spaghetti bryozoan *A. verticillata* as vessel biofouling in the Westhaven Marina. This NIS can be regarded as being established in the Waitemata Harbour.

A closely related species, *C. californica* (one specimen) was detected on a visiting vessel in Nelson Harbour as biofouling in 2005, but this species is not regarded as being established in New Zealand. *C. scauroides* has been recorded (as *C. californica*) from all around Japan, Korea, Yellow Sea, Cairns (Queensland, Australia), Sydney (New South Wales, Australia), Hobsons Bay (Victoria, Australia) and Cockburn Sound (Western Australia, Australia), with confirmed *C. scauroides* recorded in Japan and Hong Kong (Takeuchi and Oyamada 2012). Recent molecular work has verified that *C. scauroides* is a monophyletic, distinct species. NIWA taxonomists are currently working on elucidating the taxonomic identity of the Waitemata Harbour detection.

Charybdis (Charybdis) japonica

Recorded in Waitemata and Whangarei harbours during both surveys, and Opua Marina/Waikare Inlet during the winter survey.

- Opua: near Hermione Rock.
- Waitemata: channels in the upper lower harbour, including far up the harbour in Paremoremo and Lucas creeks; Westpark Marina; Bayswater Marina; Westhaven Marina; Orakei Marina; Port of Auckland; and Devonport Naval Base. No native paddle crabs (*Ovalipes catharus*) were captured during either survey.
- Whangarei: Kissing Point Marina; Port Nikau; near Limestone Island; Mangapai River; Shell Cut Reach; near Motukioire Island; Reserve Point; Munro Bay; and Marsden Cove Marina.

Chironemus maculosus

Recorded in Port Taranaki during the winter survey near the Reclamation Jetty. This species of cryptic kelpfish, known as Silverspot and normally confined to southern Australia, is typically associated with reefs/algae 1–10 m in depth, and grows up to 33 cm total length. This represents a MHRSS programme **range extension**. It has been recorded previously from New Zealand in Cook Strait.

Ciona spp.

Recorded in Lyttelton, Picton and Whangarei harbours during both surveys, Nelson Harbour during the winter survey, and Tauranga, Waitemata and Wellington harbours during the summer survey.

- Lyttelton: Magazine Bay Marina; Port of Lyttelton; Cashin Quay; and Diamond Harbour.
- Nelson: Nelson Marina.
- Picton: Havelock Marina; and Picton Marina.
- Tauranga: Tauranga Marina.
- Waitemata: Westhaven Marina; and Viaduct and Hobson West Marina.
- Wellington: Seaview Marina.
- Whangarei: Port Nikau; and Marsden Cove Marina.

Clavelina lepadiformis

Recorded in Nelson and Picton harbours during both surveys, and Wellington Harbour during the winter survey. This represents a MHRSS programme **range extension** into Wellington Harbour (previously recorded from Nelson and Picton harbours).

- Nelson: Nelson Marina.
- Picton: Picton Marina.
- Wellington: Seaview Marina.

Ectopleura spp.

Recorded in Opuā Marina/Waikare Inlet, Tauranga, Waitemata and Whangarei harbours during both surveys.

- Opuā: Ti and Tapu points; Opuā Wharf; and Opuā Marina.
- Tauranga: Sulphur Point; Port of Tauranga; and Tauranga Bridge Marina.
- Waitemata: Harrier Point; Kauri Point; and Devonport Naval Base.
- Whangarei: Town Basin; Port Nikau; and Marsden Cove Marina.

Ficopomatus enigmaticus

Recorded in Whangarei Harbour during both surveys in the Town Basin.

Grateloupia turuturu

Recorded in Lyttelton Harbour and Port Taranaki during the winter surveys.

- Lyttelton: Magazine Bay Marina.
- Port Taranaki: inside the Lee Breakwater.

Limaria orientalis

Recorded in the Waitemata Harbour during both surveys in the main channel in the upper and middle harbour, Port of Auckland and Orakei Marina.

Metapenaeus bennettiae

Recorded in the Waitemata Harbour during both surveys, and Whangarei Harbour during the summer survey.

- Waitemata: Henderson Creek; the upper harbour; Port of Auckland; Whakatakataka Bay; and Okahu Bay.
- Whangarei: Town Basin; Port Nikau; Portland Reach; Marsden Cove Marina; and Marsden Point.

Polyandrocarpa zorritensis

Recorded in Whangarei Harbour during the summer survey at Port Nikau.

Pyromaia tuberculata

Recorded in Opuā Marina/Waikare Inlet, Waitemata and Whangarei harbours during both surveys.

- Opuā: near Hermione Rock; Kororareka Bay; and Veronica Channel near the Opuā Wharf.
- Waitemata: main channels of the upper and lower harbour; Port of Auckland; and Devonport Naval Base.
- Whangarei: Portland Wharf; near Limestone Island; Shell Cut Reach; and Marsden Point.

Symplegma brakenhielmi

Recorded in Waitemata and Whangarei harbours during the summer survey.

- Waitemata: main channels in the upper and lower harbour; Westhaven Marina; Bayswater Marina; Orakei Marina; Viaduct and Hobson West Marina; Port of Auckland; and Devonport Naval Base. This species has rapidly expanded its distribution throughout the harbour since it was first detected in early 2016.
- Whangarei: Port Nikau. This species was detected here (Marsden Cove Marina) as a New to New Zealand species in 2015.

Theora lubrica

Recorded in Lyttelton, Nelson, Picton, Waitemata, Wellington and Whangarei harbours, and Opuā Marina/Waikare Inlet during both surveys in soft, muddy sediments using benthic sleds, in Tauranga Harbour during the winter survey, and Port Taranaki during the summer survey.

- Lyttelton: north-western region of upper harbour from Governors Bay to Cashin Quay breakwall; Magazine Bay; and Port of Lyttelton.
- Nelson: inside the Boulder Bank; Port Nelson; and Nelson Marina.
- Opuā: Te Ti Bay; around Hermione Rock; Kororareka Bay; Veronica Channel; and Opuā Marina.
- Picton: Havelock Marina and immediate channel; Shakespeare Bay; Port of Picton; Picton Marina; Waikawa Marina; and Waikawa Bay.
- Port Taranaki: middle of port area; and commercial berths (Moturoa and Blyde wharves, and Newton King Tanker Terminal).
- Tauranga: Tauranga Marina; Port of Tauranga; and channel south of the Hewletts Road bridge.
- Waitemata: upper harbour; West Park Marina; Whau River channel; Bayswater Marina; Westhaven Marina; Viaduct and Hobson West Marina; Port of Auckland; Orakei Marina; and Whakatakataka Bay.
- Wellington: Lambton Harbour; the port and from Kaiwharawhara past Ngauranga; Seaview Marina; Seaview Wharf/Terminal; and Evans Bay.
- Whangarei: Town Basin; Port Nikau; Portland Reach; Parua Bay; and Marsden Cove Marina.

Tritia burchardi

Recorded in Waitemata and Whangarei harbours during both surveys, and Opuā Marina/Waikare Inlet during the summer survey.

- Opuā: near Hermione Rock.

- Waitemata: main channels in the upper and lower harbour; Westhaven Marina; Bayswater Marina; Orakei Marina; Viaduct and Hobson West Marina; Port of Auckland; and Devonport Naval Base.
- Whangarei: Town Basin; Port Nikau; Portland Reach, near Limestone Island; McLeod Bay; and Urquharts Bay.

Undaria pinnatifida

Recorded in Bluff, Lyttelton, Nelson, Otago, Picton, Port Taranaki, Tauranga, Waitemata and Wellington harbours during both surveys.

- Bluff: western side of the harbour up past Tikore Island; main channel; Island Harbour; Fishing Boat Wharves; Town Wharf; and Tiwai Wharf.
- Lyttelton: north-western region of upper harbour from Governors Bay to Cashin Quay breakwall; Magazine Bay; Port of Lyttelton; Breeze Bay and Mechanics Bay; Charteris Bay; Diamond Harbour; Purau Bay; and Pile Bay.
- Nelson: Main Wharf; inside the Boulder Bank; Port Nelson; and Nelson Marina.
- Otago: recorded throughout upper and lower harbour; Port Otago; Leith Marina; Port Chalmers; Careys Bay; Portobello Bay, Omate Beach; and Rauore Beach.
- Picton: Shakespeare Bay; Port of Picton; Picton Marina; and Waikawa Marina.
- Port Taranaki: port area; commercial berths (Moturoa and Blyde wharves, and Newton King Tanker Terminal); reclamation; and inside the Lee Breakwater.
- Tauranga: Tauranga Marina; swing moorings near Maunganui; Port Tauranga; and Tauranga Bridge Marina.
- Waitemata: Harrier Point; Birkenhead Wharf; Bayswater Marina; Westhaven Marina; Viaduct and Hobson West Marina; Whakatakataka Bay; Orakei Marina; and North Head.
- Wellington: throughout the south-western margin of the harbour from Kaiwharawhara to Point Jerningham; Evans Bay; Miramar Peninsula from Burnham Wharf to Scorching Bay; Seaview Marina; and Seaview Wharf/Terminal.

Discussion

The Winter 2016 and Summer 2016–17 rounds of MHRSS programme surveys generally achieved the overall target numbers of sampling locations at the 11 High Risk Sites. The presence of a large leopard seal resident in the Waitemata Harbour represented a significant hazard to divers, and meant that the diver search component of the winter survey at this High Risk Site could not be safely conducted.

No primary target species were detected during the surveys, but the four secondary target species were all recorded: *Arcuatula senhousia* (Waitemata and Whangarei); *Eudistoma elongatum* (Opuia and Whangarei); *Sabella spallanzanii* (Lyttelton, Nelson, Picton, Tauranga, Waitemata and Whangarei); and *Styela clava* (Lyttelton, Nelson, Opuia, Otago, Picton, Tauranga, Waitemata, Wellington and Whangarei). These target species have been recorded at the respective High Risk Sites during previous surveys. Seventy-one specimens were collected and sent to MITS for formal identification from both surveys combined (24 from the winter survey and 47 from the summer survey); 15 of these specimens were NIS.

Non-target, non-indigenous species of note recorded during the surveys included the following: *Acentrogobius pflaumii*; *Amathia verticillata*; *Apocorophium acutum*; *Arenigobius bifrenatus*; *Botrylloides giganteum*; *Caprella mutica*; *C. cf. penantis* (**New to New Zealand**, detected in Tauranga Harbour); *C. scauroides* (**New to New Zealand**, detected in Waitemata Harbour); *Charybdis (Charybdis) japonica*; *Chironemus maculosus* (MHRSS programme **range extension**, detected in Port Taranaki); *Clavelina lepadiformis* (MHRSS programme **range extension**, detected in Wellington Harbour); *Ficopomatus enigmaticus*; *Grateloupia turuturu*; *Limaria orientalis*; *Metapenaeus bennettiae*; *Polyandrocarpa zorritensis*; *Pyromaia tuberculata*; *Symplegma brakenhielmi*; *Theora lubrica*; *Tritia burchardi* and *Undaria pinnatifida*.

All *S. spallanzanii* found in Lyttelton, Nelson, Picton and Tauranga harbours were enclosed in zip-lock bags in situ, removed and disposed of to landfill. All *S. clava* found in Picton, Tauranga and Wellington harbours were also collected, and either preserved and sent to MITS for formal identification, or disposed of to landfill. Increasing proliferation of *S. clava* in Nelson and Otago harbours meant that collection and disposal at these High Risk Sites was not undertaken during this round (as in the Summer 2014–15 surveys).

Recommendations

- Survey sampling techniques as currently employed in the MHRSS programme still reflect international best practice for effective detection of the MHRSS programme primary and secondary target species and the results indicate that they are effective at detecting actual and suspect NIS. However, continued evaluation as to their effectiveness in relation to any alternative/emergent detection tools/techniques is advised (see item on genetic probes in the following Innovations/efficiencies section).
- The distribution of sampling effort in Opuia, as proposed in the revised design report (Morrissey et al, 2012a) and based on stochastic scenario tree modelling (Morrissey et al, 2012b), will continue to be used in future rounds of Opuia surveys. Stochastic scenario trees were also developed for all other MHRSS programme High Risk Sites (Morrissey et al, 2012b) to estimate the detection sensitivity of different strategies for allocating samples, and to explore the optimisation of sample allocation for individual target species and estimate current levels of sensitivity. This optimisation approach may be applied to other High Risk Sites in the future, pending decisions on potential

review of target sites and species by MPI, and will be explored via further discussion with MPI.

Innovations/efficiencies

In 2016–17, NIWA invested in developing the following innovations to help improve surveillance for marine NIS:

- NIWA invested \$50 k of its Strategic Science Investment Fund (SSIF) to develop sediment and habitat maps from environmental point observations made during the MHRSS programme. Habitat and sediment maps (and estimates of uncertainty) have been generated for all 11 MHRSS High Risk Sites. The maps may be used to refine the survey design for primary target species, but will also provide an important resource for regional councils and other estuarine management.
- NIWA invested in a 3-year PhD scholarship (\$25k p.a. + additional operational funding) to support research into the use of settlement plates and next generation sequencing for marine surveillance. The aim of this research is to develop high-throughput tools that will allow faster, more cost-efficient use of this method of detection. The PhD candidate is now approximately halfway through her research.
- NIWA invested in the re-development of a quantitative real-time polymerase chain reaction (qPCR) probe for *Sabella spallanzanii*. The probe was developed by the Cawthron Institute and is currently being evaluated for sensitivity to *S. spallanzanii* and specificity in a collaborative project between NIWA and the Cawthron Institute. Redesign of the qPCR probe was necessary as an earlier probe developed by the South Australian Research and Development Institute (SARDI) cross-reacted with native New Zealand sabellid worms. There is potential for the improved probe to be incorporated into future sampling within the MHRSS programme for a range of target species. Initial sampling trials were undertaken in close timing with the Summer 2016–17 surveys of Nelson and Waitemata harbours. Other genetic probes have also been developed (e.g., for *A. amurensis*, *P. amurensis* and *A. senhousia*). Further sampling trials will be conducted at other High Risk Sites over the coming winter and summer surveys.

During the MHRSS programme, there have been practical challenges to using ruggedized computers/tablets on small boats with saltwater spray/rain, without hindering survey operational efficiency. These challenges have impeded the reliable uptake to electronic data capture in MHRSS surveys. Several ruggedized computers/tablets have been trialled and found wanting/problematic. Recent developments in software for Android® tablets have led to the possibility of using low cost tablets in ruggedized cases with mobile network capabilities for GIS and data security. A new low-cost tablet was trialled in the Summer 2016–17 survey round, which has proven promising. Further development of electronic data capture specific to the MHRSS programme will occur over the coming winter and summer surveys, with the aim of using it across all High Risk Sites.

Other

Problems encountered during sampling

Winter 2016 surveys

The presence of a large leopard seal in the Waitemata Harbour presented a significant health and safety issue for the NIWA survey dive team, and they were advised by NIWA's National Diving Safety Officer and Diving Control Board not to undertake any diving operations

within the harbour whilst the leopard seal (which marina operators advised at the time was aggressive) was present throughout the harbour and hauling-out on marina pontoons until any associated risk could be quantified. MPI was informed at the time as to our inability to undertake the survey diving component. Second only to the killer whale (orca) among Antarctica's top predators, leopard seals live primarily in cold Antarctic and sub-Antarctic waters, where they are known to prey on seals, penguins and fish, but leopard seals are known to also be aggressive to humans, with one fatality recorded. The Department of Conservation (DOC) posted warning notices within the marina and the MHRSS team maintained regular contact with the DOC to discuss their management options for the leopard seal (non-intervention unless there was significant cause to act (e.g., actual harm to a person)), as well as marina operators monitoring the presence of the leopard seal, in the interim until the following summer survey.

Strong winds and large swells during the Port Taranaki survey required pre-allocated diver search locations to be relocated from the inner side of the Main Breakwater to the inner side of the more sheltered Lee Breakwater. A number of crab trap and diver search sample locations pre-allocated to the main port shipping berths had to be relocated to nearby appropriate sites due to vessel occupation and where steel debris (scaffolding) had reportedly fallen from the wharf, presenting an entanglement hazard.

Stormy weather delayed the Wellington survey, with all boating activity having to be cancelled over several days. Consequently, survey activity extended over a period of two weeks instead of the usual one week. Boating/staff resource conflicts in the following weeks with other contracted NIWA activities meant that four benthic sled tows were unable to be completed.

Logging ships present in Port Chalmers limited access to the Beach Street Berth for the duration of the Otago Harbour survey. Consequently, crab trap and diver search sampling locations pre-allocated to this area were relocated to nearby appropriate areas.

Summer 2016–17 surveys

The continued presence of a leopard seal in the Waitemata Harbour delayed diving operations during the scheduled summer survey in March. Diving operations were deferred until late May (with agreement from MPI) once the departure of the leopard seal (which had moved northwards to Whangarei Harbour) was confirmed.

During the Port Taranaki summer survey, several crab trap and diver search sample locations pre-allocated to the main port shipping berths had to be relocated to nearby appropriate sites due to vessel occupation and the continued presence of steel debris (scaffolding) that had reportedly fallen from the wharf, presenting an entanglement hazard.

Earthquake damage to the CentrePort commercial port area prevented access to the Thorndon Container Wharf area during the Wellington Harbour survey, but the survey team were granted access to the exclusion zone along the Aotea Wharf 200 m north of the northernmost container crane. Boating/staff resource conflicts with other booked NIWA activities meant that survey operations extended over several weeks.

The magnitude 7.8 Kaikōura earthquake delayed the start of the boating component to the Lyttelton Harbour summer survey due to tsunami and aftershock threats. A decision was made at the time to postpone the diving component of the survey (most which is around and under wharf structures) to a later date when tsunami/aftershock threats had subsided. A combination of strong winds and gear malfunctions extended the non-diving survey activity

over a period of two weeks. The diver search component of the Lyttelton Harbour summer survey was completed on 12–13 December, 2016. Strong winds and vessel activity necessitated some relocation of pre-allocated crab trap and diver search sampling locations.

Lyttelton Port Company Ltd (LPC) have advised that three major wharf structures in the Port of Lyttelton (Wharves No. 4 and 5, and Gladstone Pier) are off-limits to all operations (this includes MHRSS programme crab trapping and diver search sampling) and have a 5-m exclusion zone surrounding them (see Figure 2). These structures are derelict and suffered major damage during the 2010–11 Christchurch earthquakes. NIWA was advised of the off-limit status to these structures by LPC on 17/11/2016.

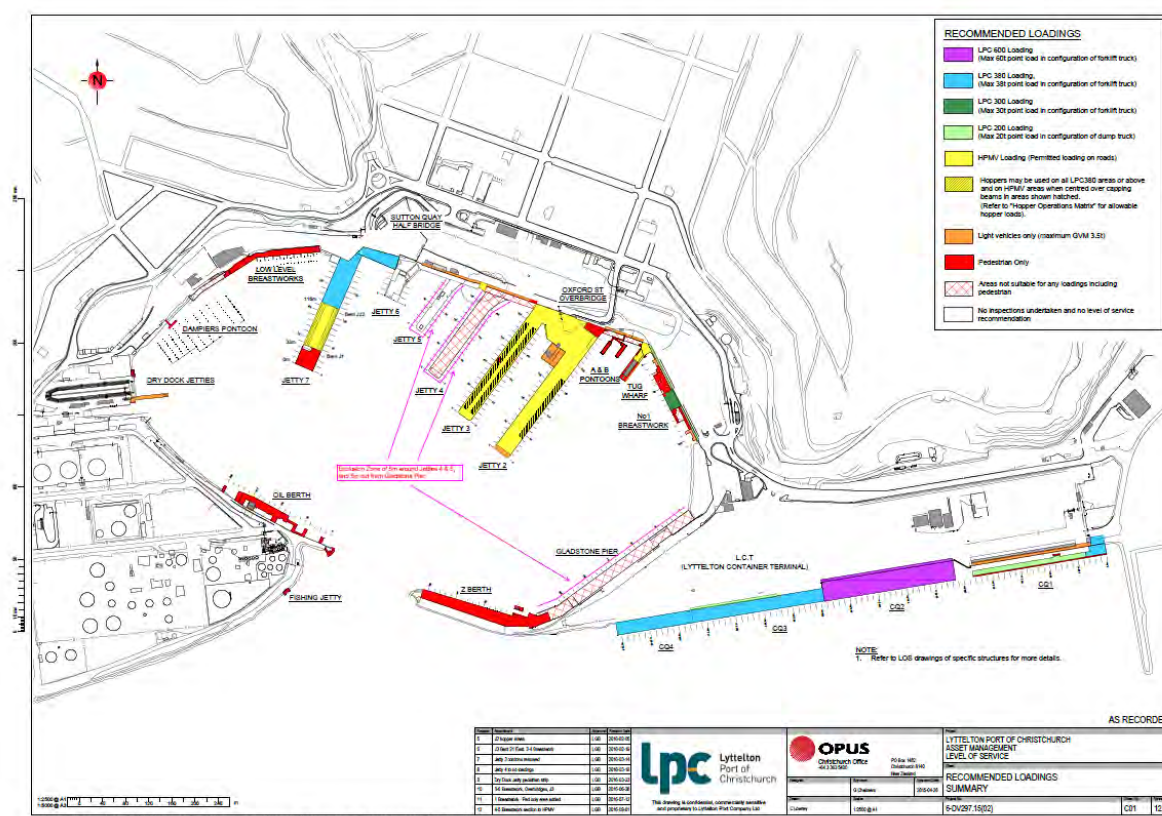


Figure 2: Detail of the Port of Lyttelton wharf structures. Wharves No. 4 and 5, and Gladstone Pier exclusion zones are indicated in pink outline.

Dredging activities taking place in the Port Chalmers basin during the Otago Harbour summer survey, along with the presence of a cruise ship, logging ship and container vessels berthed in the basin during the week necessitated the relocation of pre-allocated crab trap and diver search sampling locations in this port to nearby appropriate locations. Strong winds limited boating activity in the first two survey days, and delayed trapping operations by a day. Following fine weather facilitated the successful completion of survey activities.

Difficulties encountered in meeting minimum monitoring requirements

Except for the leopard seal issue in the Waitemata Harbour surveys, any difficulties encountered were successfully managed, allowing us to meet MHRSS programme minimum monitoring requirements (see above comments).

Problems encountered in reporting surveillance results

None.

Management actions taken to reduce problems encountered

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

The working solution to sampling within the marine farming area to the north of Tikore Island in Bluff Harbour is to be maintained with the farm owner's consent and the following modifications to sample design; no trapping or sledging will be conducted in the farm lease area, but diver searches will be allocated there to search the submerged farm structures.

Regarding the leopard seal issue, a specific Standard Operating Procedure (SOP) has been developed, and approved for implementation by the NIWA Diving Control Board (DCB), for deploying divers and field staff (i.e., during shore searches) at sites where leopard seals have been detected. NIWA will continue to liaise with DOC and port/marina companies as to the whereabouts of any leopard seals prior to surveys taking place. The spatial and temporal distribution of leopard seals in New Zealand waters is to be investigated for the first time in a new NIWA project based on records from a DOC database and the published literature, with a view to identifying possible causes for transient leopard seals appearing in New Zealand waters. The research will expand NIWA research on Antarctic marine mammals and aligns with a new NIWA strategic research direction that is focused on assessing marine mammal distribution and movements in New Zealand waters. The project will also serve as a pilot study to potentially leverage funding for passive acoustic monitoring of leopard seals around New Zealand by NIWA. Furthermore, on the back of concerns over the threats posed by leopard seals, we are currently formalising a SOP for diving activities in the presence of sea lions; a lesser threat compared to leopard seals, but still a significant hazard to divers at some southern High Risk Sites.

As identified earlier, isolated instances of theft/removal of unattended sampling gear does occur. To discourage theft and/or people inspecting/moving our crab (box) traps and condos, we have commissioned rugged waterproof tags that are now attached to survey sampling gear that is left unattended. These tags identify NIWA as the agency responsible for the gear, and specify penalties under the Biosecurity Act 1993 for interfering with the sampling gear.

Management actions taken to address foreseeable problems

The Health and Safety at Work Act 2015 (HSWA) has seen significant changes to Health & Safety policies/practices at some commercial port areas at High Risk Sites. Whilst this has not yet prevented NIWA conducting MHRSS programme surveys, it has increased stakeholder liaison workload, need for proof of NIWA safe working practices and requirement for site induction processes. Proactive and timely liaison with pertinent stakeholders (by both NIWA and MPI) regarding the implementation of the MHRSS programme surveys will be an ongoing requirement. During the Winter 2016 Port Taranaki survey (25–29 July), the NIWA field team leader was informed by the Port Taranaki Permit Systems Coordinator that for future surveys, at least one member of the field team would have to have undergone NZQA-training to be a qualified Permit to Work Receiver (PWR, New Zealand Qualifications Authority Unit Standard 17588) in order to be able to apply for, understand, and hold a daily Work Permit for NIWA to operate in the port. We have currently negotiated an 'Access Permit' arrangement with Port Taranaki in the interim. As this Work Permit issue cuts across all commercial New Zealand ports, we are being proactive and all NIWA MHRSS field team leaders (FTLs) are to undertake PWR training to ensure continued port access; seven NIWA FTLs have undertaken PWR training to date.

MHRSS programme survey operations entail an inherent biosecurity risk, whereby non-indigenous/unwanted organisms could potentially be spread within, and between High Risk locations associated with our small boats, vehicles and sampling gear. Thus, a biosecurity Standard Operating Procedure (SOP) specific to the MHRSS programme has been developed that details survey 'decontamination' procedures for NIWA small boats, vehicles and sampling gear to manage any associated biosecurity risk associated with survey activities within, and between MHRSS High Risk Sites. This Biosecurity SOP has been provided to all NIWA FTLs and to MPI. The SOP is a 'living' document that is to be revised as applicable.

MPI has provided NIWA with an exemption under Biosecurity Act 1993, sections 52 and 53, relating to the ability to move or "communicate" notifiable pests. This will legally cover NIWA from prosecution (by MPI) in terms of transporting (preserved/fixed) notifiable pests from High Risk locations to MITS for the purposes of identification.

NIWA FTLs are Authorised Persons under the Biosecurity Act 1993 for survey activities undertaken as part of the MHRSS programme. Although vessels are not target structures for inspection during MHRSS programme surveys, such inspections may occur. Where removal of Suspect Samples is undertaken from private vessels or structures, the removal must be undertaken by, or supervised by an Authorised Person, and undertaken in accordance with the Biosecurity Act 1993. If a Suspect Sample is identified on a private vessel or structure, and the person appearing to be in charge of that vessel or structure objects to the collection of a Suspect Sample, we are not required to collect a sample. In this circumstance, we will inform the MPI Operational Liaison as soon as practical, providing information on the vessel type, name, identifying features, and location. If the MPI Operational Liaison is not available, then we will call the pest and disease hotline as soon as practical, providing information on the vessel type, name, identifying features, and location. If we take a Suspect Sample from a vessel, and the owner/operator is not present, we must leave an appropriate notification. MPI has provided NIWA with an appropriate inspection notification form for this purpose.

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 aside from restricted access to some site-specific locations at certain times due to port/marina operations and vessel traffic, no overall problems were encountered with regard to access to sample locations. Introduction of the new Health and Safety at Work Act 2015 (HSWA) has seen port and marina companies increasing their health and safety requirements pertaining to external agencies operating in their jurisdiction. This has resulted in new/upgraded operating area induction processes, varying degree of permitting of survey activities and evidence of appropriate compliance with the HSWA for the MHRSS programme survey field teams.

The identification of known or potential hazards specific to each High Risk Site is a critical component of our workplace health and safety practice. In addition to our own specific MHRSS programme process of identifying and managing site-specific risks, during the pre-survey stakeholder communications process NIWA FTLs are also now specifically requesting that the stakeholders identify any known or potential hazards they are aware of that could affect the survey team. Any hazards identified by stakeholders, as well as by the survey team themselves, are to be detailed in the interim post-sampling reports which are sent to both MPI and the NIWA FTLs.

To answer any concern from stakeholders about not being aware of the MHRSS programme surveys, MPI have provided NIWA with a one-page summary marine pest survey notification poster for wider pre-survey dissemination. For each survey, this one-page summary marine pest survey notification poster (see Appendix 5) was sent to our main stakeholder contacts (e.g., port and marina operators, harbourmaster, regional councils etc.) for them to disseminate to their own stakeholders as appropriate. Copies of these posters were also placed by the survey field teams at strategic points (e.g., boat ramps, marina/boat club noticeboards etc.) at the start of each survey to inform wider stakeholders and the public as to the survey activity.

The reporting of MHRSS programme survey results to stakeholders was conducted via MPI following the completion (and identification of any samples collected) of each survey.

During MHRSS programme surveys, individuals representing various stakeholders with vested interest in survey locations, biosecurity and education activities sometimes accompanied the field teams to observe, and sometimes participate in sampling activities (see Table 7).

Table 7: Stakeholders observing/participating in the Winter 2016 and Summer 2016–17 Marine High Risk Site Surveillance (MHRSS) programme surveys.

Port	Winter 2016 survey	Summer 2016–17 survey
Bluff Harbour		
Lyttelton Harbour/Whakaraupō		
Nelson Harbour	Nelson College	Ministry for Primary Industries
Opuā Marina/Waikare Inlet		Northland Regional Council (Biosecurity)
Otago Harbour		
Picton Harbour		
Port Taranaki		
Tauranga Harbour		
Waitemata Harbour	Auckland Regional Council (Biosecurity)	Auckland Regional Council (Biosecurity)
Wellington Harbour	Fairfax Media Ministry for Primary Industries	Ministry for Primary Industries
Whangarei Harbour		Ministry for Primary Industries Northland Regional Council (Biosecurity)

During the Wellington Harbour Winter 2016 survey, a Fairfax media crew joined the survey team to document survey activities for the Dominion Post and Stuff.co.nz. This was pre-approved by MPI as per our communications strategy. Consequently, an article was published in *The Dominion Post* on 10 September 2016, and also appeared on *Stuff* on Friday September 9th (<http://www.stuff.co.nz/environment/83960990/on-the-hunt-for-marine-pests-in-wellington-harbour-with-niwa>).

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

Acknowledgements

We thank the stakeholders with vested interest at each High Risk Site surveyed for facilitating the surveys. Their co-operation and assistance is greatly appreciated. We also thank the MPI Operational Liaisons, formerly Tim Riding, and latterly Abraham Growcott, for their partnership in facilitating the MHRSS programme. Thank you to the (other) NIWA survey field team leaders (Stephen Brown, Dane Buckthought, Megan Carter, Crispin Middleton, Kate Neil, Caroline Roberts, Matt Smith and Leigh Tait) for organising and running the MHRSS surveys, and also the many enthusiastic and efficient NIWA field team members (Sara Allen, Anna Bradley, Evan Baddock, Michael Breckel, Mike Brewer, Caroline Chin, Serena Cox, Roberta D'Archino, Niki Davey, Ralph Dickson, Jim Drury, Mark Fenwick, Jeff Forman, Sean Handley, Lindsay Hawke, Christian Hyde, Tim Kane, Derek Kater, Warwick Lyon, Graeme Mackay, Peter Marriott, Andrew Miller, Sadie Mills, Graeme Moss, Pete Notman, Louis Olsen, Mike Page, Anne Parkinson, Darren Parsons, Pete Pattinson, Nicola Rush, Jeremy Rutherford, Keren Spong, Eric Stevens, Rob Stewart, Dean Stotter, Colin Sutton, Hamish Sutton, Andrew Willsman and John Mark Woolley). Thank you to Leigh Tait for reviewing a draft version of this report and Barb Hayden for final review and approval for release of the report.

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Appendix 1. Summary of sampling methods, target species and habitats in the Marine High Risk Site Surveillance (MHRSS) programme

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?
Benthic sled	<i>Asterias amurensis</i> <u><i>Eudistoma elongatum</i></u> <u><i>Arcuatula senhousia</i></u> <i>Potamocorbula amurensis</i> <u><i>Sabella spallanzanii</i></u> <u><i>Styela clava</i></u>	<u><i>Acentrogobius pflaumii</i></u> <u><i>Chaetopterus</i> sp.</u> <u><i>Charybdis (Charybdis) japonica</i></u> <i>Didemnum</i> sp. <i>Grateloupia turuturu</i> <i>Hypnea</i> sp. <u><i>Pyromaia tuberculata</i></u> <u><i>Theora lubrica</i></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 100 m tow length and high replication (100+ per location) enables a reasonably large area to be sampled (ca 3500 m 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 block the 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?
Crab (box) traps	<i>Asterias amurensis</i> <i>Carcinus maenas</i> <i>Eriocheir sinensis</i>	<i>Acentrogobius pflaumii</i> <u><i>Charybdis</i></u> <u><i>(Charybdis)</i></u> <u><i>japonica</i></u> <u><i>Pyromaia tuberculata</i></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 (e.g. <i>Hemiplax hirtipes</i> , <i>Notomithrax</i> spp., <i>Ovalipes catharus</i> , <i>Metacarcinus novaezelandiae</i>) and echinoderms (e.g. <i>Patiriella regularis</i> , <i>Coscinasterias muricata</i>). Also sample a wide range of fish species. Biofouling species may also be incidentally captured with this method if attached to mobile organisms attracted to the traps (e.g. <i>Styela clava</i> attached to masking crabs)	Quick to deploy and recover, so high replication possible.	Most locations and weather conditions.	Yes	Yes (Hewitt and Martin 2001; May and Brown 2001; Thresher et al 2003; Yamada et al 2005)

Method	Target species	Non-target species	Habitat	Spatial coverage	Effectiveness	Cost effectiveness	Feasibility	Previous surveillance in NZ?	Previous surveillance overseas?
Crab condos	<i>Carcinus maenas</i> <i>Eriocheir sinensis</i>	<i>Acentrogobius pflaumii</i> <i>Charybdis</i> <i>(Charybdis)</i> <i>japonica</i> <i>Pyromaia tuberculata</i>	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 (e.g. <i>Austrohelice crassa</i> , <i>Hemigrapsus crenulatus</i> , <i>Hemiplax hirtipes</i>). Higher rates of detection of crabs than baited traps in muddy river banks (Veldhuizen, 2000).	Quick to deploy and recover, so high replication possible.	High – access problems at some locations (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	<i>Carcinus maenas</i> <i>Eriocheir sinensis</i> <u><i>Eudistoma elongatum</i></u> <u><i>Arcuatula senhousia</i></u> <u><i>Sabella spallanzanii</i></u> <u><i>Styela clava</i></u>	<u><i>Chaetopterus</i> sp.</u> <u><i>Charybdis (Charybdis) japonica</i></u> <u><i>Clavelina lepadiformis</i></u> <u><i>Didemnum</i> sp.</u> <u><i>Grateloupia turuturu</i></u> <u><i>Hypnea</i> sp.</u> <i>Pyromaia tuberculata</i>	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	<i>Asterias amurensis</i> <i>Carcinus maenas</i> <u><i>Eudistoma elongatum</i></u> <u><i>Sabella spallanzanii</i></u> <u><i>Styela clava</i></u>	<u><i>Caprella mutica</i></u> <u><i>Chaetopterus</i> sp.</u> <u><i>Charybdis (Charybdis) japonica</i></u> <u><i>Clavelina lepadiformis</i></u> <u><i>Didemnum</i> sp.</u> <u><i>Grateloupia turuturu</i></u> <u><i>Hypnea</i> sp.</u> <i>Pyromaia tuberculata</i>	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

Appendix 2. Summaries of target versus achieved number of sampling locations for Winter 2016 and Summer 2016–17 Marine High Risk Site Surveillance (MHRSS) programme surveys

BLUFF HARBOUR

Sampling method	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
WINTER 2016			
Crab condo lines	8	8	100.0
Crab (box) trap lines	68	69	101.5
Benthic sled tows	84	86	102.4
Diver searches	40	40	100.0
Shore searches	25	25	100.0
Sample total	225	228	101.3
SUMMER 2016–17			
Crab condo lines	8	8	100.0
Crab (box) trap lines	68	68	100.0
Benthic sled tows	84	85	101.2
Diver searches	40	40	100.0
Shore searches	25	25	100.0
Sample total	225	226	100.4

LYTTELTON HARBOUR/WHAKARAUPŌ

Sampling method	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
WINTER 2016			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	101	101.0
Diver searches	30	30	100.0
Shore searches	25	25	100.0
Sample total	243	244	100.4
SUMMER 2016–17			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	78*	97.5
Benthic sled tows	100	100	100.0
Diver searches	30	30	100.0
Shore searches	25	26	104.0
Sample total	243	242	99.6

* Two trap lines missing

NELSON HARBOUR

Sampling method	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
WINTER 2016			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	100	100.0
Diver searches	30	30	100.0
Shore searches	25	25	100.0
Sample total	243	243	100.0
SUMMER 2016–17			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	101	101.0
Diver searches	30	30	100.0
Shore searches	25	26	104.0
Sample total	243	245	100.8

OPUA MARINA/WAIKARE INLET

Sampling method	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
WINTER 2016			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	105	105	100.0
Diver searches	30	30	100.0
Shore searches	25	26	104.0
Sample total	248	249	100.4
SUMMER 2016–17			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	105	105	100.0
Diver searches	30	30	100.0
Shore searches	25	26	104.0
Sample total	248	249	100.4

OTAGO HARBOUR

Sampling method	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
WINTER 2016			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	100	100.0
Diver searches	30	31	103.3
Shore searches	25	25	100.0
Sample total	243	244	100.4
SUMMER 2016–17			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	101	101.0
Diver searches	30	31	103.3
Shore searches	25	28	112.0
Sample total	243	248	102.1

PICTON HARBOUR

Sampling method	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
WINTER 2016			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	101	101.0
Diver searches	30	30	100.0
Shore searches	25	25	100.0
Sample total	243	244	100.4
SUMMER 2016–17			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	100	100.0
Diver searches	30	30	100.0
Shore searches	25	26	104.0
Sample total	243	244	100.4

PORT TARANAKI

Sampling method	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
WINTER 2016			
Crab condo lines	8	7*	87.5
Crab (box) trap lines	80	79**	98.8
Benthic sled tows	100	100	100.0
Diver searches	30	30	100.0
Shore searches	25	25	100.0
Sample total	243	241	99.2
SUMMER 2016–17			
Crab condo lines	8	7*	87.5
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	101	101.0
Diver searches	30	30	100.0
Shore searches	25	25	100.0
Sample total	243	243	100.0

* One trap line missing

** One trap line snagged and had to be cut free

TAURANGA HARBOUR

Sampling method	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
WINTER 2016			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	101	101.0
Diver searches	30	30	100.0
Shore searches	25	27	108.0
Sample total	243	246	101.2
SUMMER 2016–17			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	100	100.0
Diver searches	30	30	100.0
Shore searches	25	28	112.0
Sample total	243	246	101.2

WAITEMATA HARBOUR

Sampling method	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
WINTER 2016			
Crab condo lines	16	16	100.0
Crab (box) trap lines	160	160	100.0
Benthic sled tows	200	201	100.5
Diver searches	60	0*	0.0
Shore searches	50	52	104.4
Sample total	486	429	88.3
SUMMER 2016–17			
Crab condo lines	16	16	100.0
Crab (box) trap lines	160	160	100.0
Benthic sled tows	200	200	100.0
Diver searches	60	61	101.7
Shore searches	50	54	108.0
Sample total	486	491	101.0

* Diver searches unable to be conducted due to the presence of a leopard seal

WELLINGTON HARBOUR

Sampling method	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
WINTER 2016			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	96*	96.0
Diver searches	30	30	100.0
Shore searches	25	25	100.0
Sample total	243	239	98.4
SUMMER 2016–17			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	100	100.0
Diver searches	30	30	100.0
Shore searches	25	25	100.0
Sample total	243	243	100.0

* Severe weather interruptions and resourcing constraints resulted in four benthic sled tows being unable to be completed

WHANGAREI HARBOUR

Sampling method	Target number of sampling locations	Achieved number of sampling locations	% of target achieved
WINTER 2016			
Crab condo lines	8	6	75.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	100	100.0
Diver searches	30	30	100.0
Shore searches	25	26	104.0
Sample total	243	242	99.6
SUMMER 2016–17			
Crab condo lines	8	8	100.0
Crab (box) trap lines	80	80	100.0
Benthic sled tows	100	101	101.0
Diver searches	30	30	100.0
Shore searches	25	27	108.0
Sample total	243	246	101.2

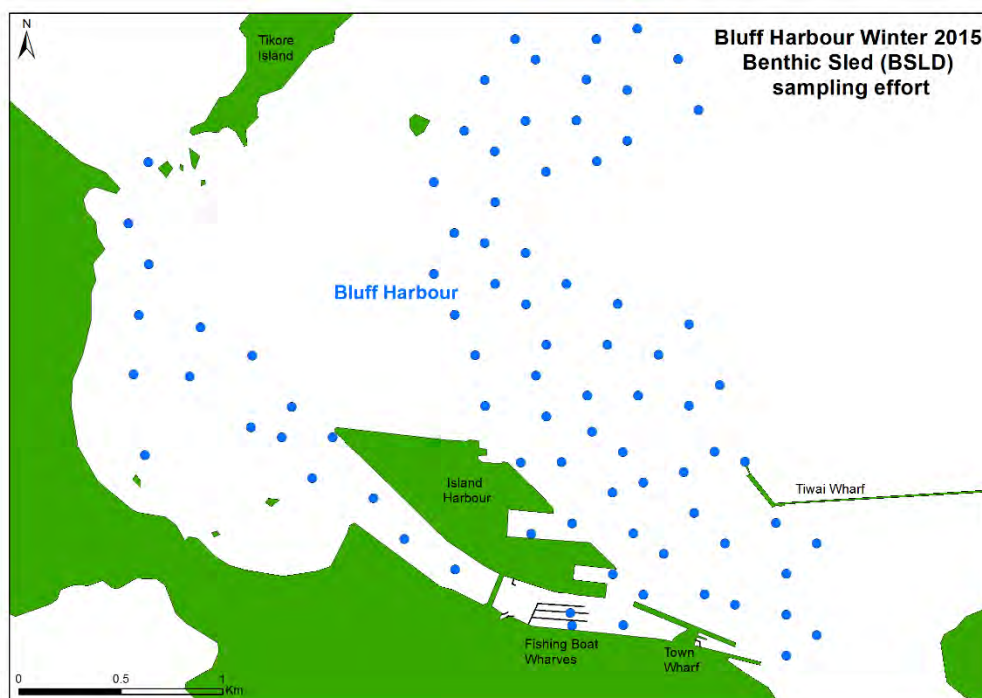
Appendix 3. Maps showing locations sampled in Winter 2016 and Summer 2016–17 Marine High Risk Site Surveillance (MHRSS) programme surveys

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

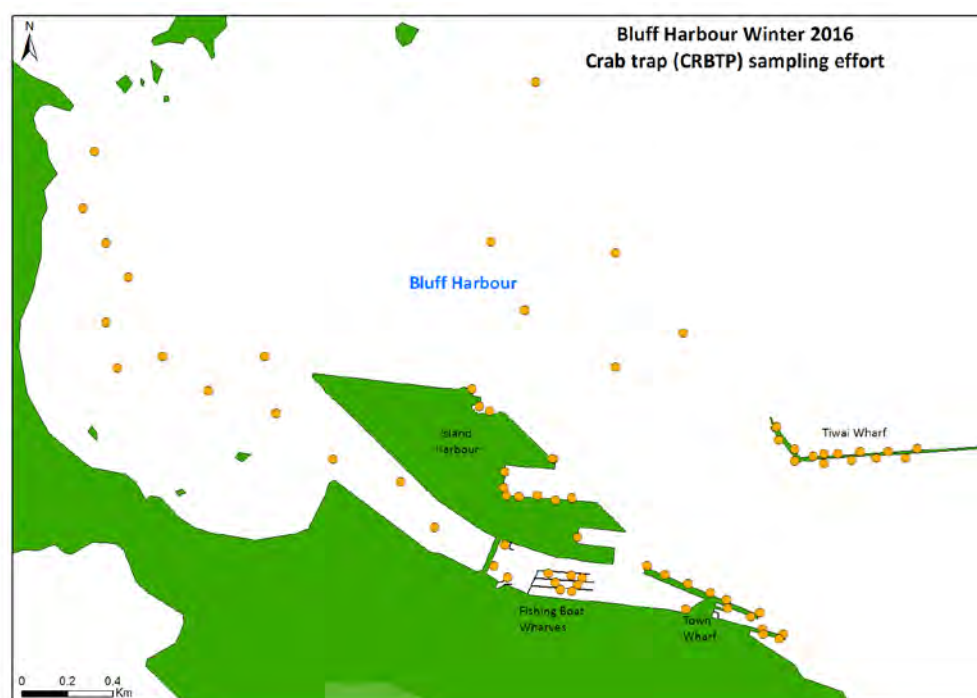
Bluff Harbour

Winter 2016

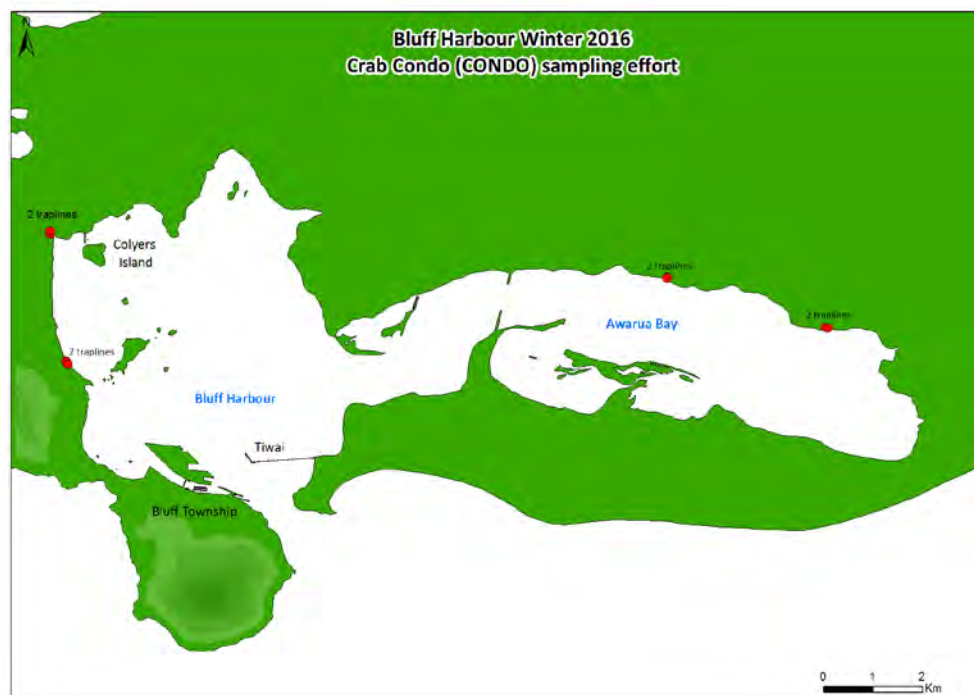
Benthic sled locations



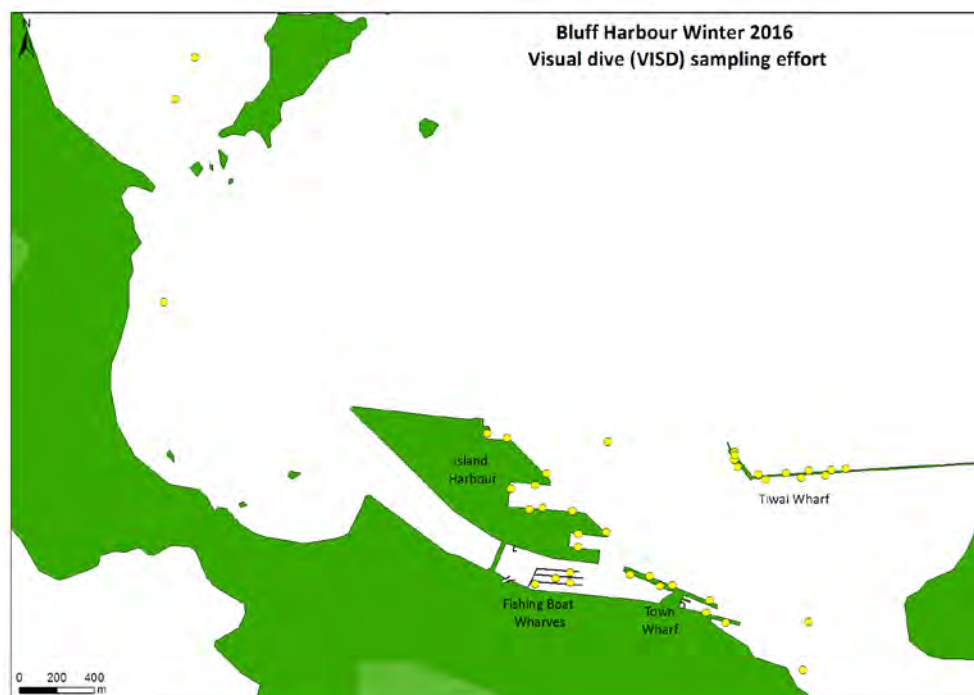
Crab (box) trap locations



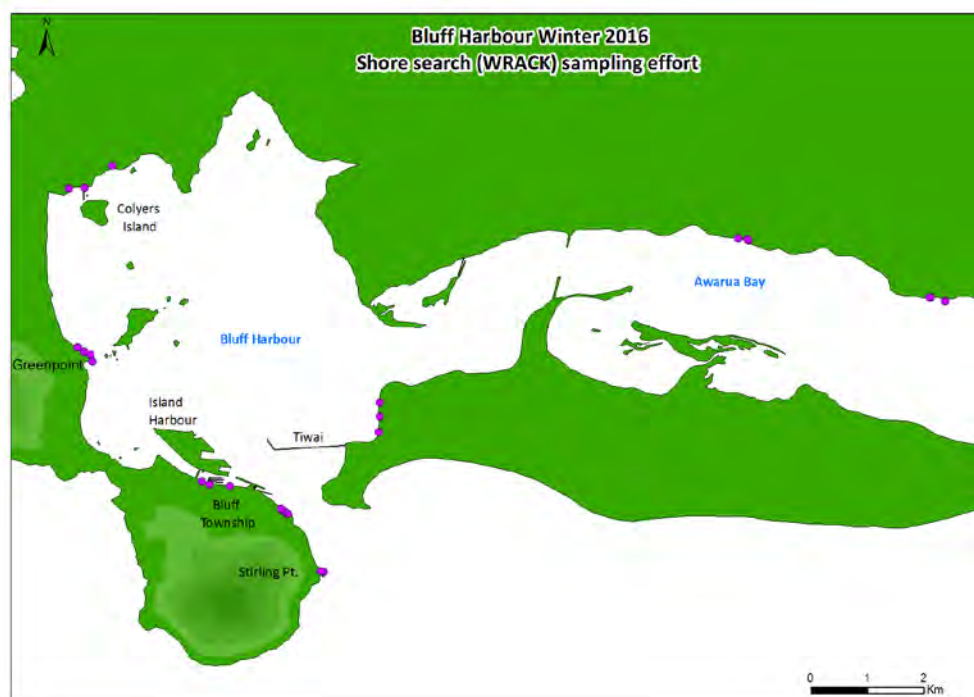
Crab condo locations



Diver search locations

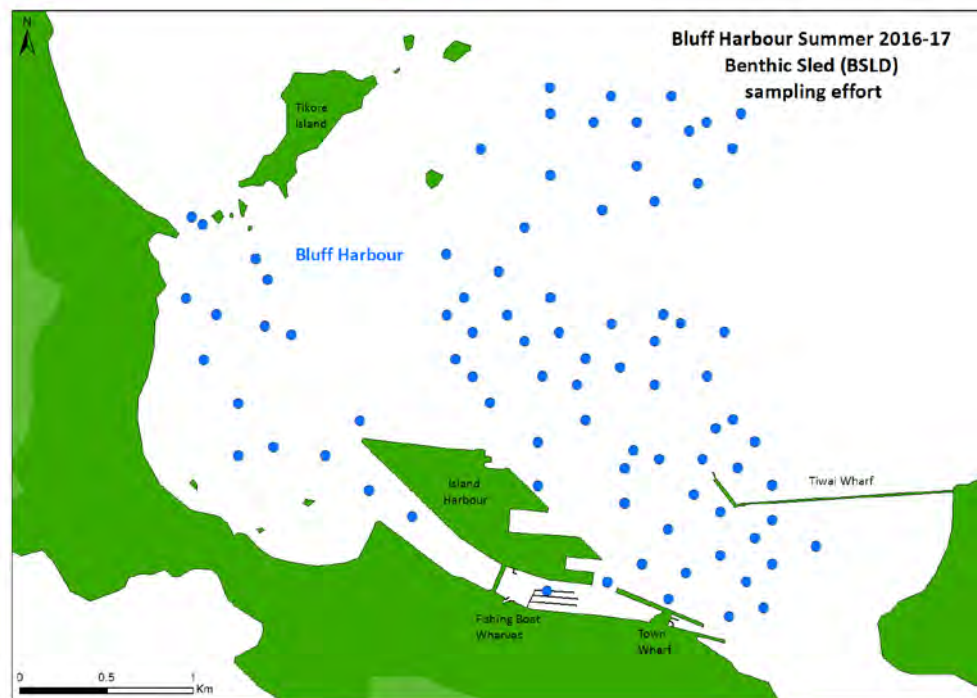


Shore search locations

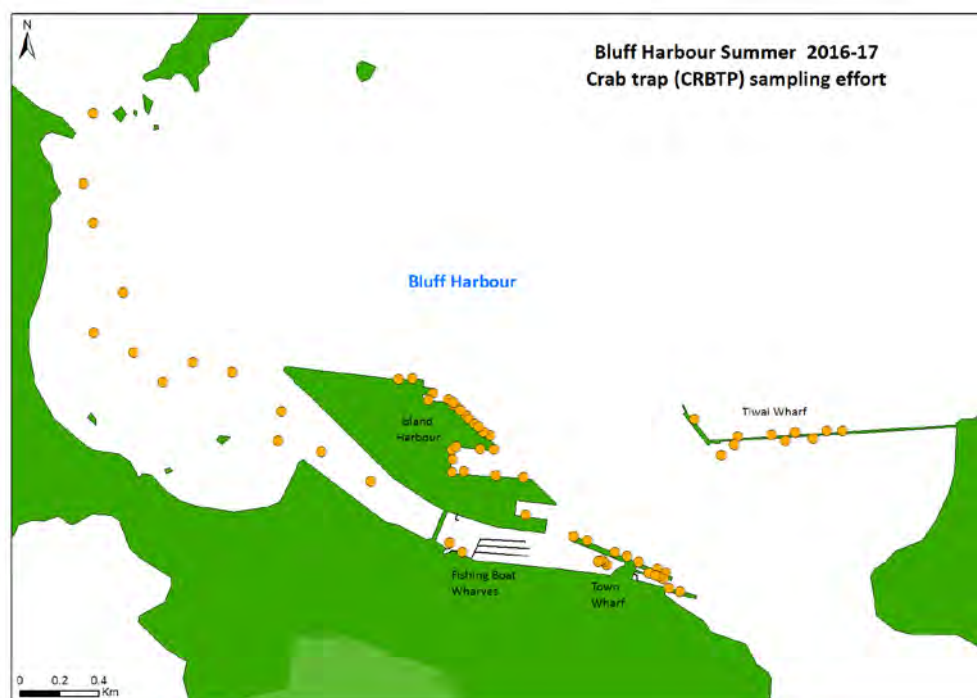


Summer 2016–17

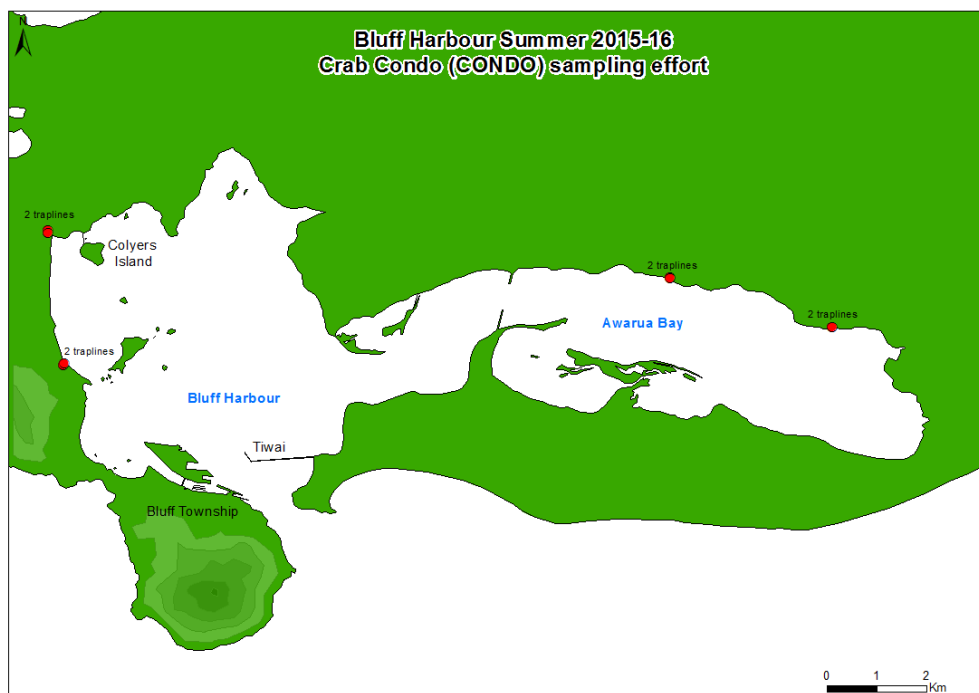
Benthic sled locations



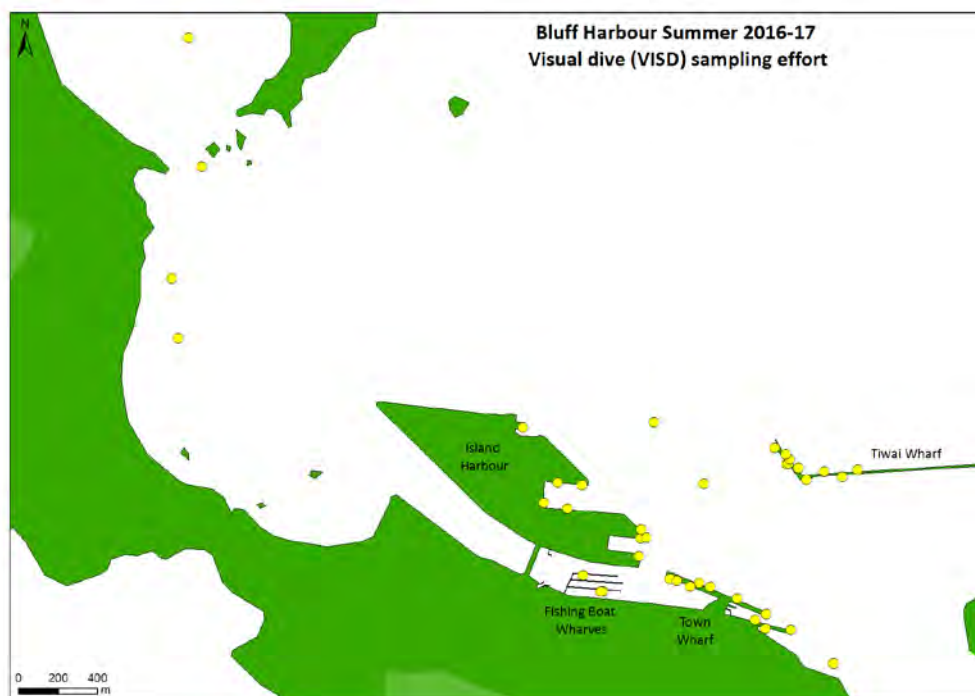
Crab (box) trap locations



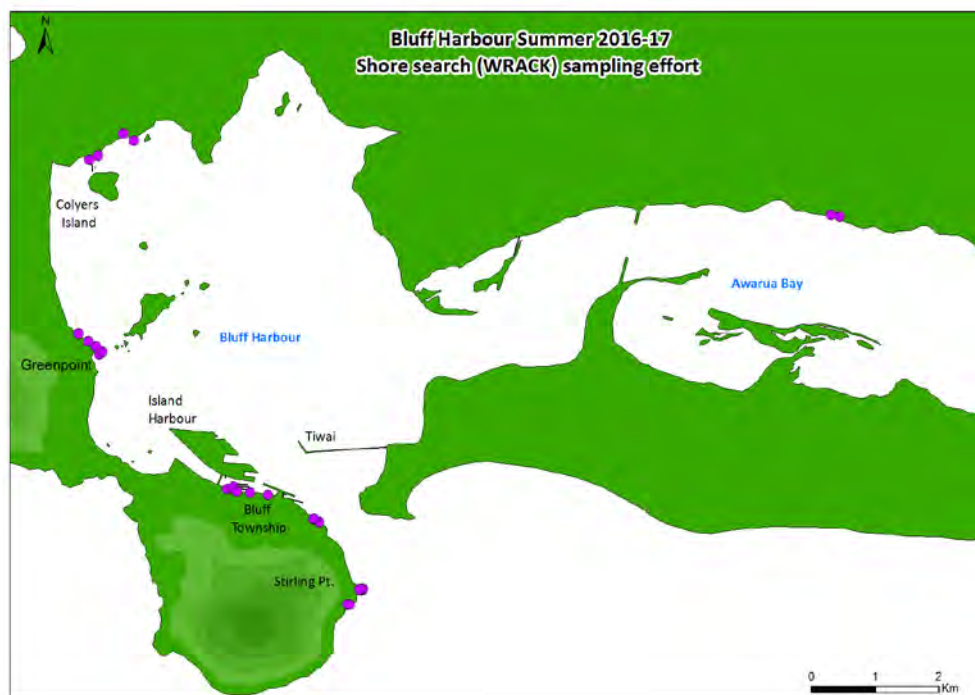
Crab condo locations



Diver search locations



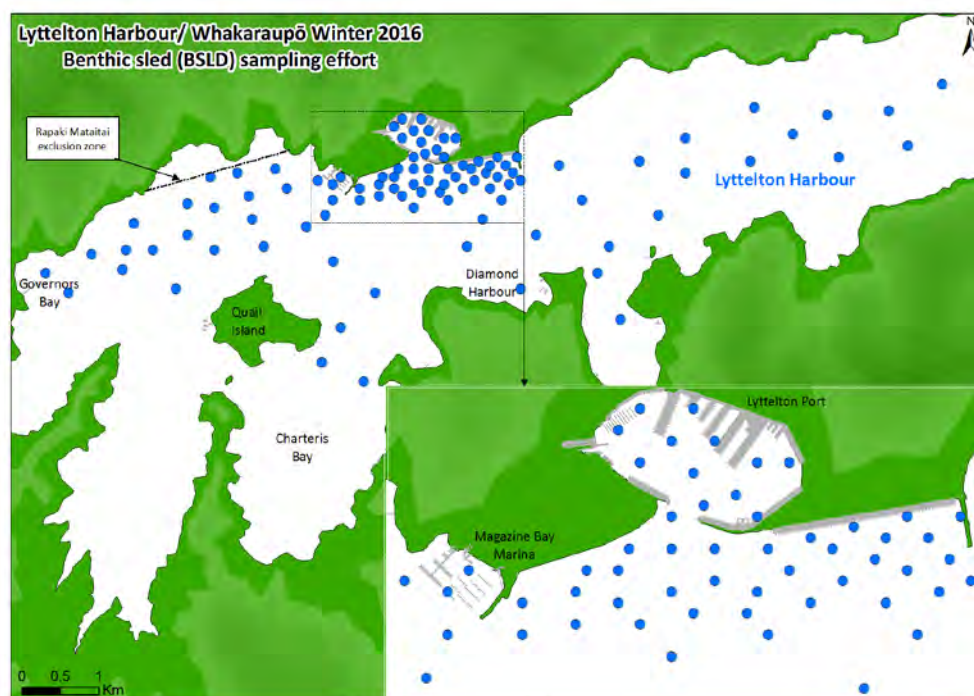
Shore search locations



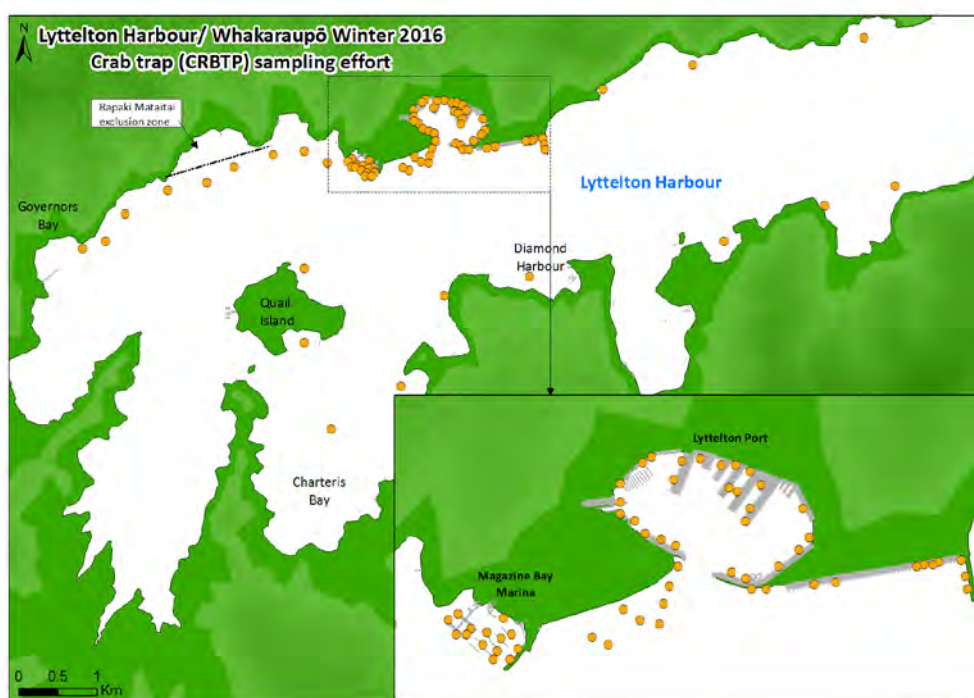
Lyttelton Harbour/Whakaraupō

Winter 2016

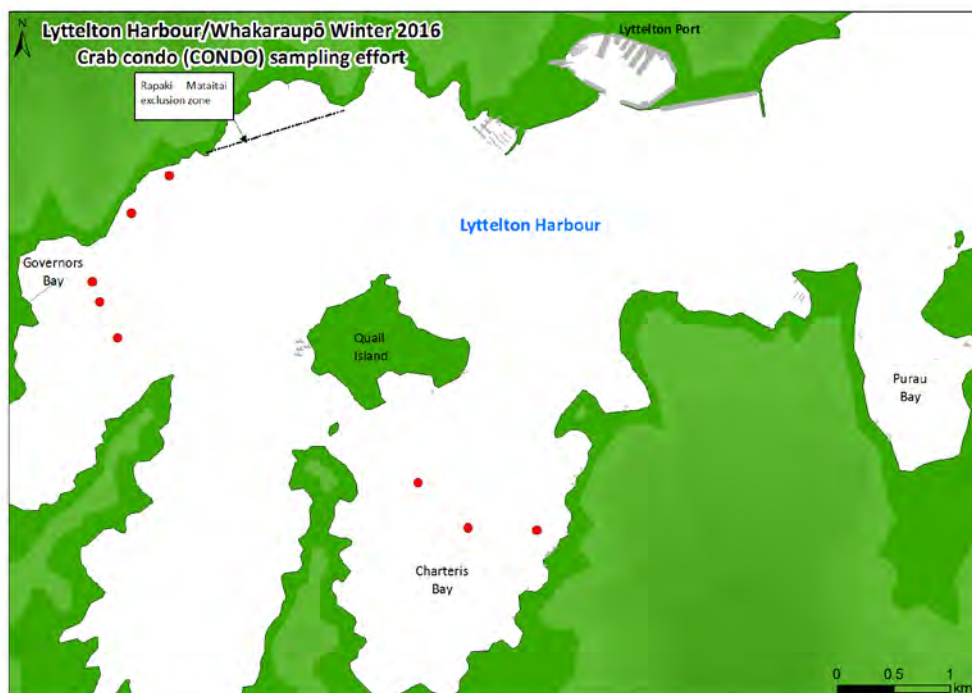
Benthic sled locations



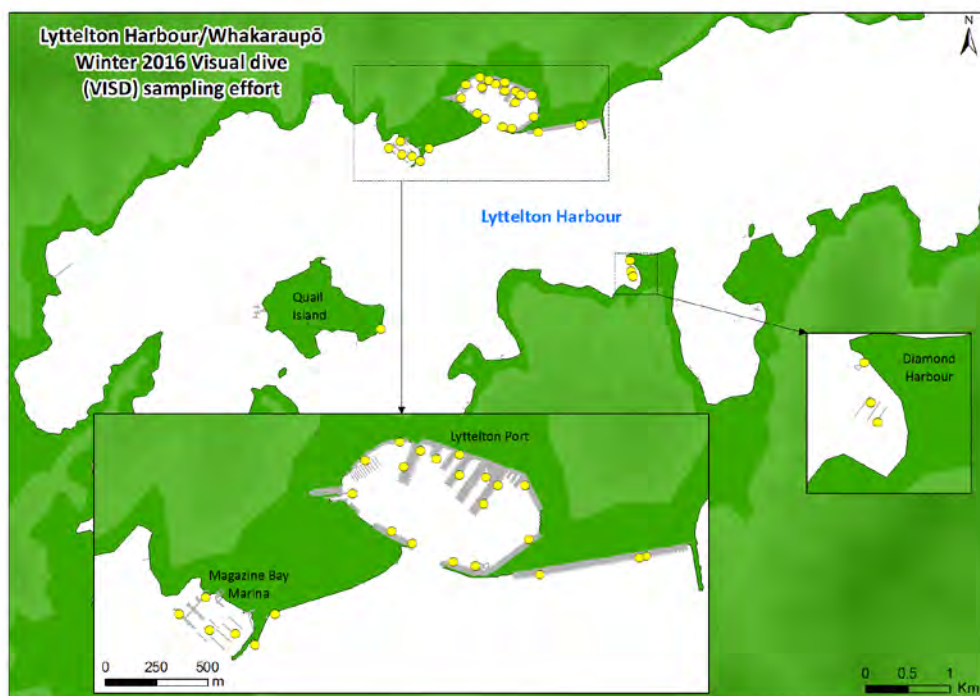
Crab (box) trap locations



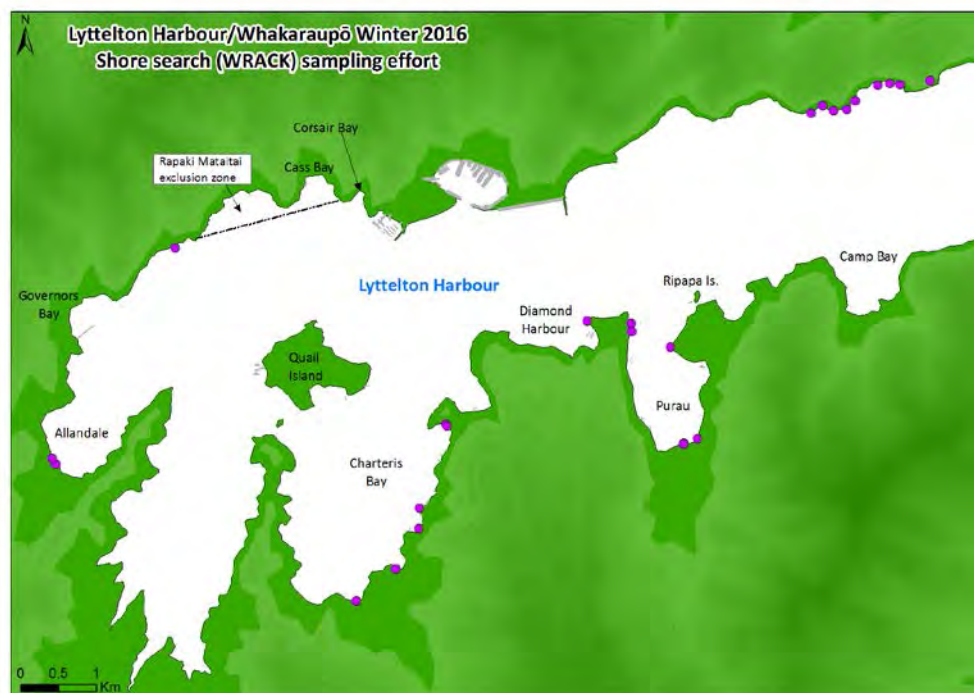
Crab condo locations



Diver search locations

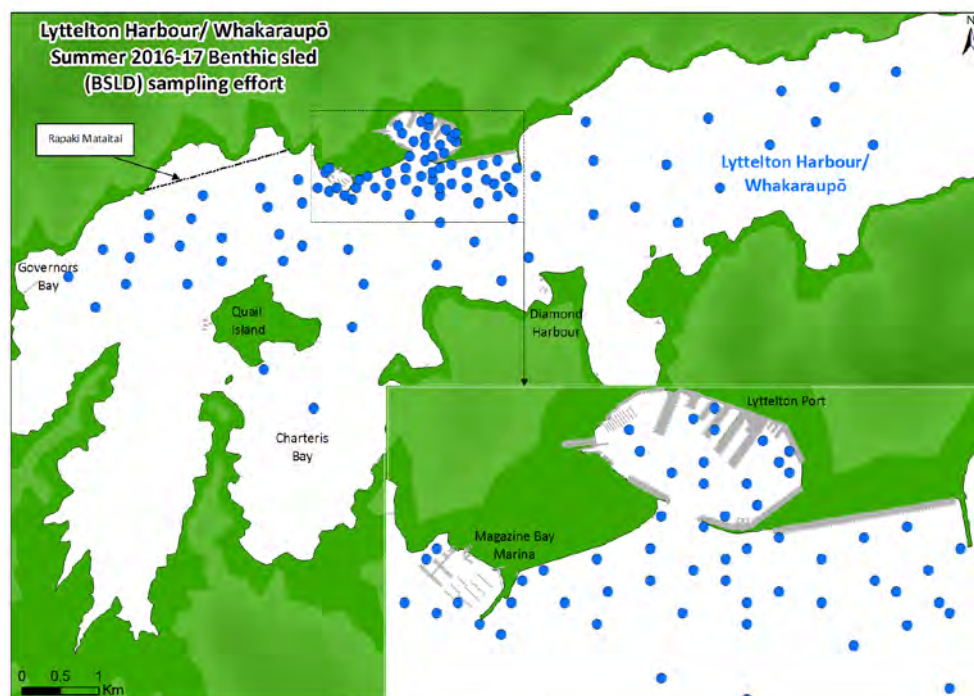


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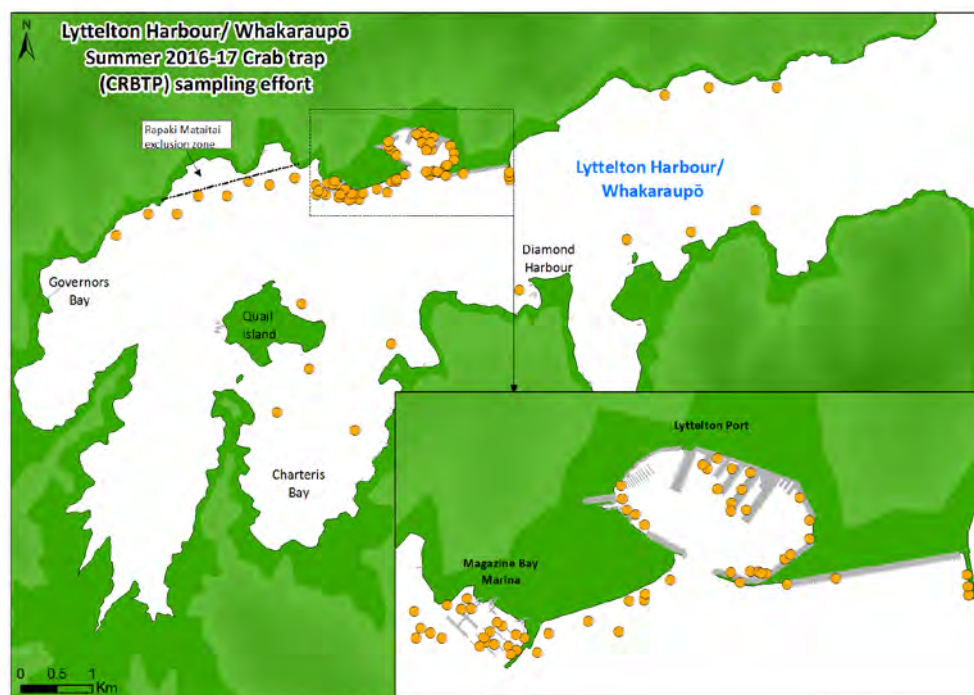


Summer 2016–17

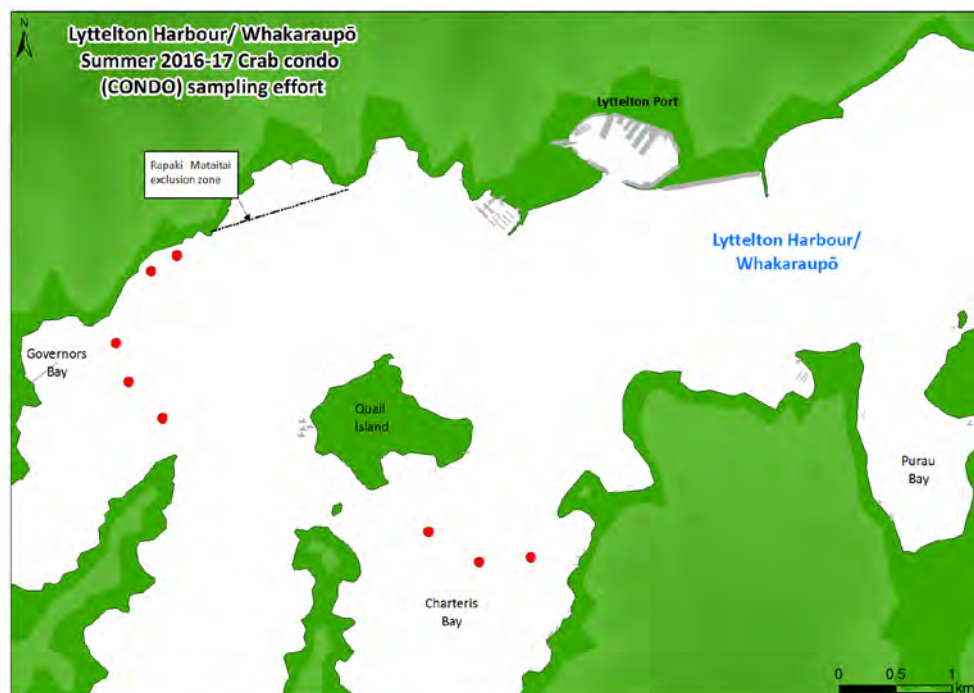
Benthic sled locations



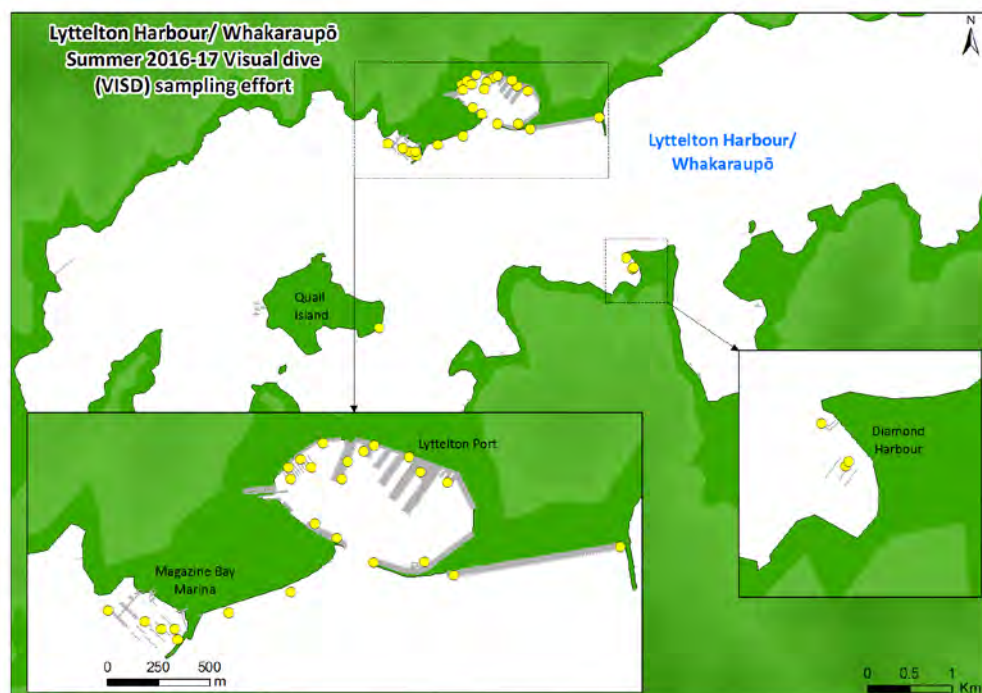
Crab (box) trap locations



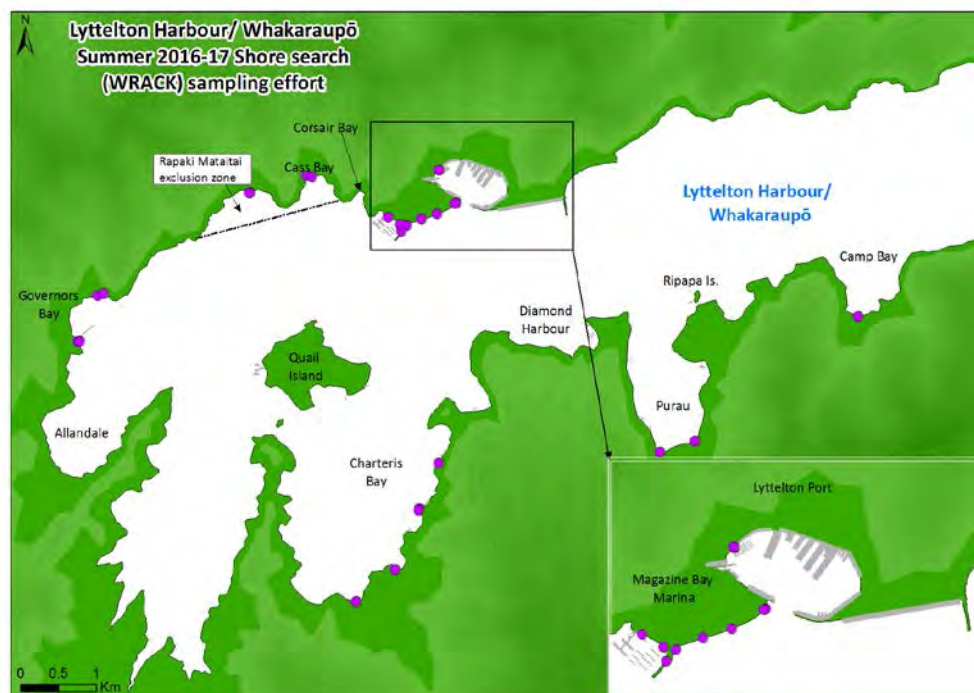
Crab condo locations



Diver search locations



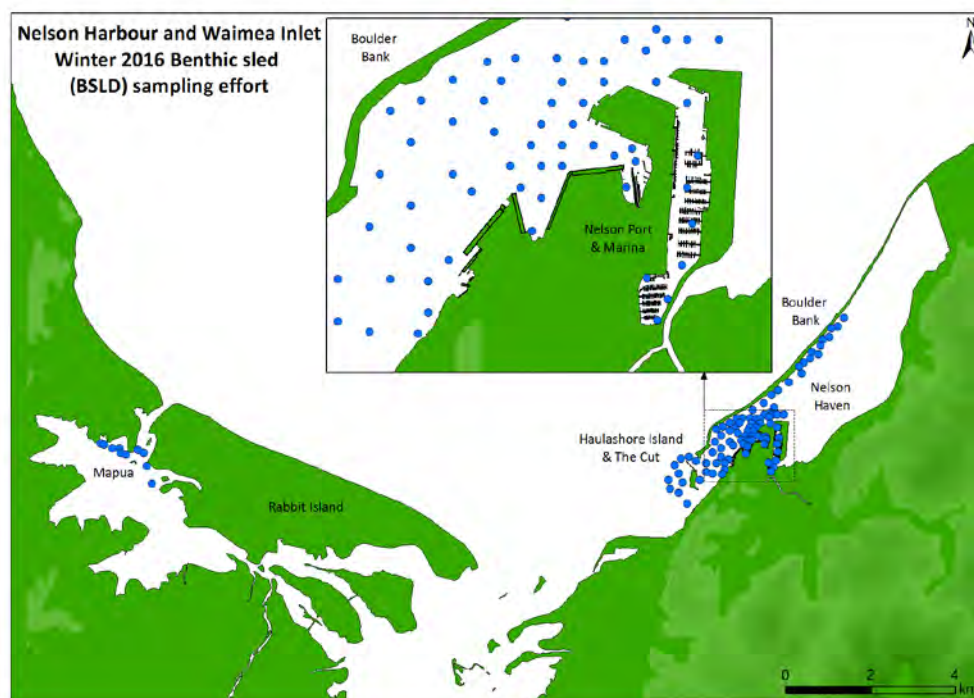
Shore search locations



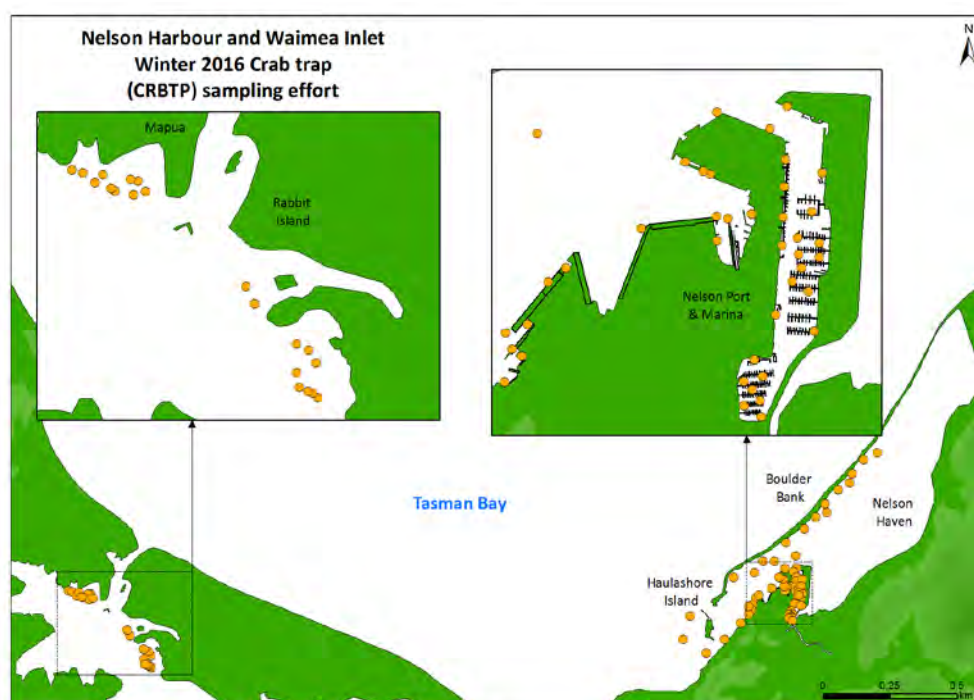
Nelson Harbour

Winter 2016

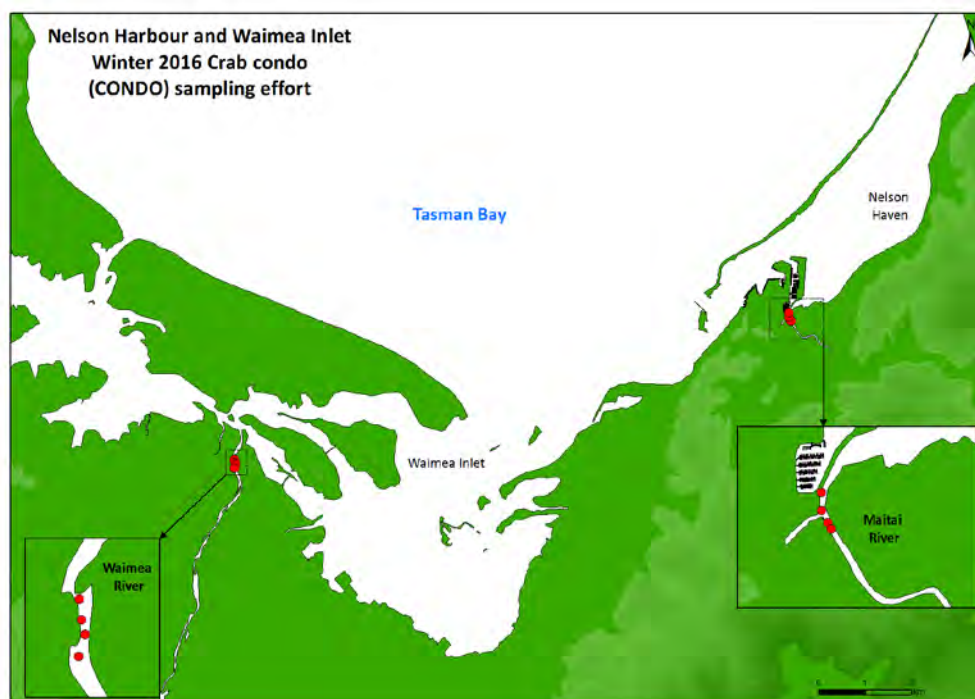
Benthic sled locations



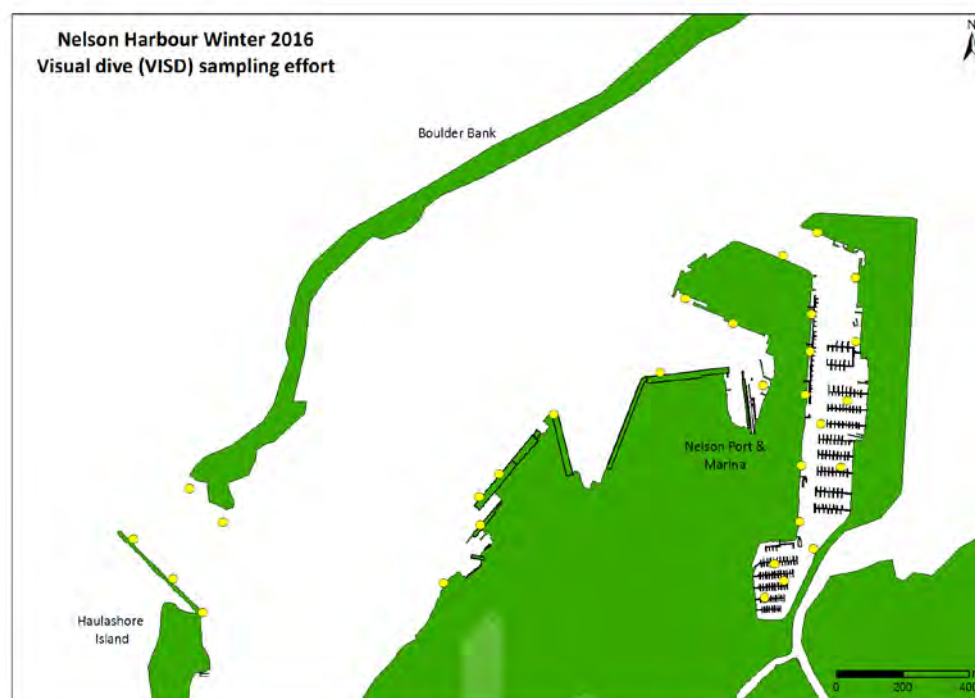
Crab (box) trap locations



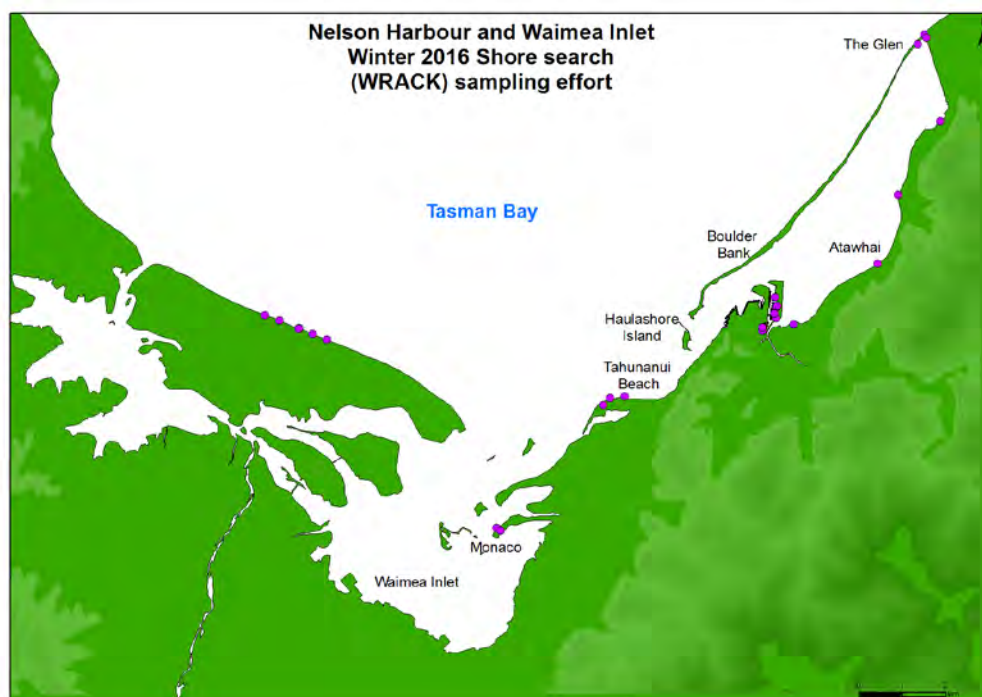
Crab condo locations



Diver search locations

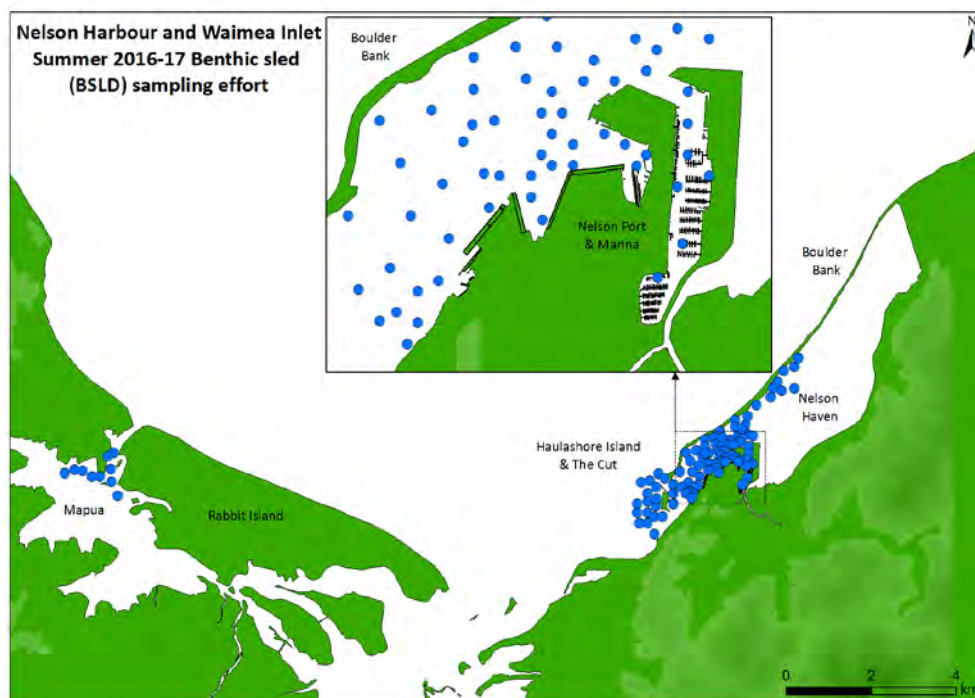


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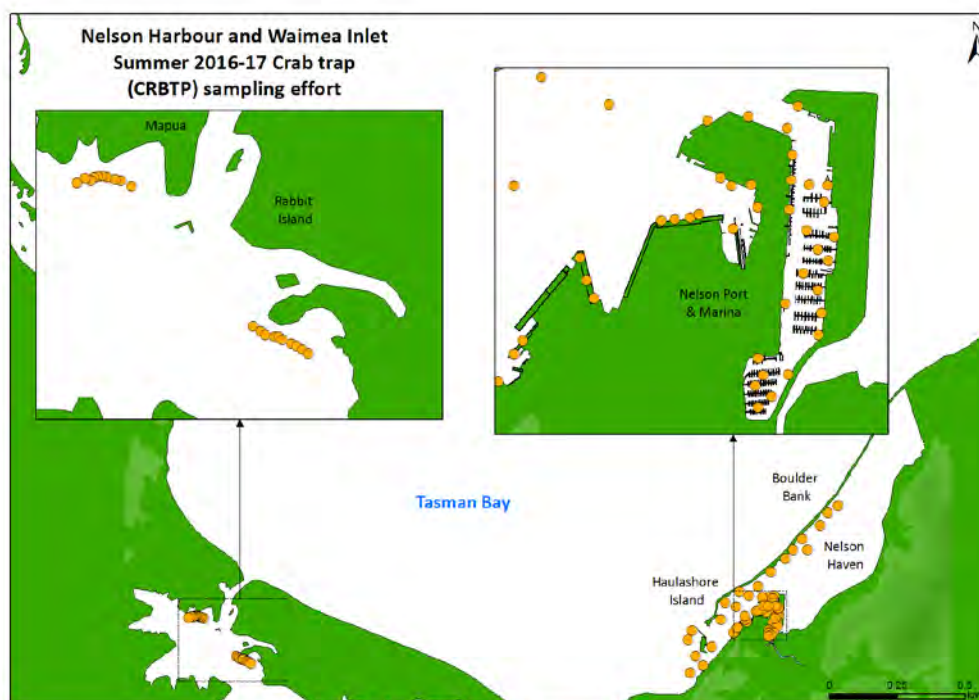


Summer 2016–17

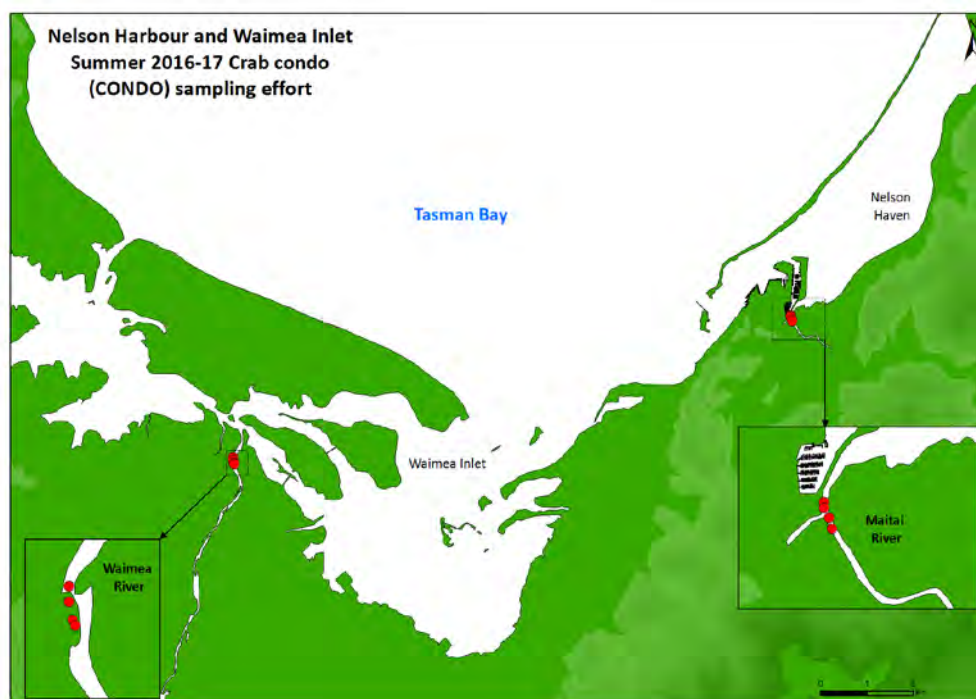
Benthic sled locations



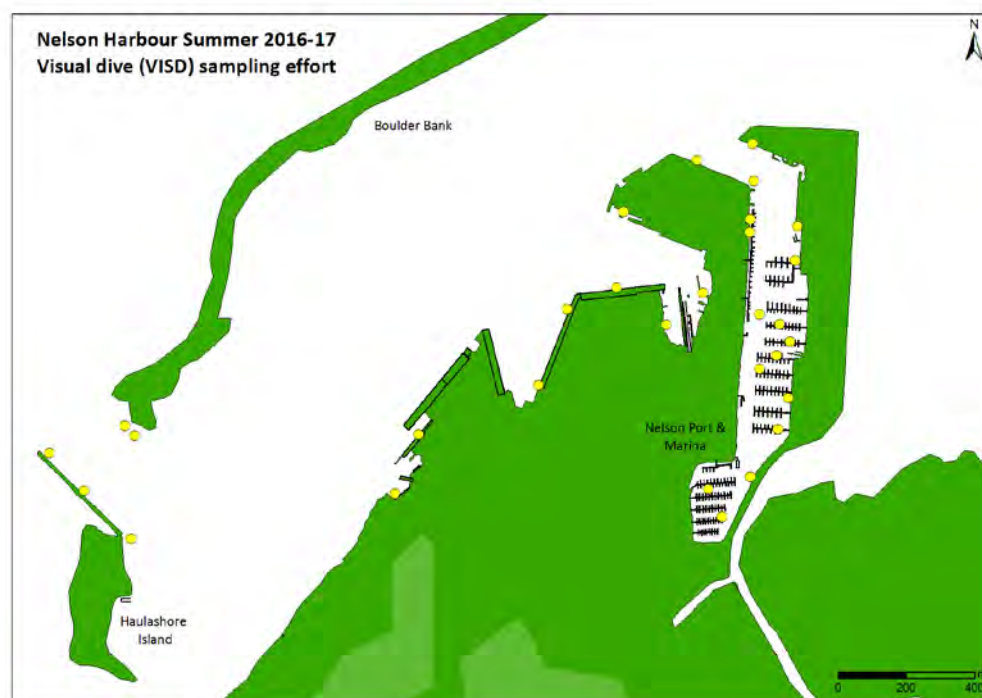
Crab (box) trap locations



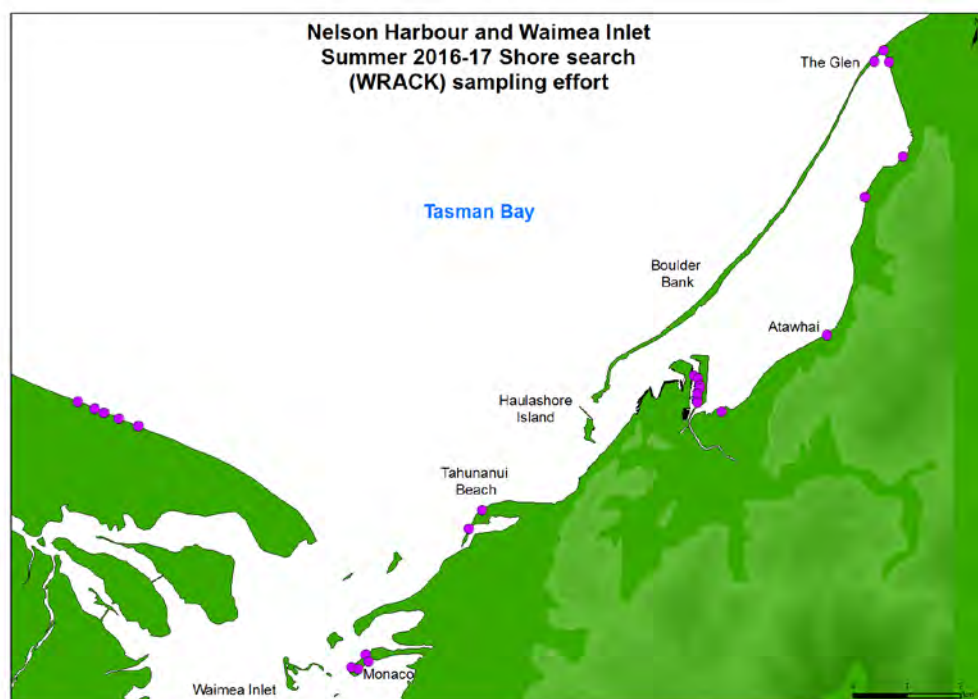
Crab condo locations



Diver search locations



Shore search locations



Opua Marina/Waikare Inlet

Note: grey crosses indicate navigational markers

Winter 2016

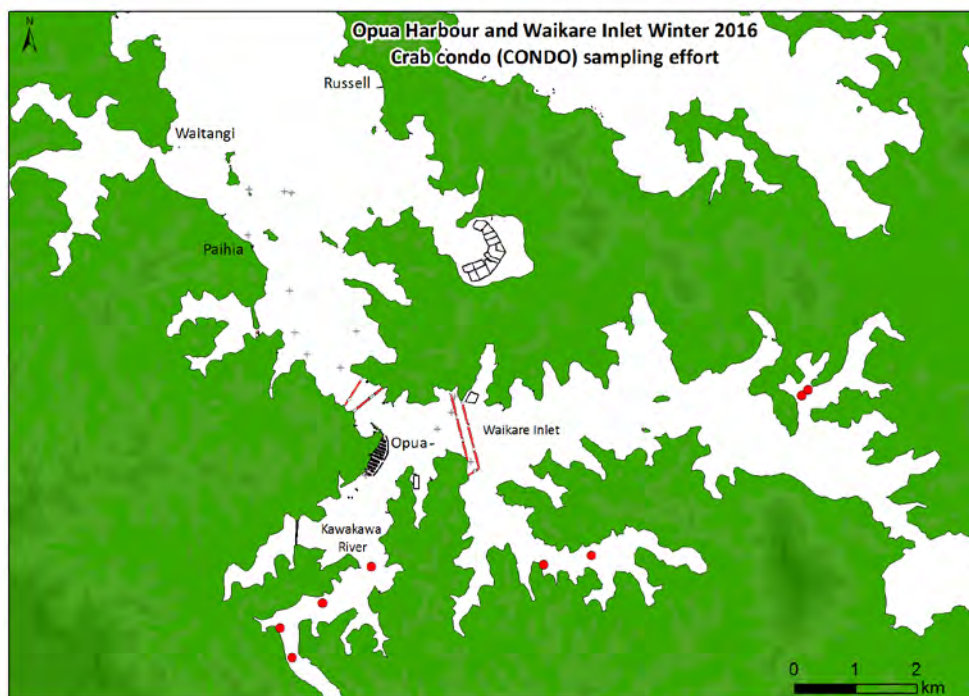
Benthic sled locations



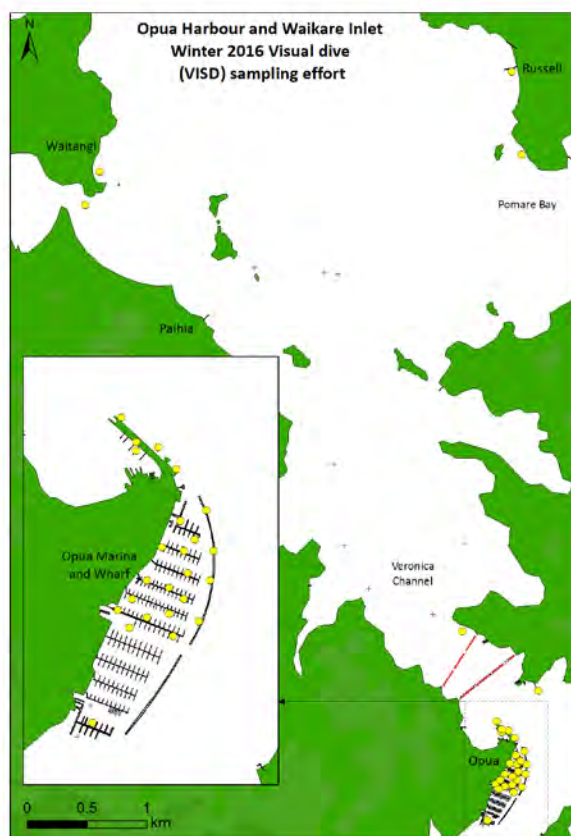
Crab (box) trap locations



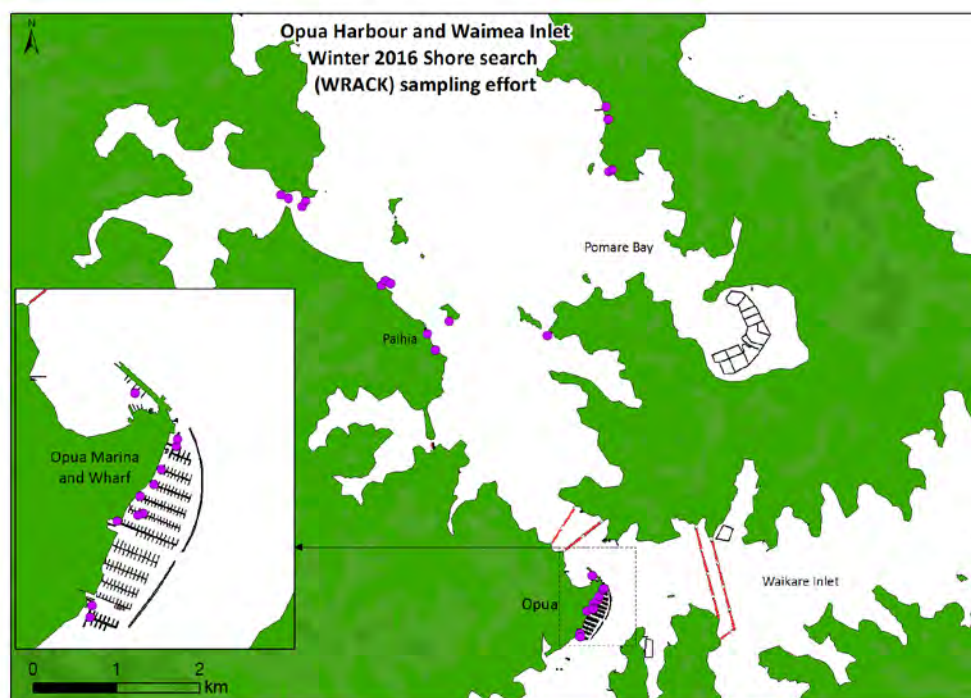
Crab condo locations



Diver search locations

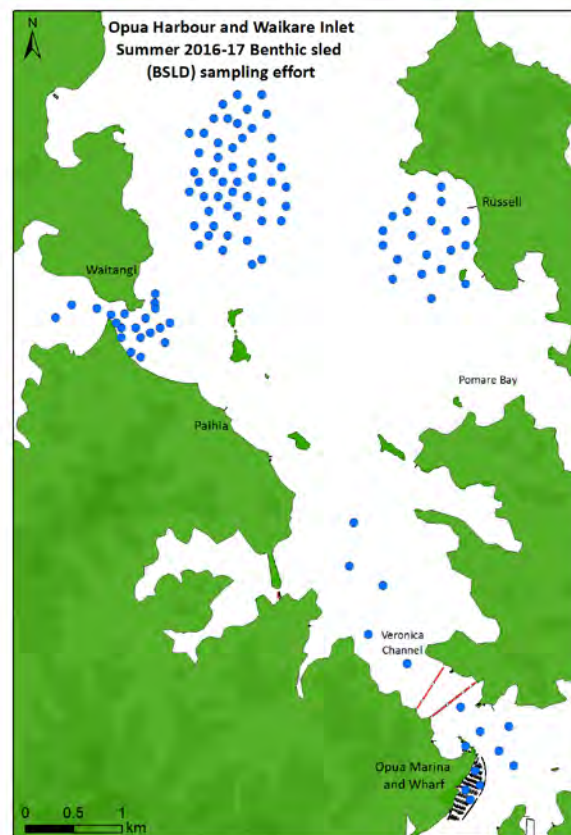


Shore search locations



Summer 2016–17

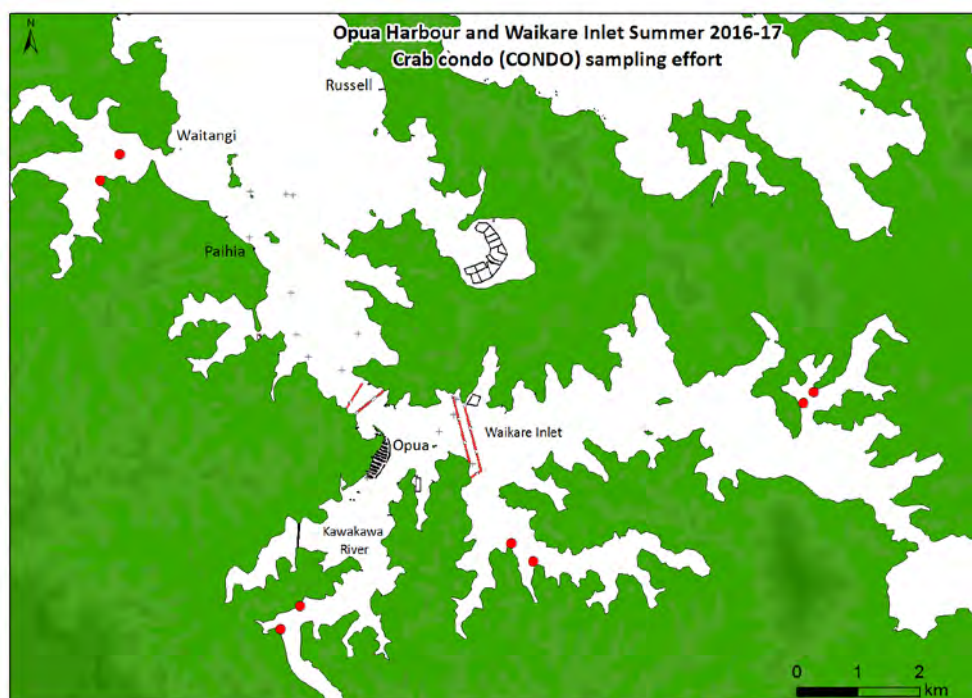
Benthic sled locations



Crab (box) trap locations



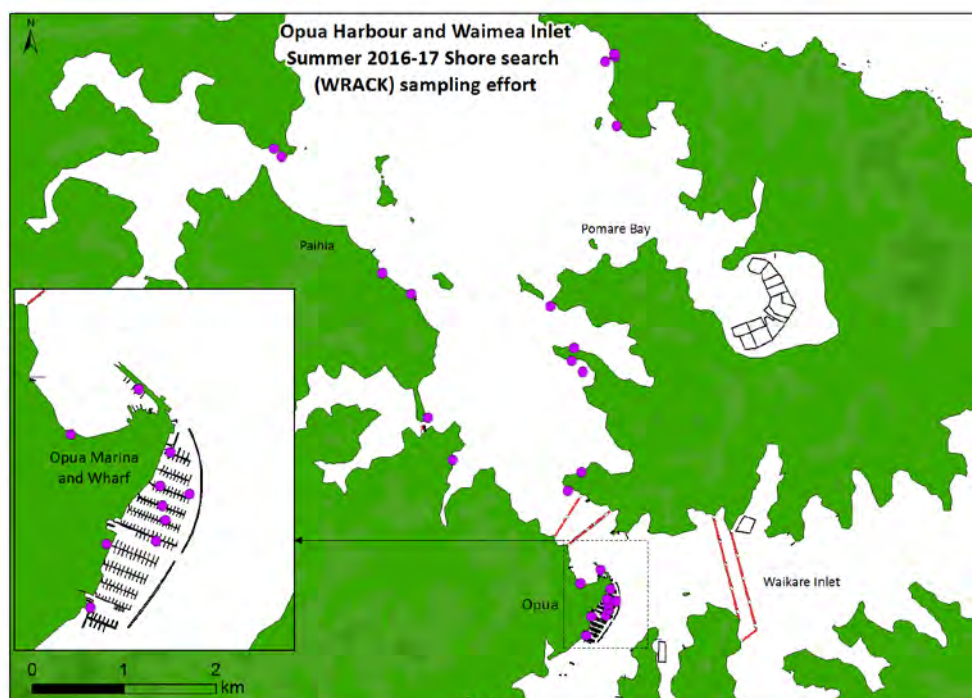
Crab condo locations



Diver search locations



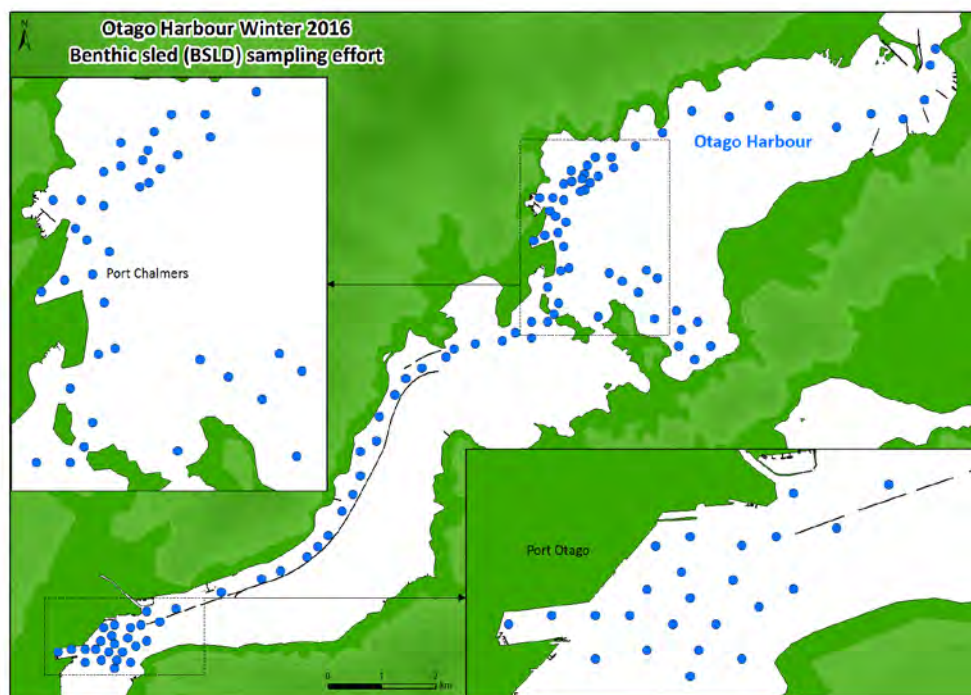
Shore search locations



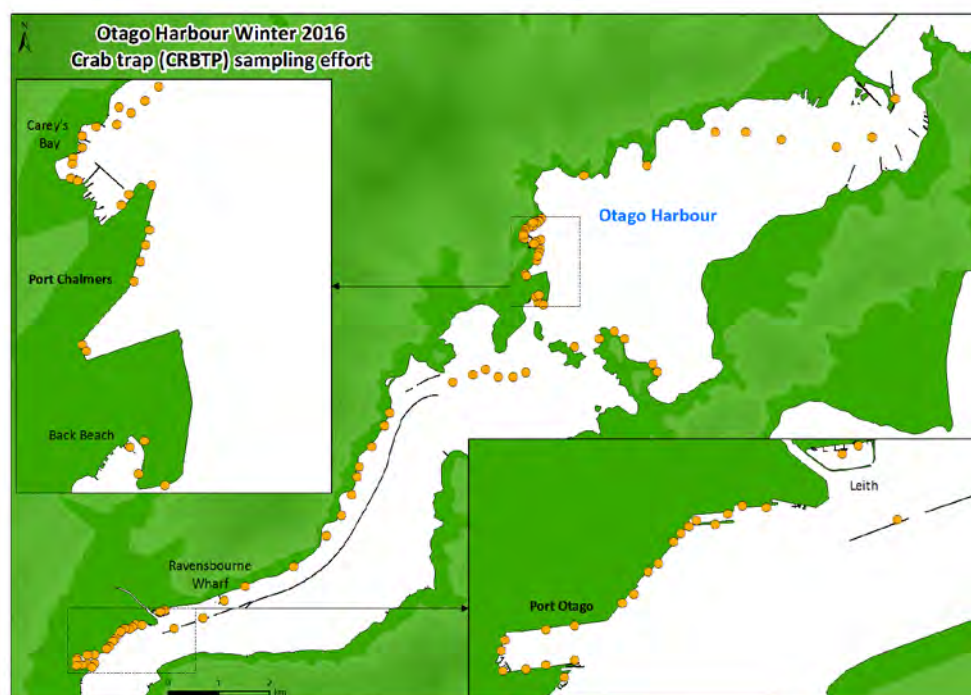
Otago Harbour

Winter 2016

Benthic sled locations



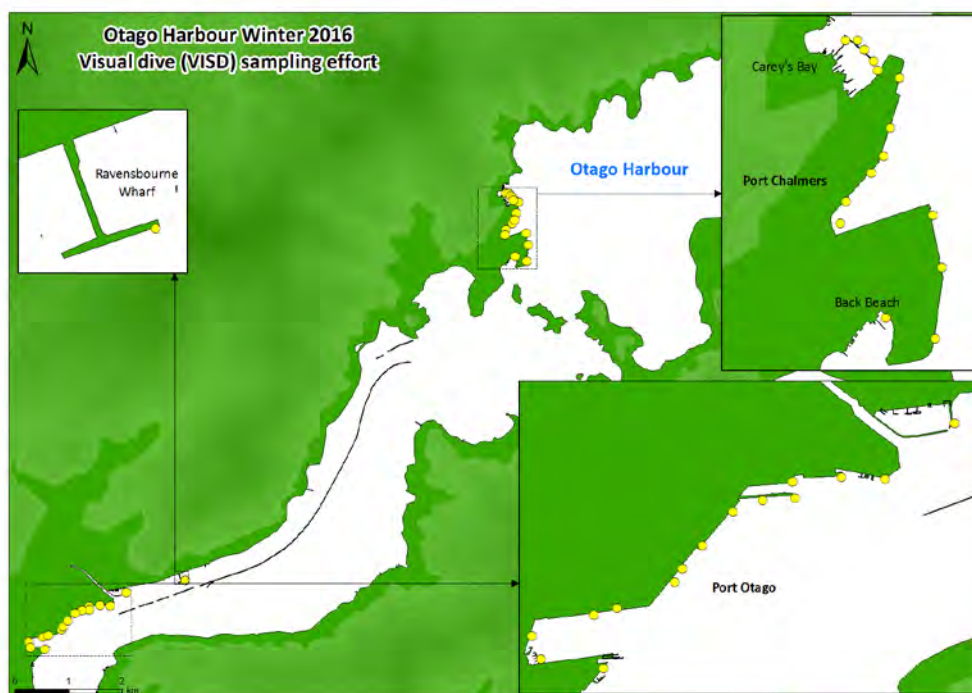
Crab (box) trap locations



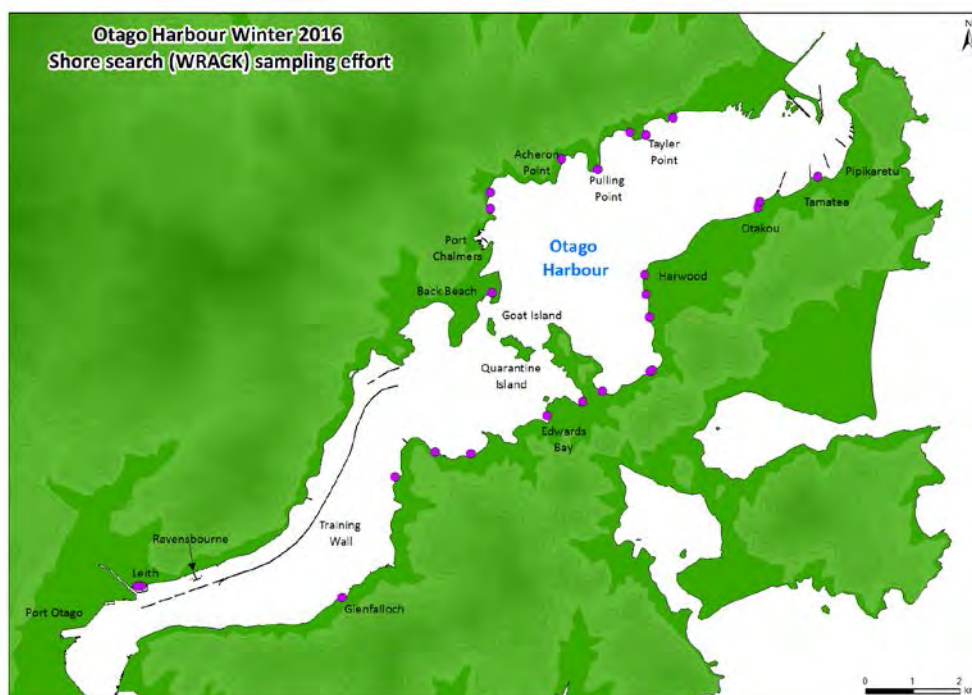
Crab condo locations



Diver search locations

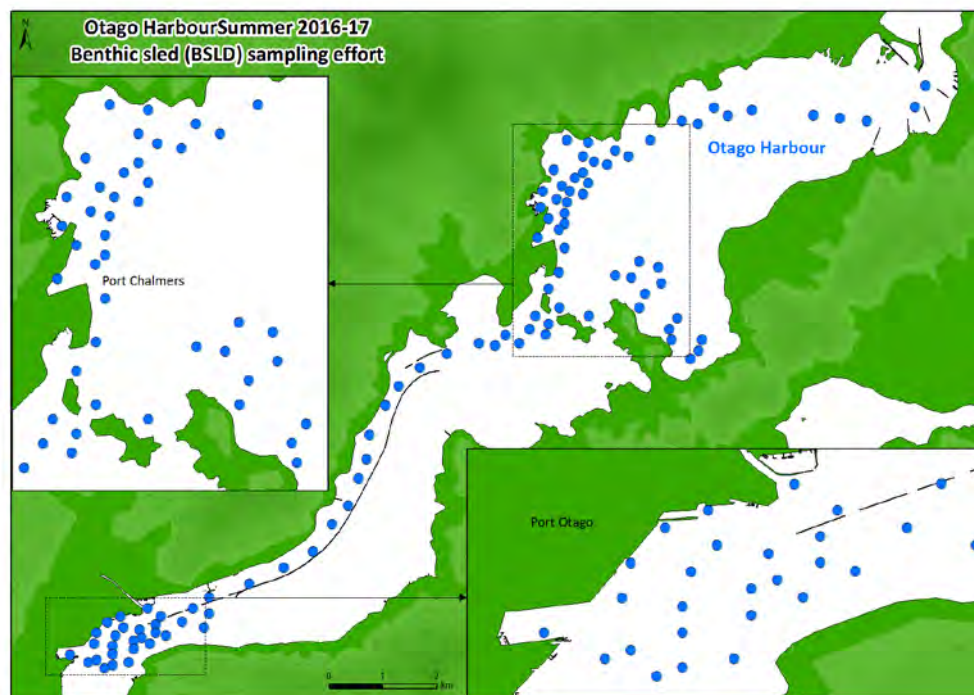


Shore search locations

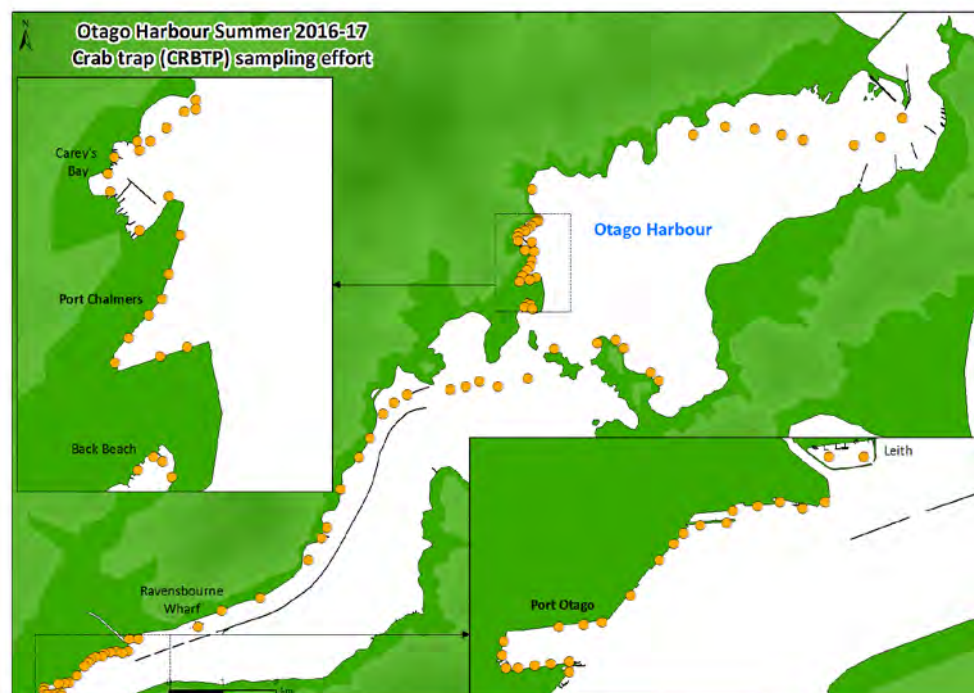


Summer 2016–17

Benthic sled locations



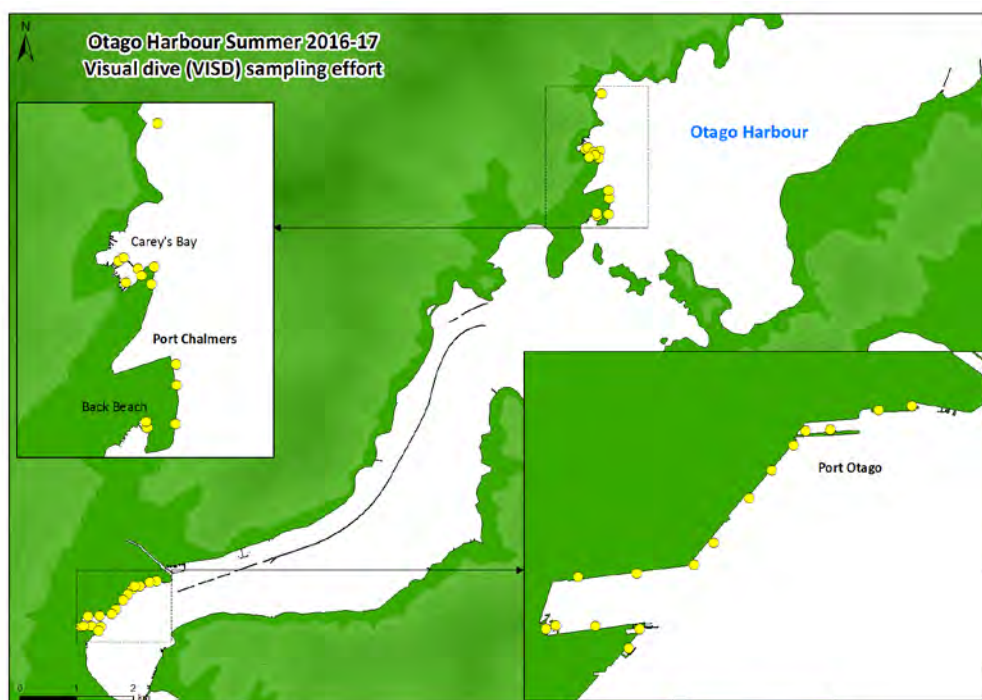
Crab (box) trap locations



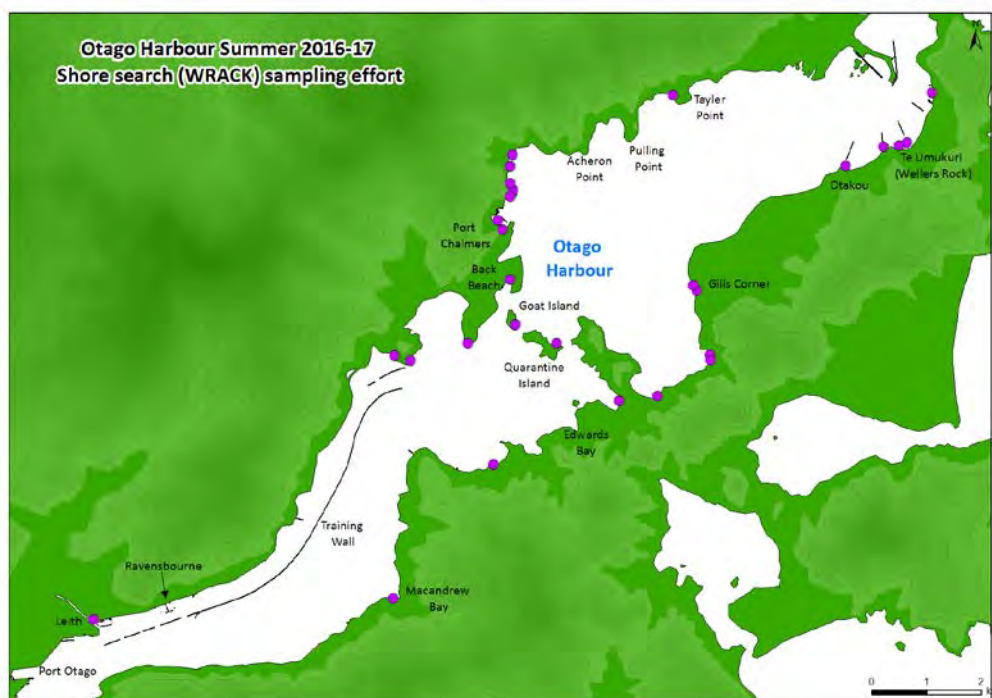
Crab condo locations



Diver search locations



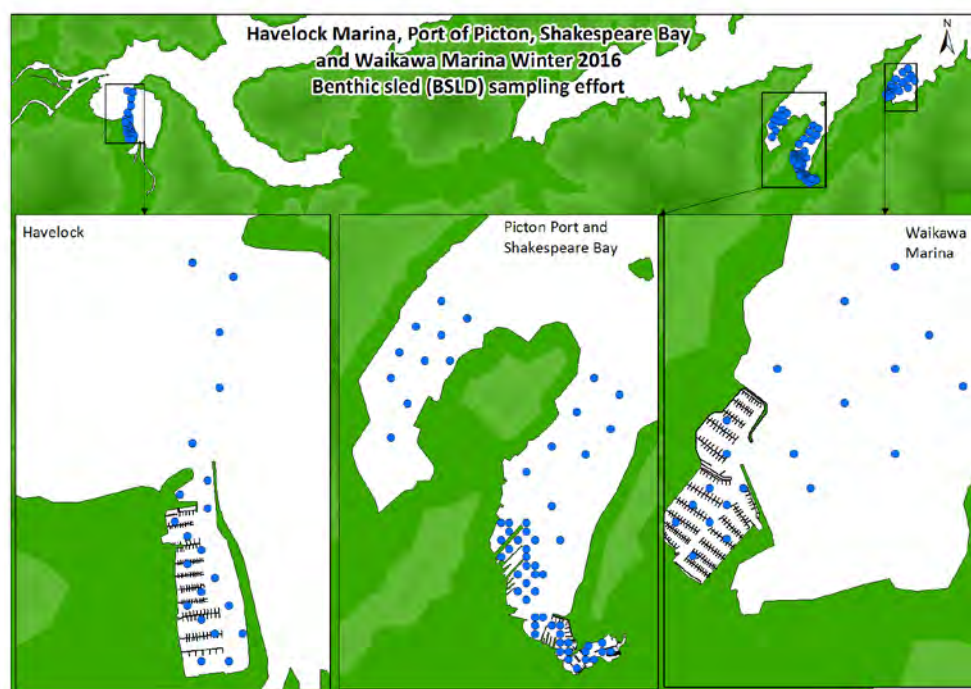
Shore search locations



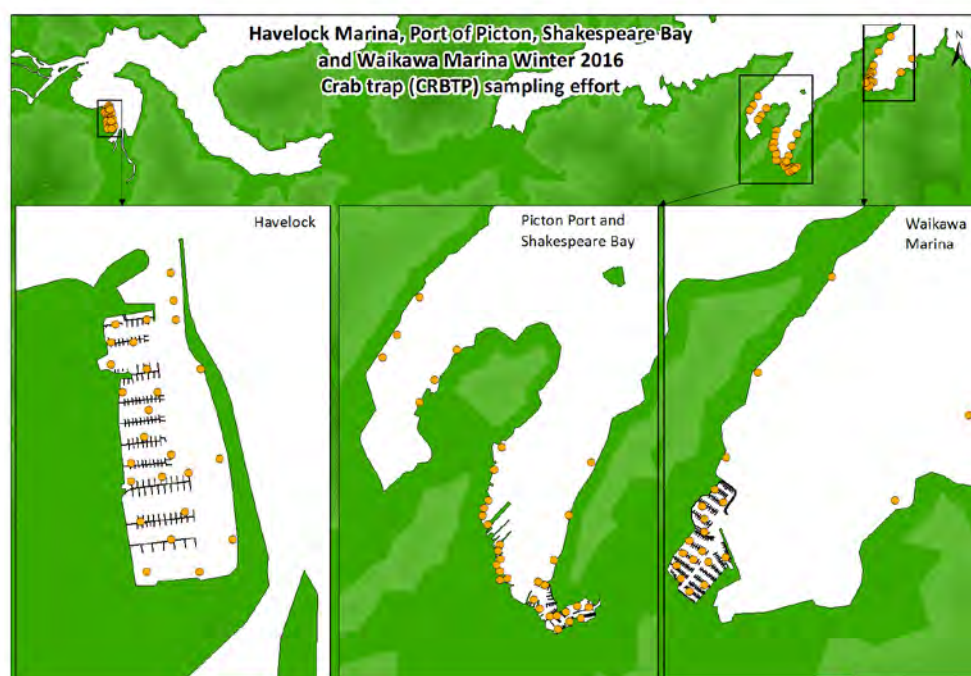
Picton Harbour

Winter 2016

Benthic sled locations



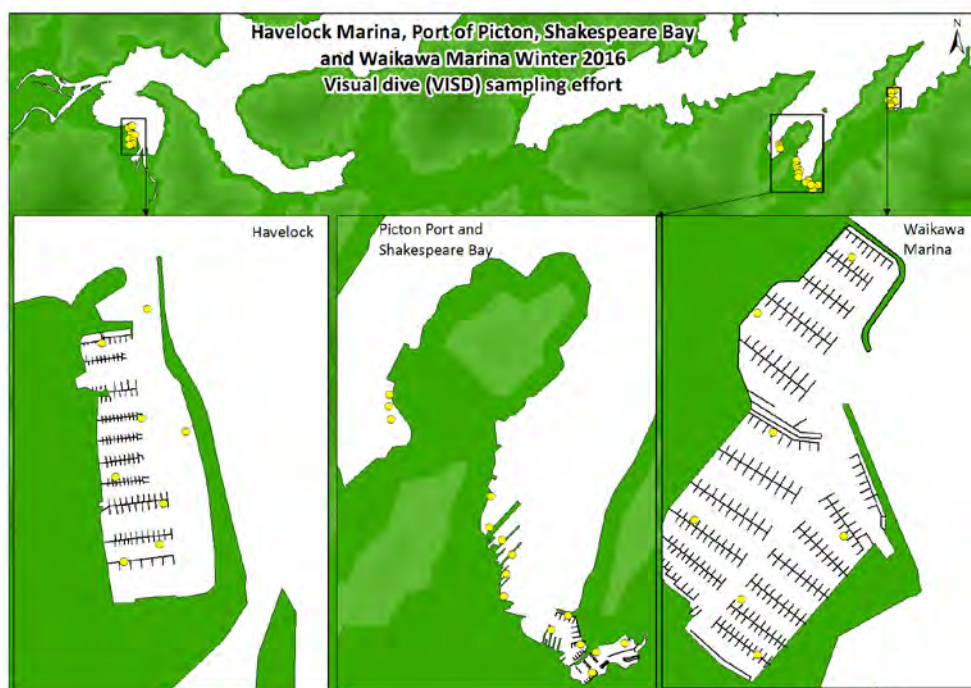
Crab (box) trap locations



Crab condo locations



Diver search locations

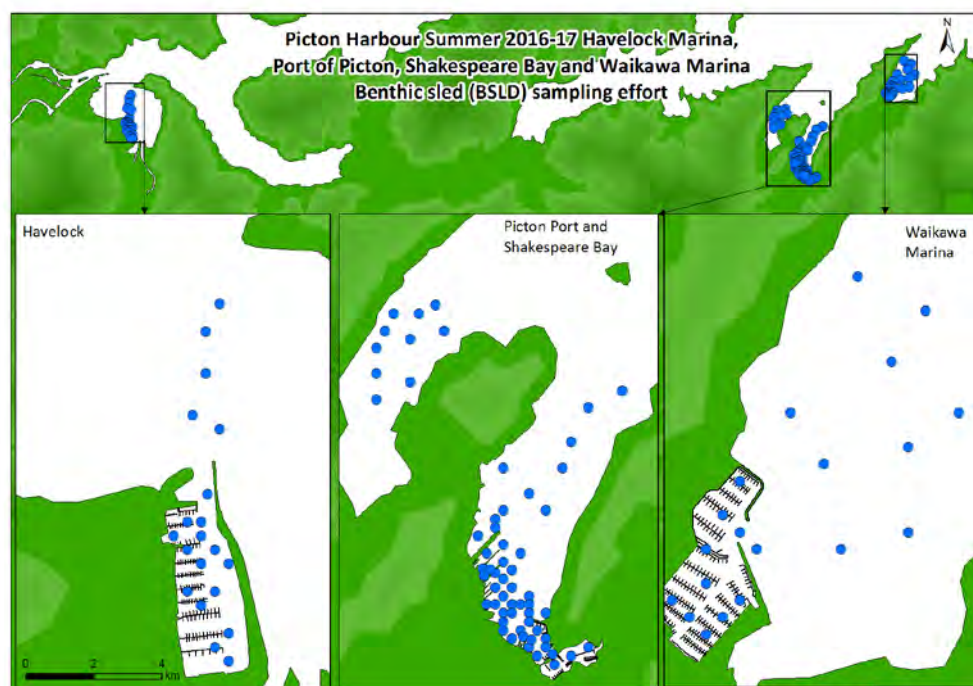


Shore search locations

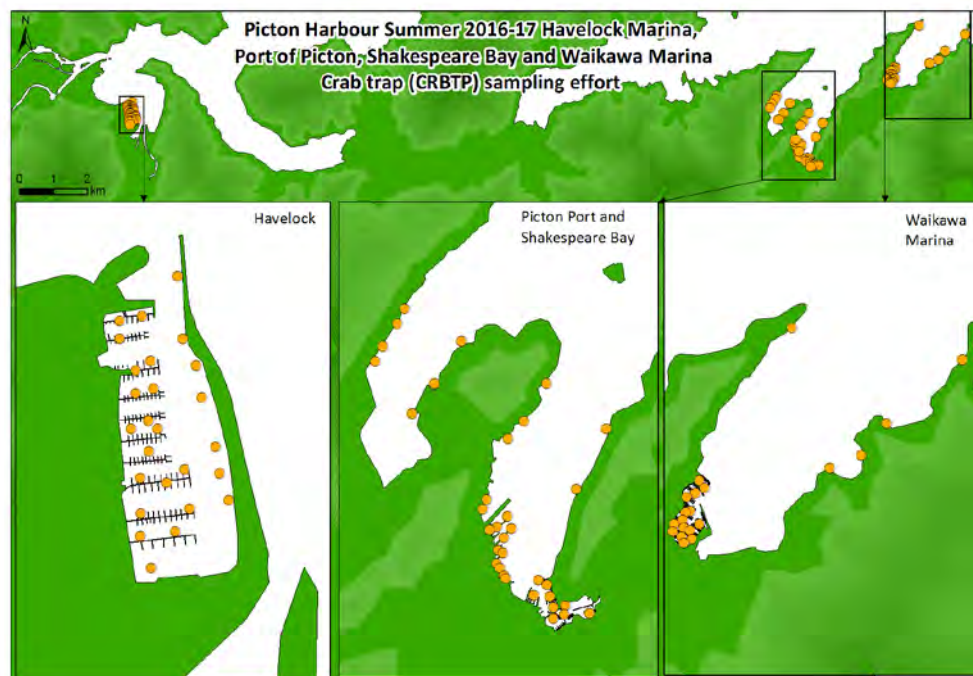


Summer 2016–17

Benthic sled locations



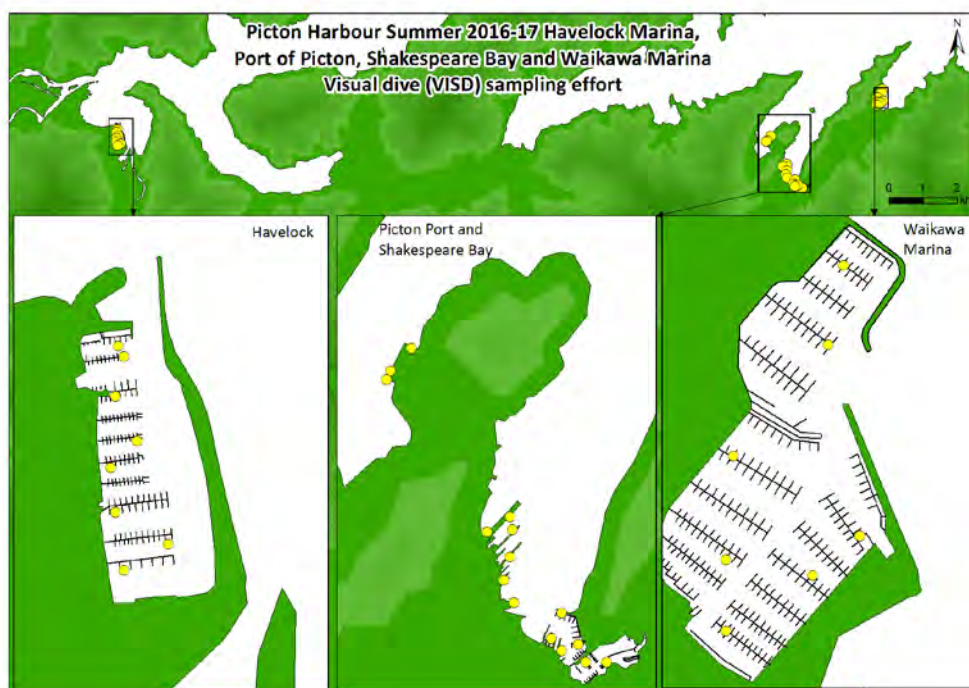
Crab (box) trap locations



Crab condo locations



Diver search locations



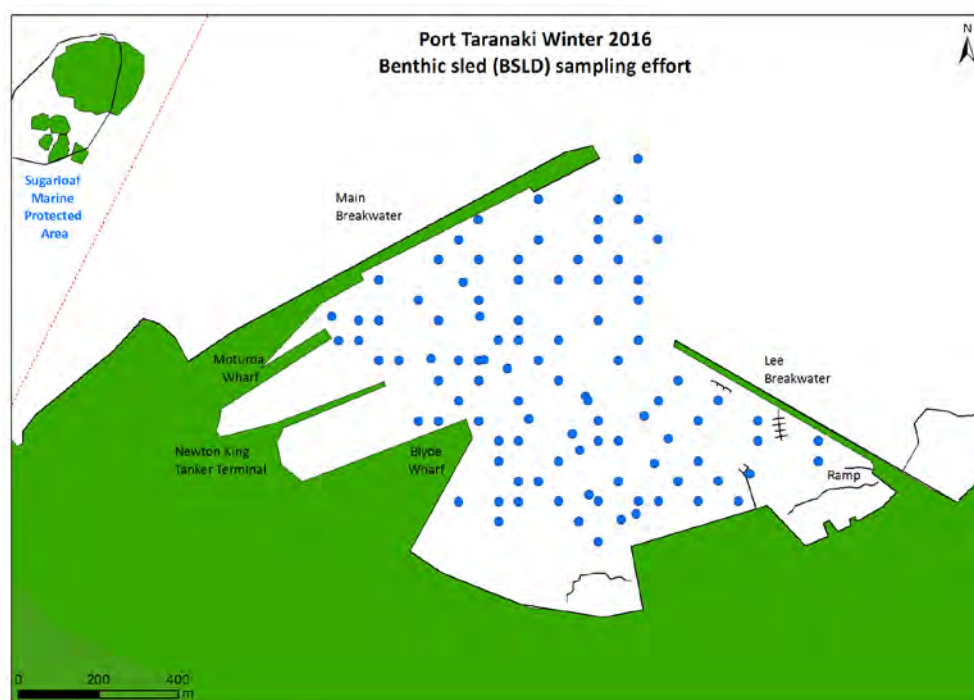
Shore search locations



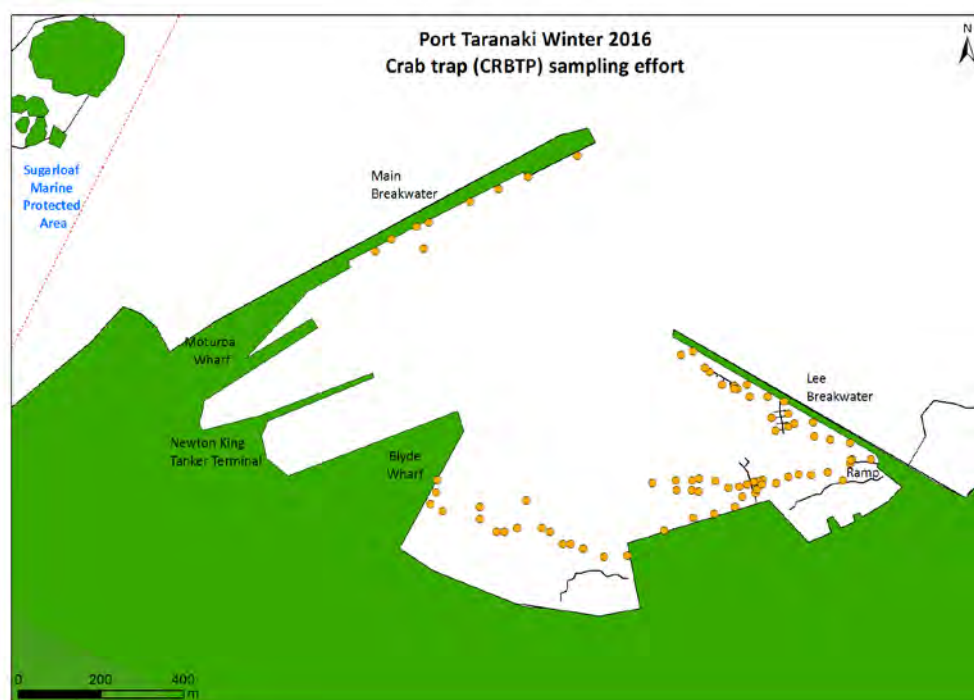
Port Taranaki

Winter 2016

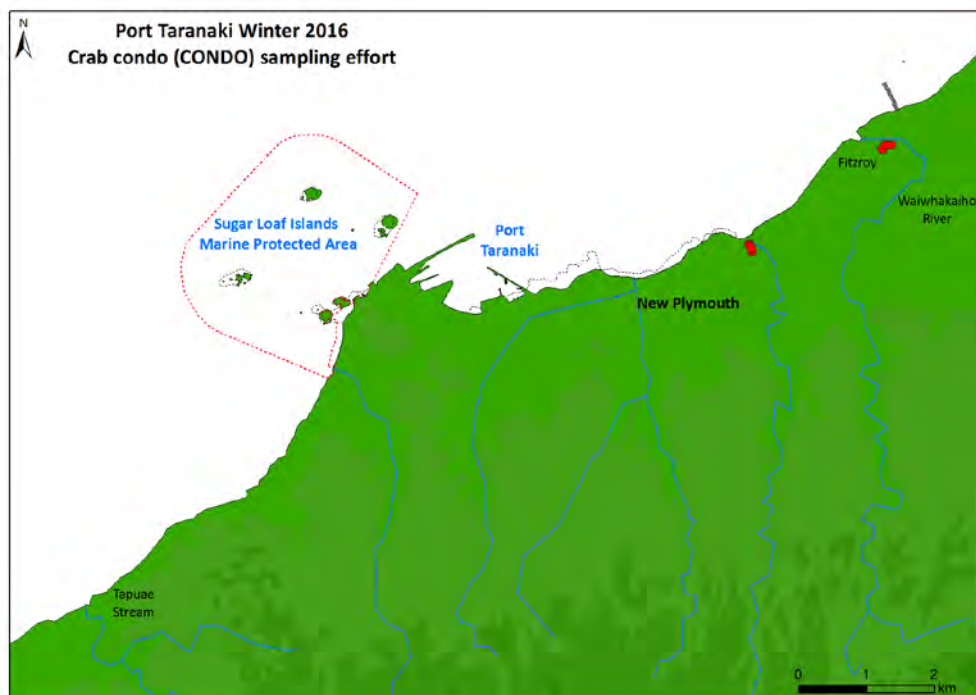
Benthic sled locations



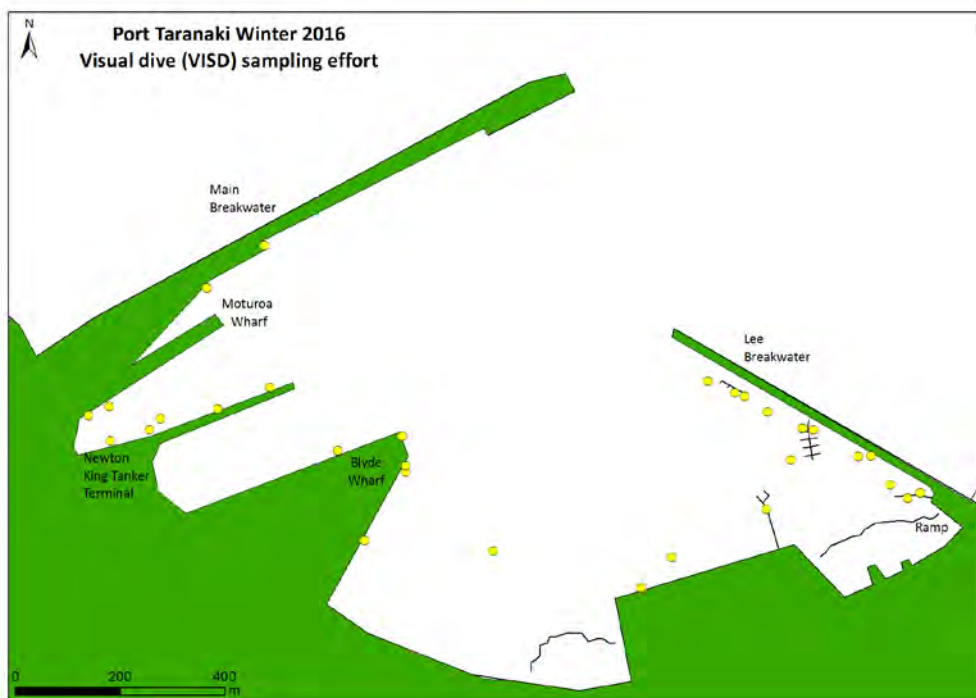
Crab (box) trap locations



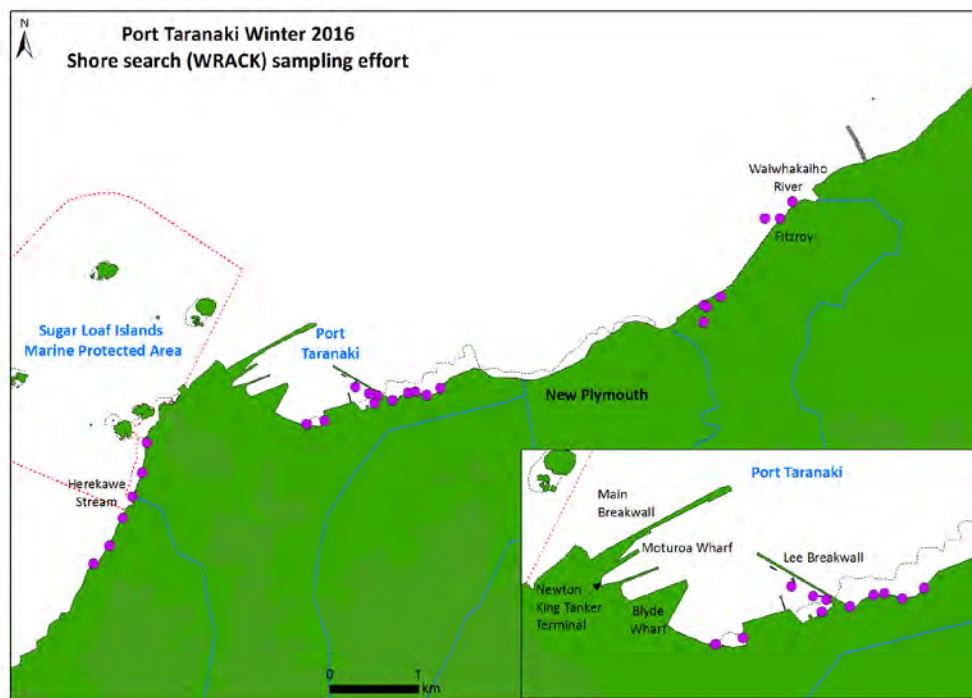
Crab condo locations



Diver search locations

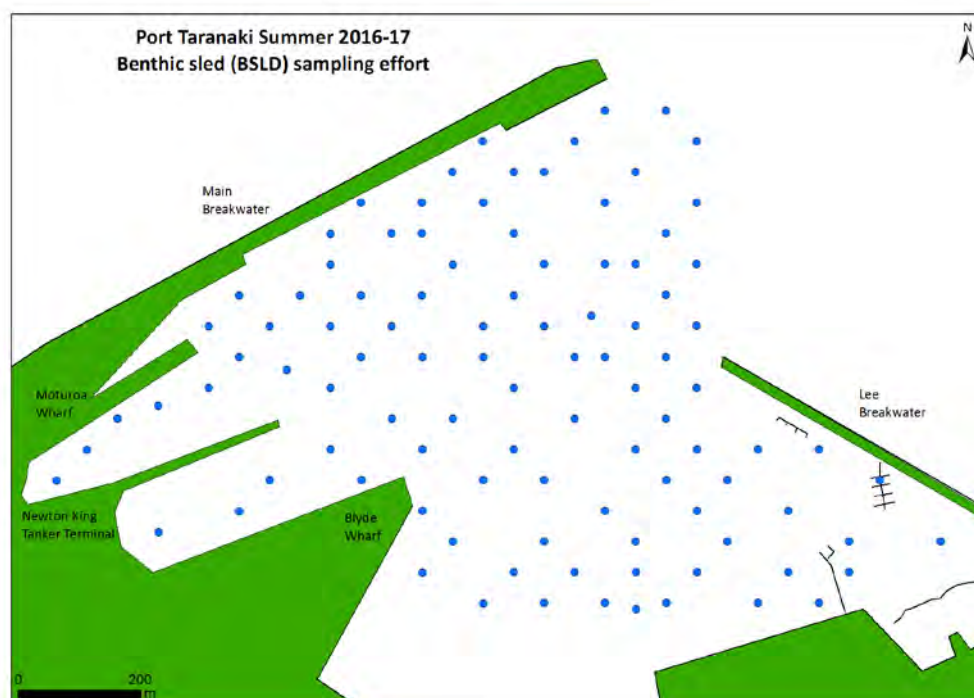


Shore search locations

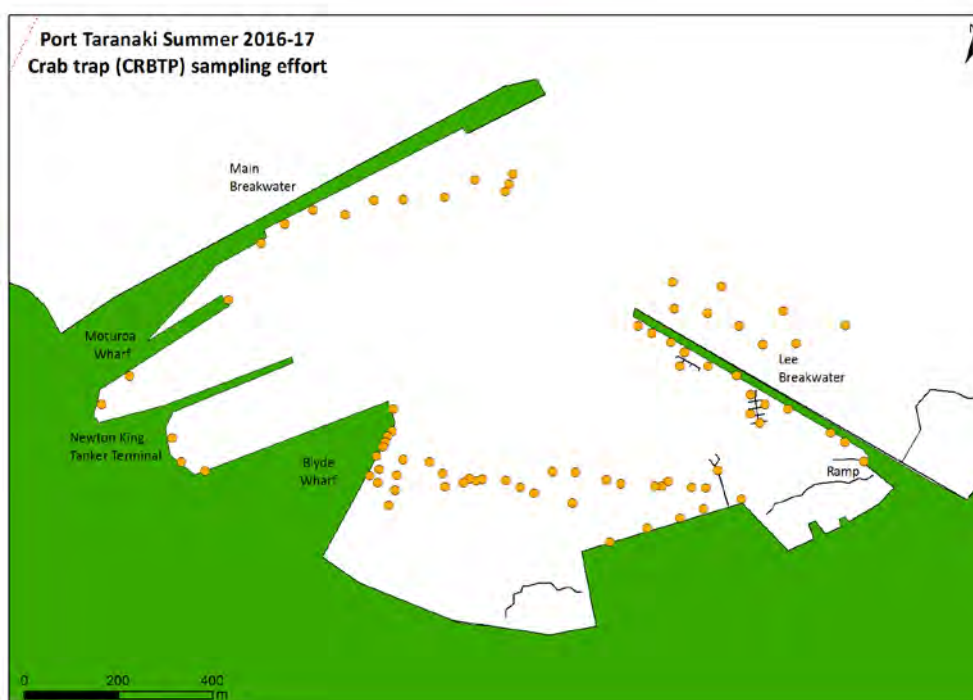


Summer 2016–17

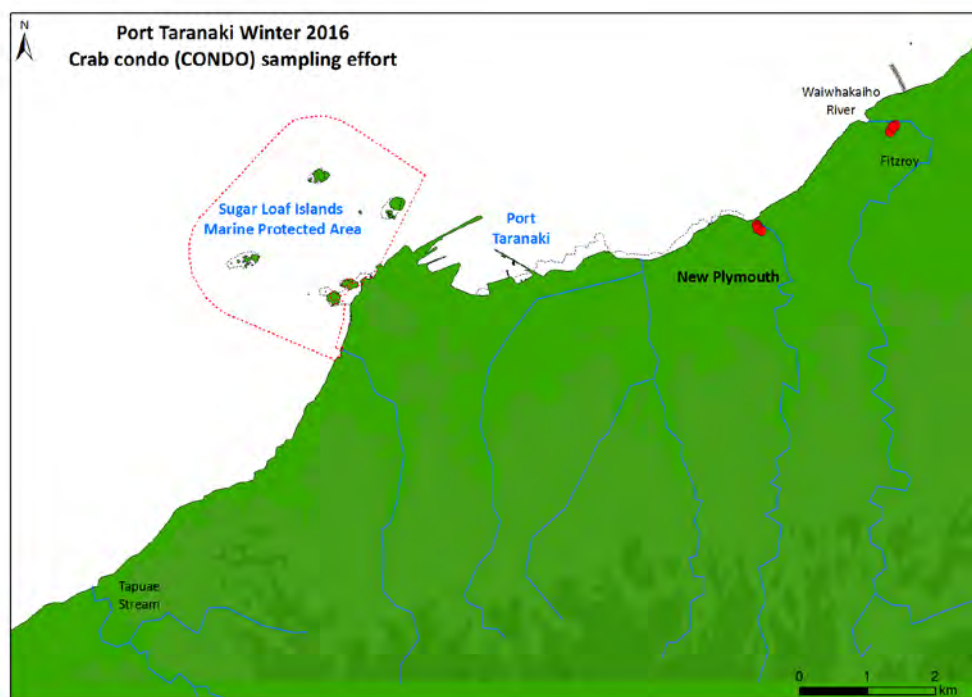
Benthic sled locations



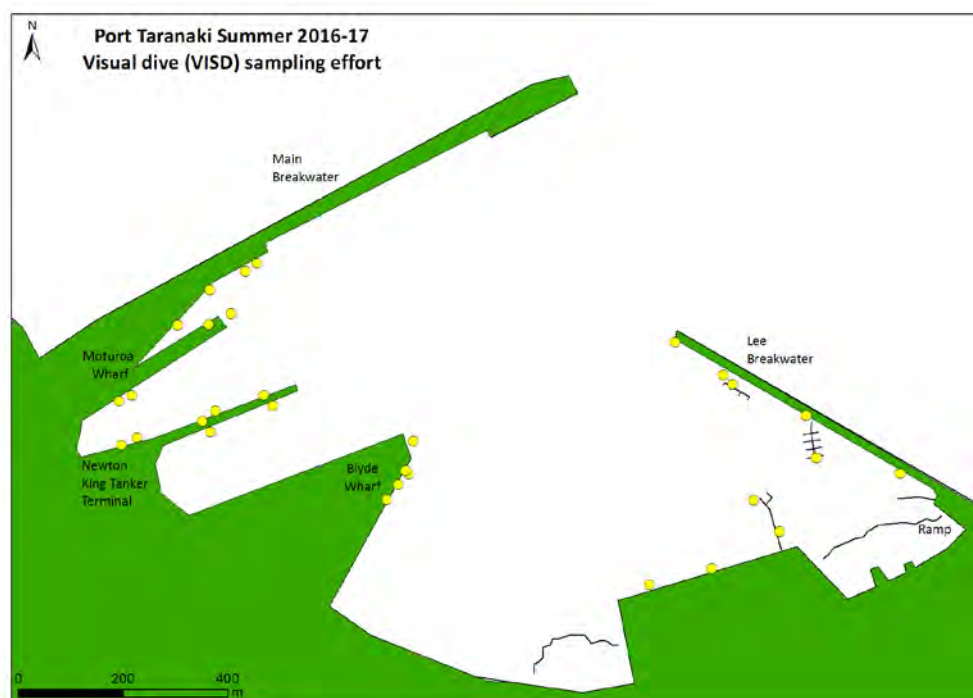
Crab (box) trap locations



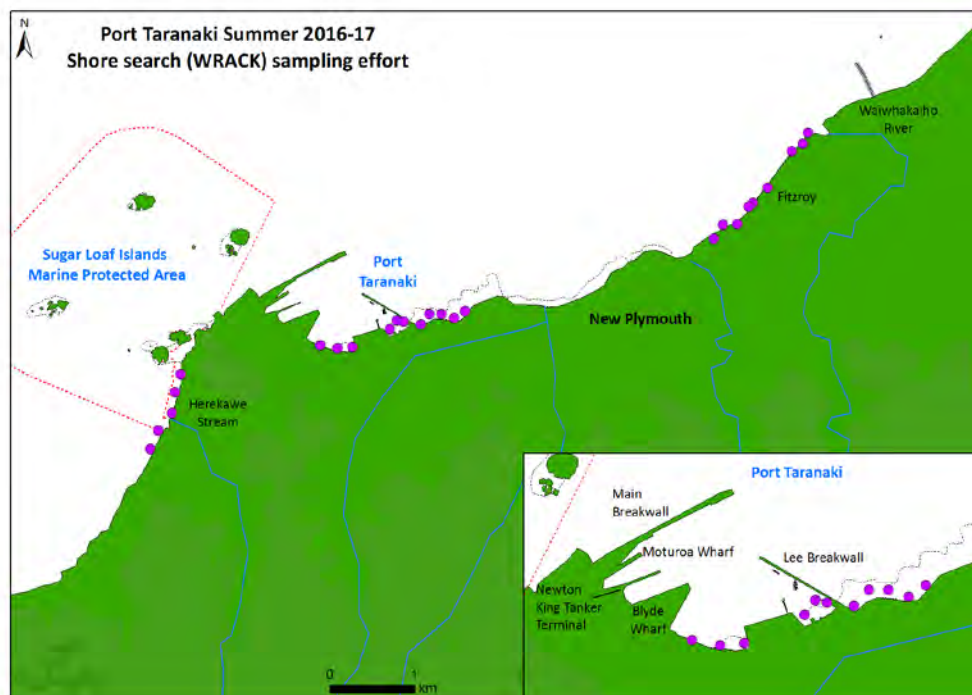
Crab condo locations



Diver search locations



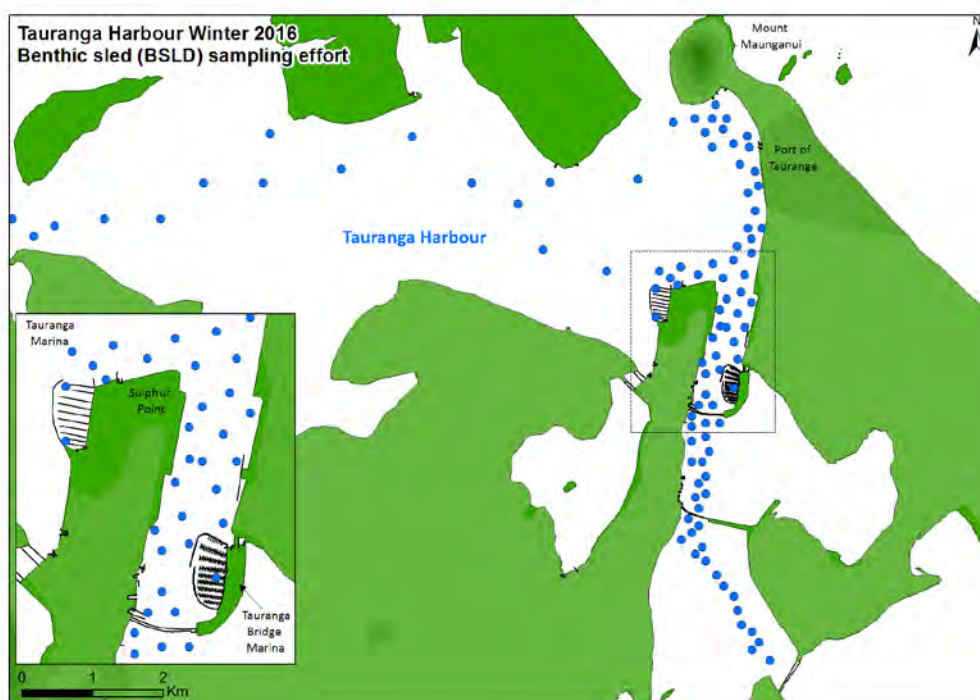
Shore search locations



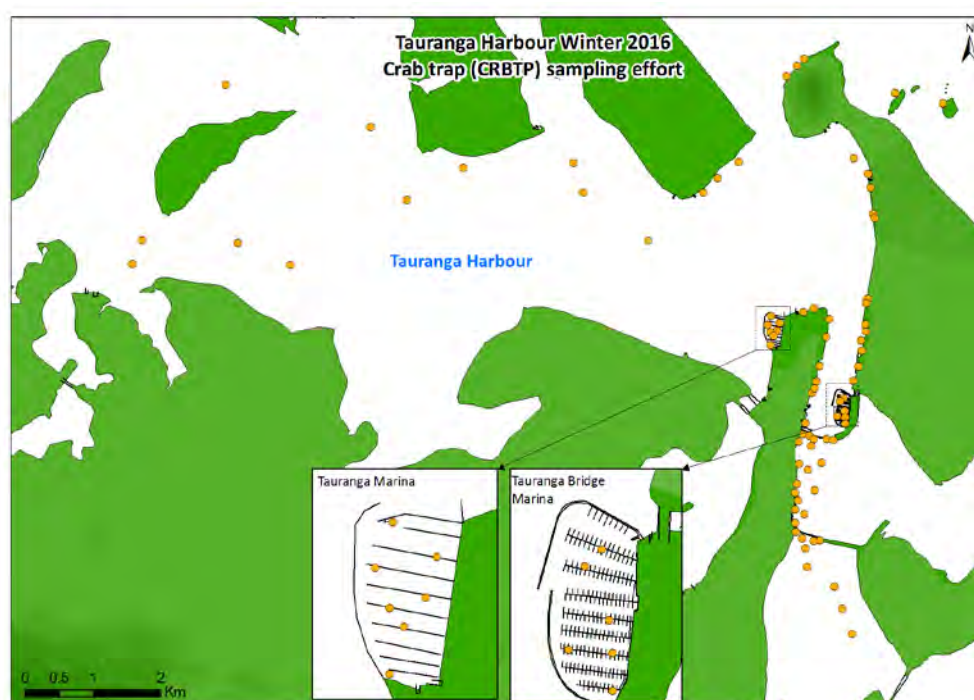
Tauranga Harbour

Winter 2016

Benthic sled locations



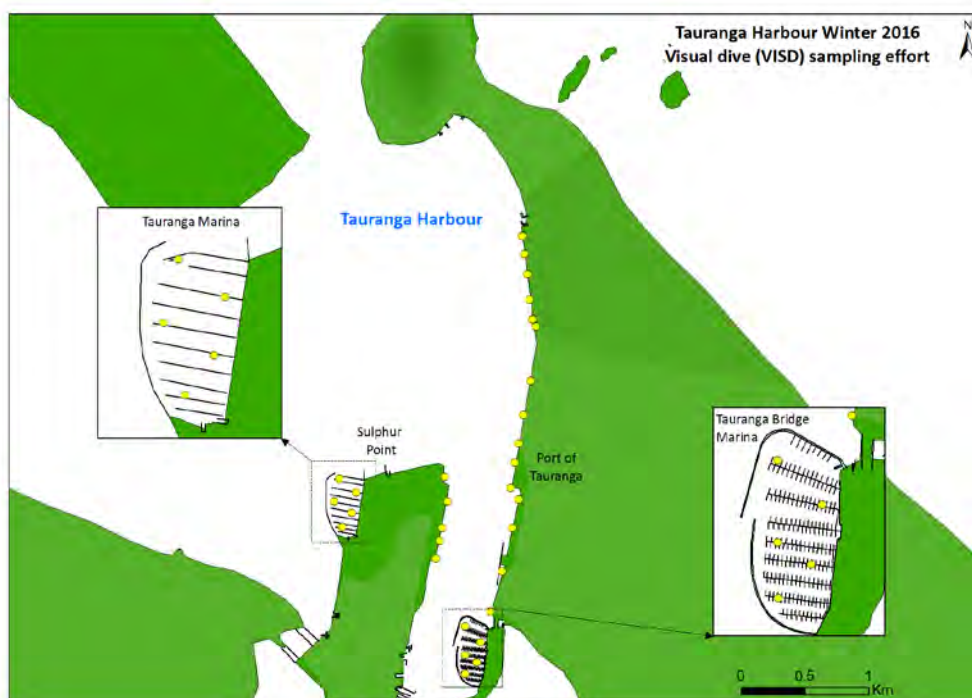
Crab (box) trap locations



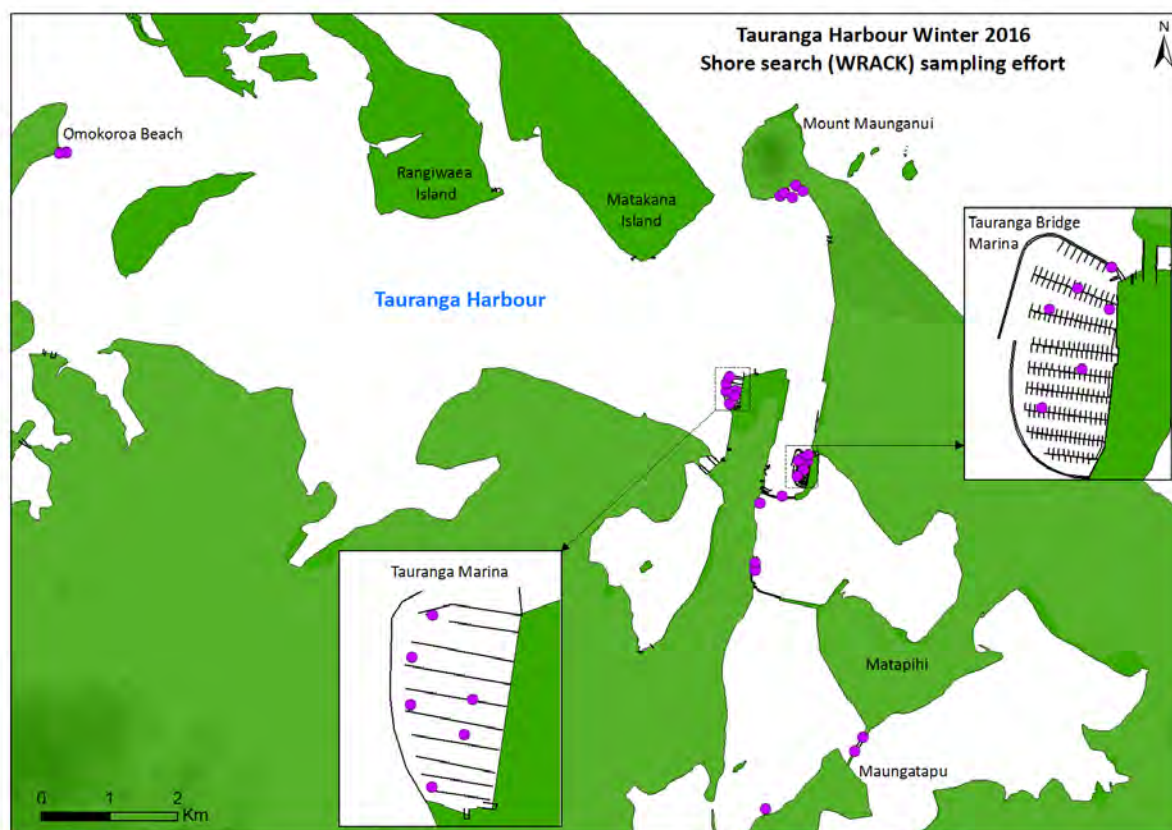
Crab condo locations



Diver search locations

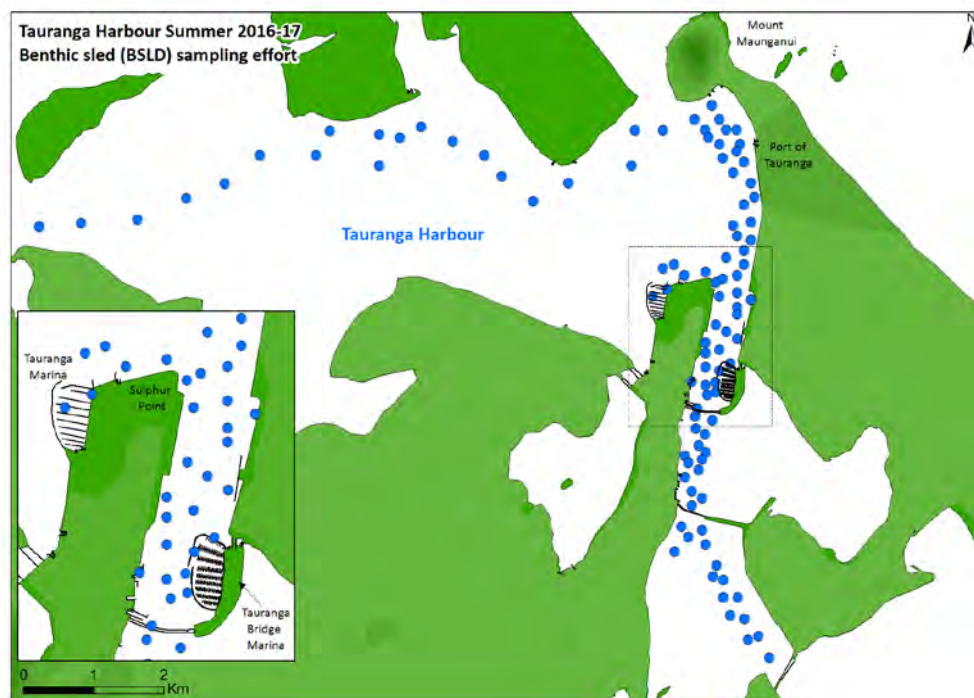


Shore search locations



Summer 2016–17

Benthic sled locations



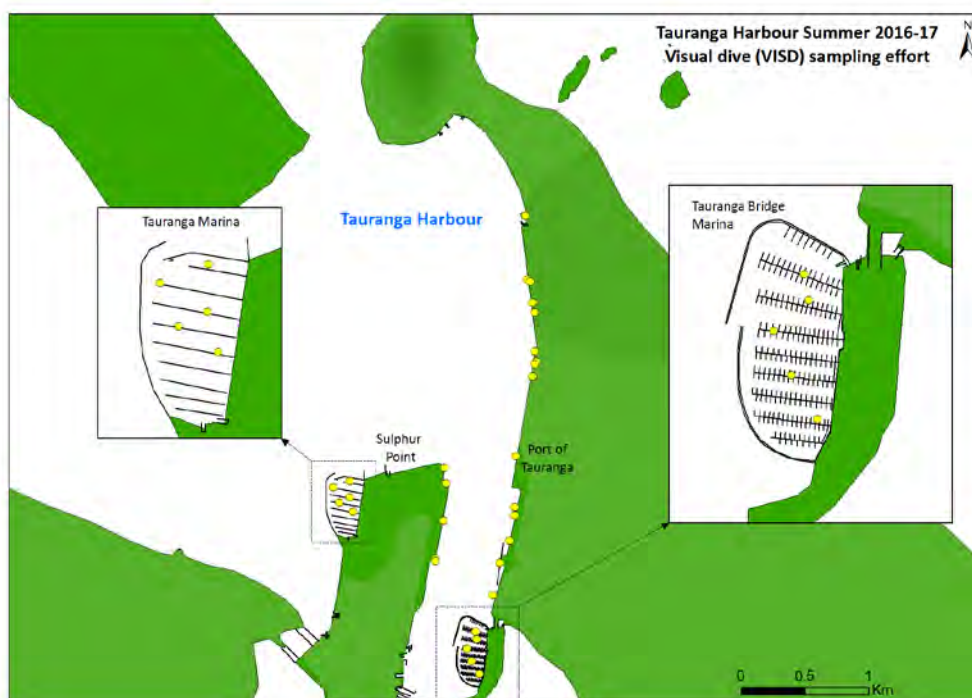
Crab (box) trap locations



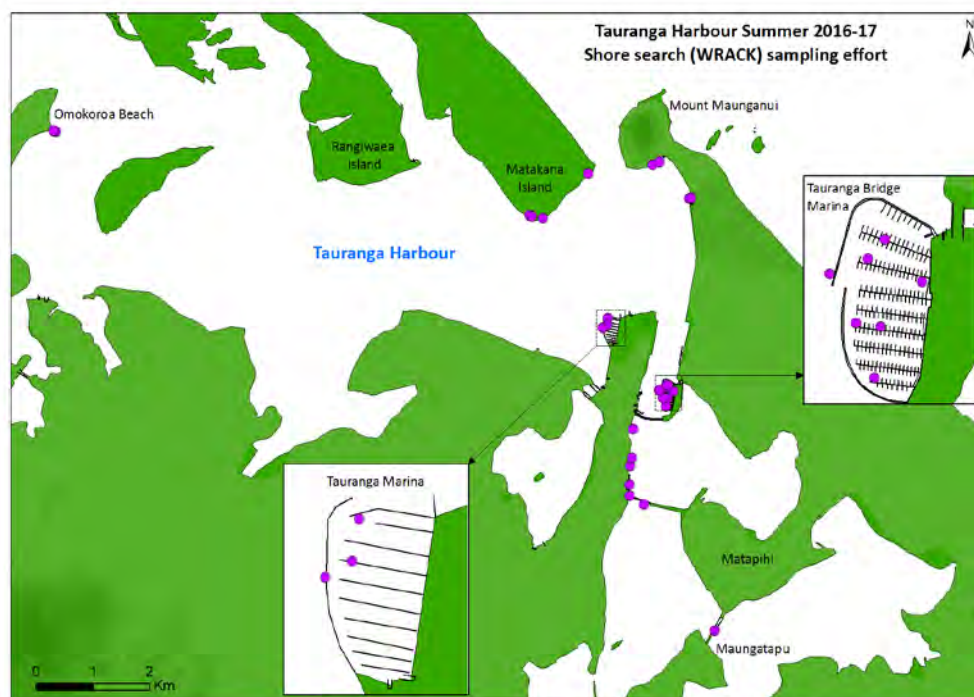
Crab condo locations



Diver search locations



Shore search locations

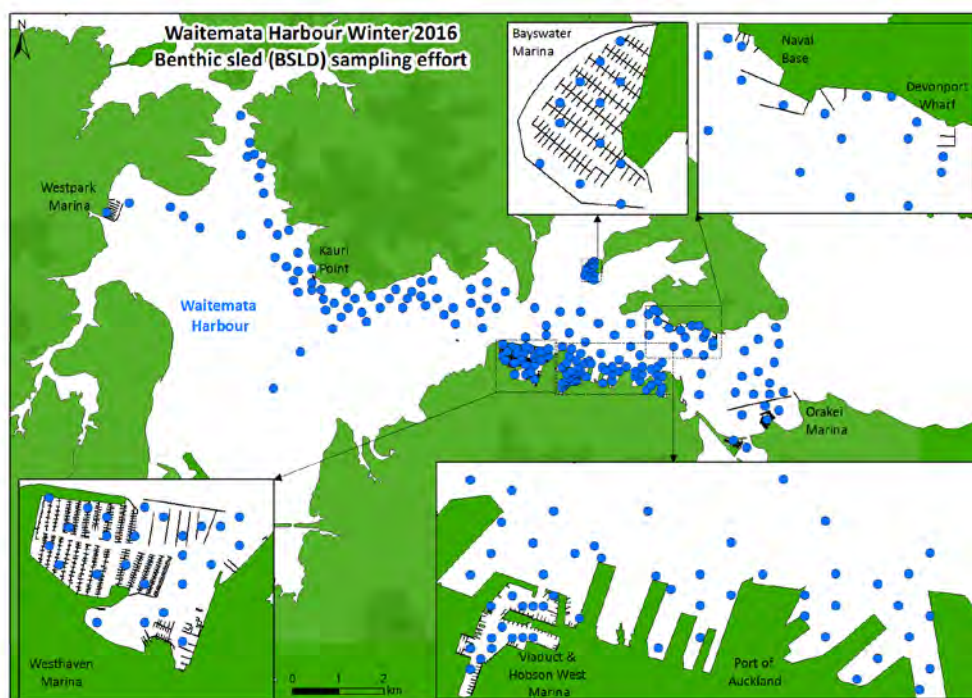


Waitemata Harbour

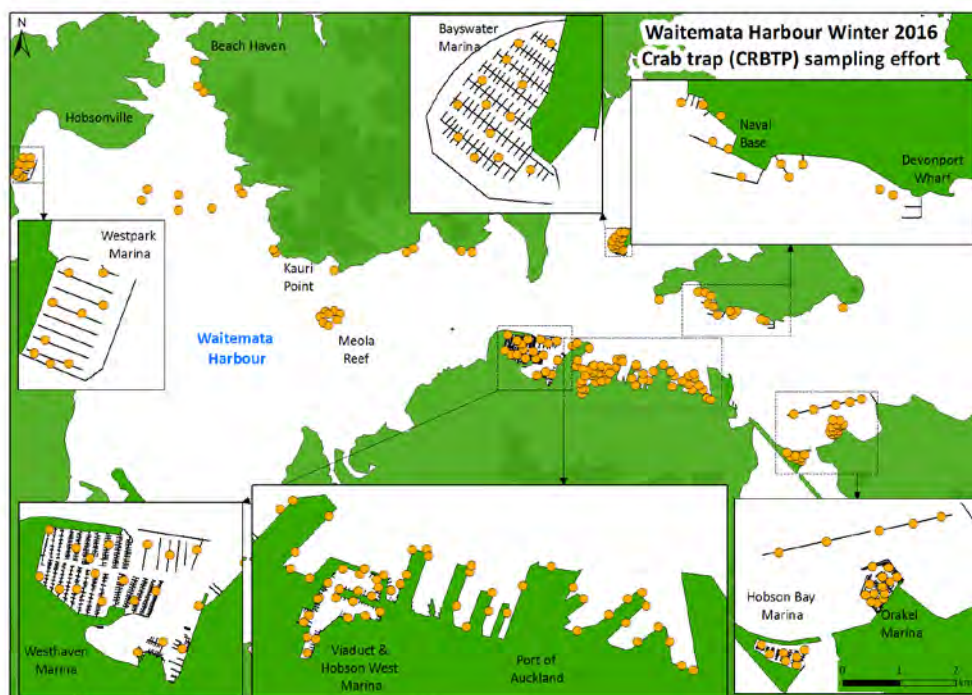
Winter 2016

Note: diver search operations were not conducted in the winter survey of the Waitemata Harbour due to the presence of a large leopard seal.

Benthic sled locations



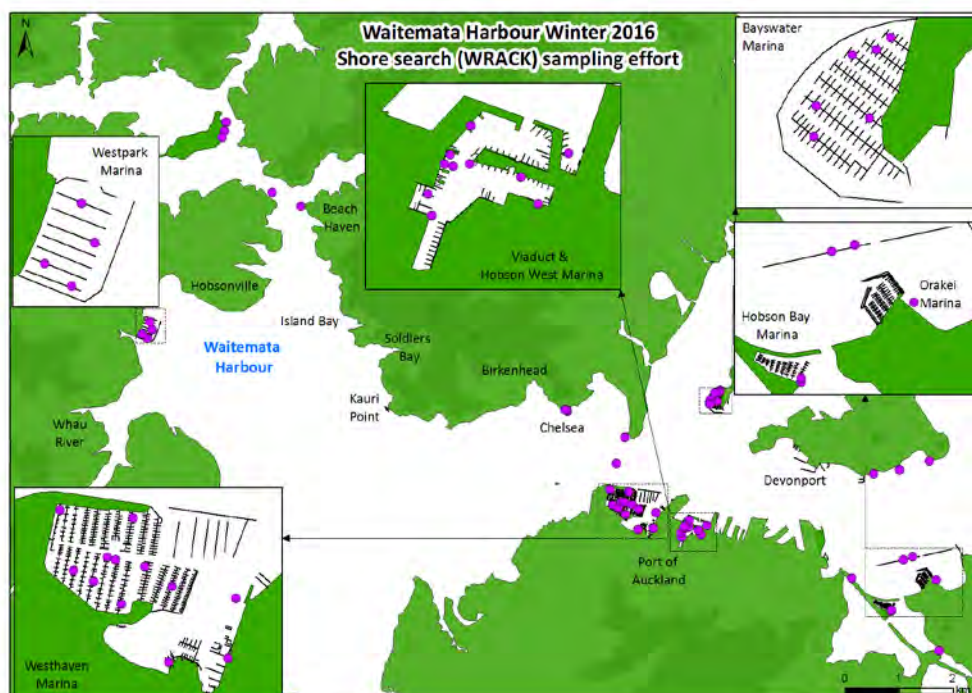
Crab (box) trap locations



Crab condo locations

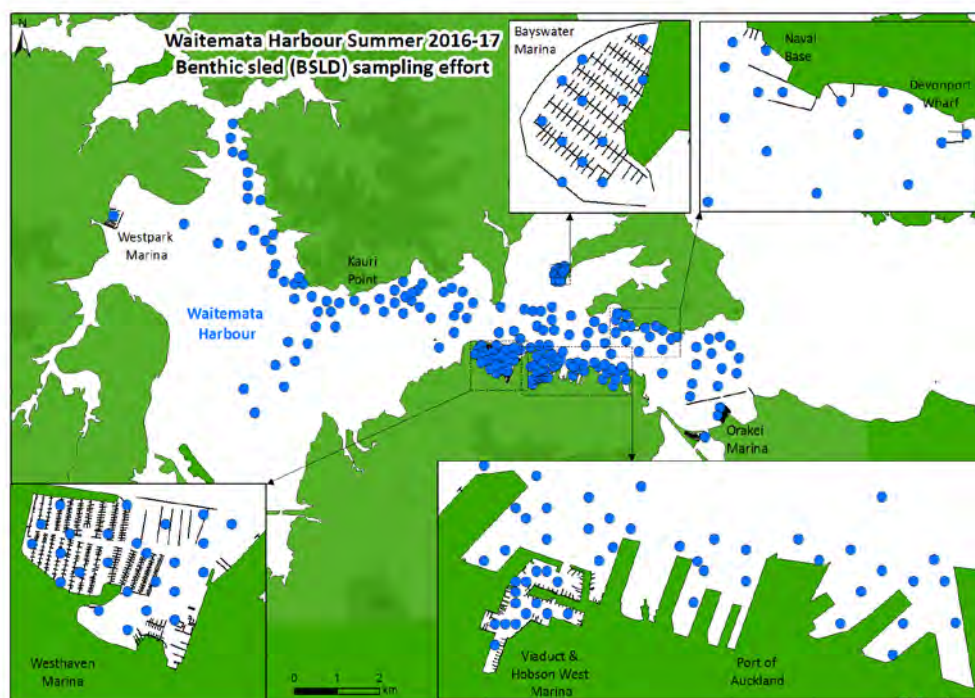


Shore search locations

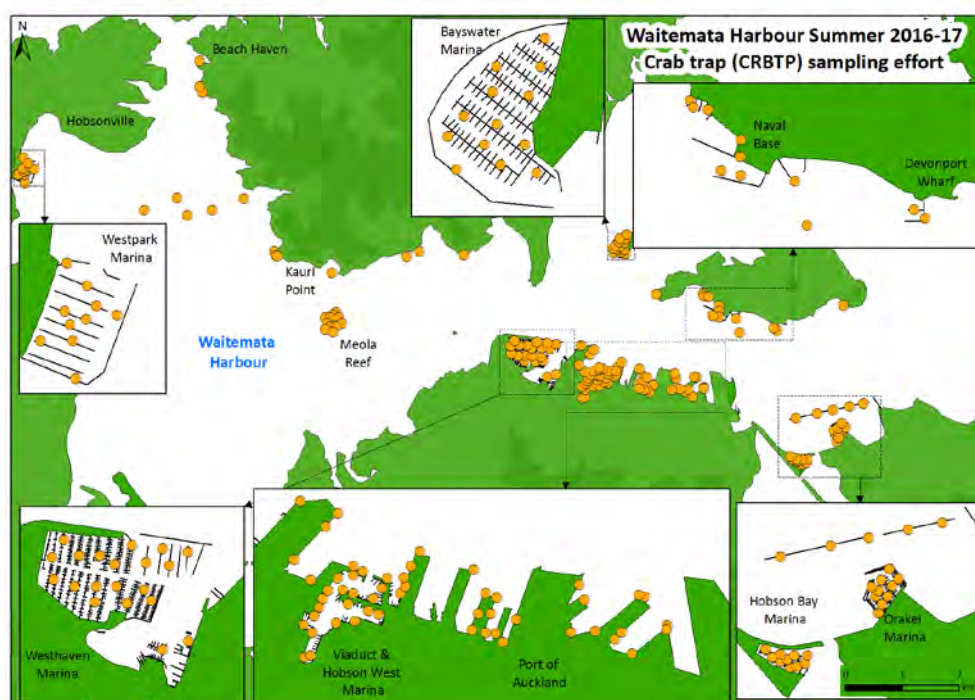


Summer 2016–17

Benthic sled locations



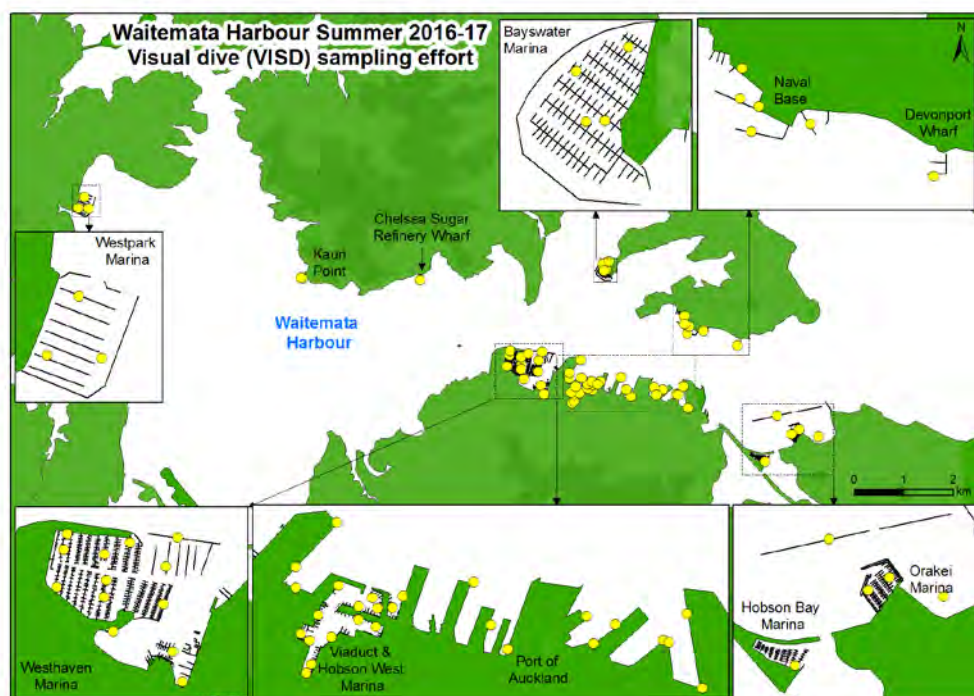
Crab (box) trap locations



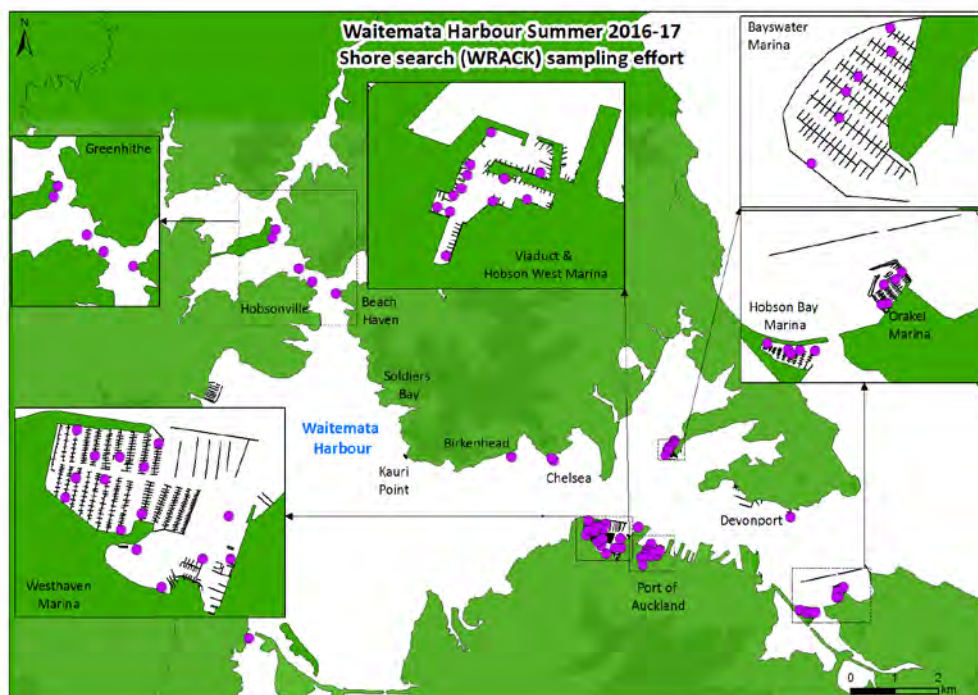
Crab condo locations



Diver search locations



Shore search locations



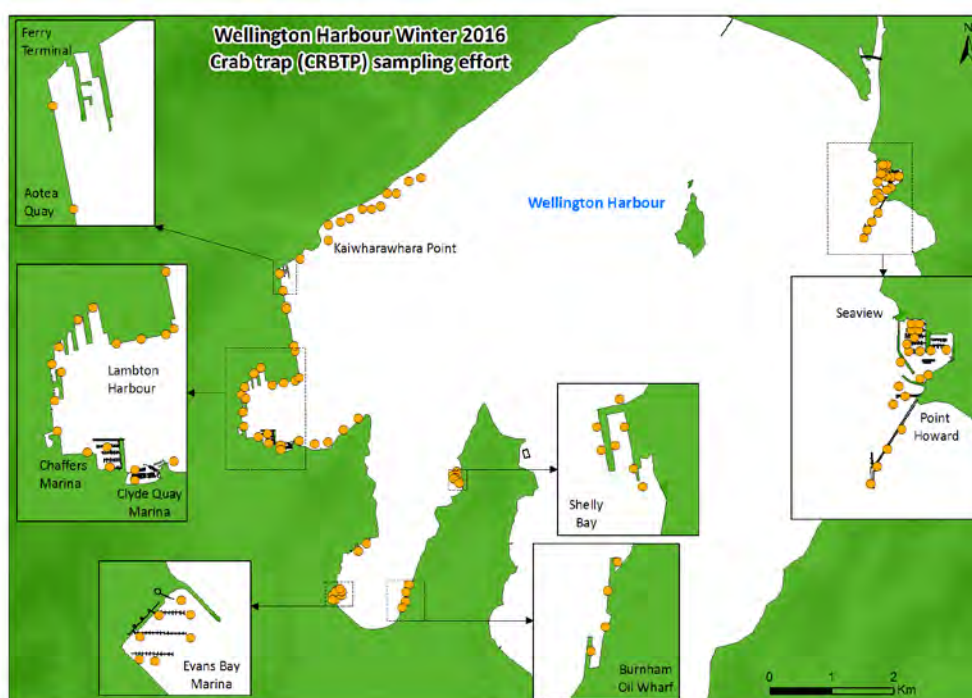
Wellington Harbour

Winter 2016

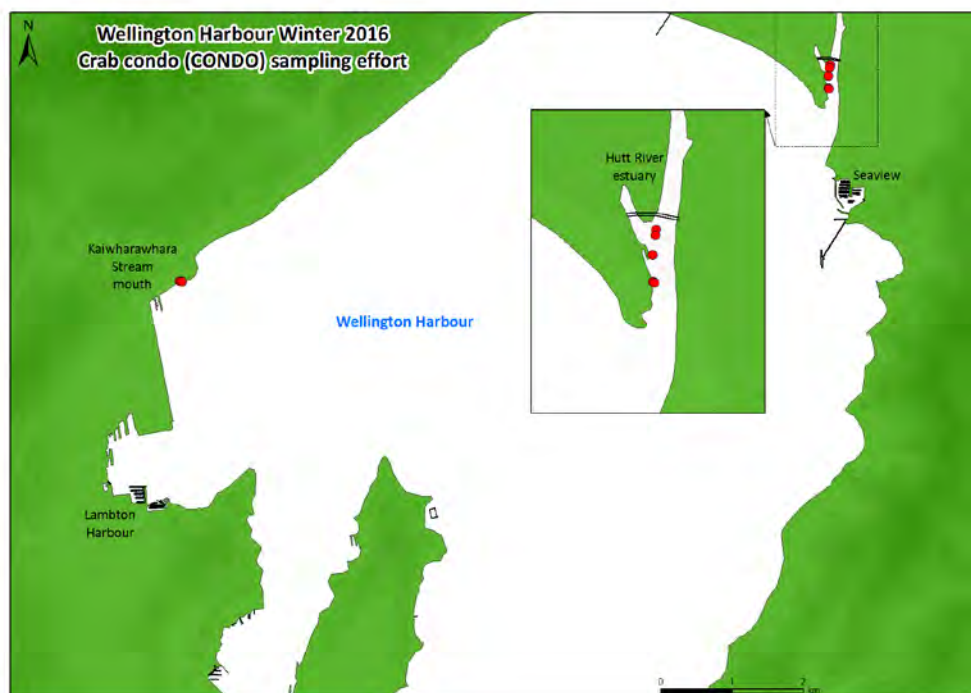
Benthic sled locations



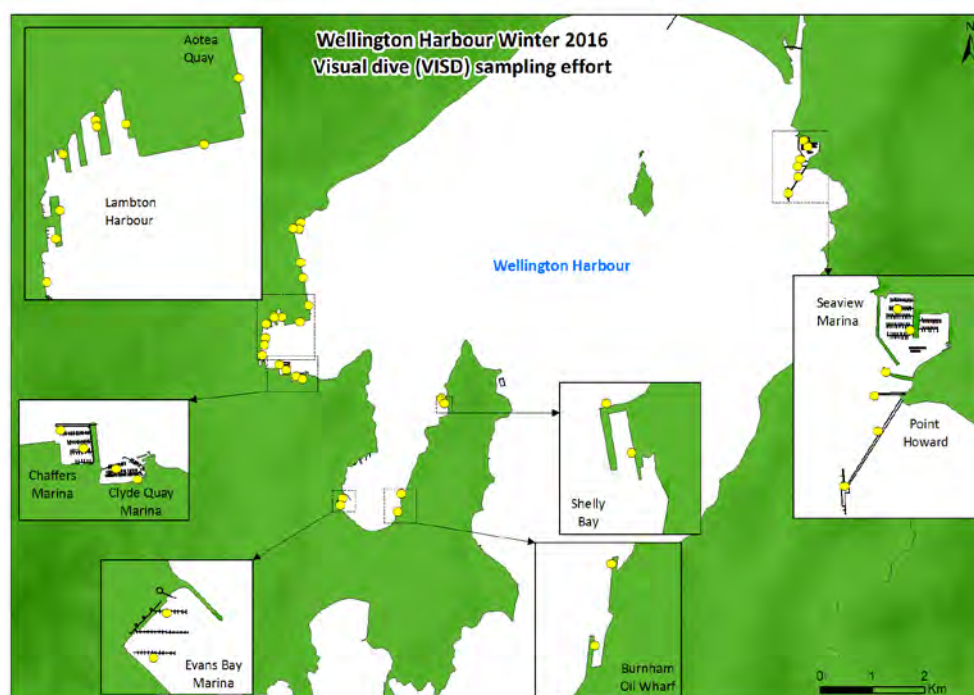
Crab (box) trap locations



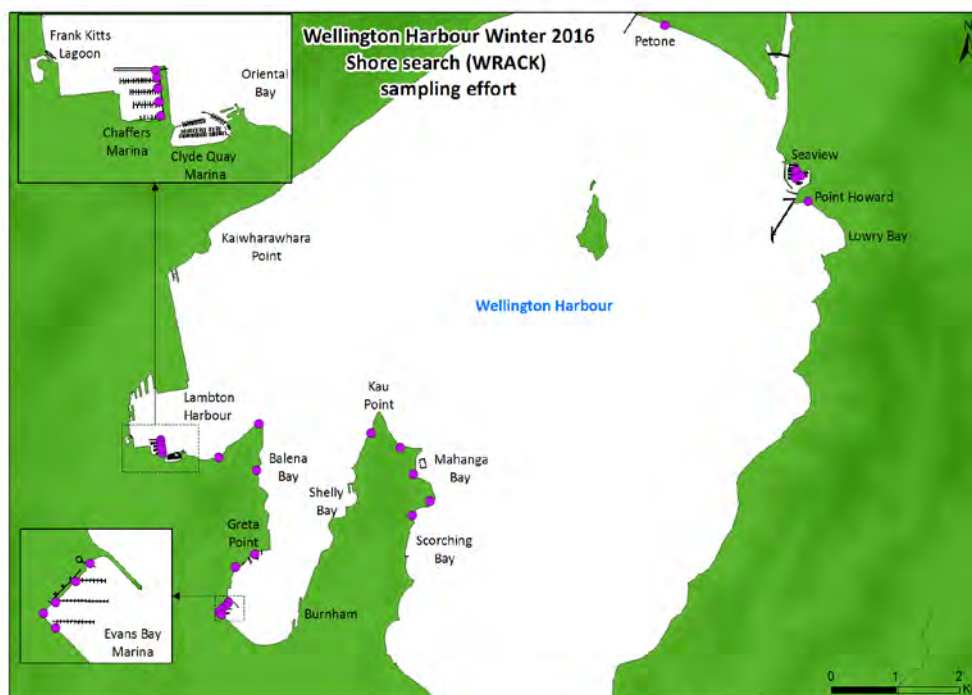
Crab condo locations



Diver search locations

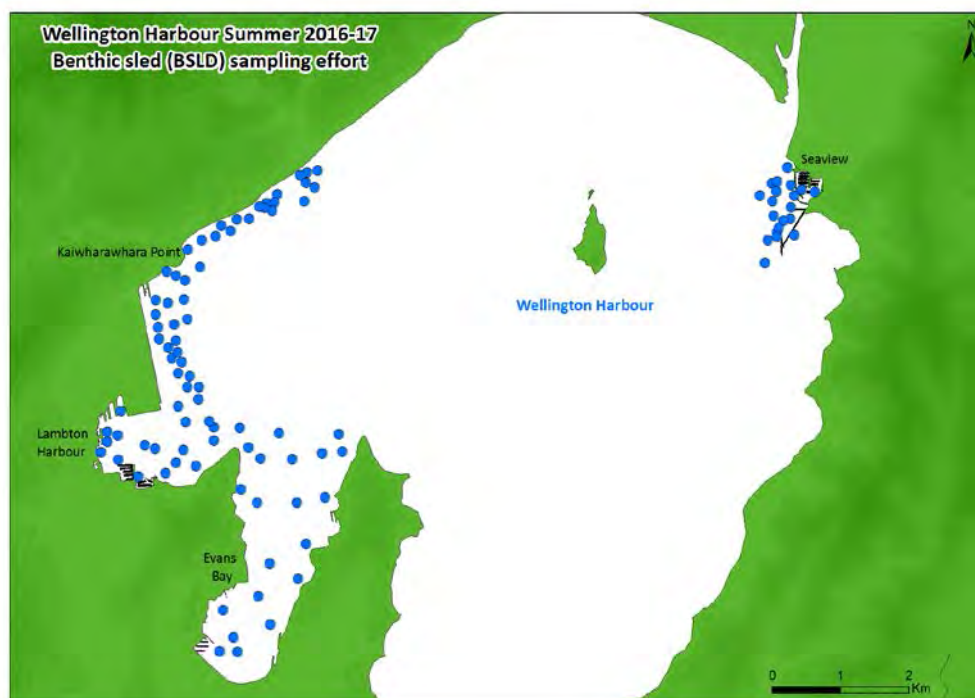


Shore search locations

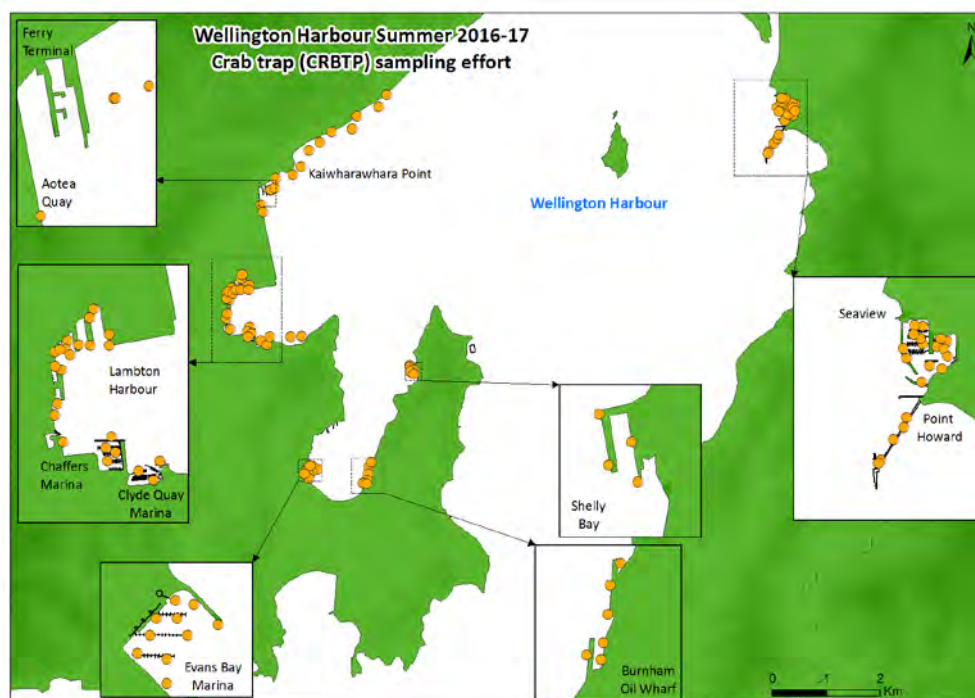


Summer 2016–17

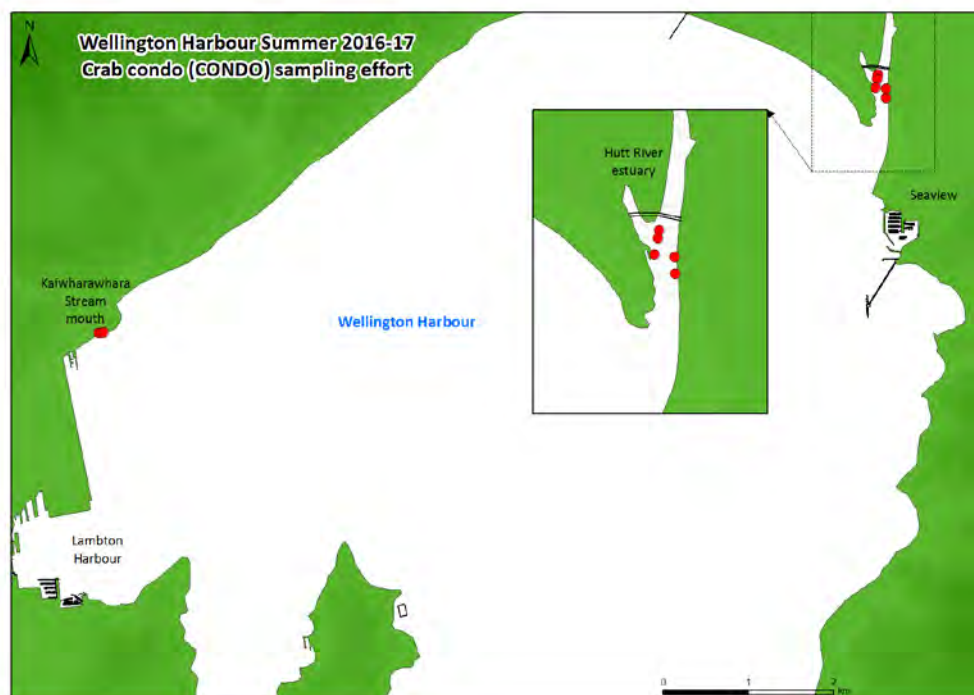
Benthic sled locations



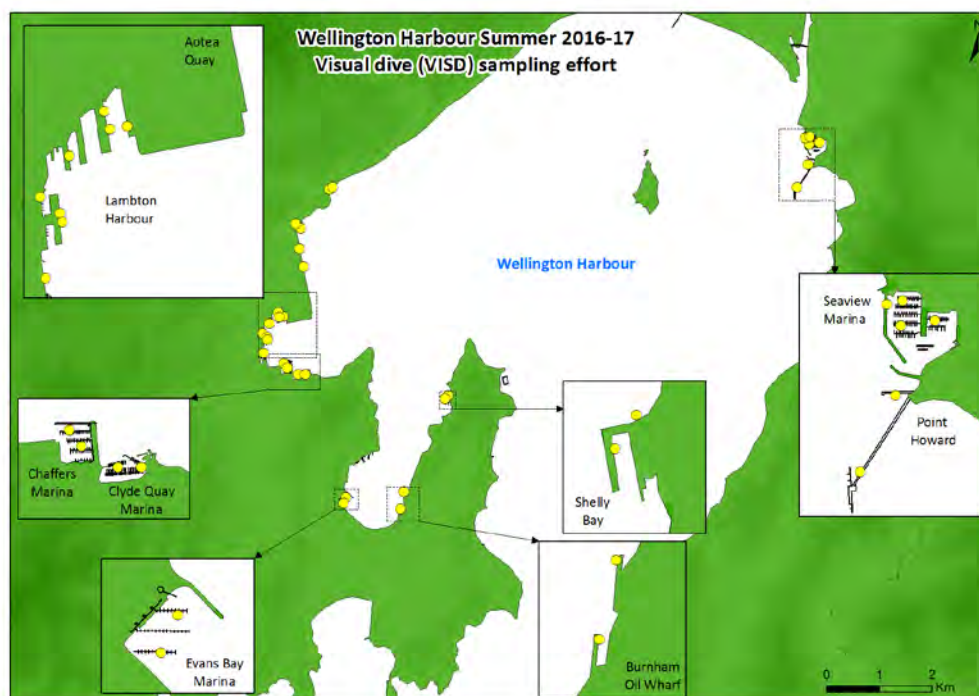
Crab (box) trap locations



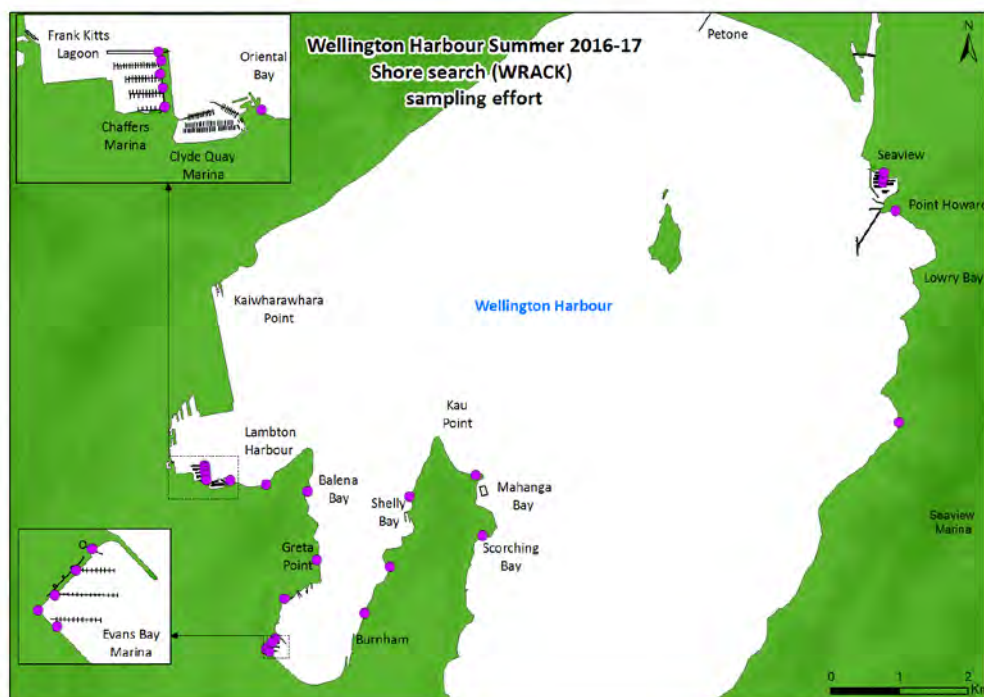
Crab condo locations



Diver search locations



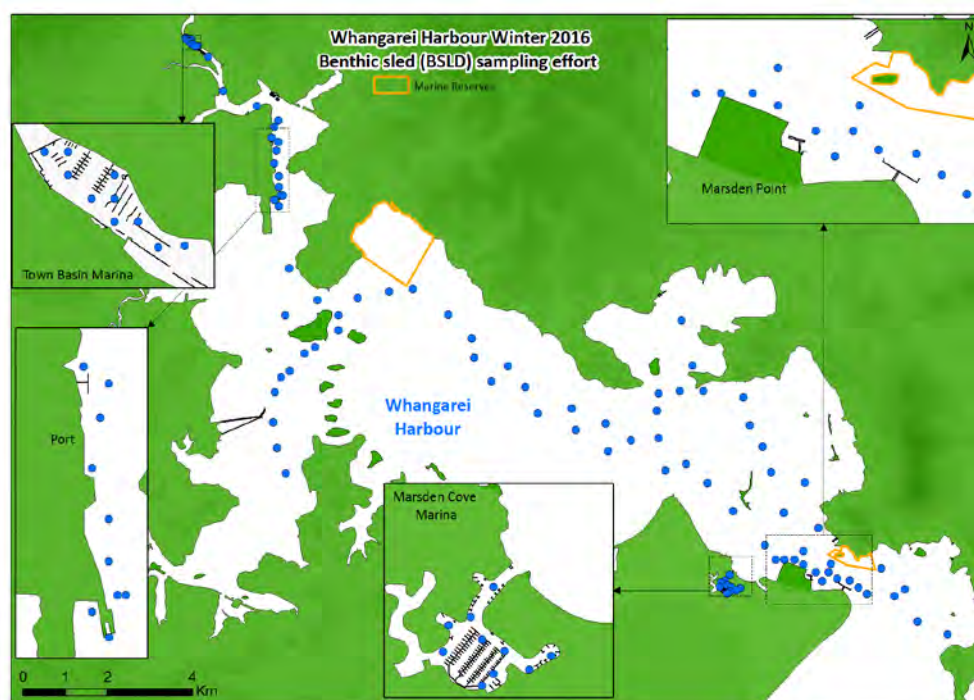
Shore search locations



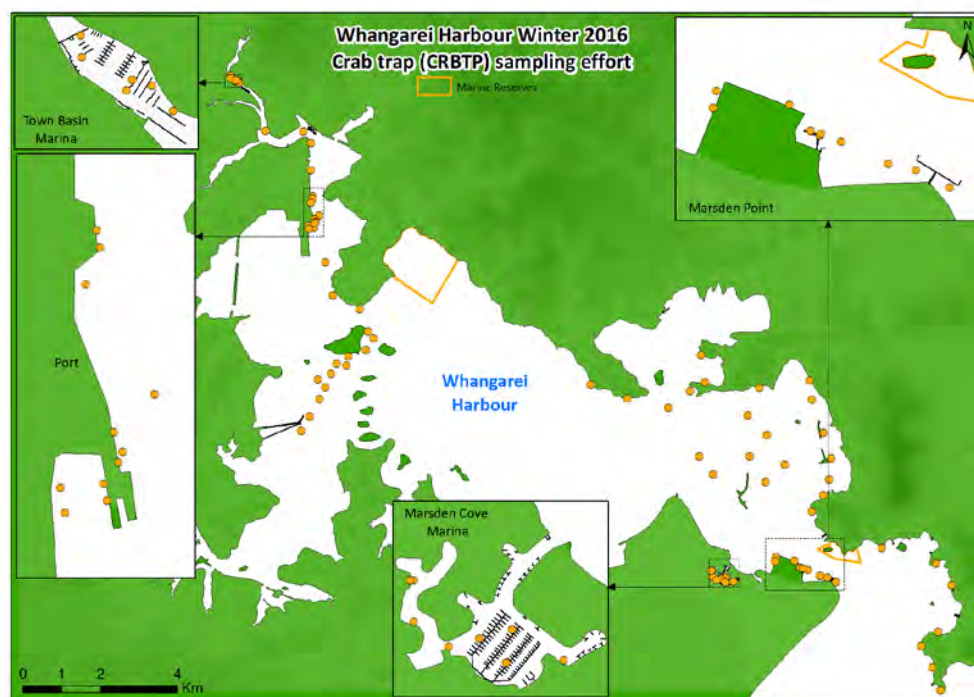
Whangarei Harbour

Winter 2016

Benthic sled locations



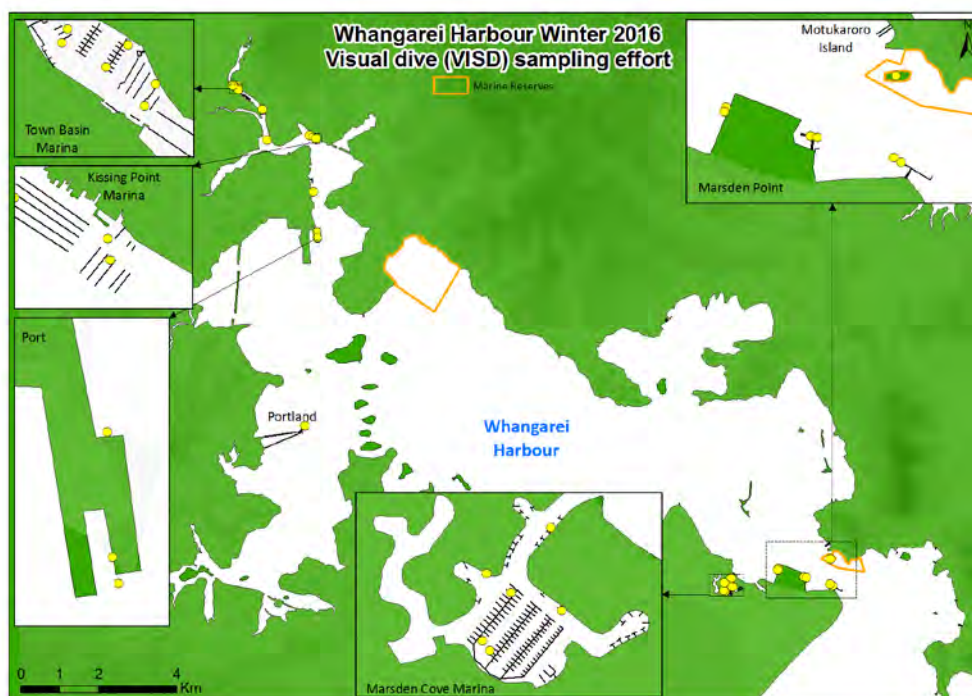
Crab (box) trap locations



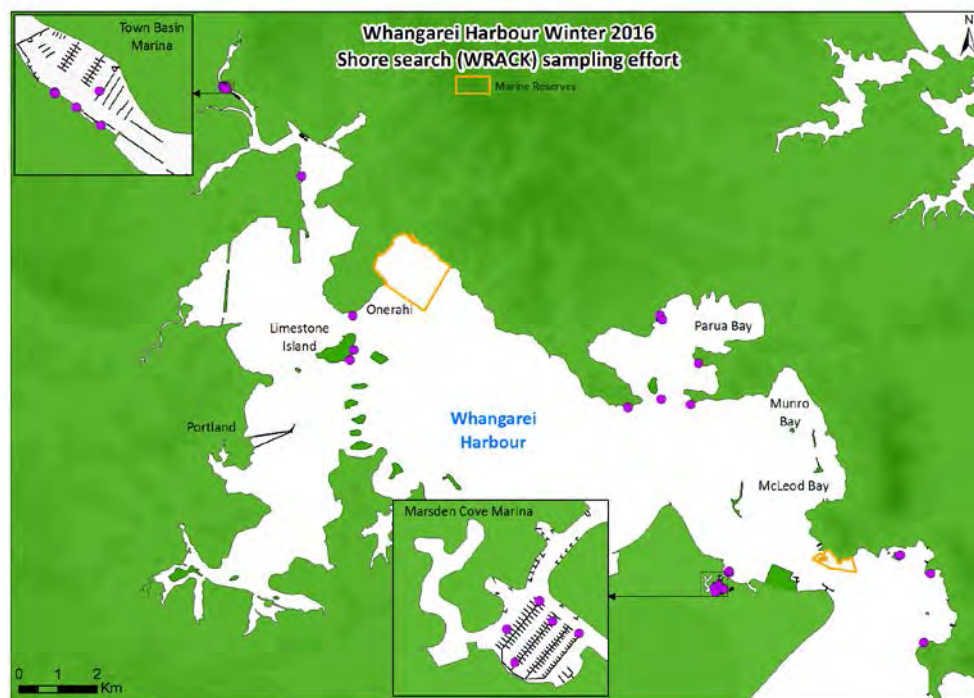
Crab condo locations



Diver search locations

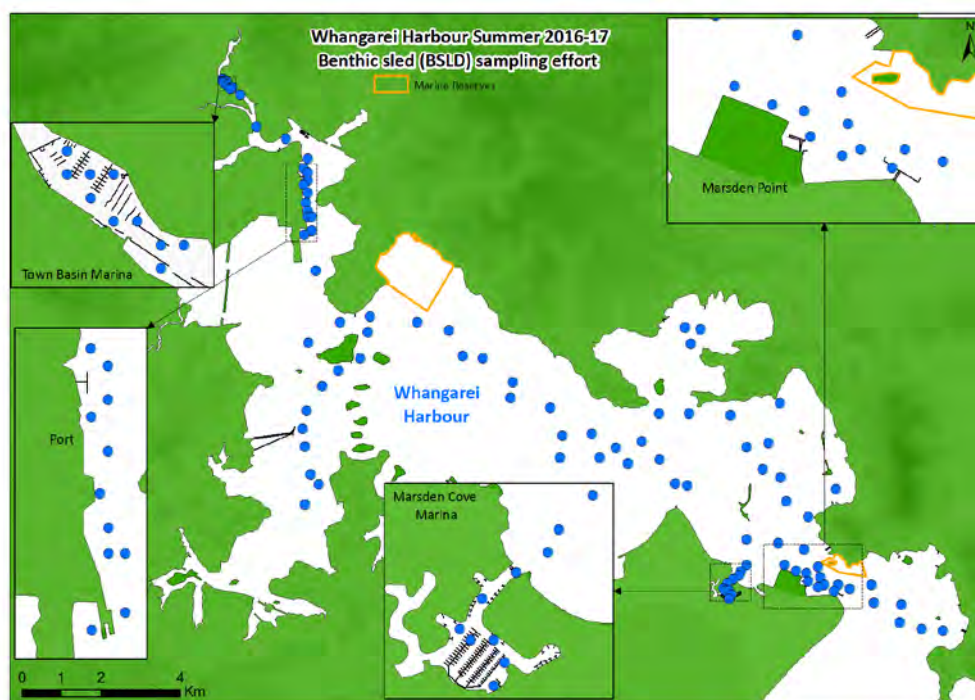


Shore search locations

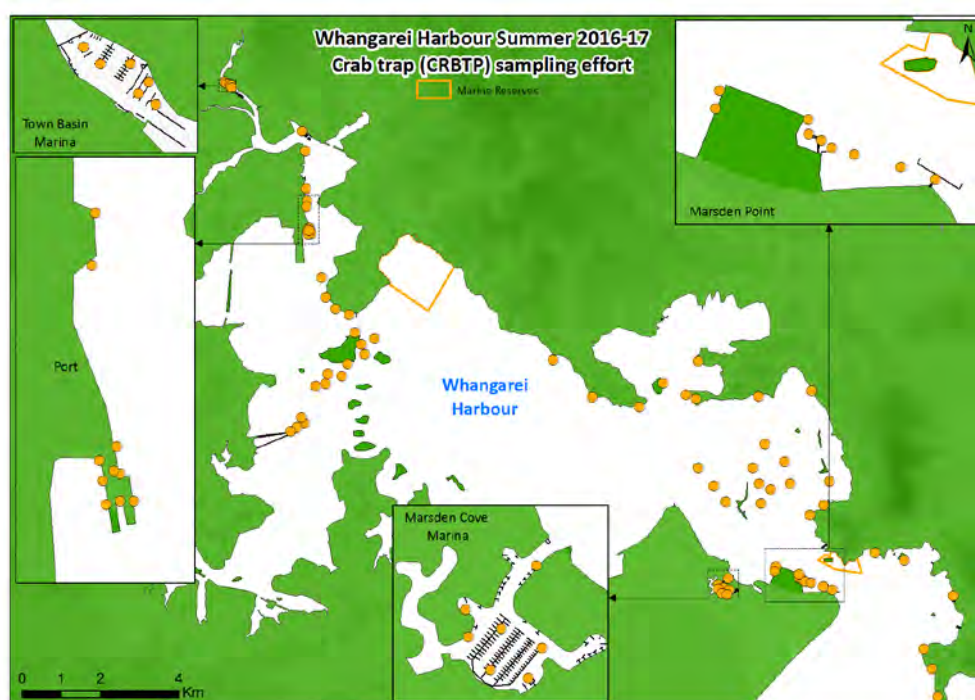


Summer 2016–17

Benthic sled locations



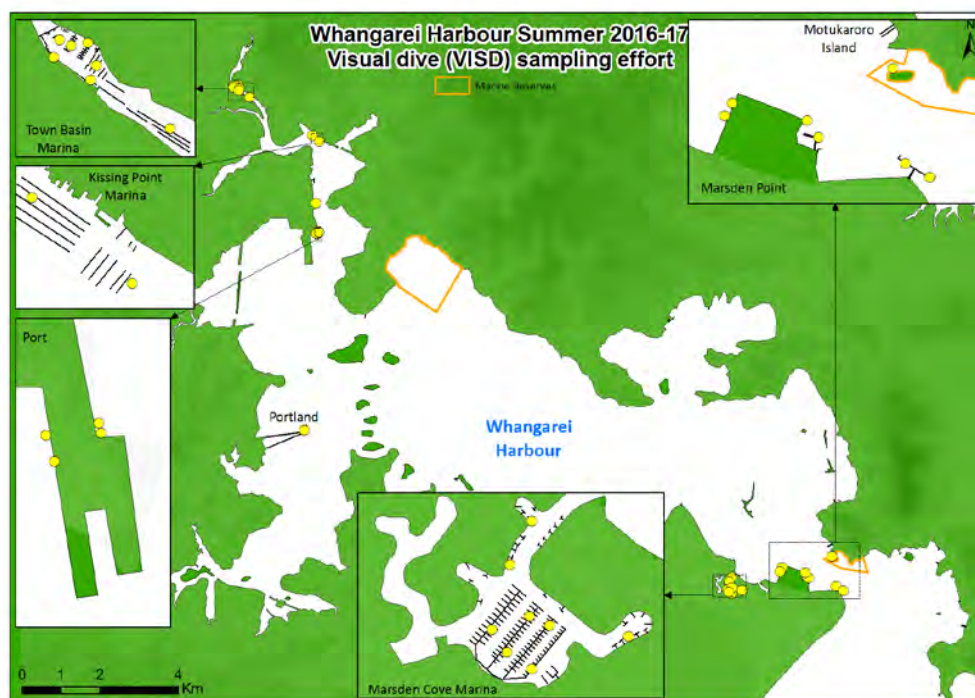
Crab (box) trap locations



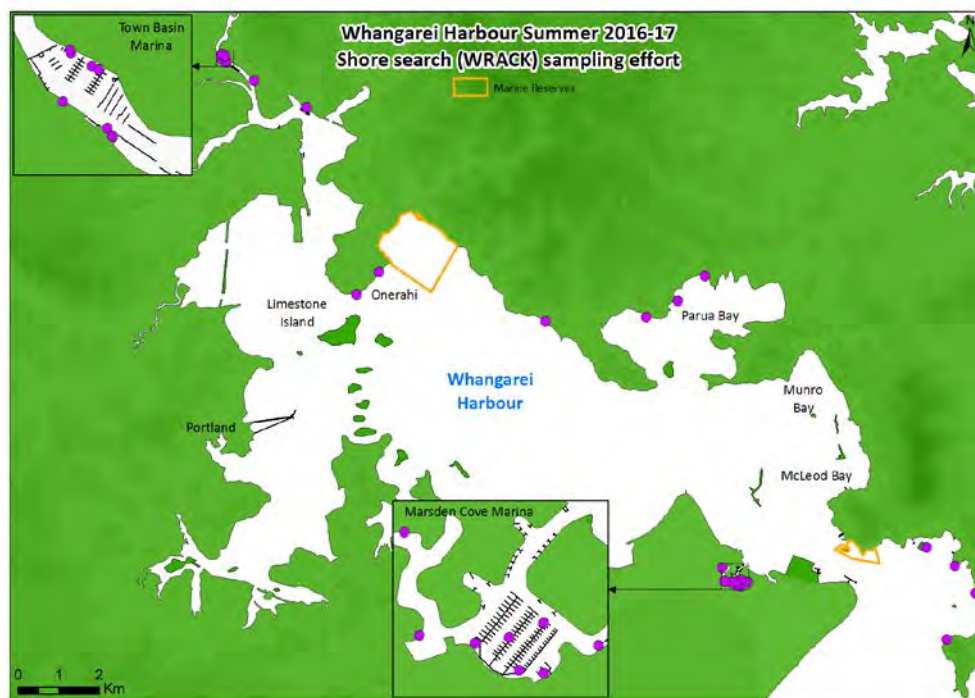
Crab condo locations



Diver search locations



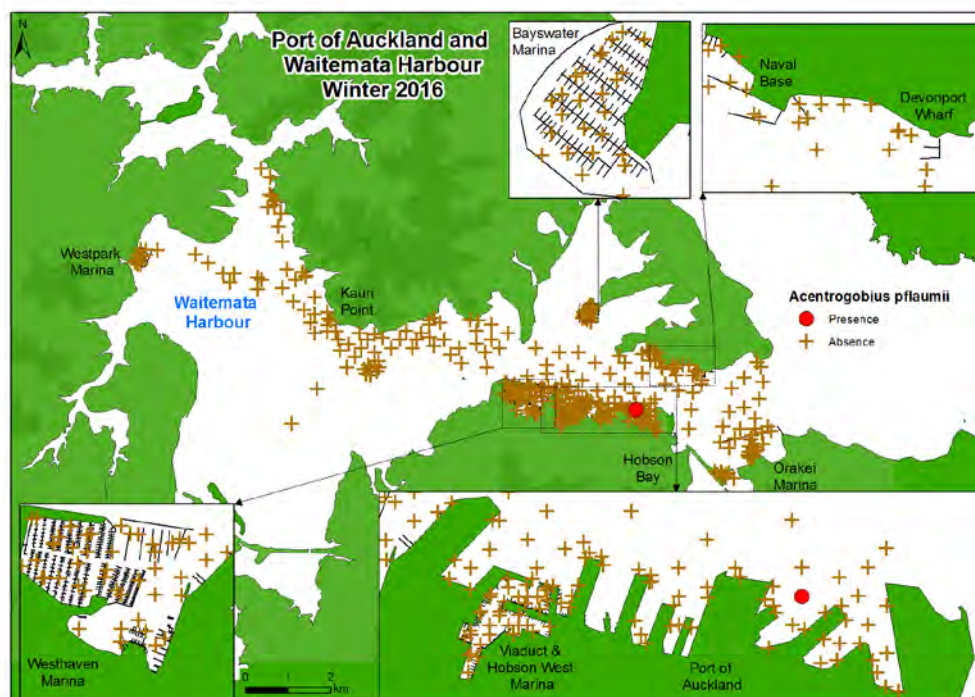
Shore search locations



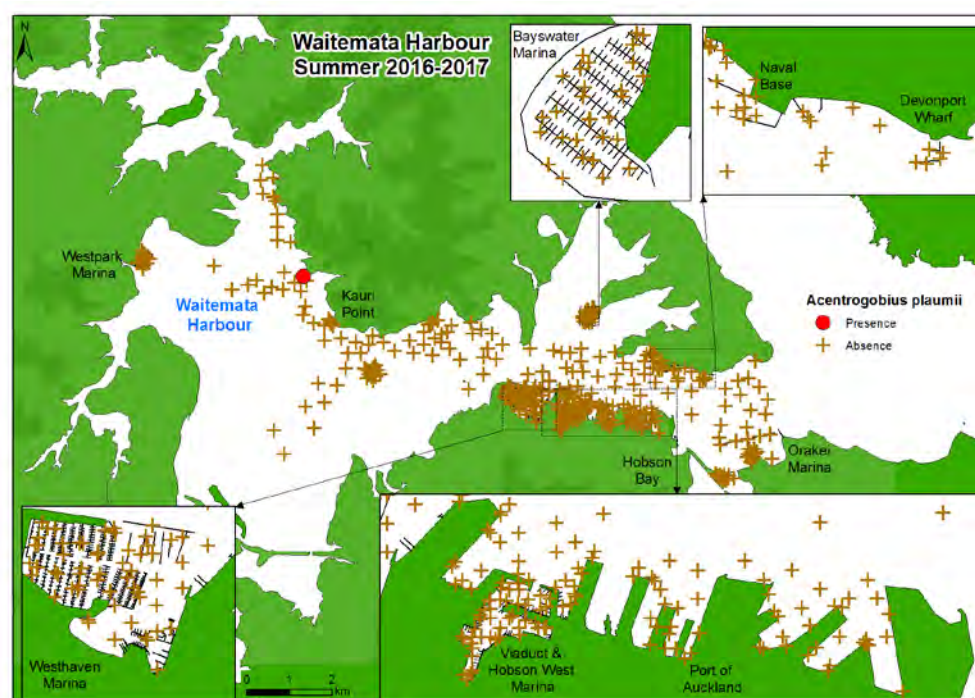
Appendix 4. Distribution maps for target and selected non-target species detected during Winter 2016 and Summer 2016–17 Marine High Risk Site Surveillance (MHRSS) programme surveys

Acentrogobius pflaumii

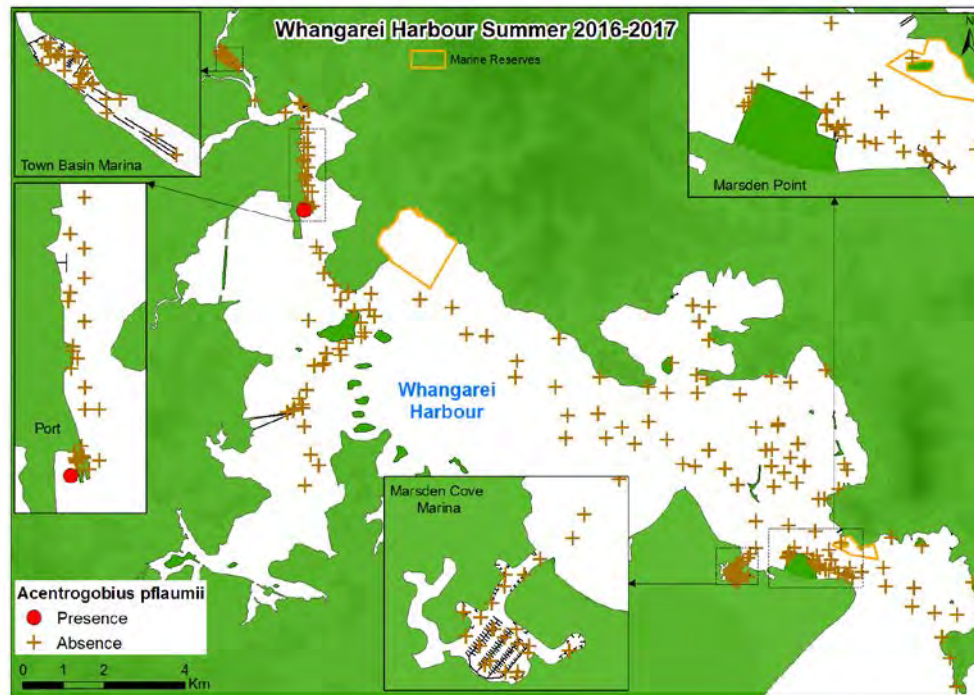
Waitemata Harbour Winter 2016



Waitemata Harbour Summer 2016–17

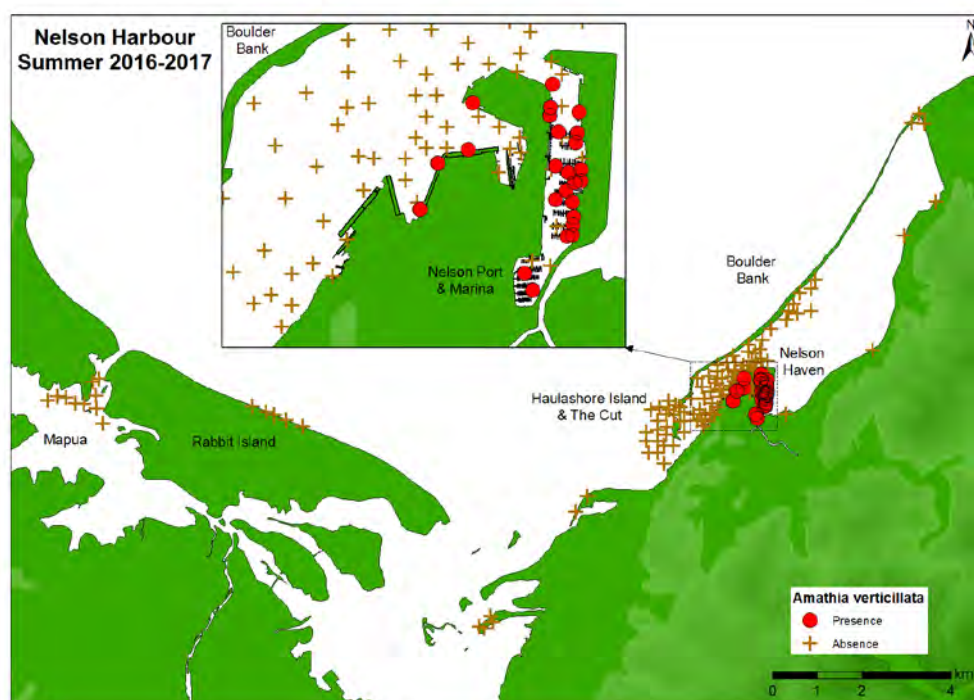


Whangarei Harbour Summer 2016–17

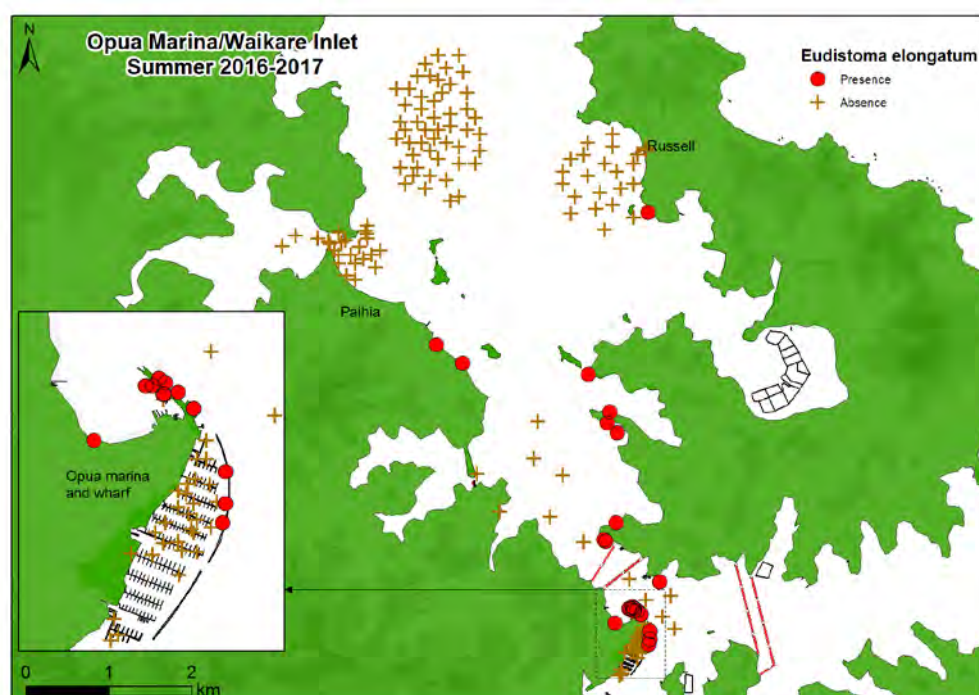


Amathia verticillata

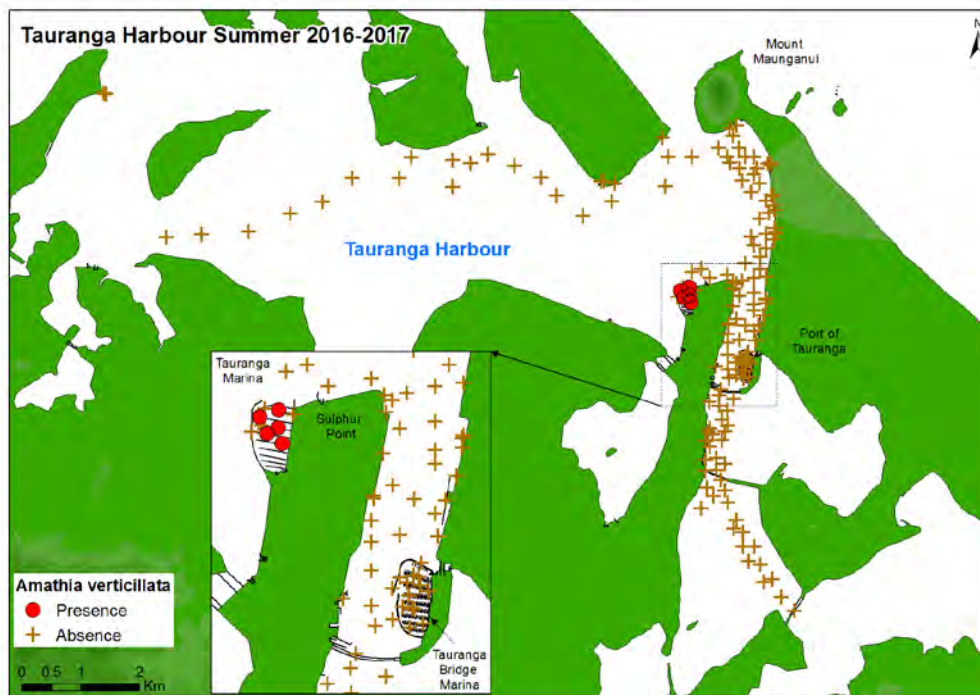
Nelson Harbour Summer 2016–17



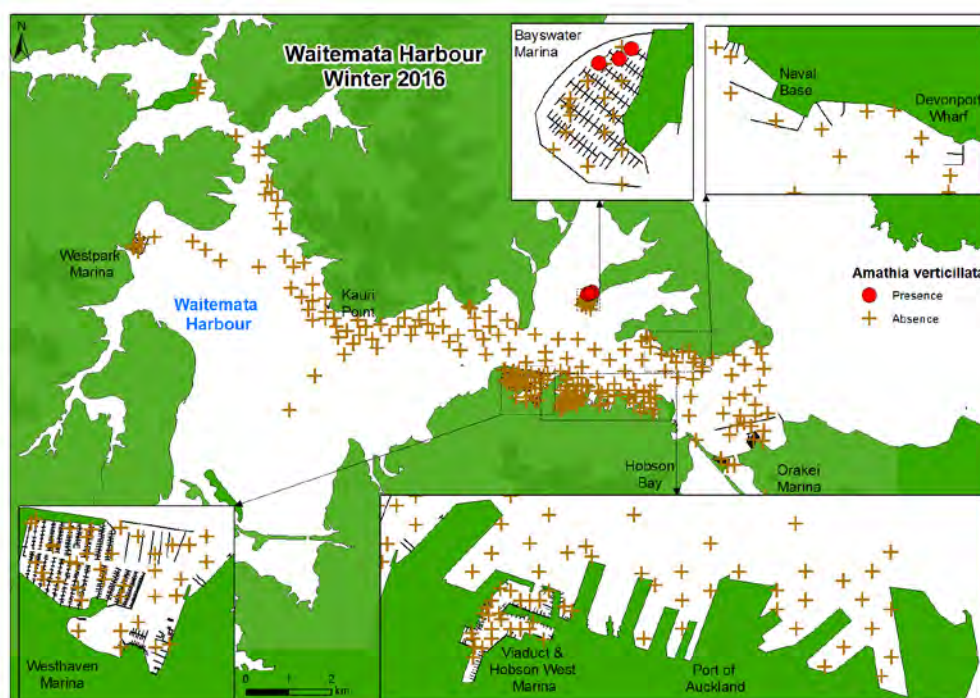
Opua Marina/Waikare Inlet Summer 2016–17



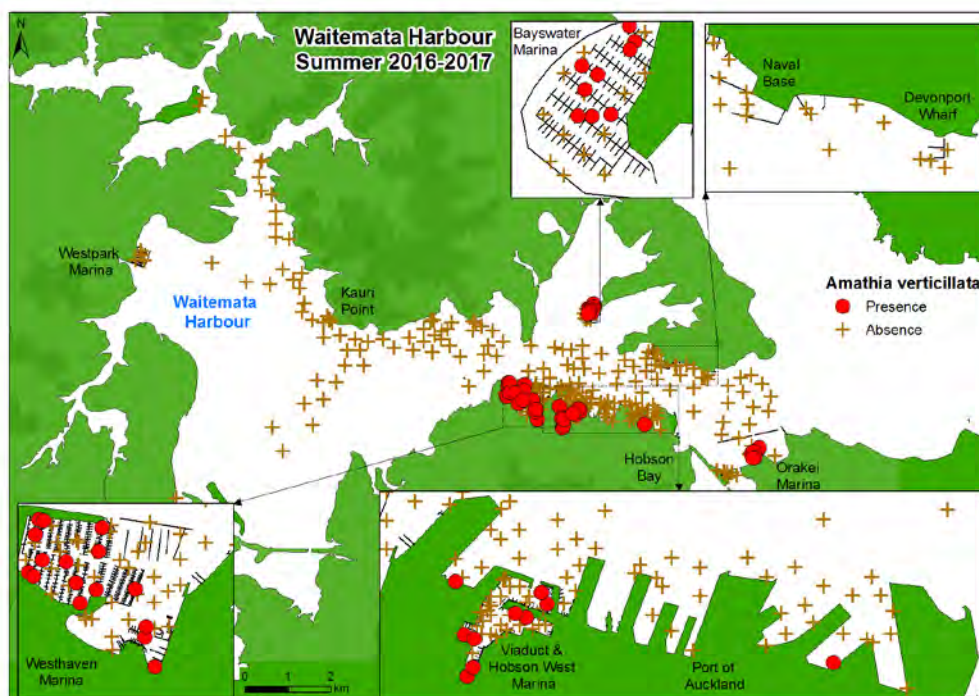
Tauranga Harbour Summer 2016–17



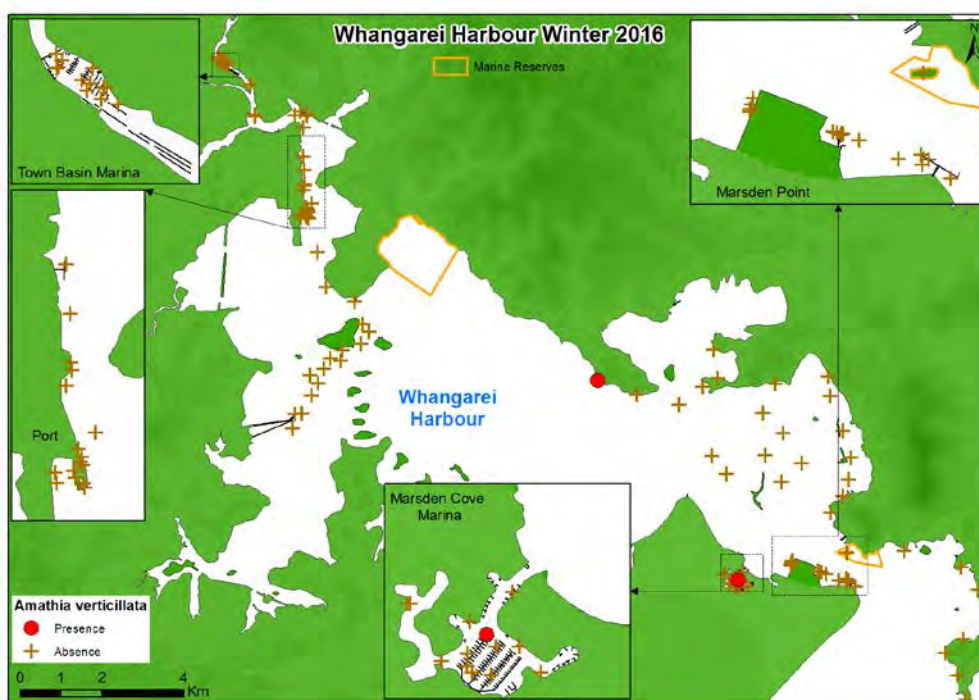
Waitemata Harbour Winter 2016



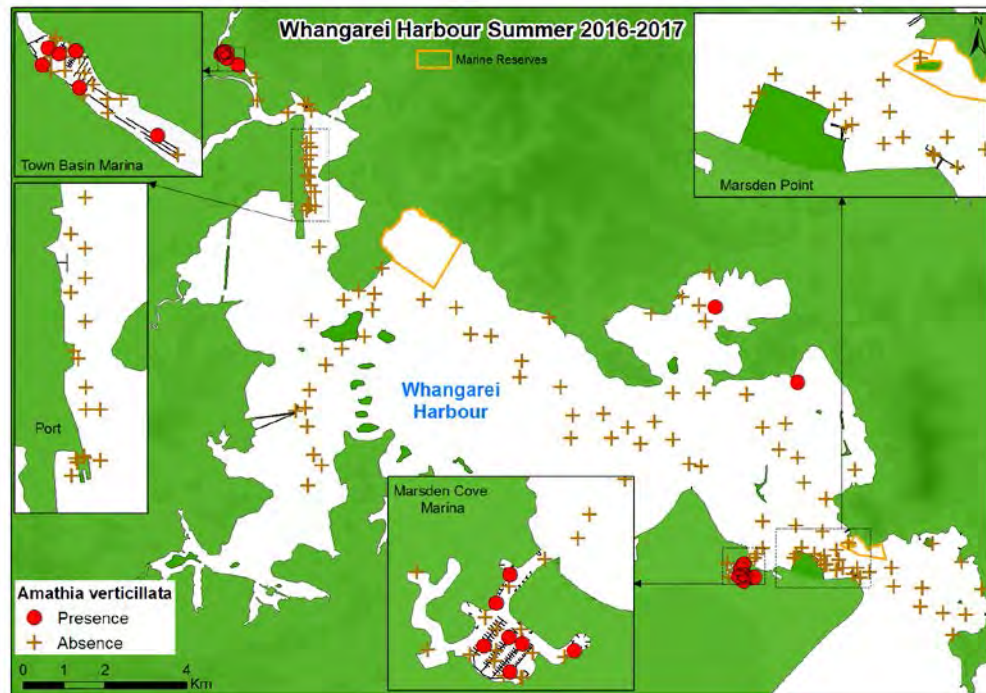
Waitemata Harbour Summer 2016–17



Whangarei Harbour Winter 2016

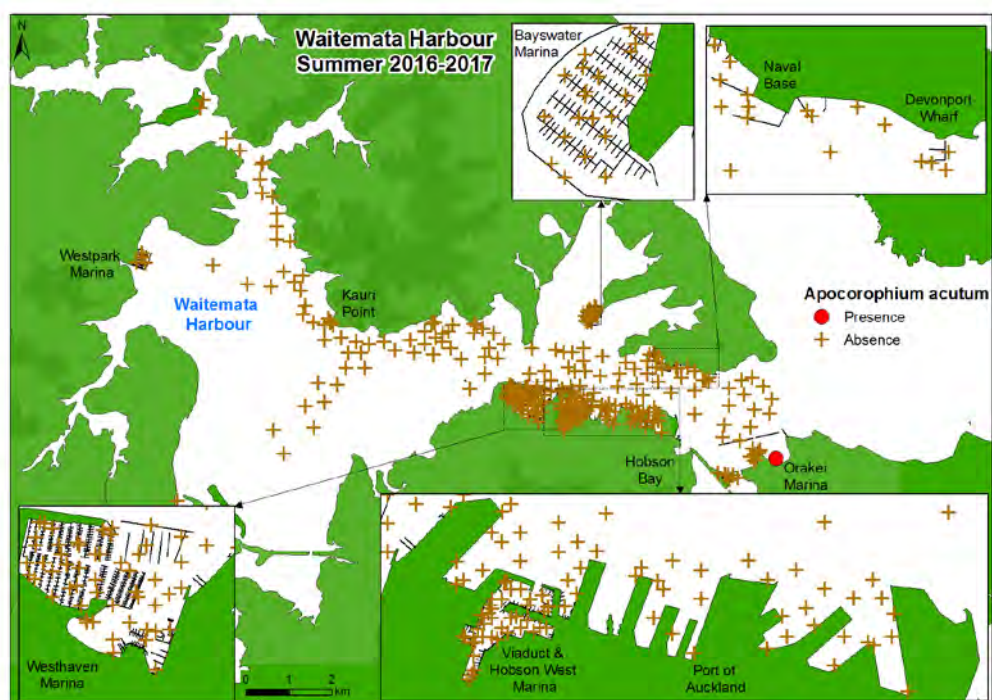


Whangarei Harbour Summer 2016–17



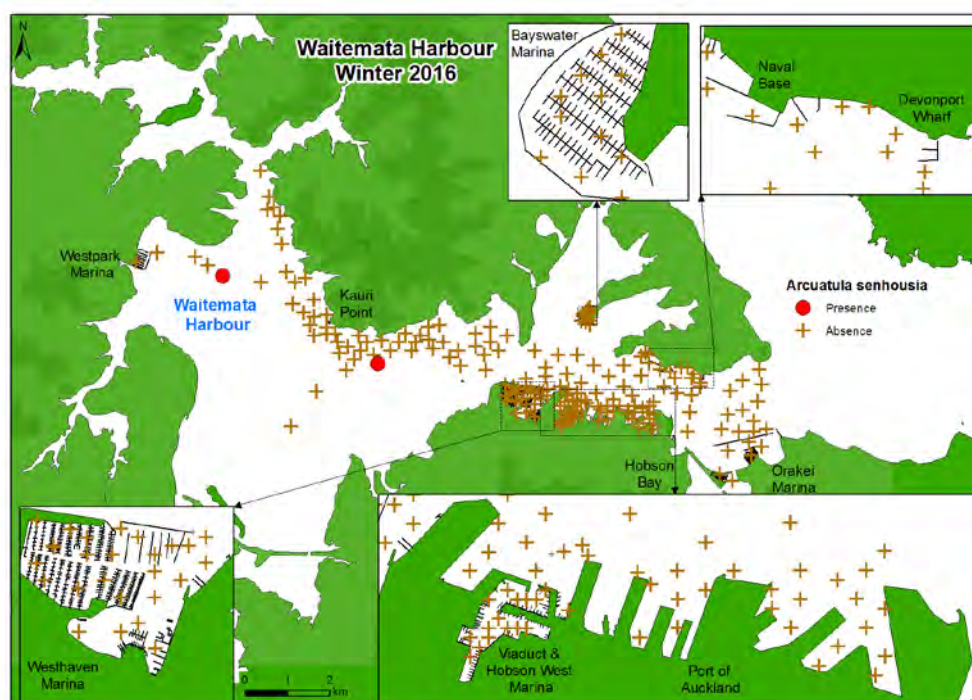
Apocorophium acutum

Waitemata Harbour Summer 2016–17

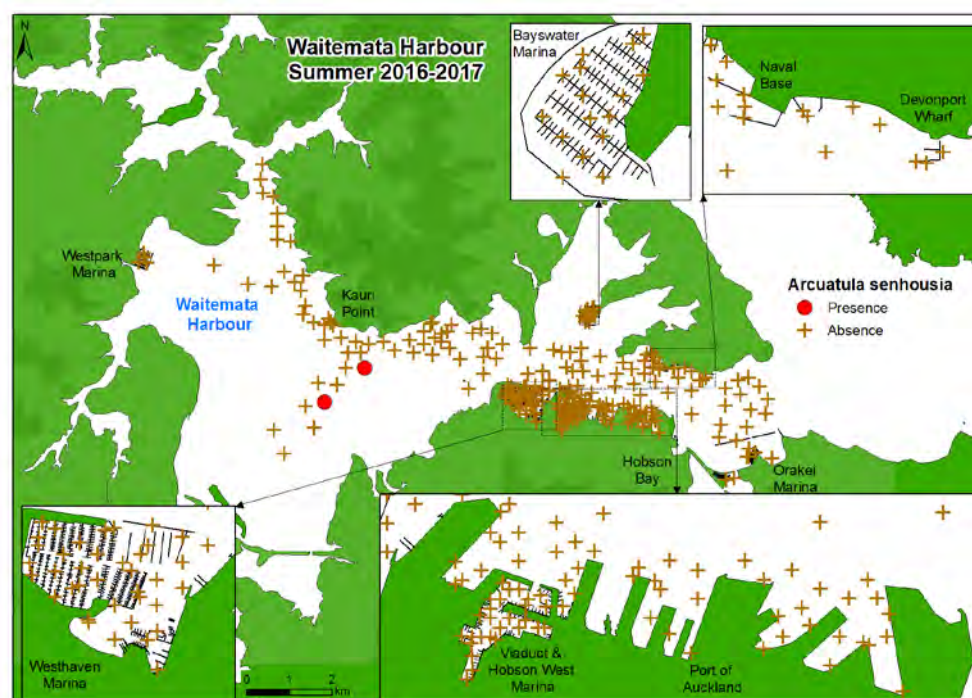


Arcuatula senhousia

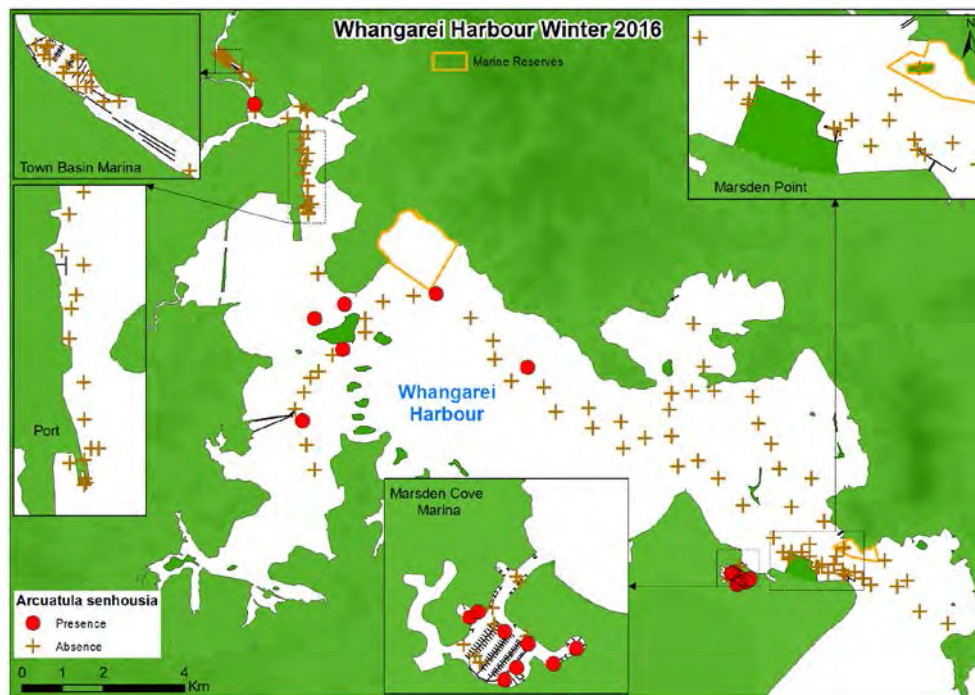
Waitemata Harbour Winter 2016



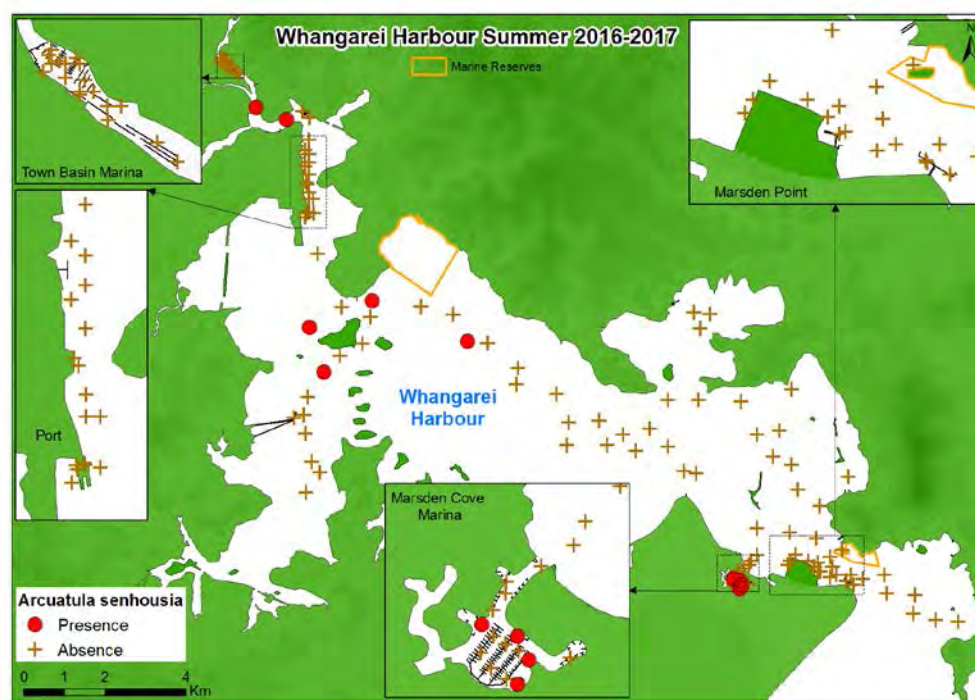
Waitemata Harbour Summer 2016–17



Whangarei Harbour Winter 2016

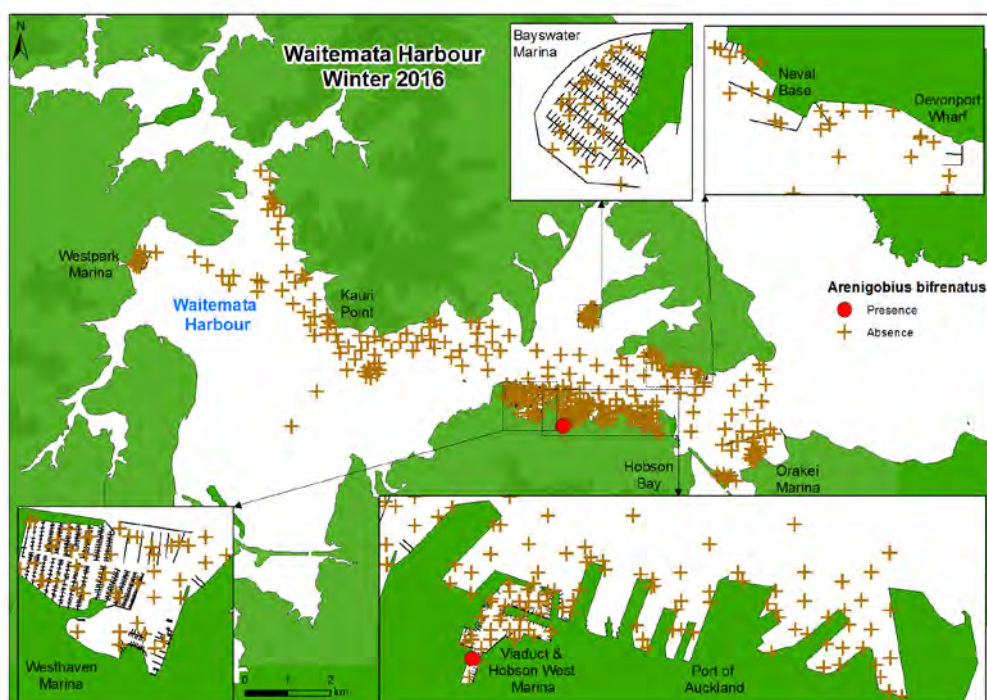


Whangarei Harbour Summer 2016–17

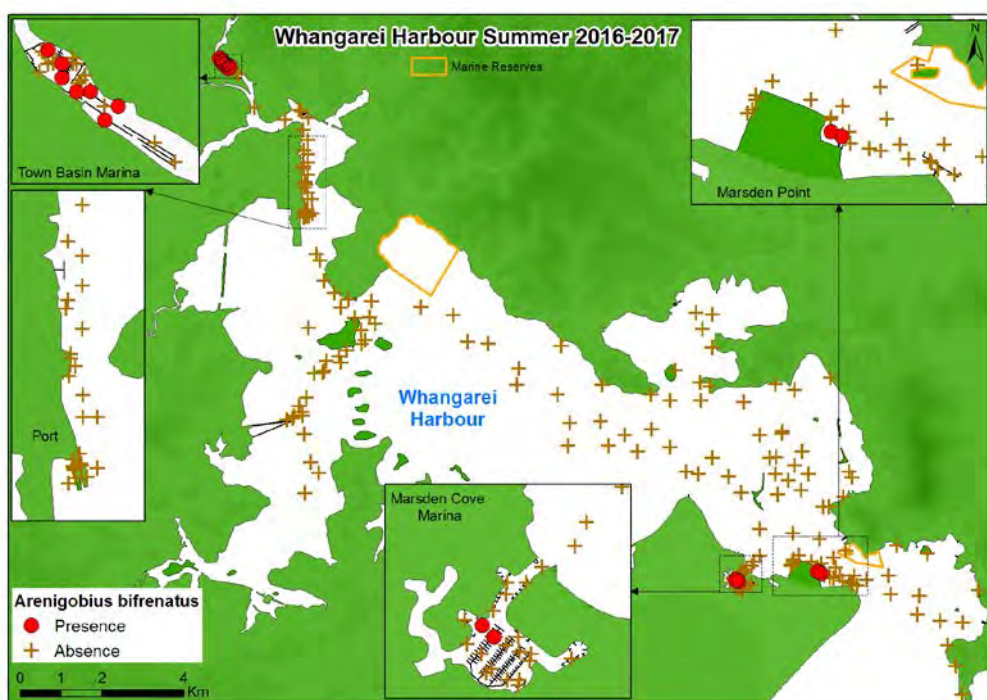


Arenigobius bifrenatus

Waitemata Harbour Winter 2016

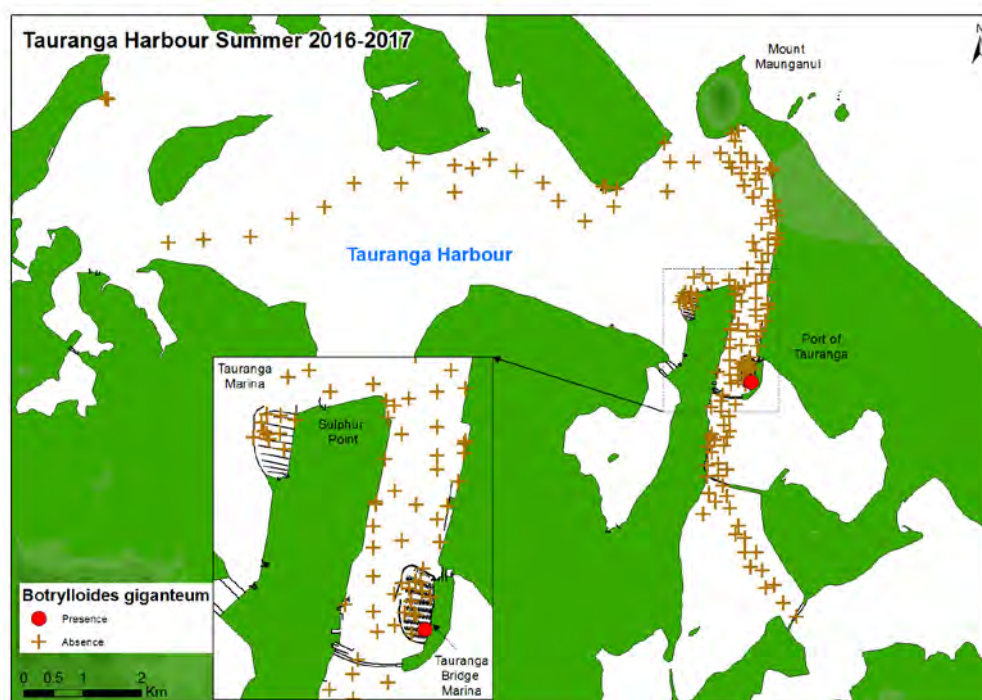


Whangarei Harbour Summer 2016-17

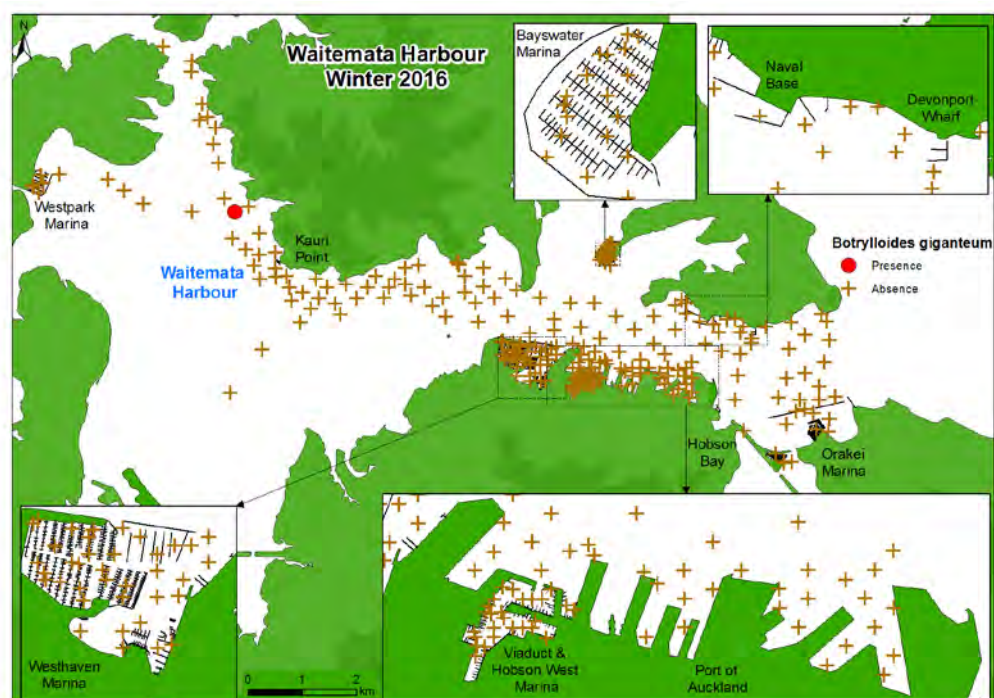


Botrylloides giganteum

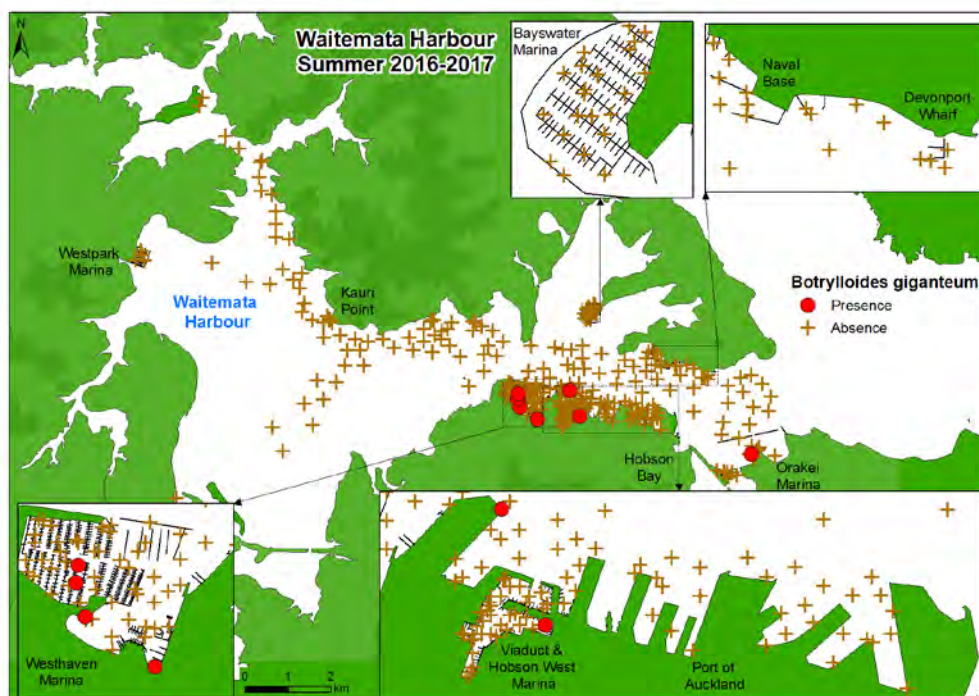
Tauranga Harbour Summer 2016–17



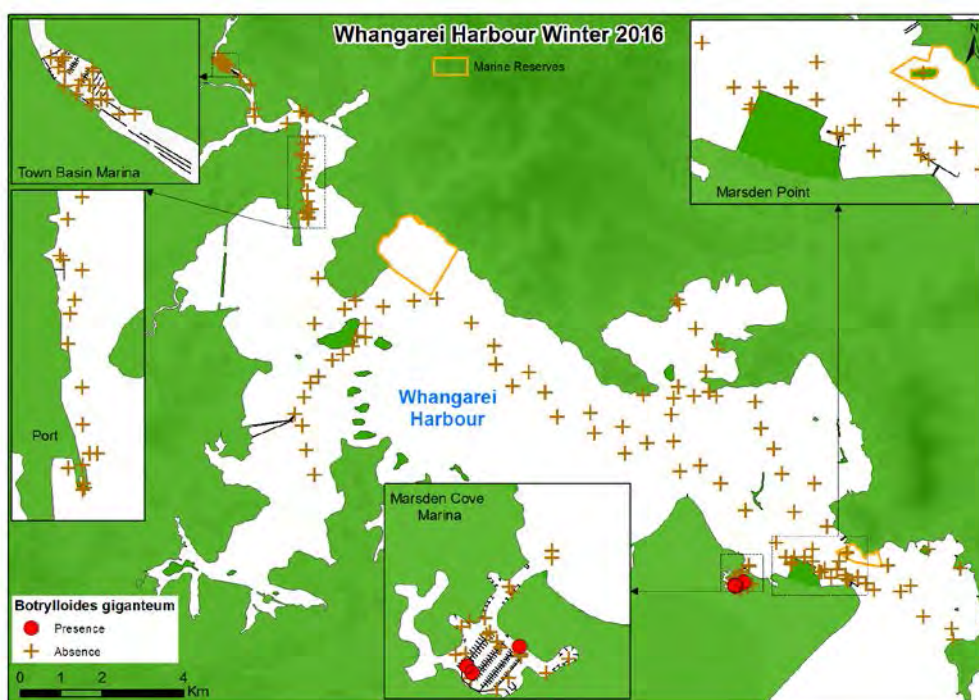
Waitemata Harbour Winter 2016



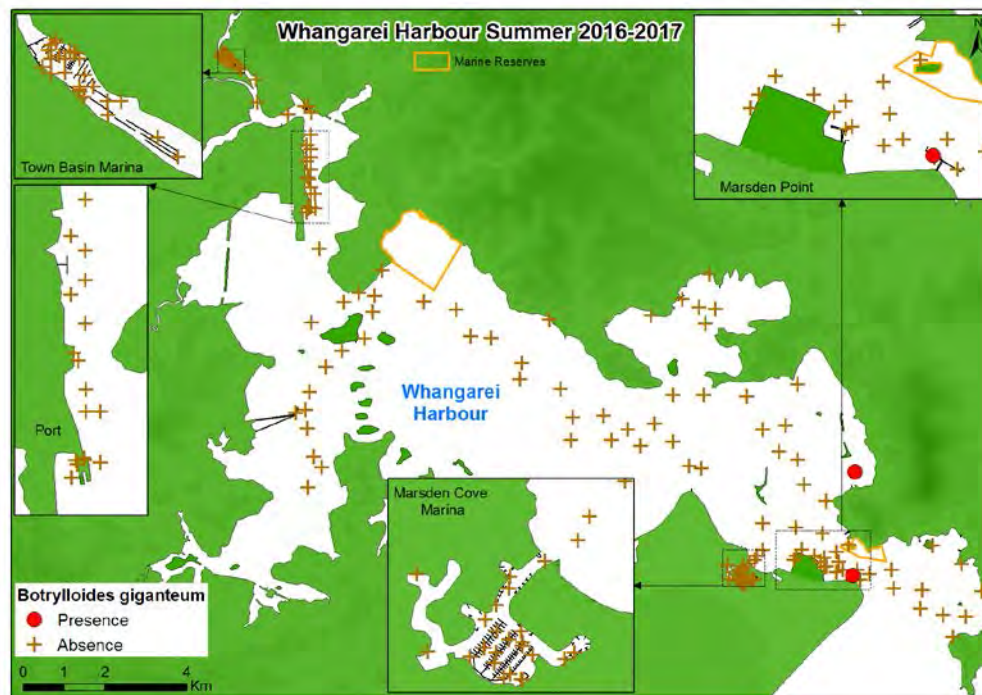
Waitemata Harbour Summer 2016–17



Whangarei Harbour Winter 2016

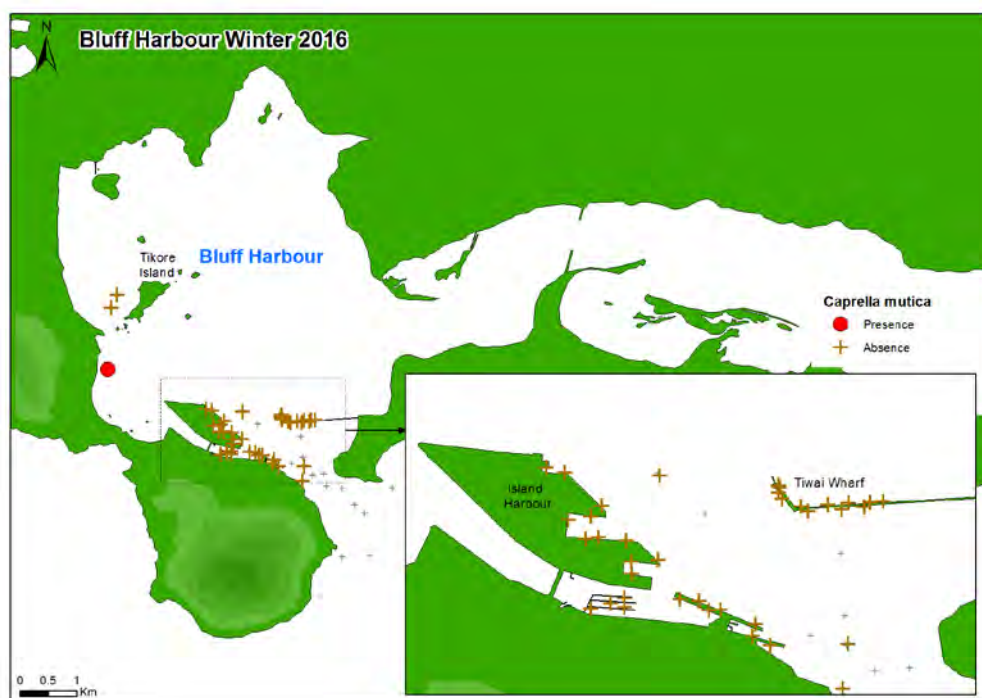


Whangarei Harbour Summer 2016–17



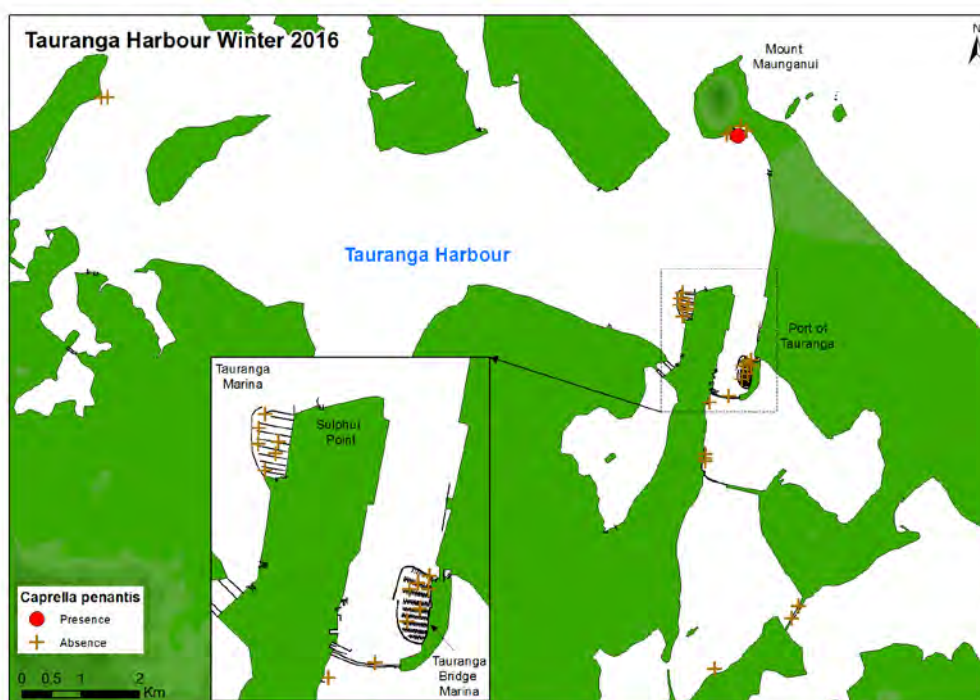
Caprella mutica

Bluff Harbour Winter 2016



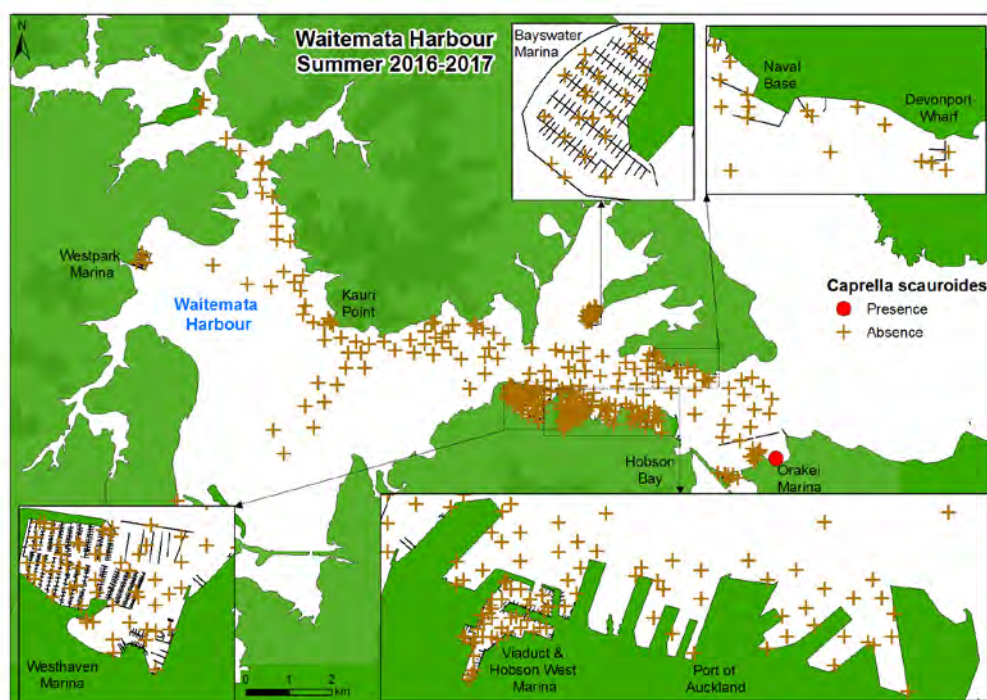
Caprella cf. penantis

Tauranga Harbour Winter 2016



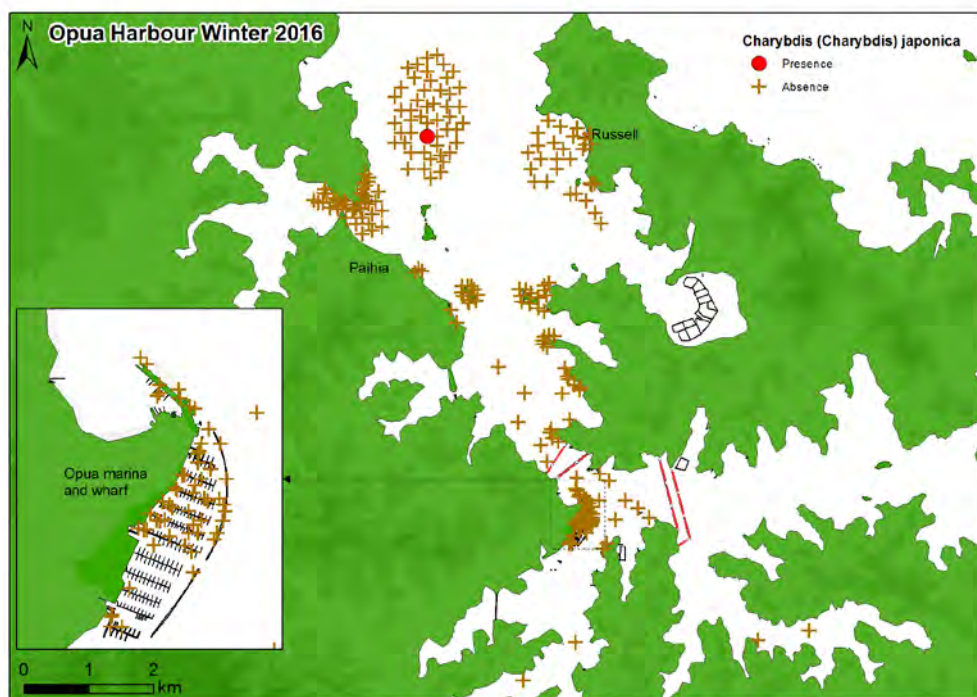
Caprella scauroides

Waitemata Harbour Summer 2016–17

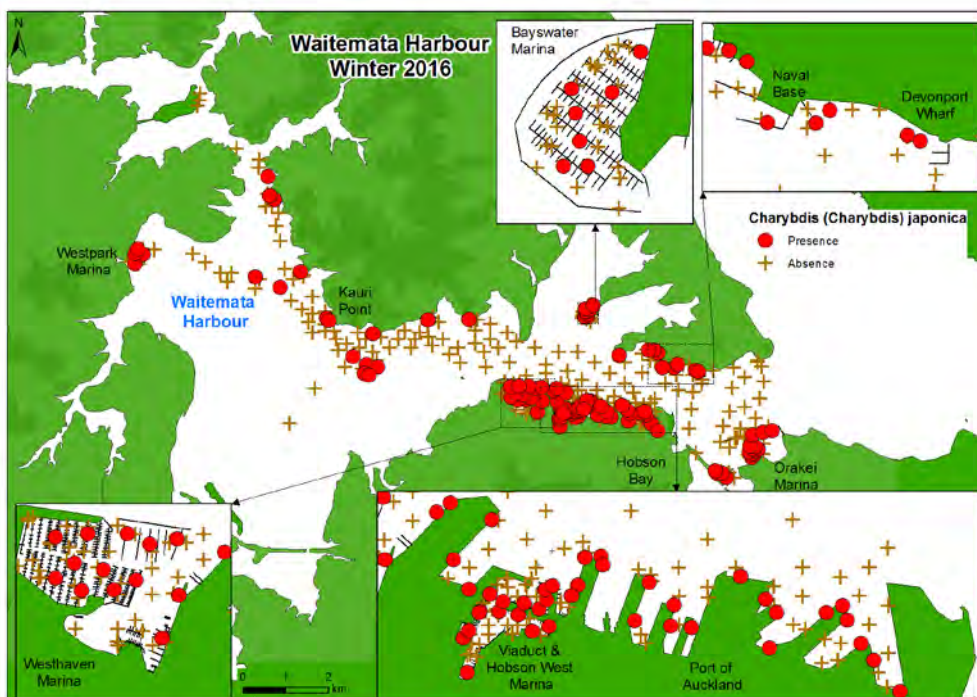


Charybdis (Charybdis) japonica

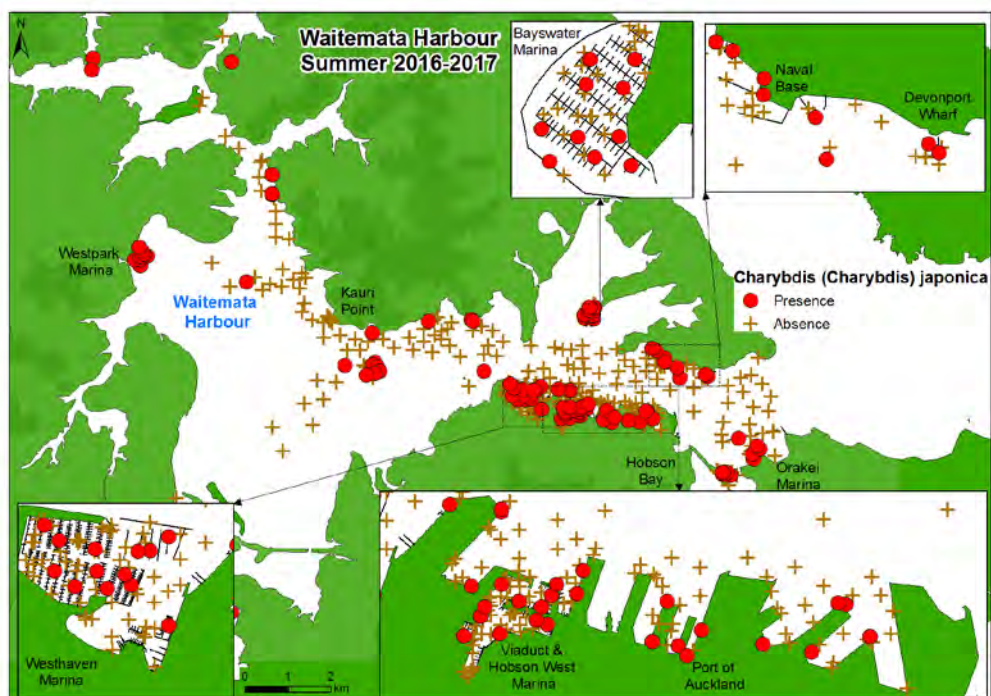
Opua Marina/Waikare Inlet Winter 2016



Waitemata Harbour Winter 2016



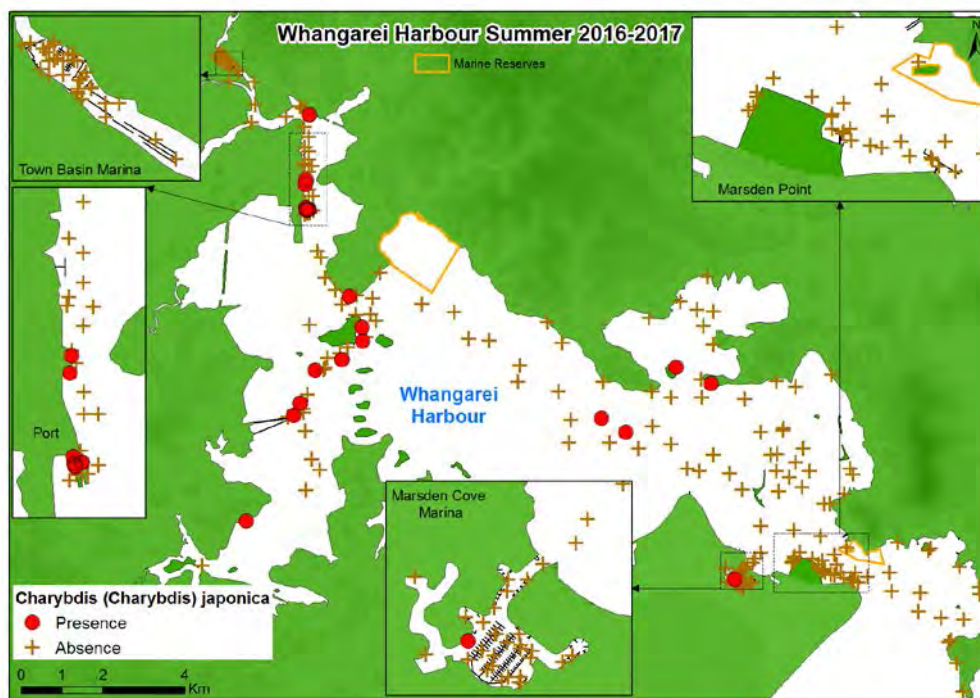
Waitemata Harbour Summer 2016–17



Whangarei Harbour Winter 2016

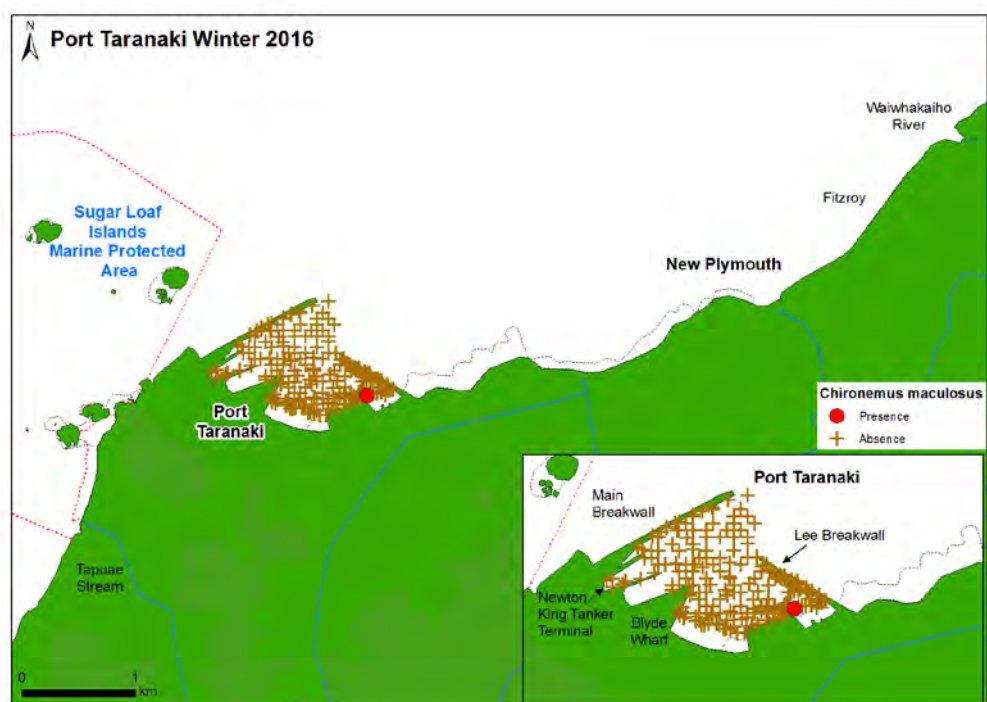


Whangarei Harbour Summer 2016–17



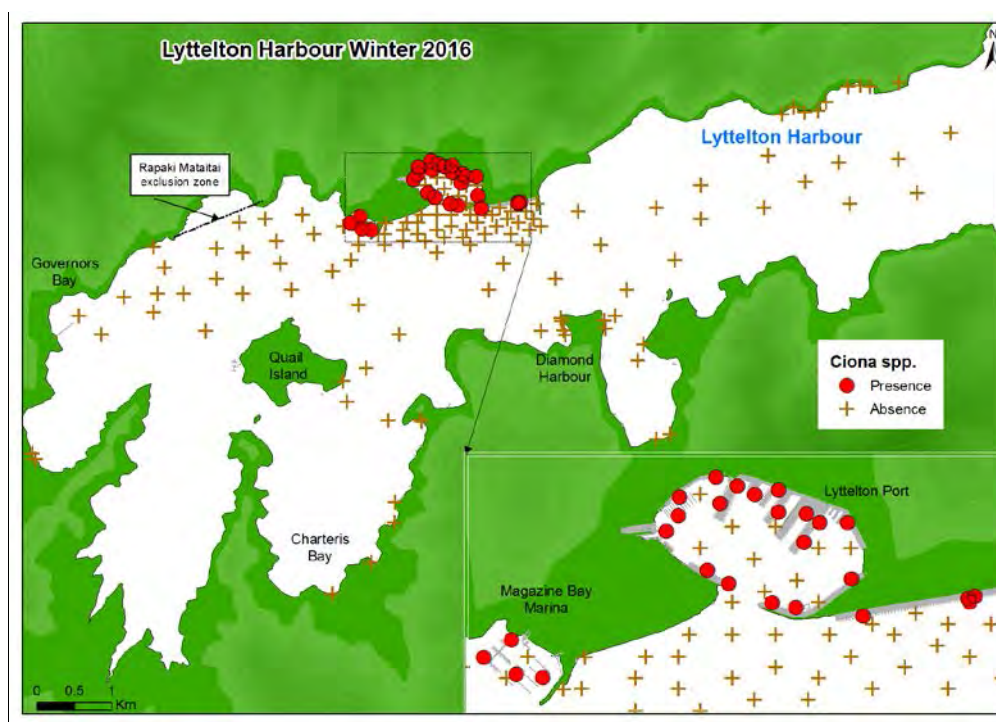
Chironemus maculosus

Port Taranaki Winter 2016

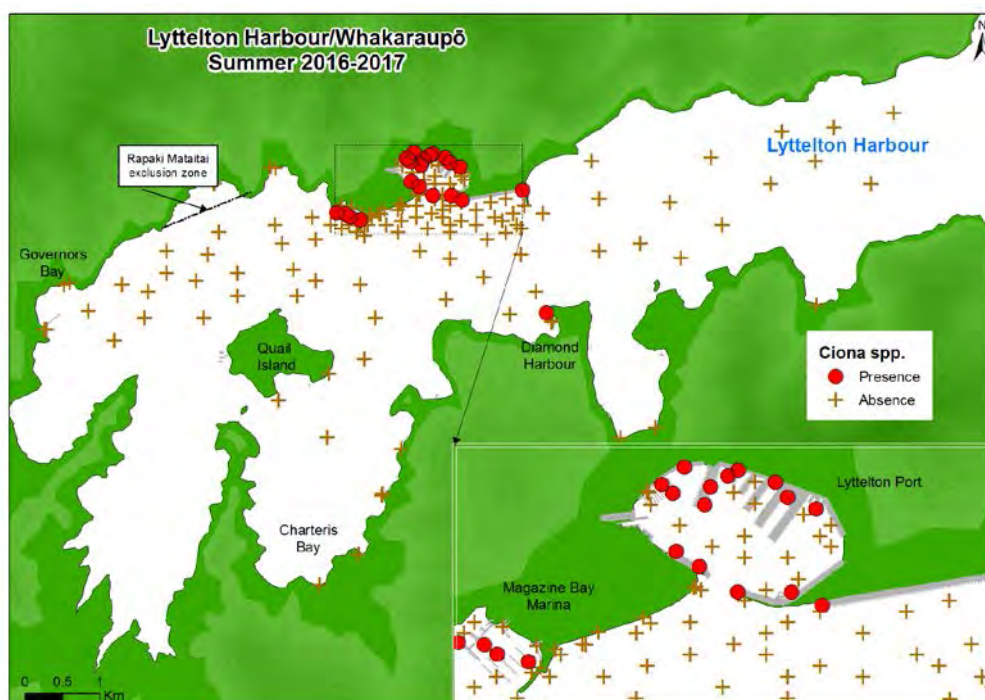


Ciona spp.

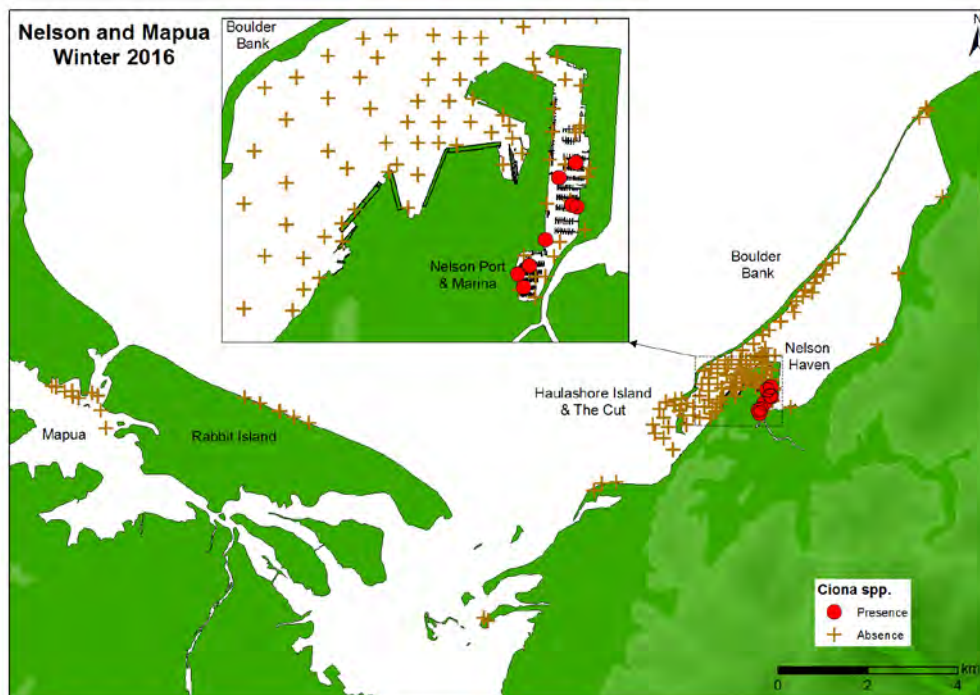
Lyttelton Harbour Winter 2016



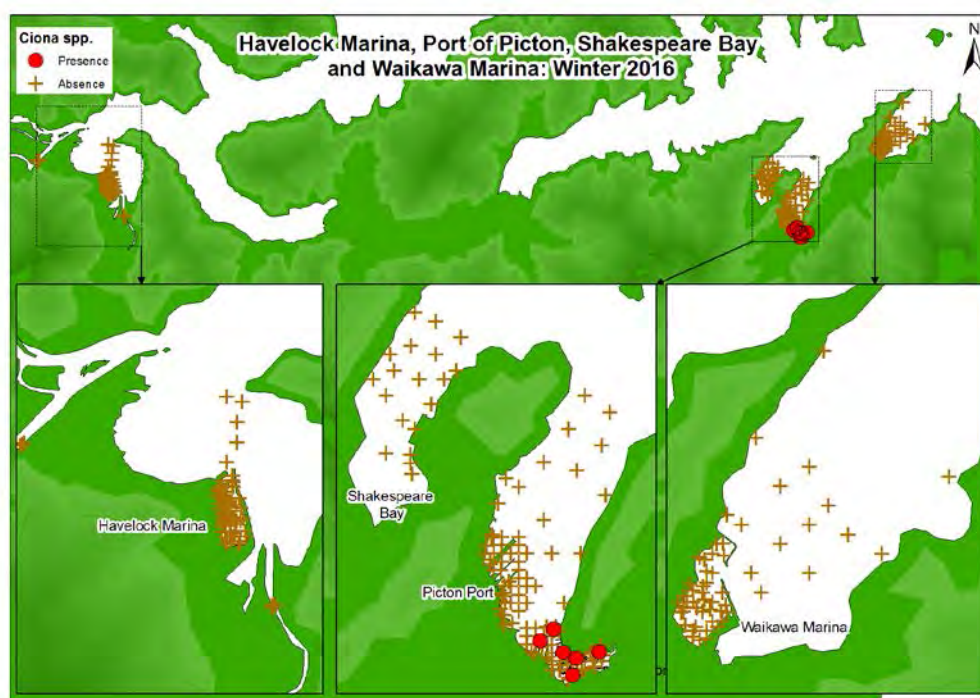
Lyttelton Harbour Summer 2016–17



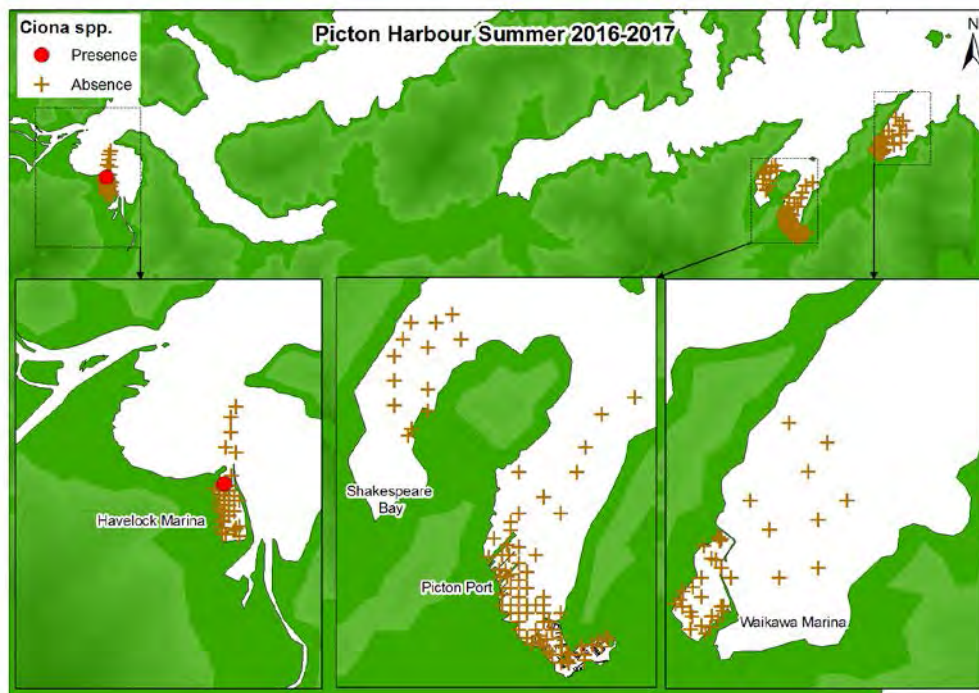
Nelson Harbour Winter 2016



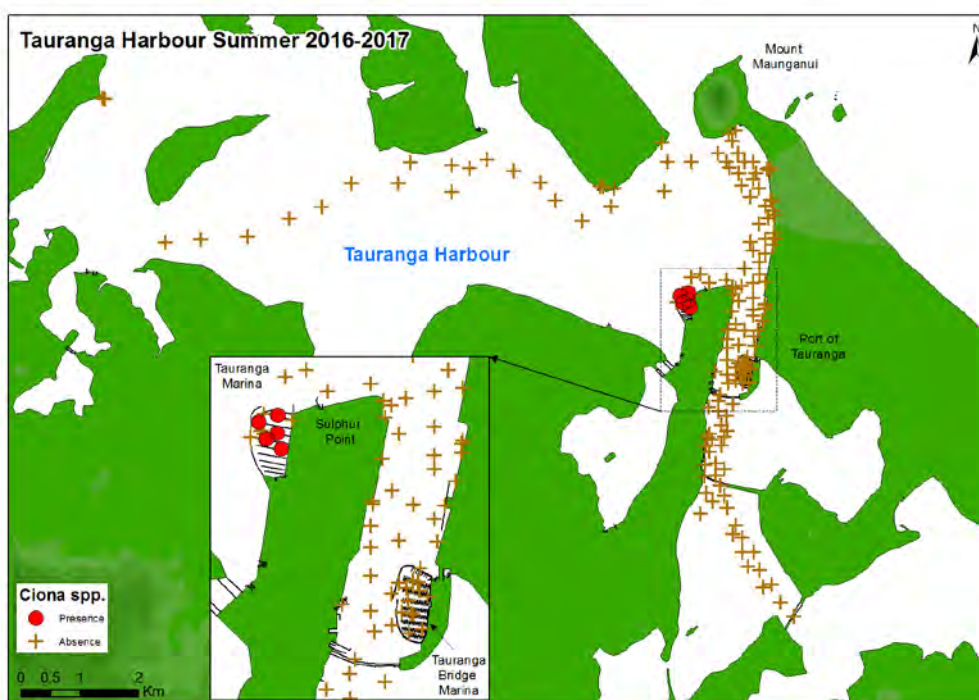
Picton Harbour Winter 2016



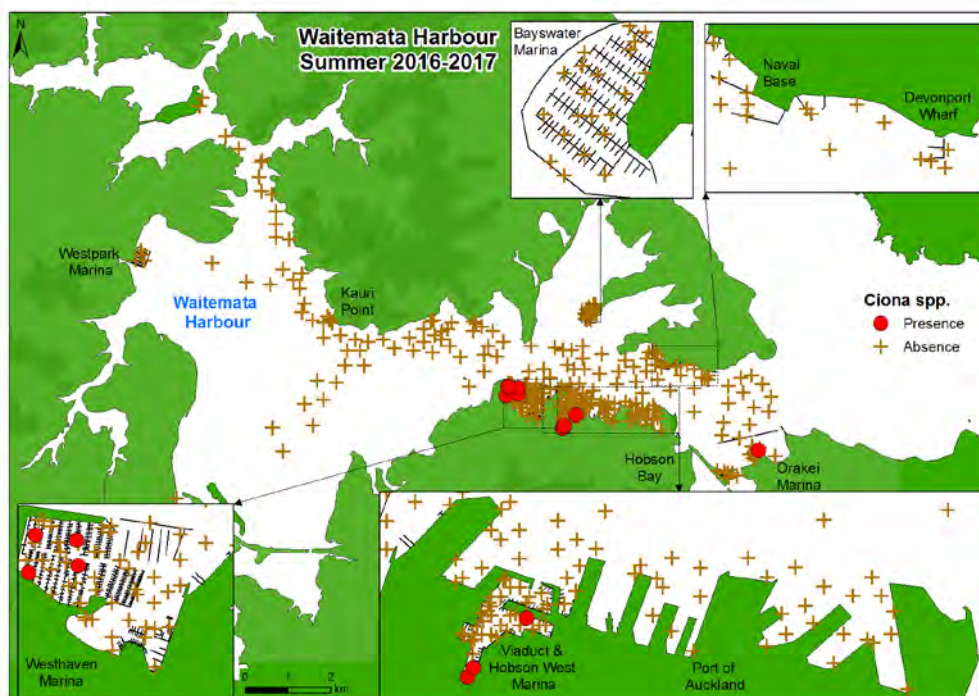
Picton Harbour Summer 2016–17



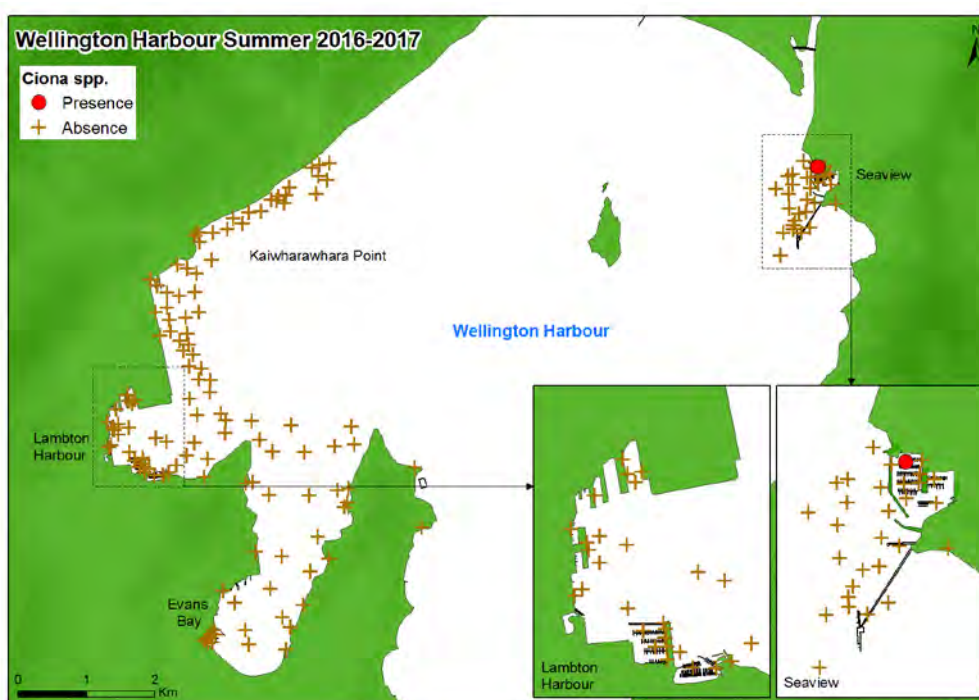
Tauranga Harbour Summer 2016–17



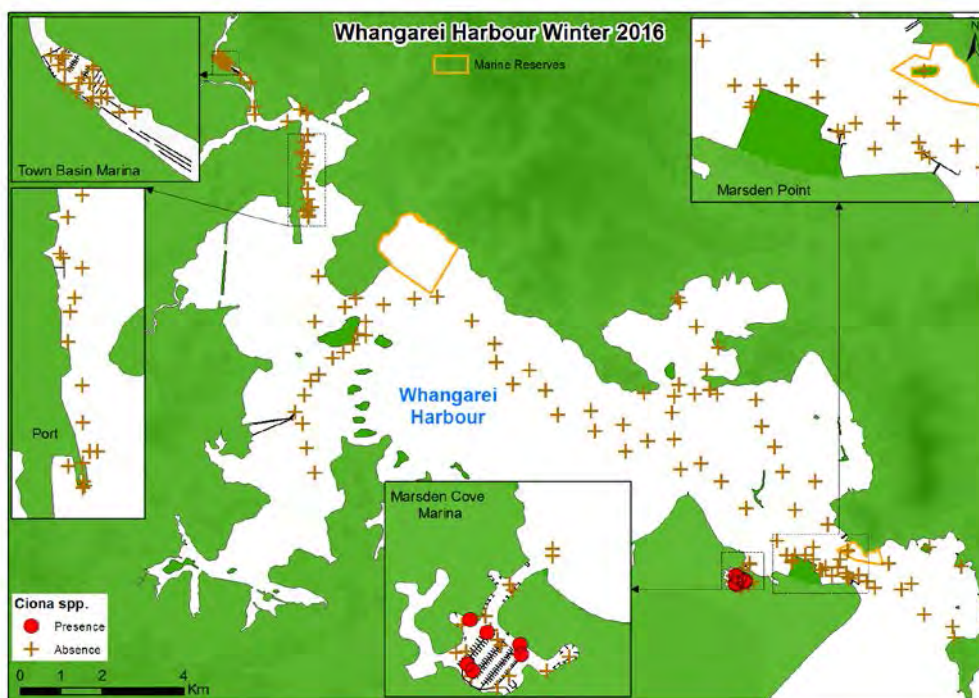
Waitemata Harbour Summer 2016–17



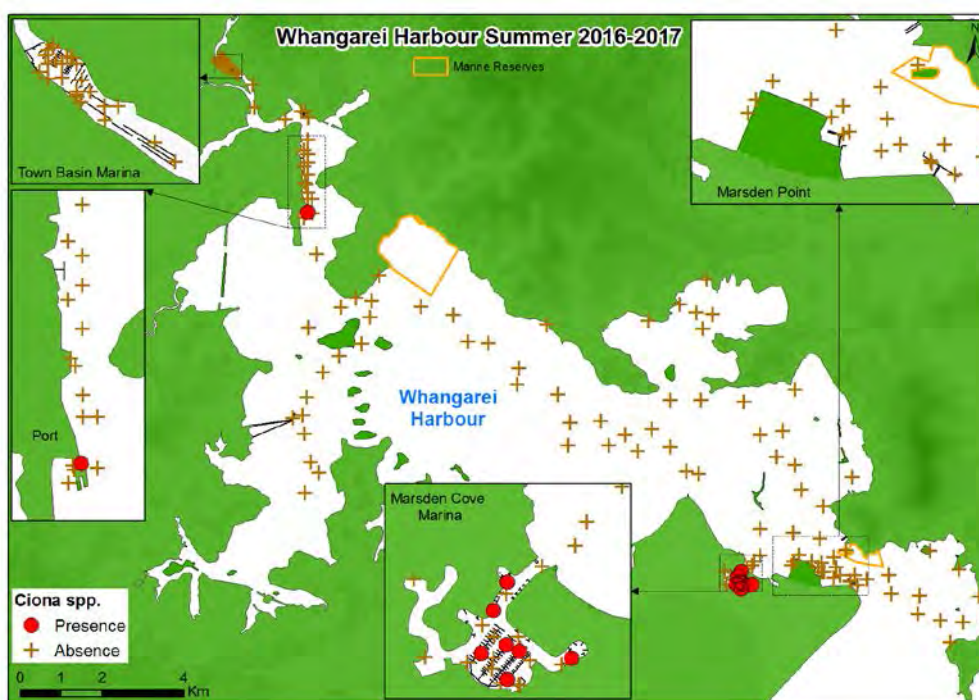
Wellington Harbour Summer 2016–17



Whangarei Harbour Winter 2016

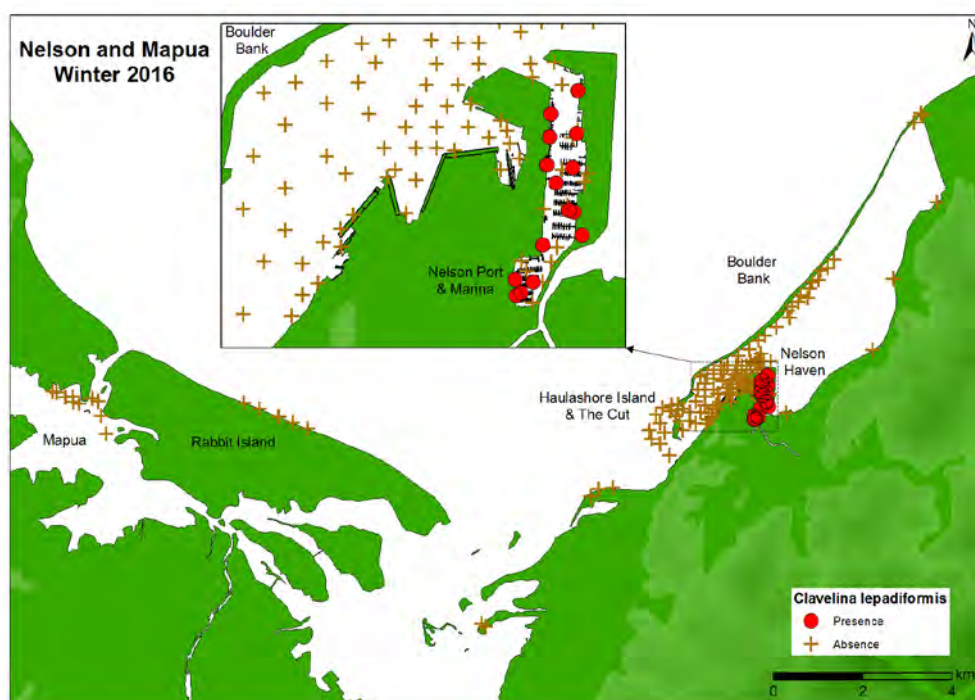


Whangarei Harbour Summer 2016–17

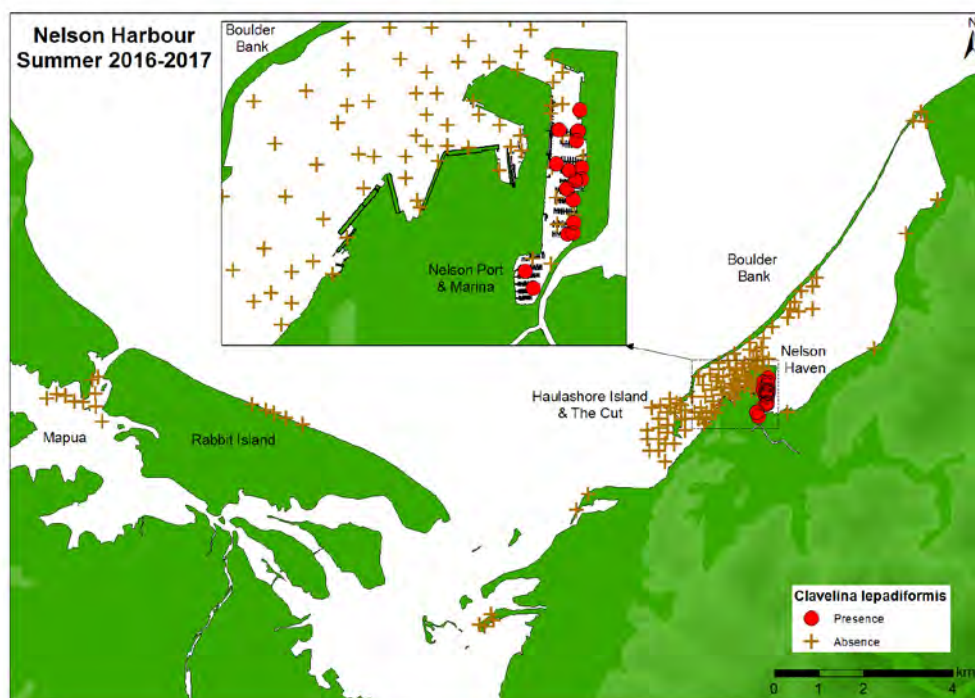


Clavelina lepadiformis

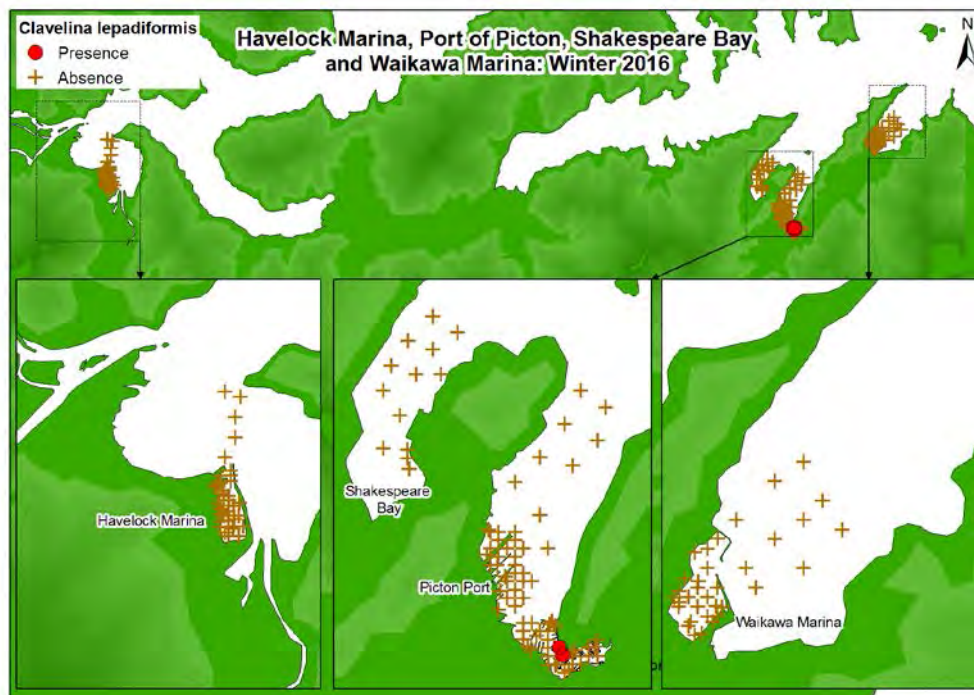
Nelson Harbour Winter 2016



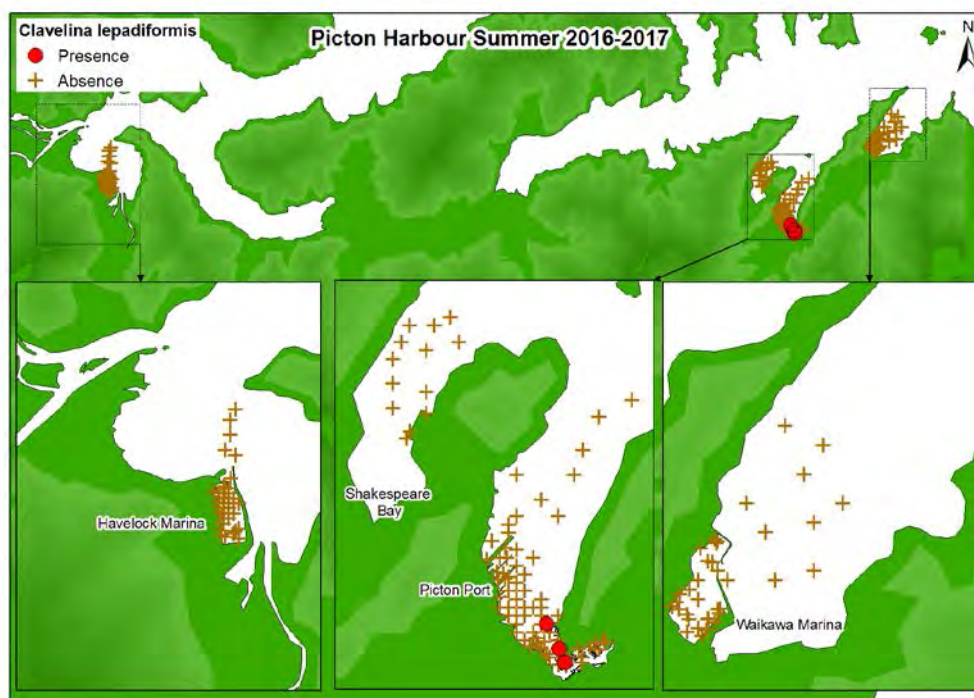
Nelson Harbour Summer 2016–17



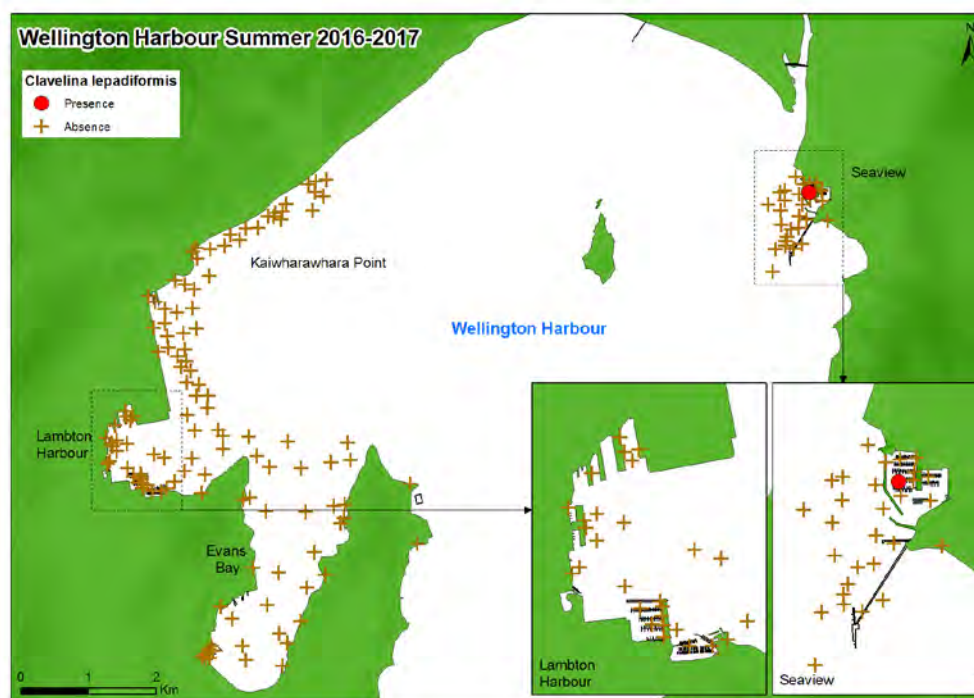
Picton Harbour Winter 2016



Picton Harbour Summer 2016–17

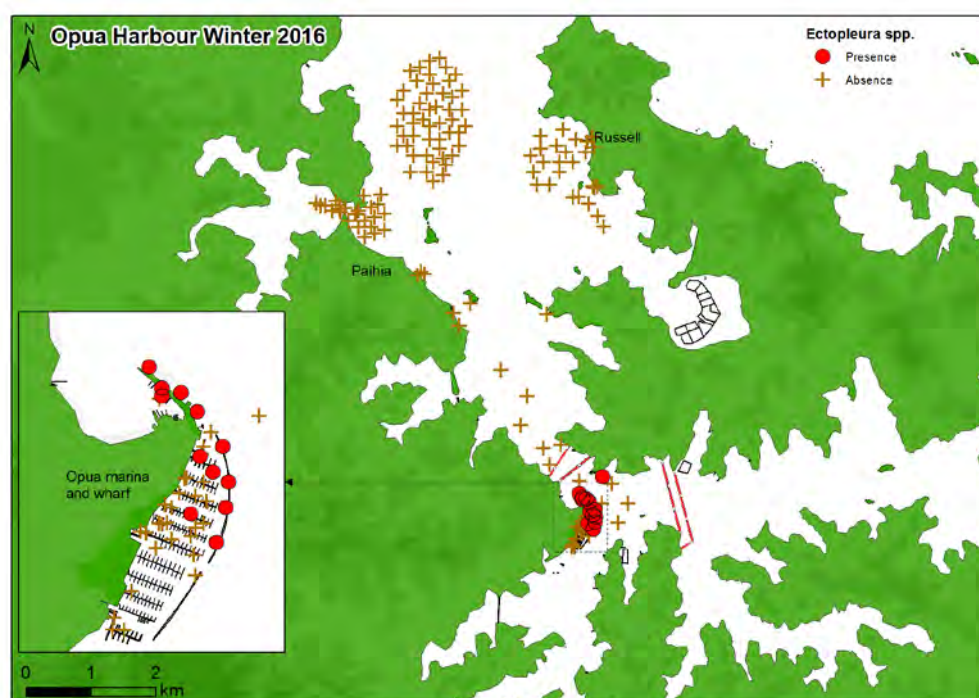


Wellington Harbour Summer 2016–17

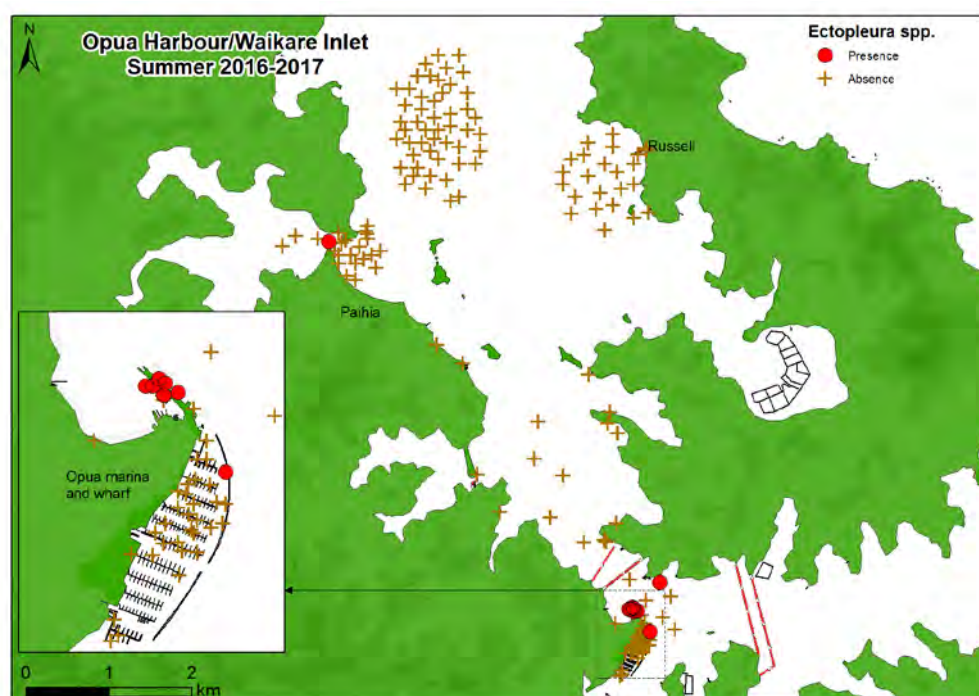


Ectopleura spp.

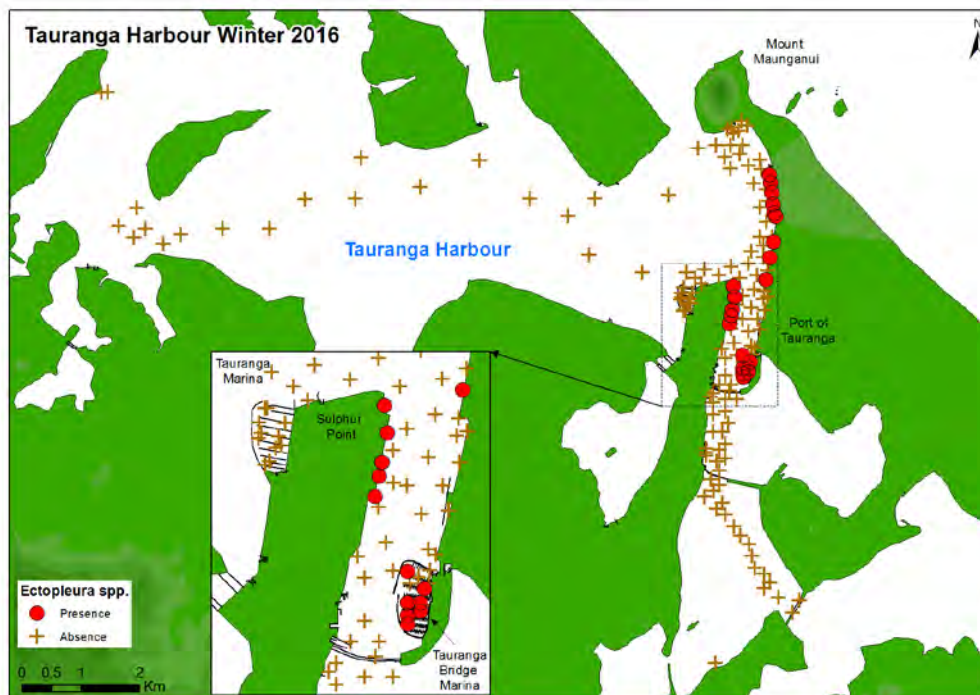
Opua Marina/Waikare Inlet Winter 2016



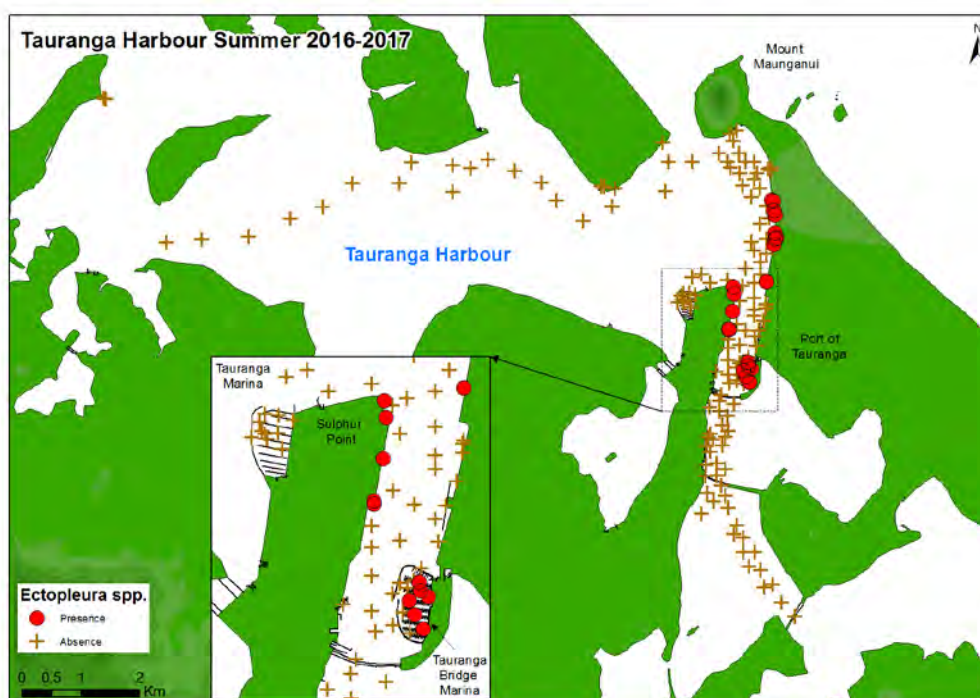
Opua Marina/Waikare Inlet Summer 2016–17



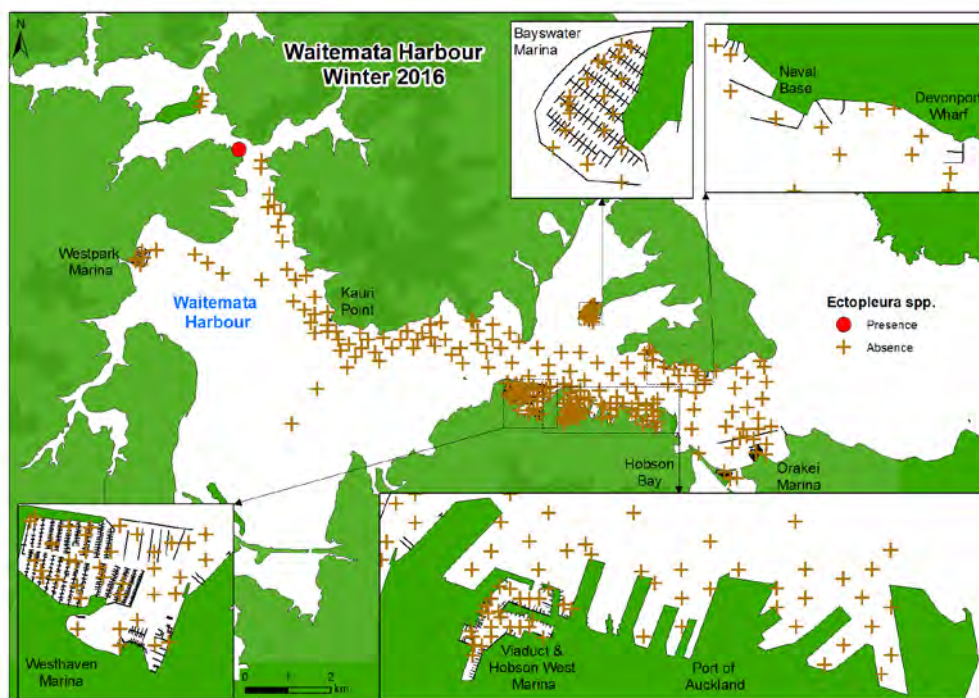
Tauranga Harbour Winter 2016



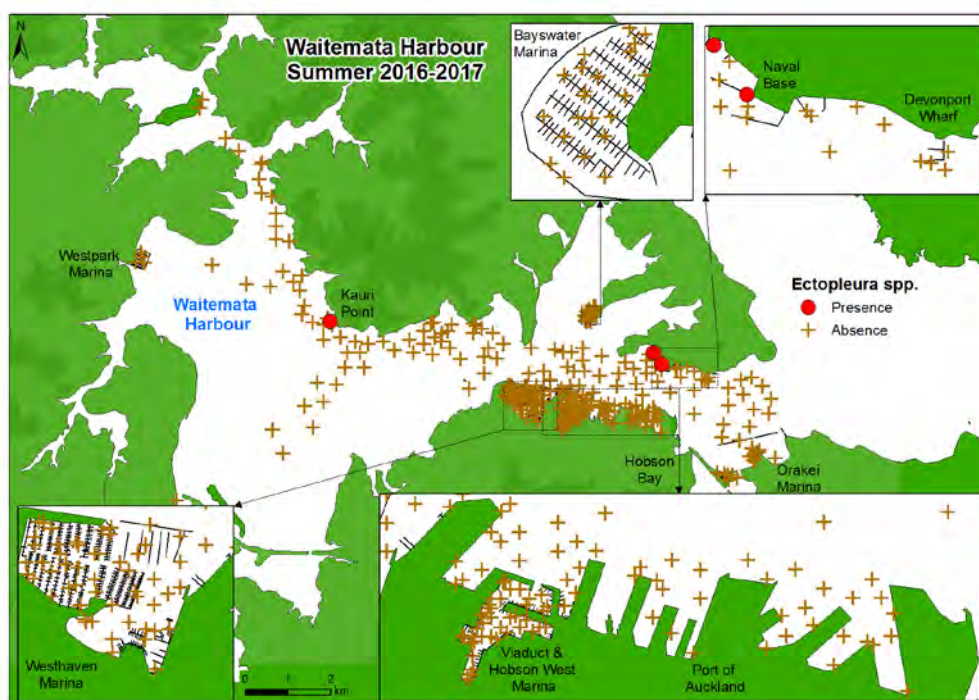
Tauranga Harbour Summer 2016–17



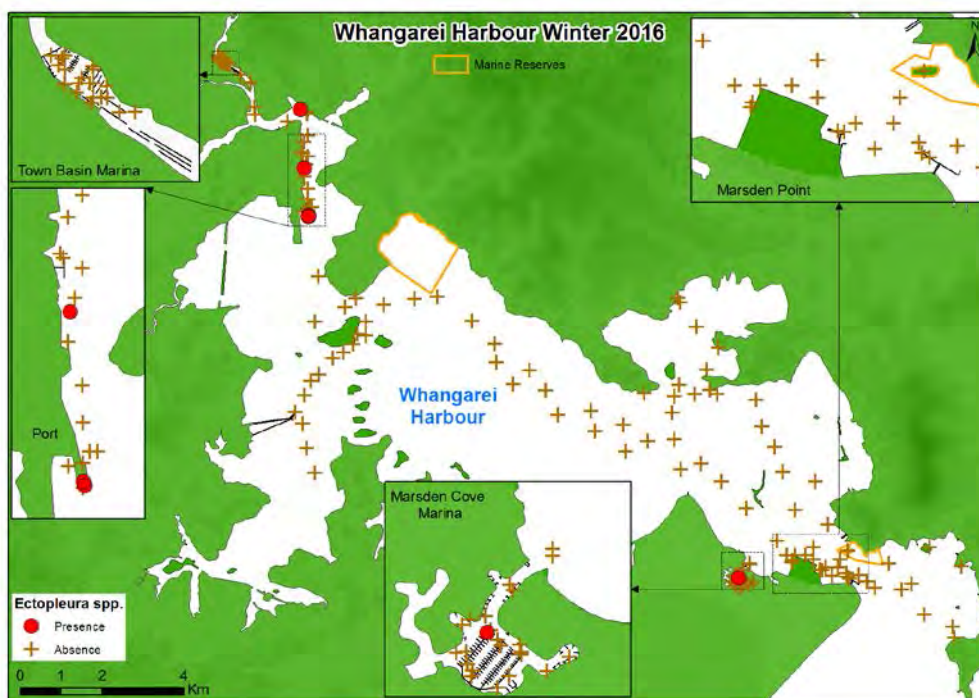
Waitemata Harbour Winter 2016



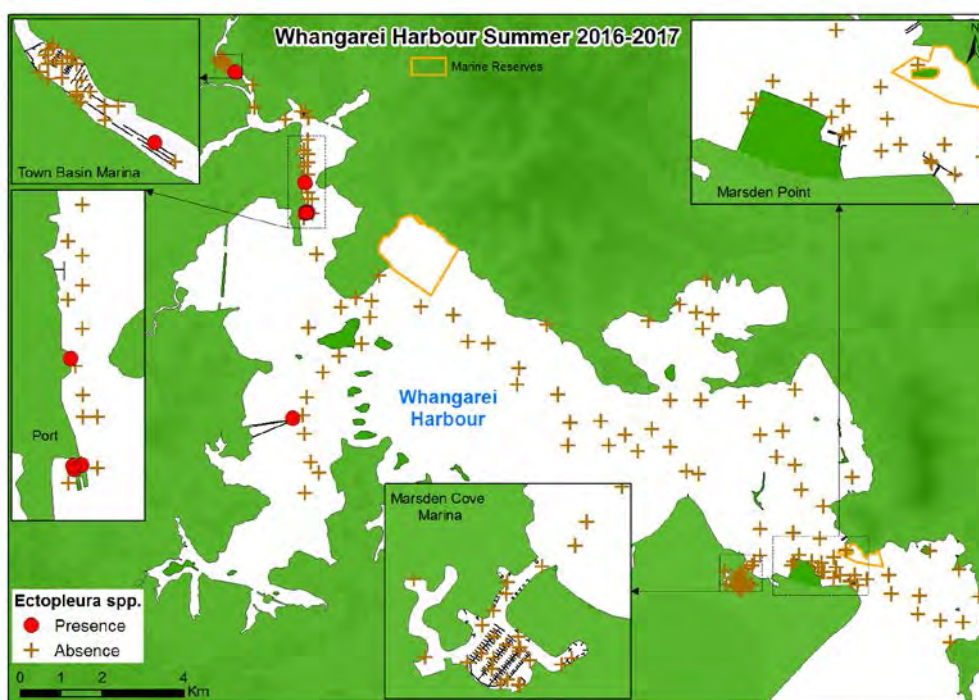
Waitemata Harbour Summer 2016–17



Whangarei Harbour Winter 2016

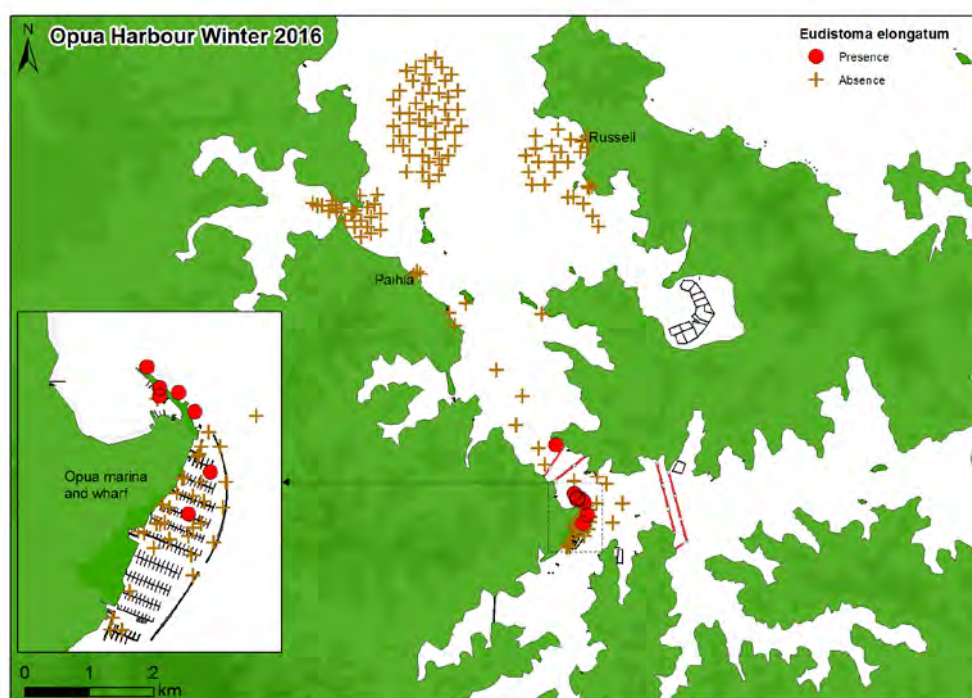


Whangarei Harbour Summer 2016-17

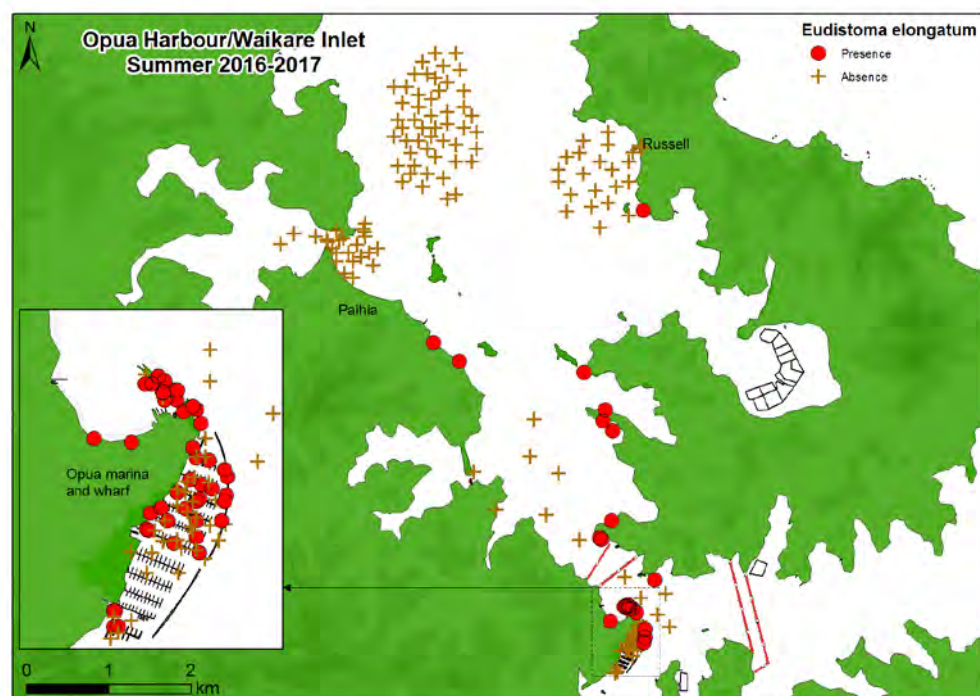


Eudistoma elongatum

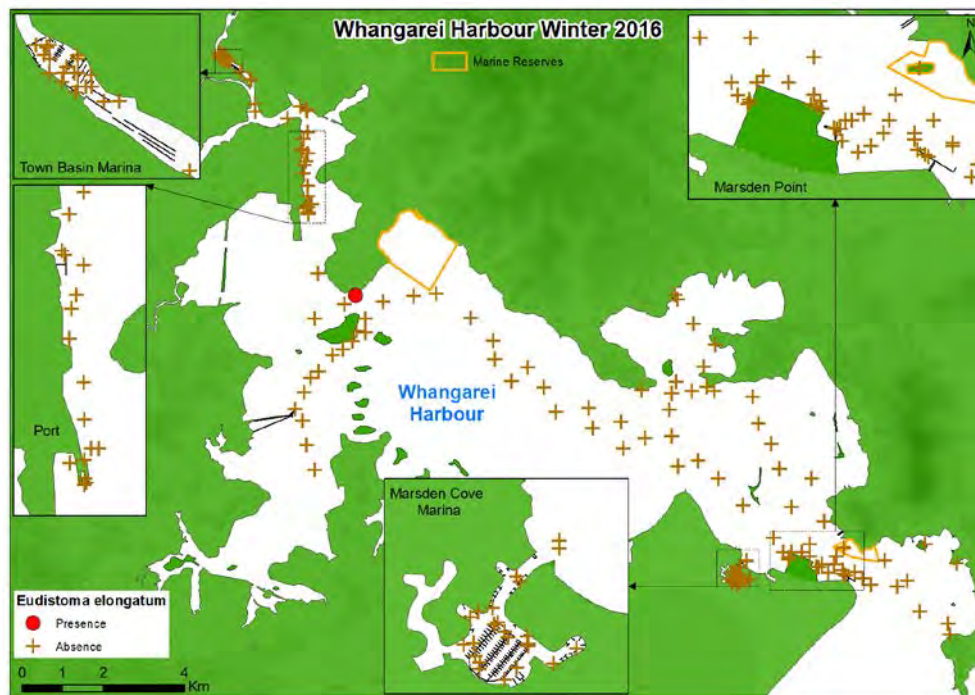
Opua Marina/Waikare Inlet Winter 2016



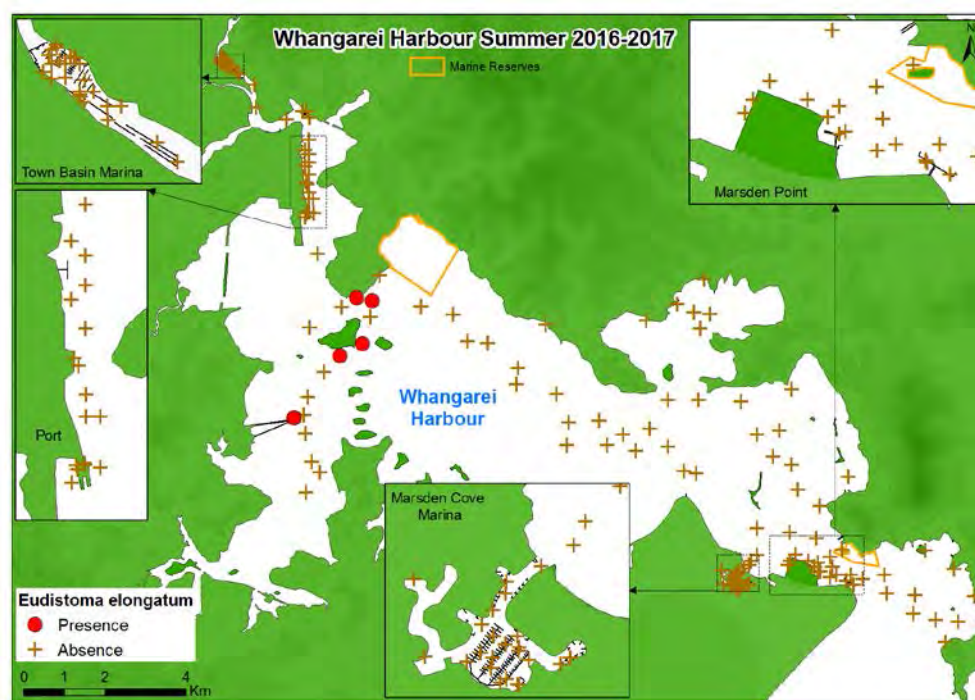
Opua Marina/Waikare Inlet Summer 2016–17



Whangarei Harbour Winter 2016



Whangarei Harbour Summer 2016-17

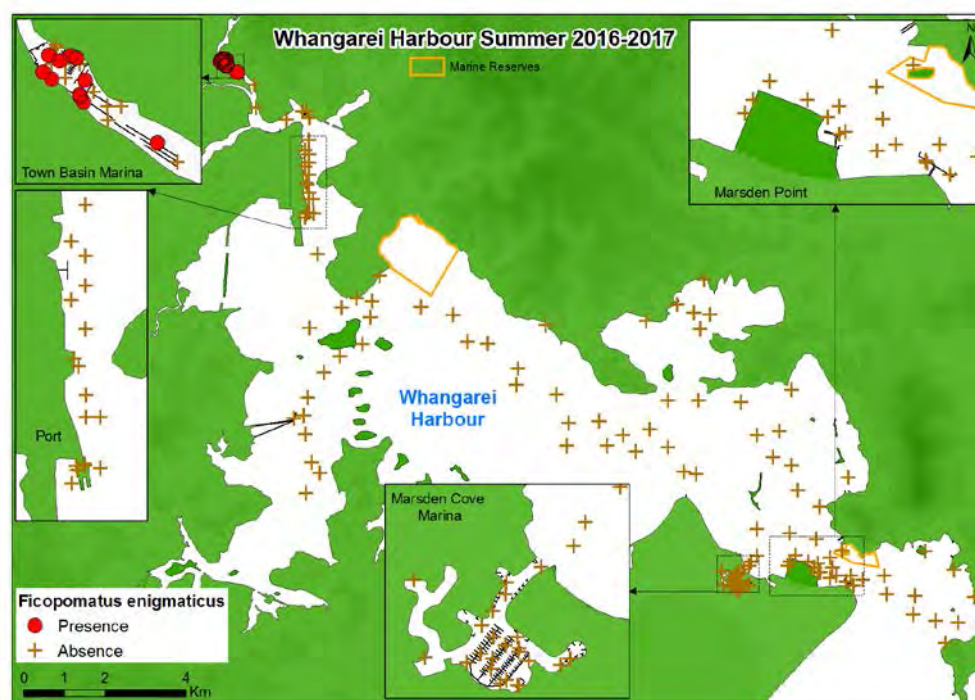


Ficopomatus enigmaticus

Whangarei Harbour Winter 2016



Whangarei Harbour Summer 2016–17

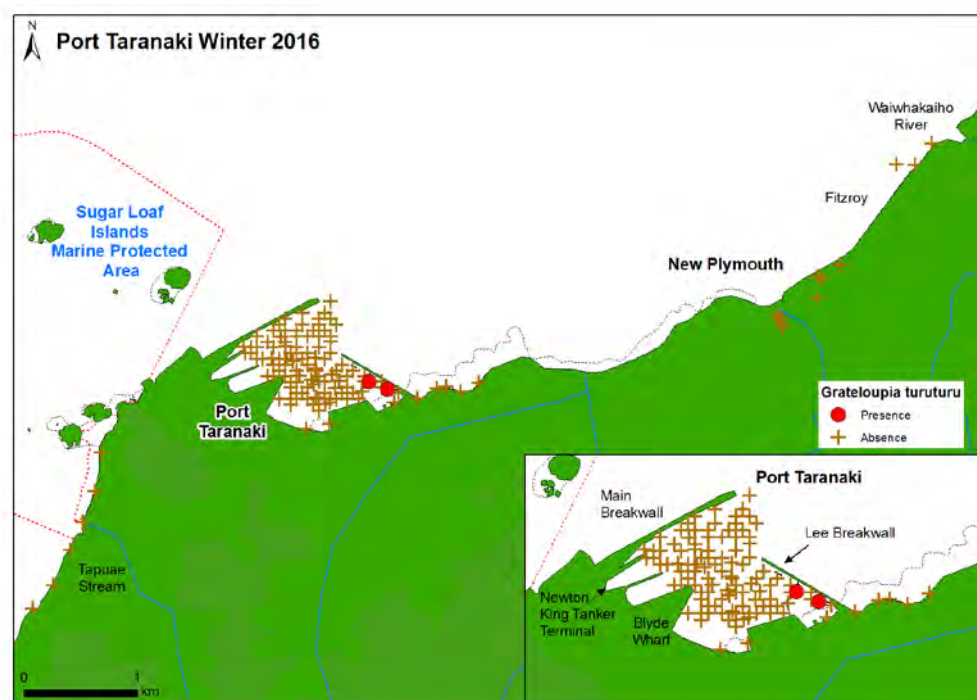


Grateloupia turuturu

Lyttelton Harbour Winter 2016

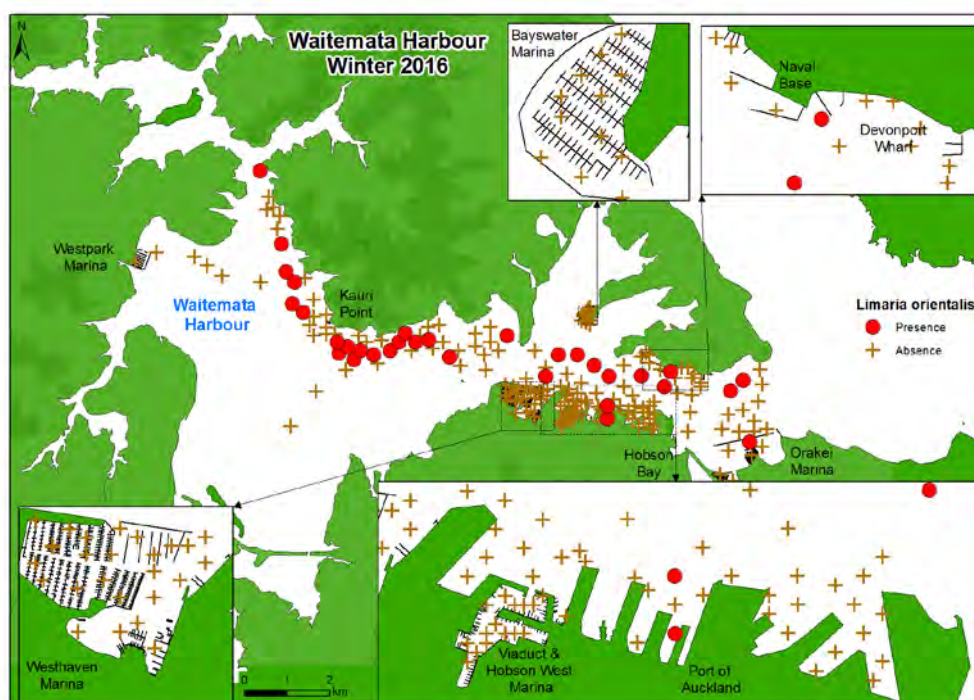


Port Taranaki Winter 2016

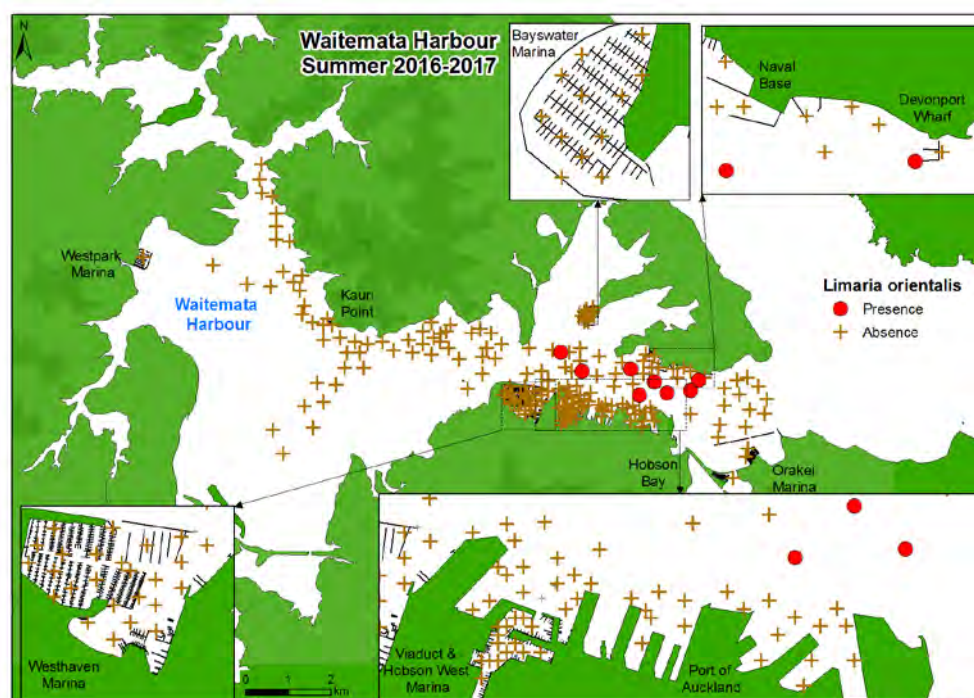


Limaria orientalis

Waitemata Harbour Winter 2016

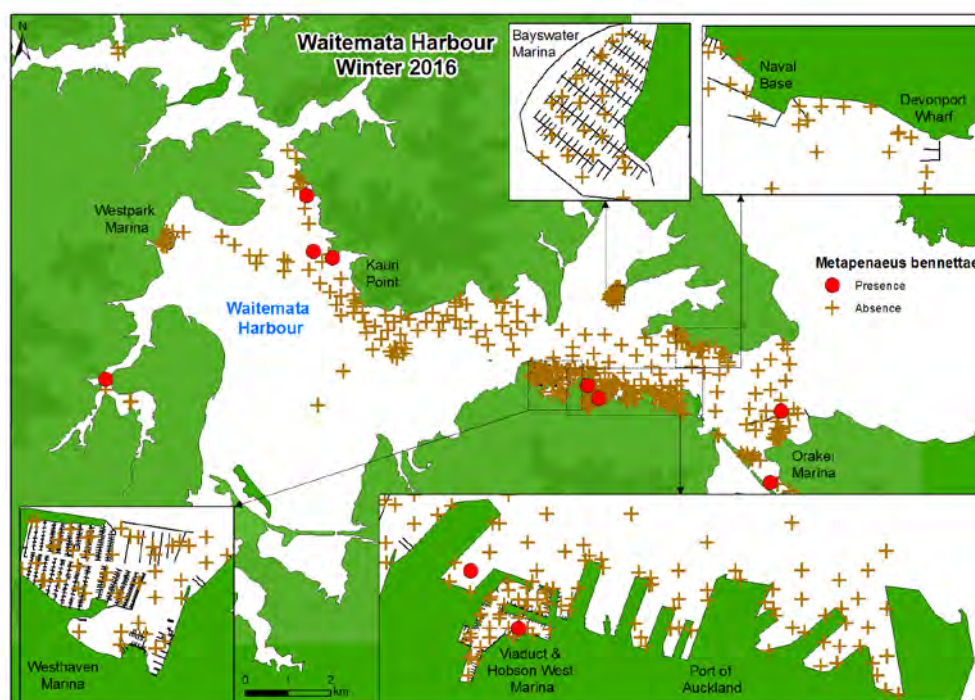


Waitemata Harbour Summer 2016–17

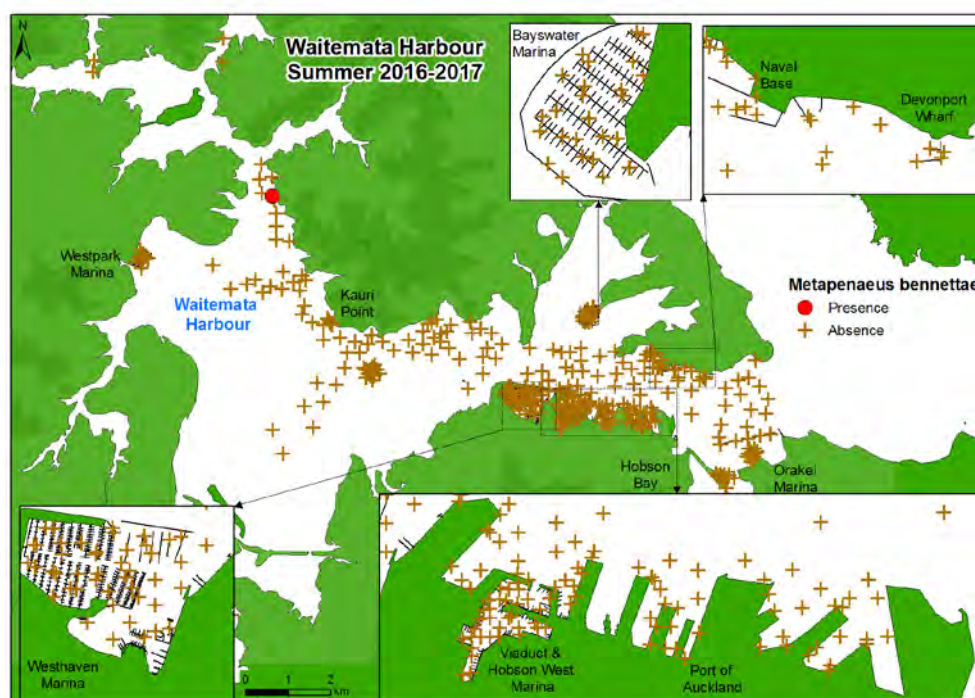


Metapenaeus bennettiae

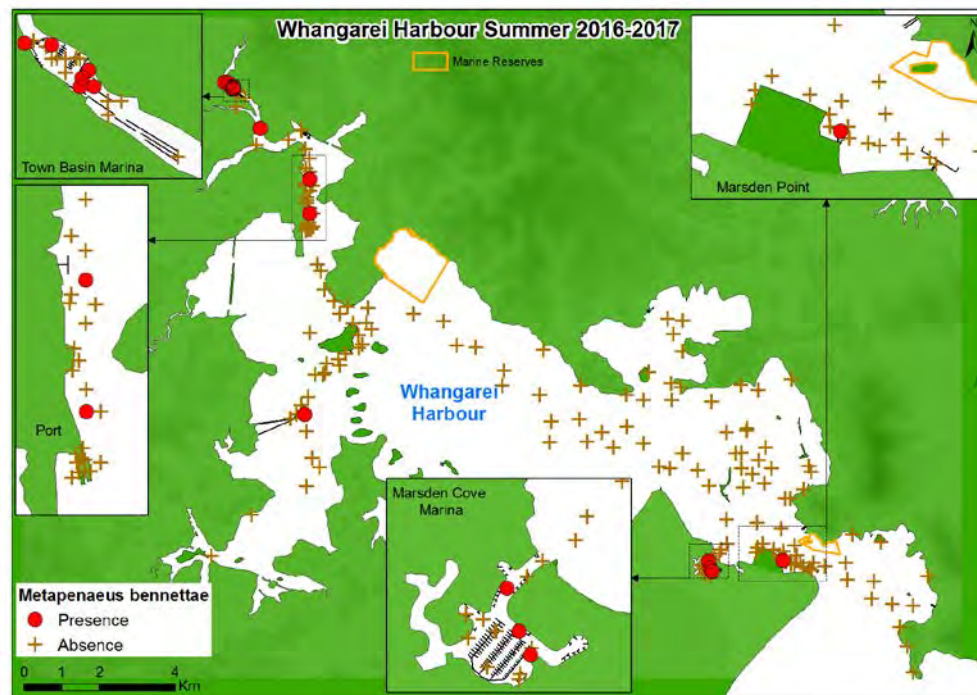
Waitemata Harbour Winter 2016



Waitemata Harbour Summer 2016–17

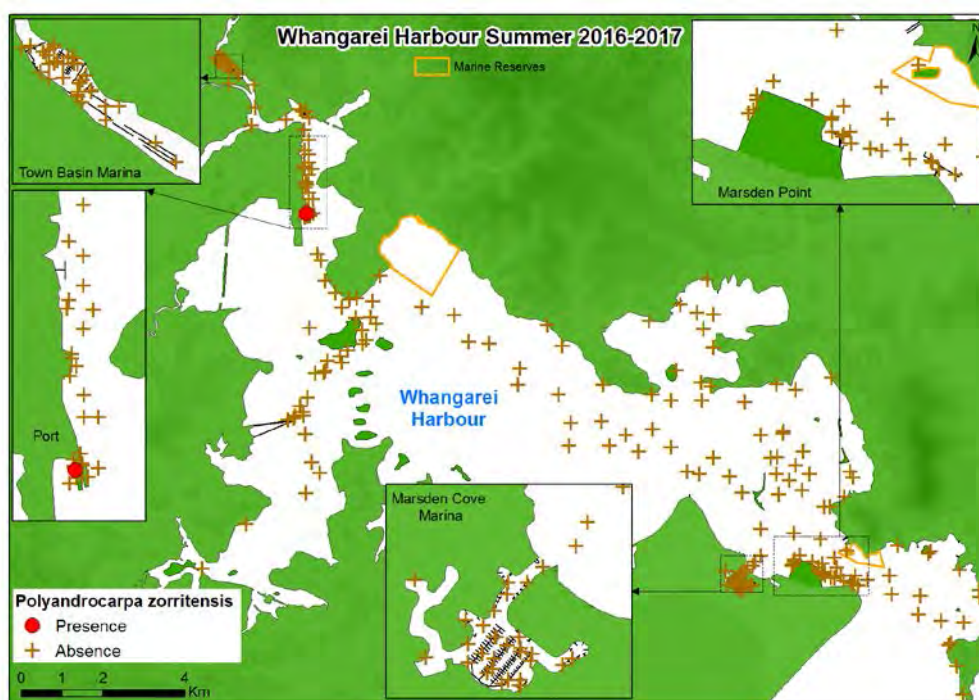


Whangarei Harbour Summer 2016–17



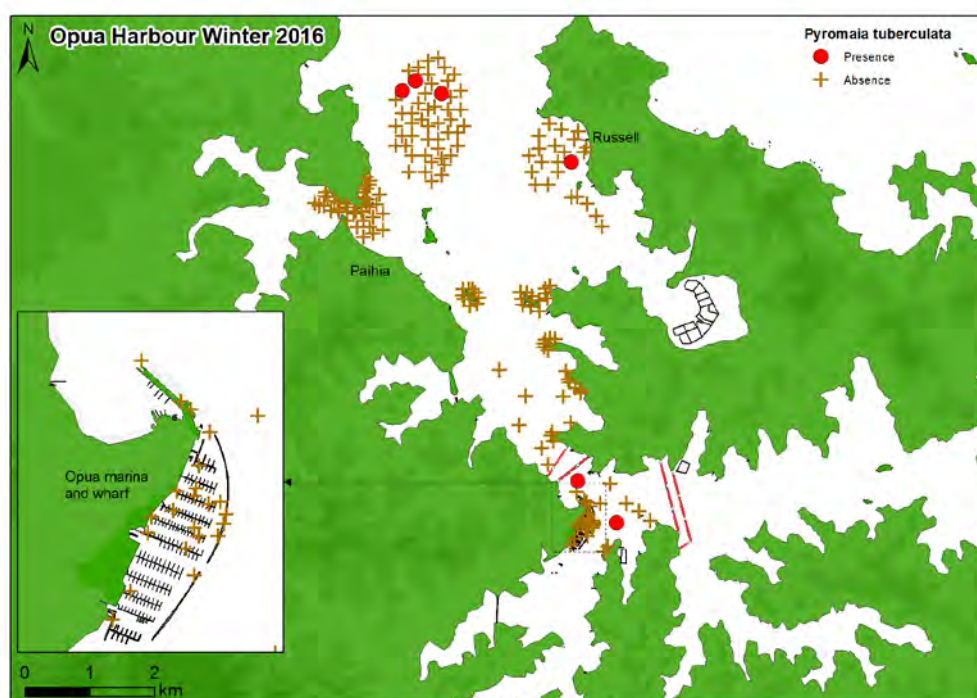
Polyandrocarpa zorritensis

Whangarei Harbour Summer 2016–17

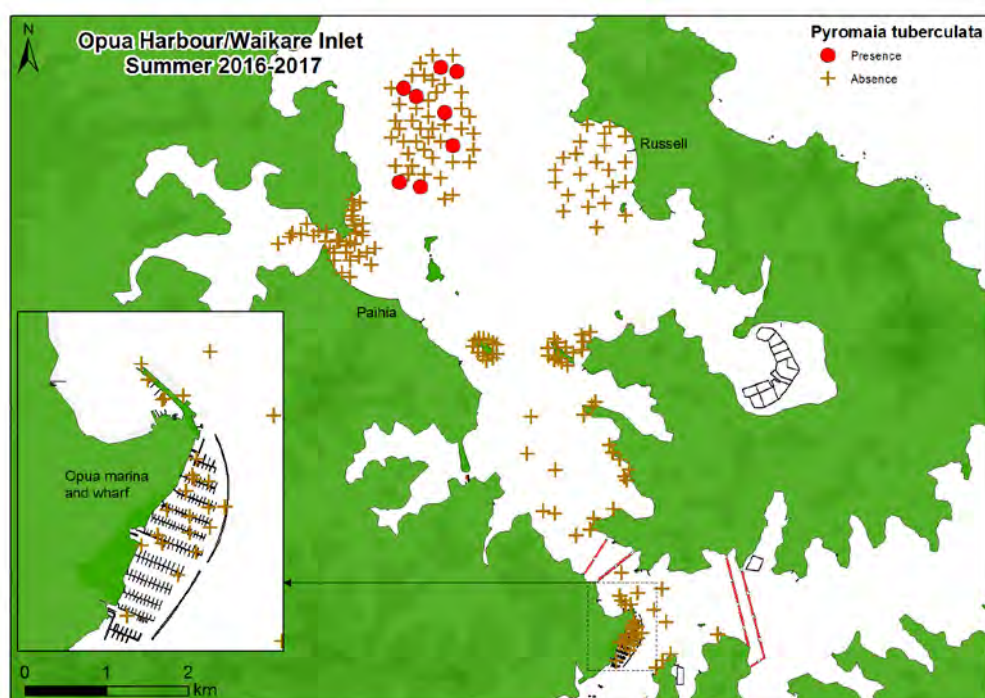


Pyromaia tuberculata

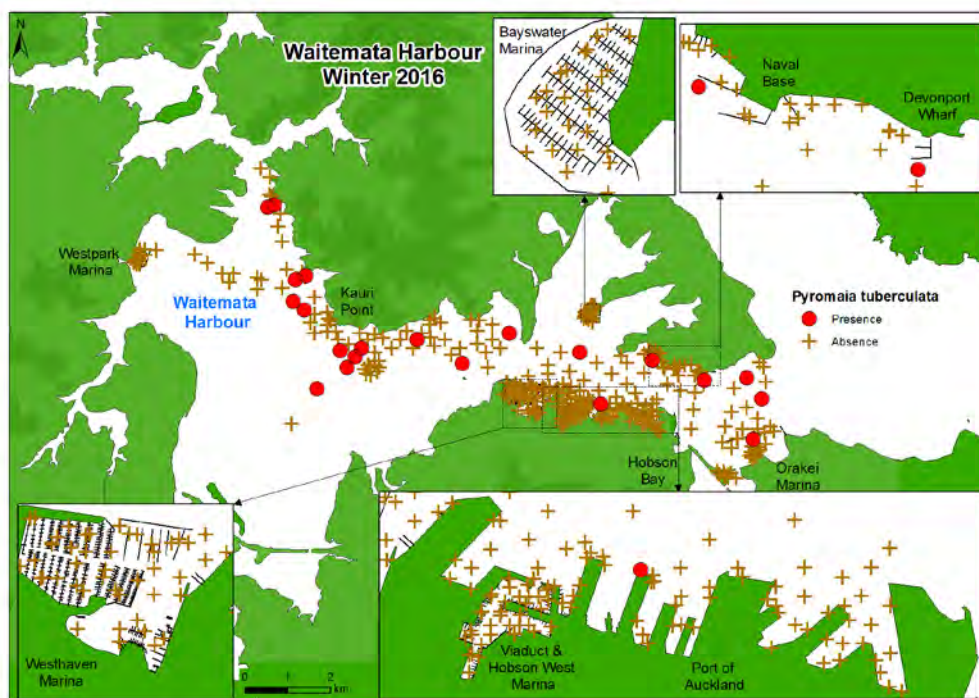
Opua Marina/Waikare Inlet Winter 2016



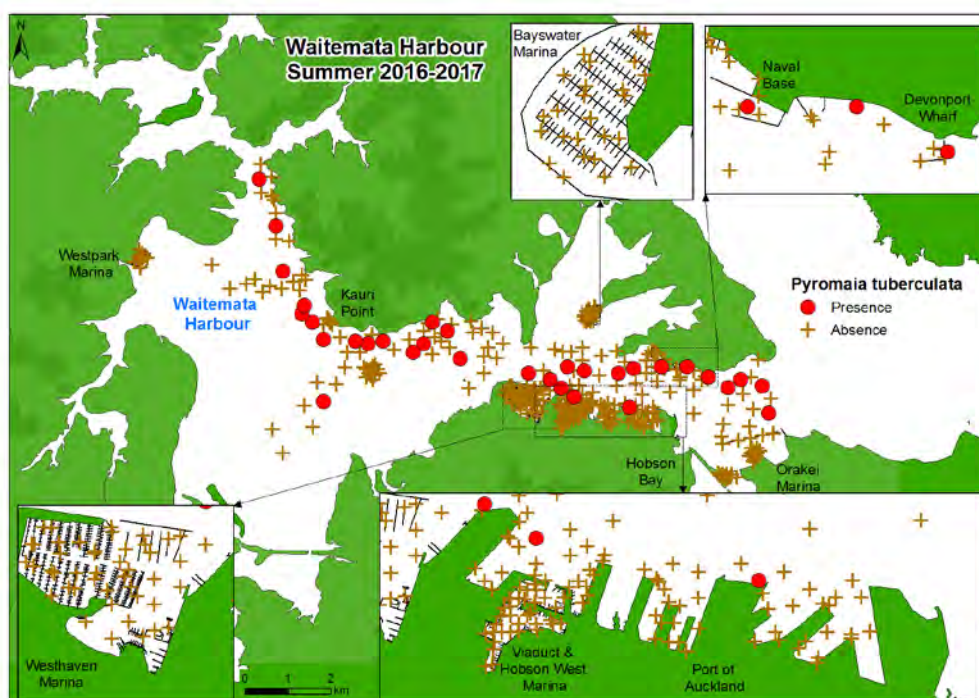
Opua Marina/Waikare Inlet Summer 2016–17



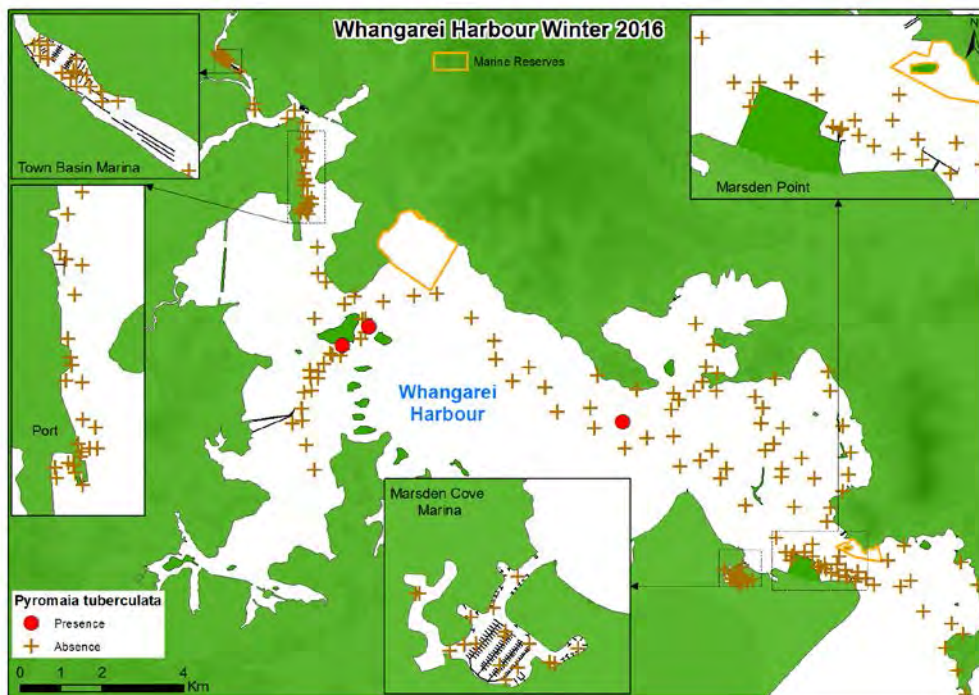
Waitemata Harbour Winter 2016



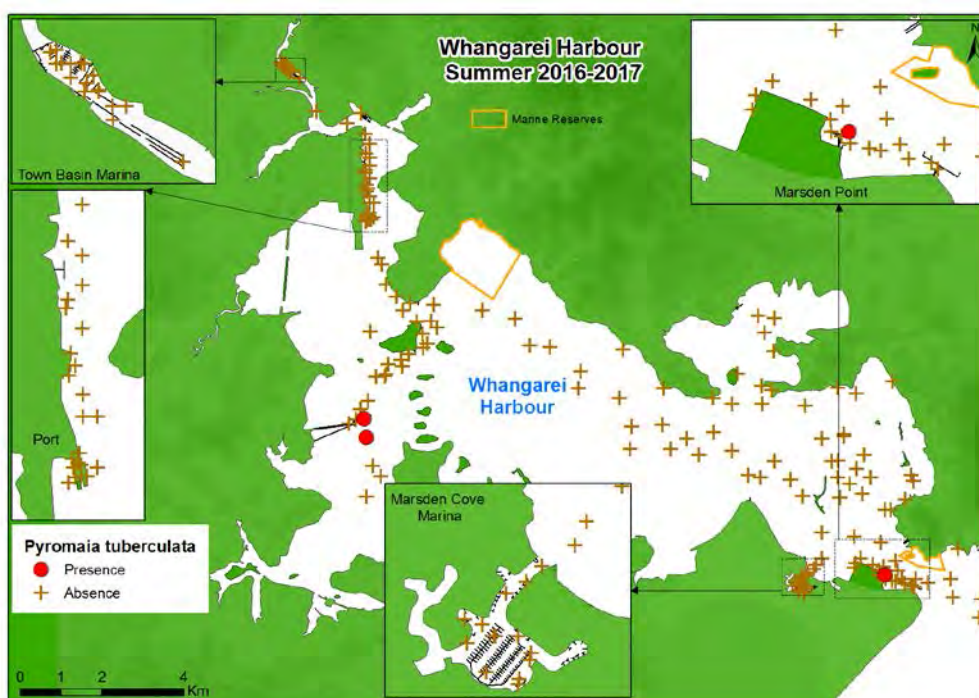
Waitemata Harbour Summer 2016–17



Whangarei Harbour Winter 2016

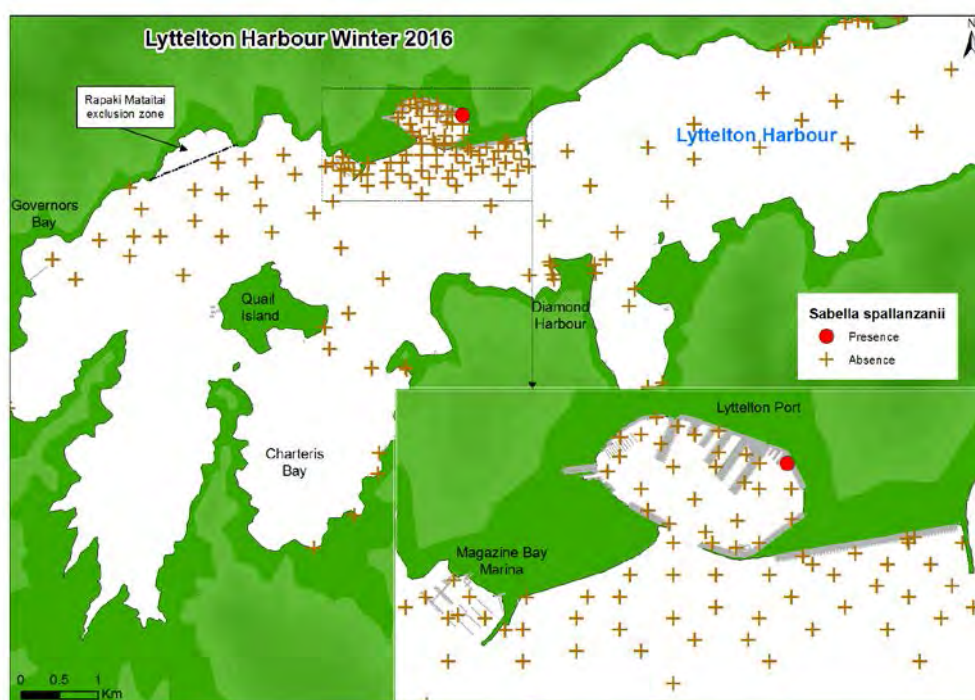


Whangarei Harbour Summer 2016–17

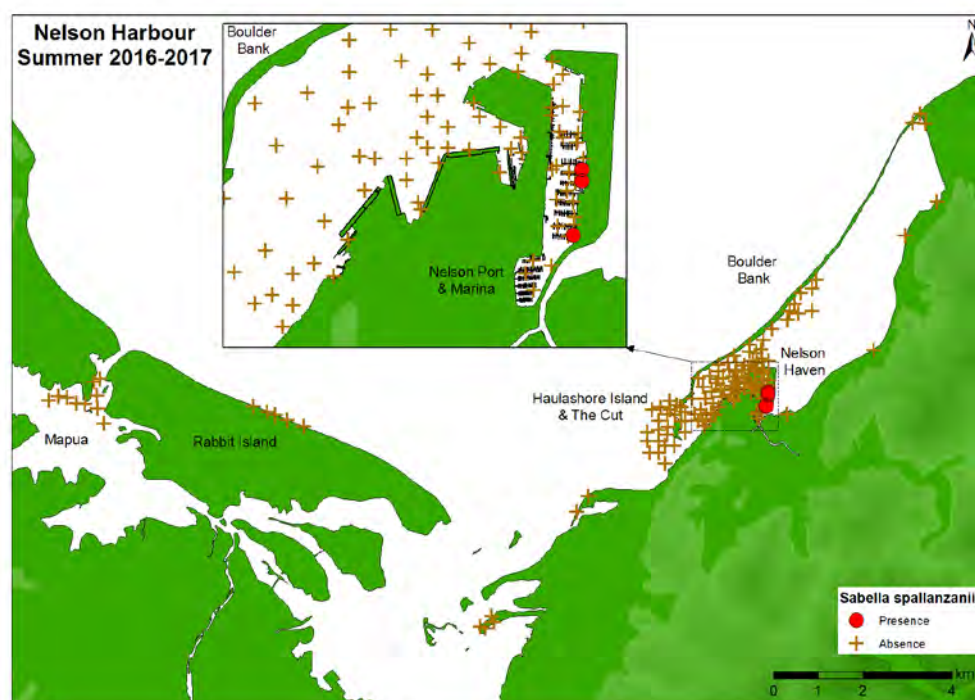


Sabella spallanzanii

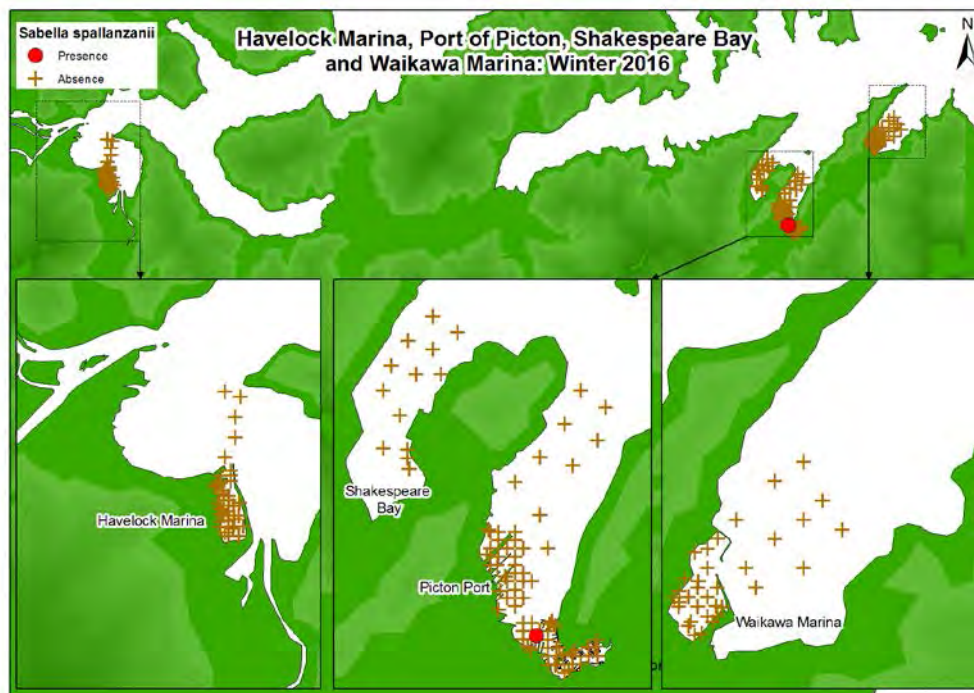
Lyttelton Harbour Winter 2016



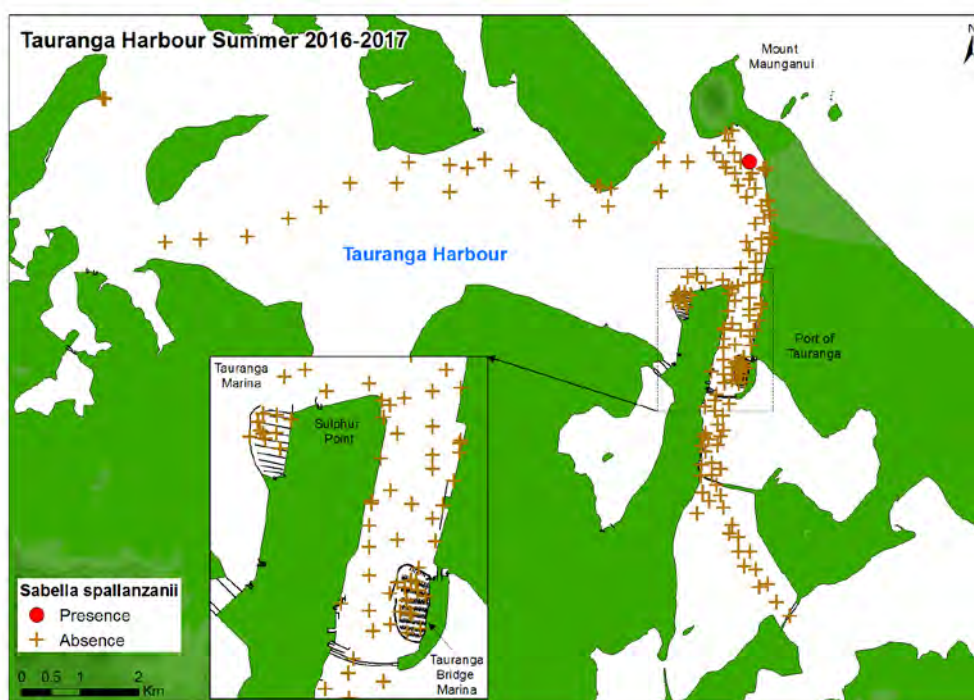
Nelson Harbour Summer 2016–17



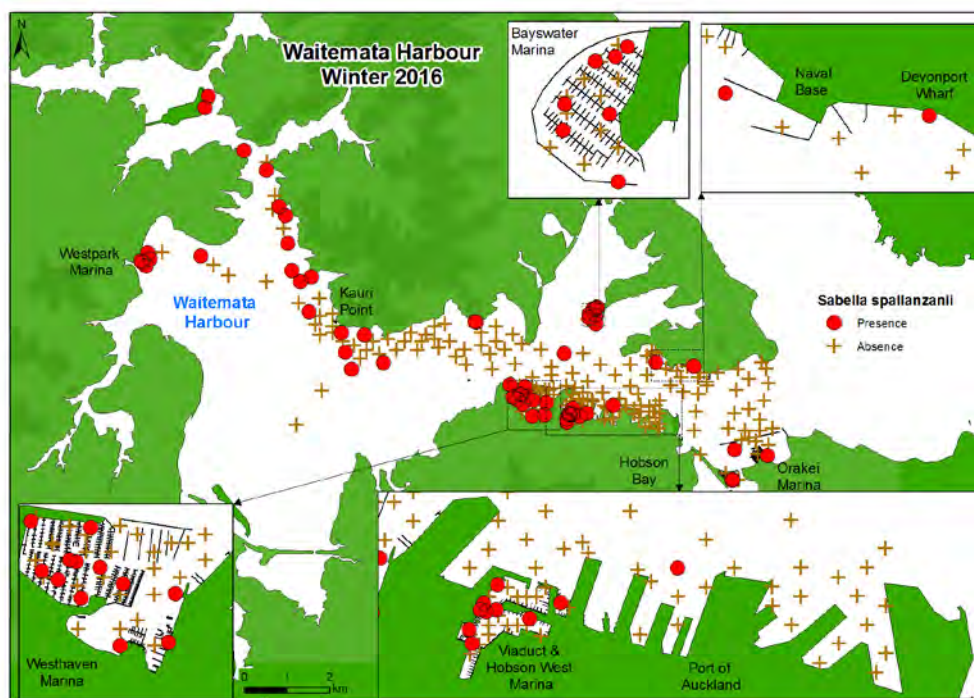
Picton Harbour Winter 2016



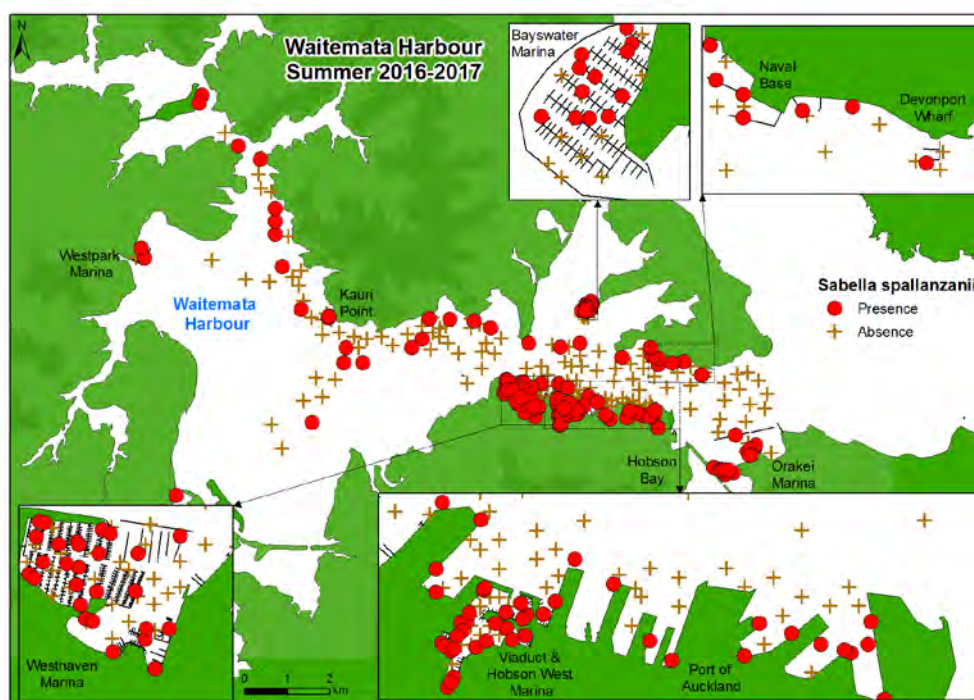
Tauranga Harbour Summer 2016–17



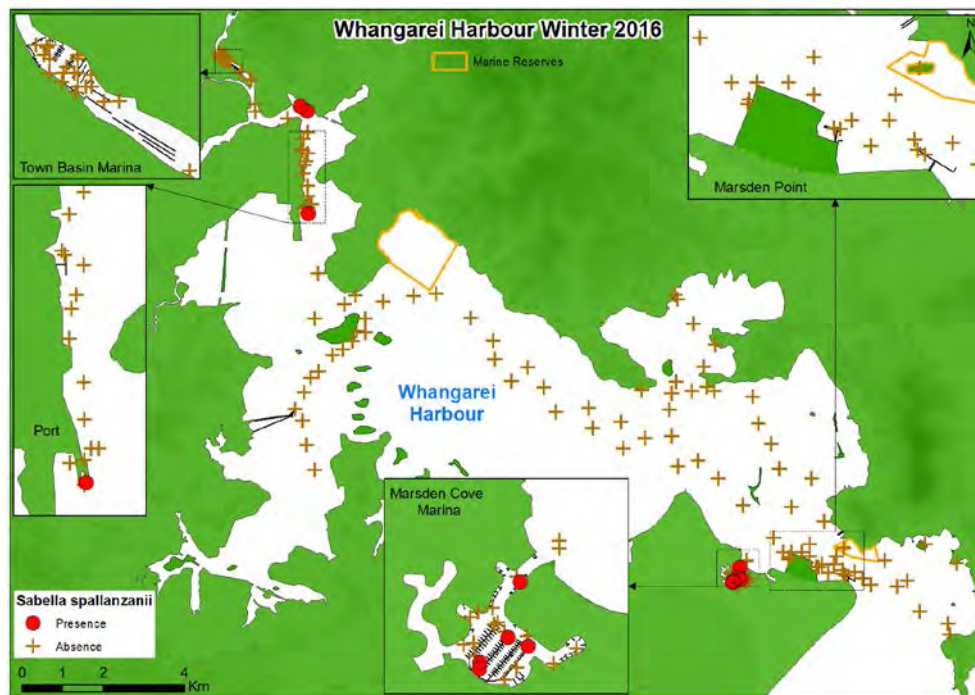
Waitemata Harbour Winter 2016



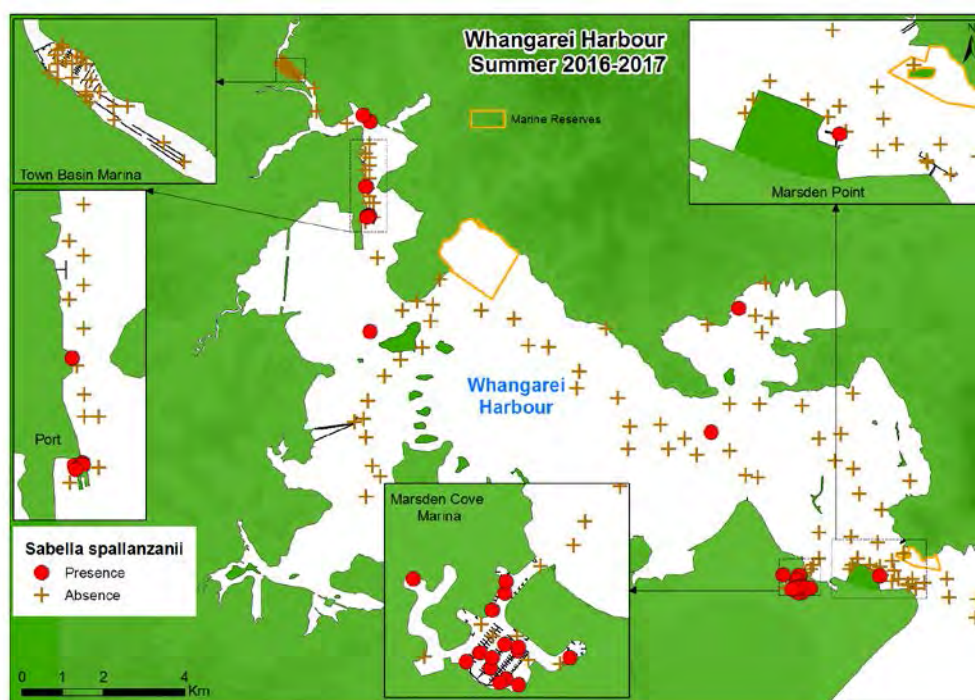
Waitemata Harbour Summer 2016–17



Whangarei Harbour Winter 2016

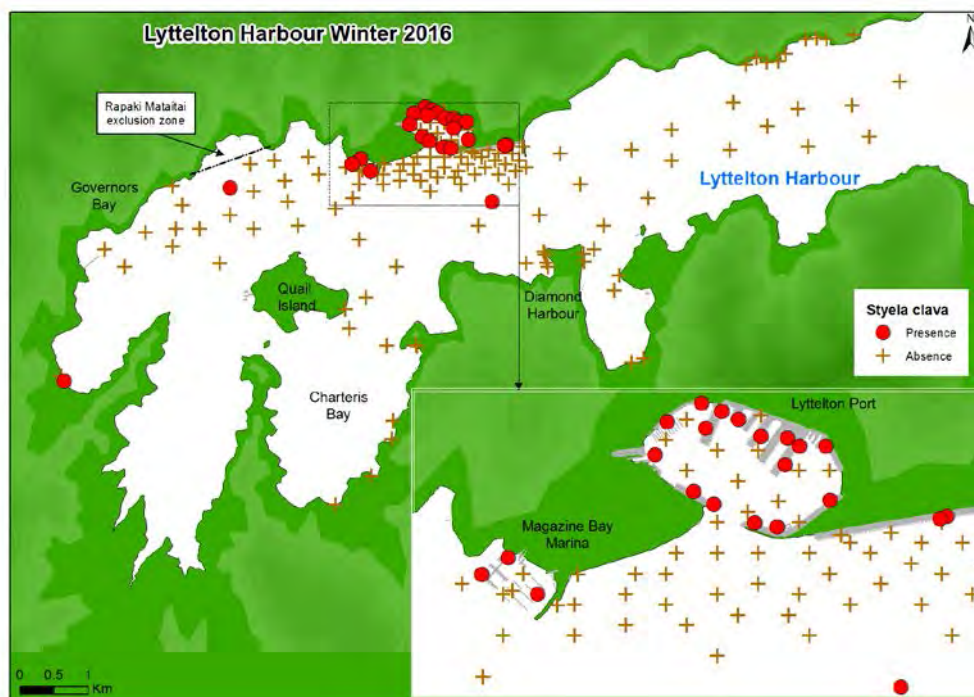


Whangarei Harbour Summer 2016–17

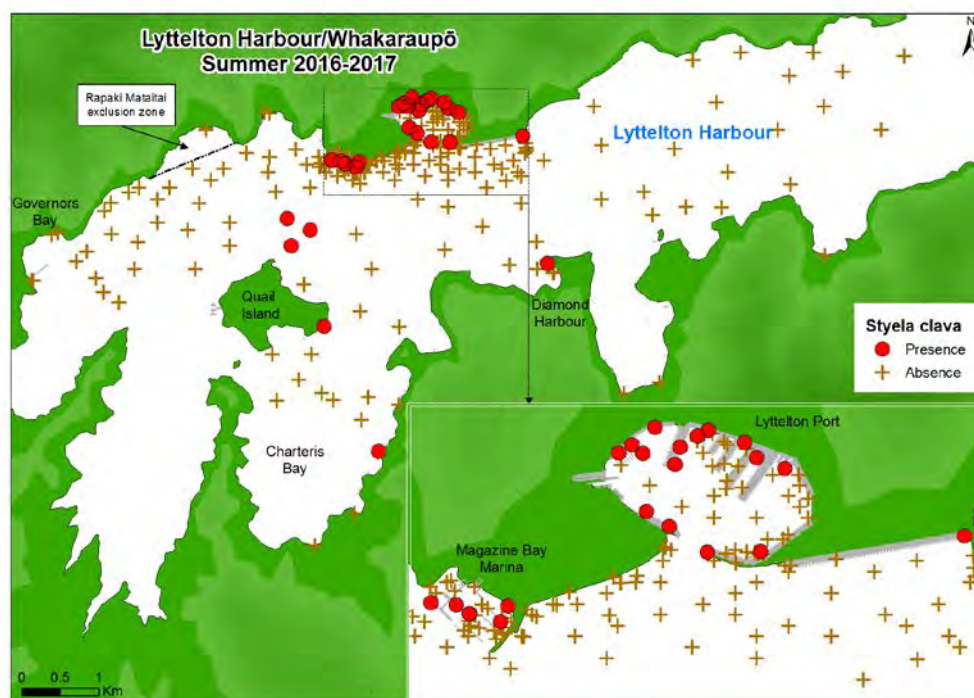


Styela clava

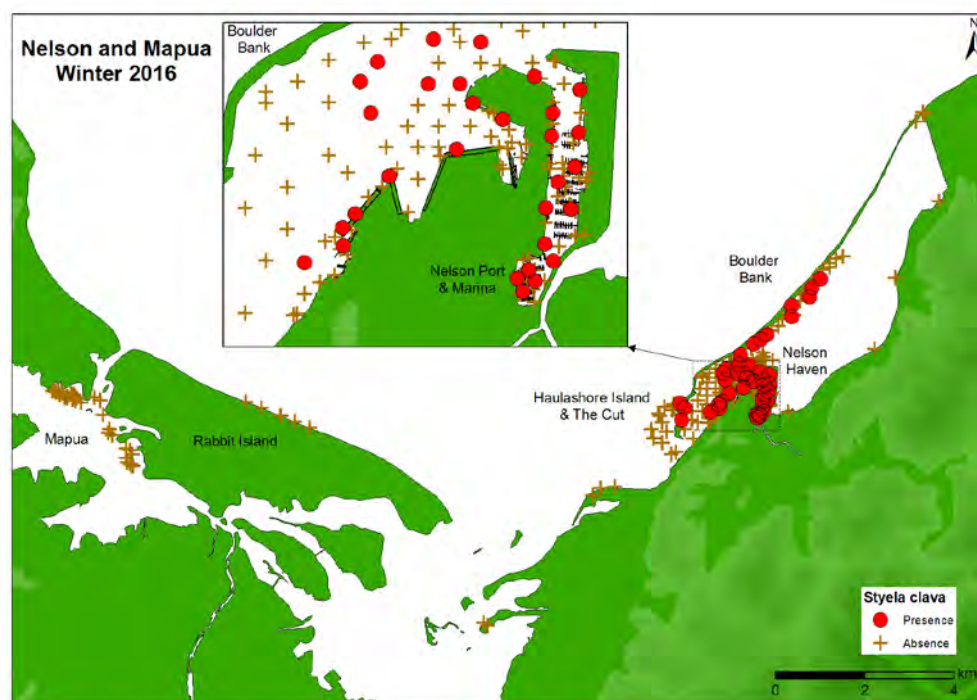
Lyttelton Harbour Winter 2016



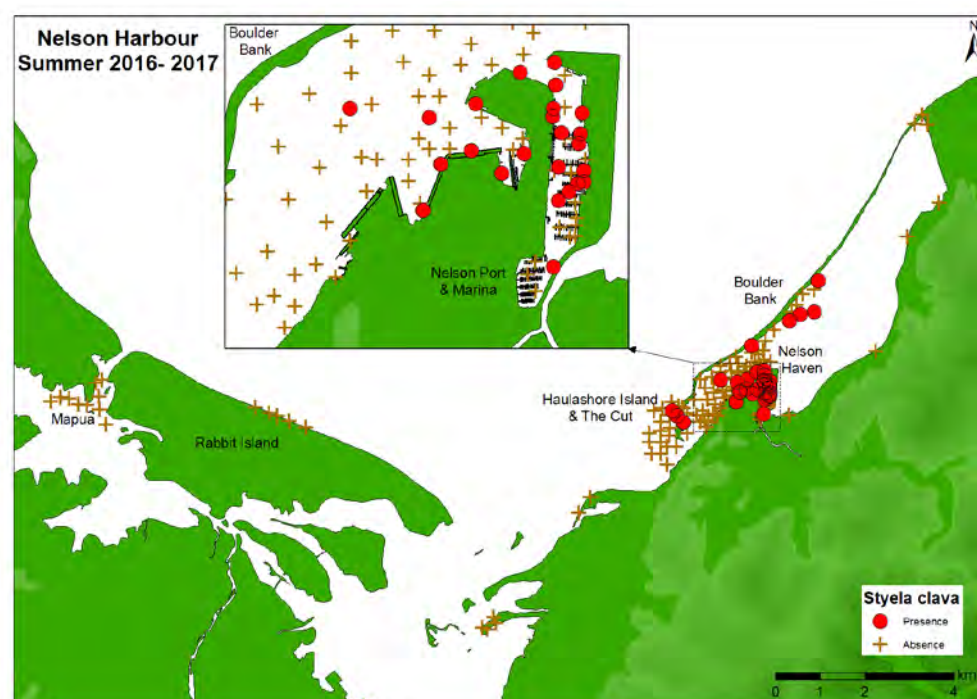
Lyttelton Harbour Summer 2016–17



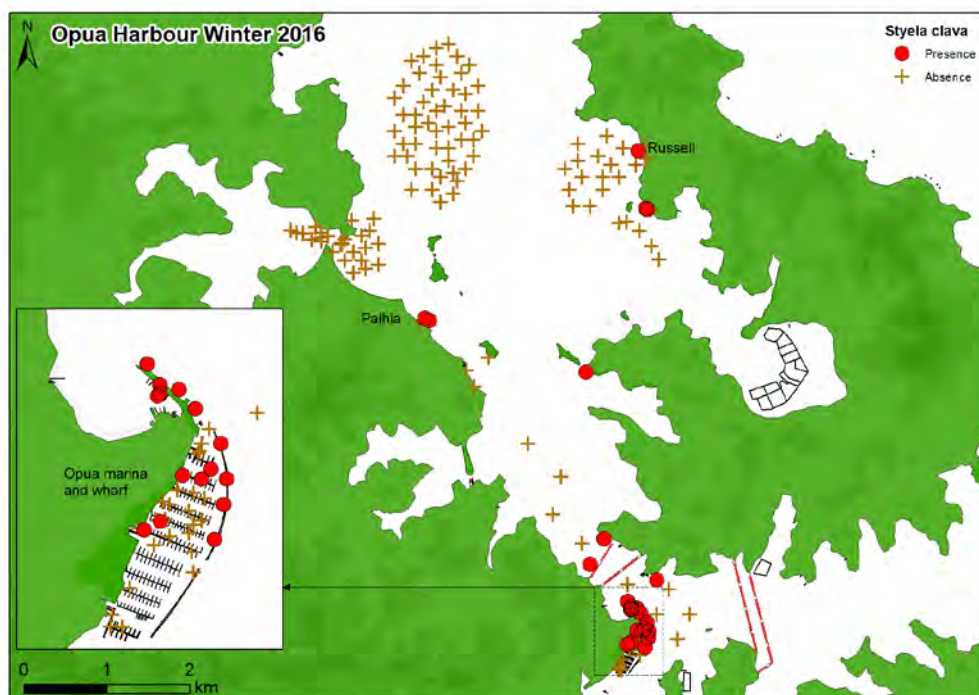
Nelson Harbour Winter 2016



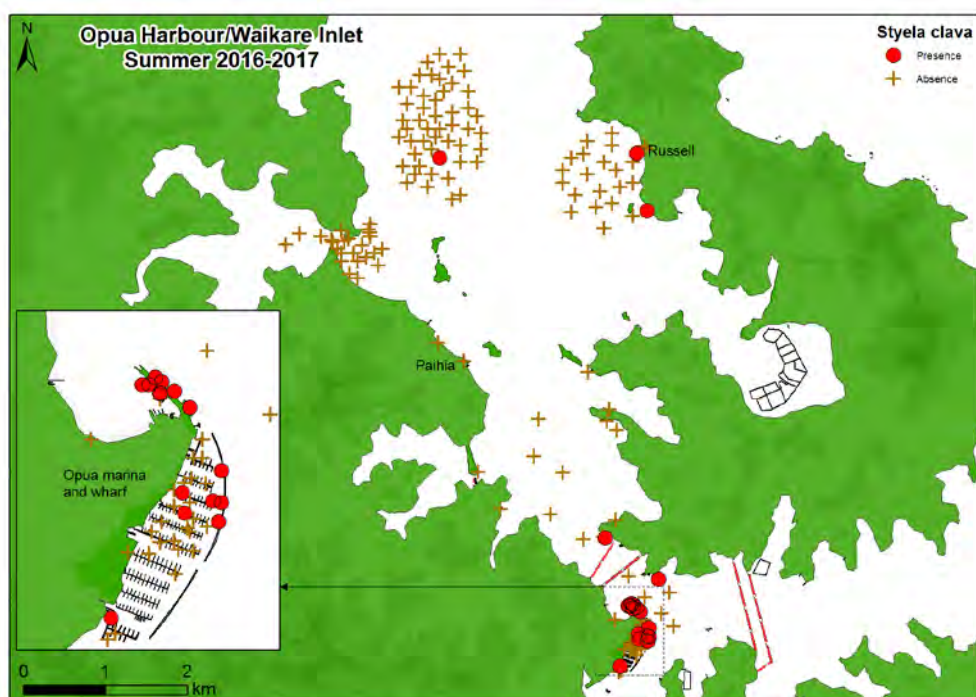
Nelson Harbour Summer 2016–17



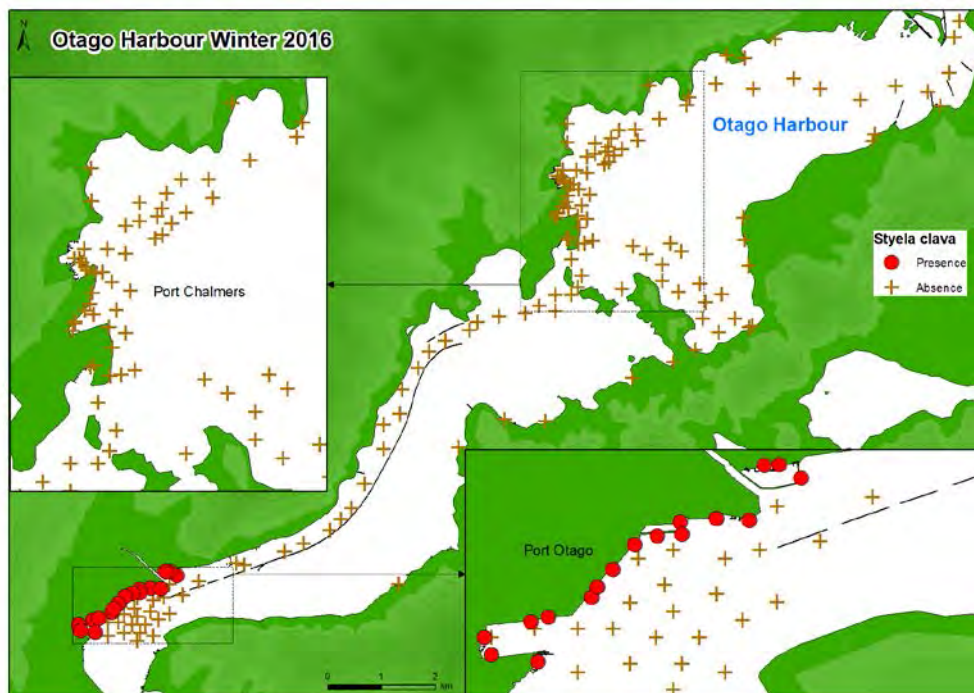
Opua Marina/Waikare Inlet Winter 2016



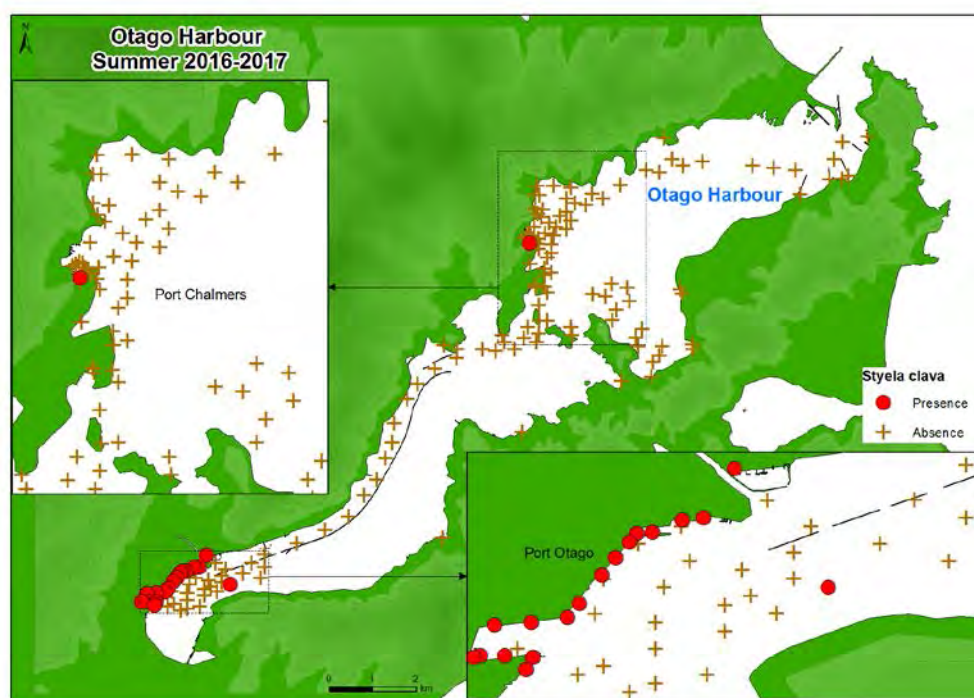
Opua Marina/Waikare Inlet Summer 2016–17



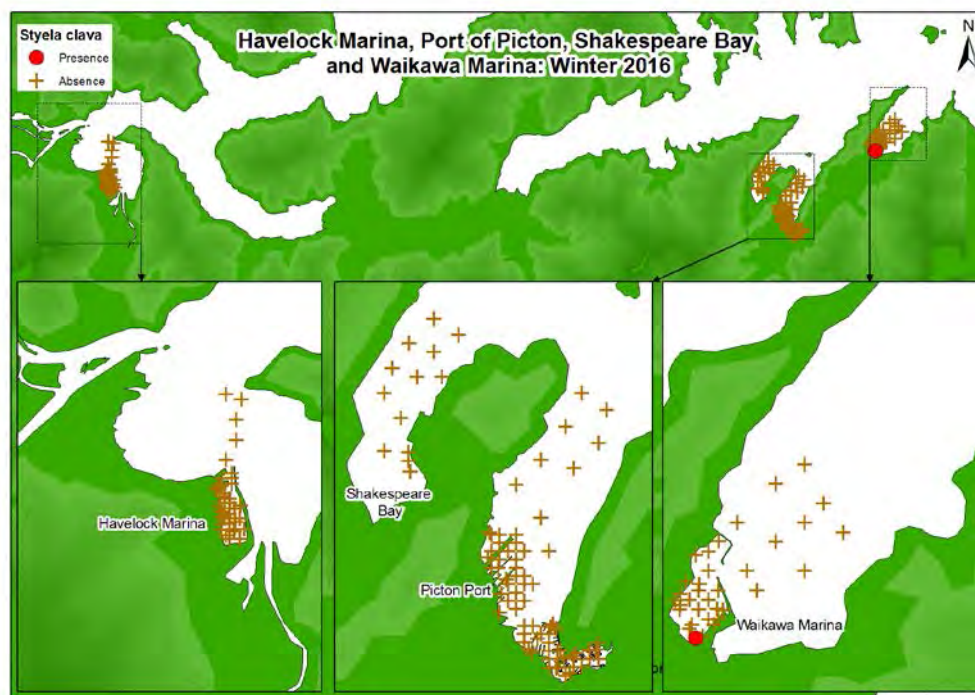
Otago Harbour Winter 2016



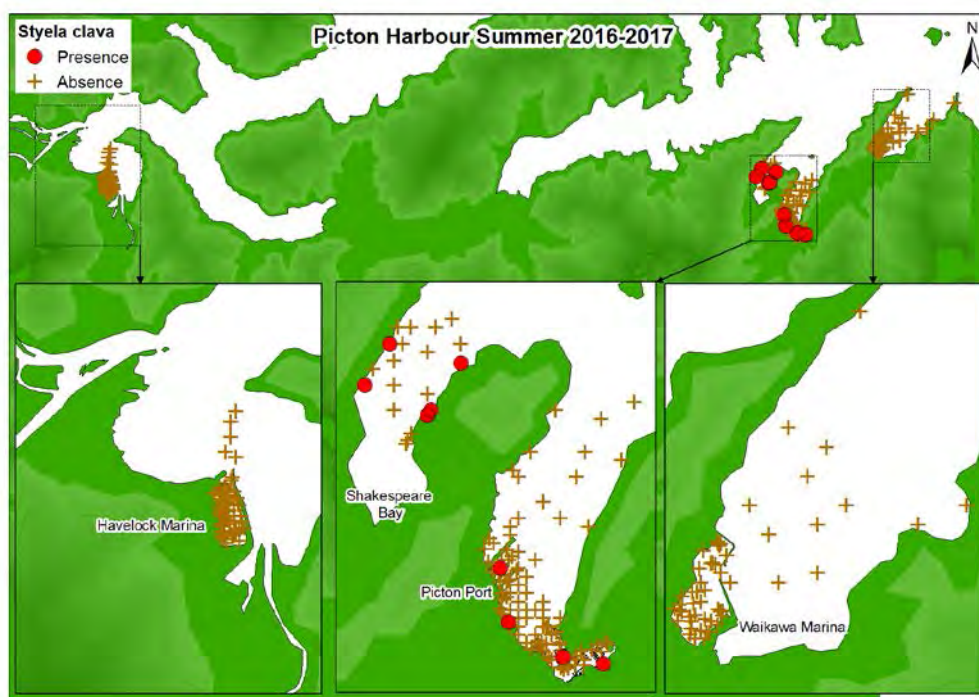
Otago Harbour Summer 2016–17



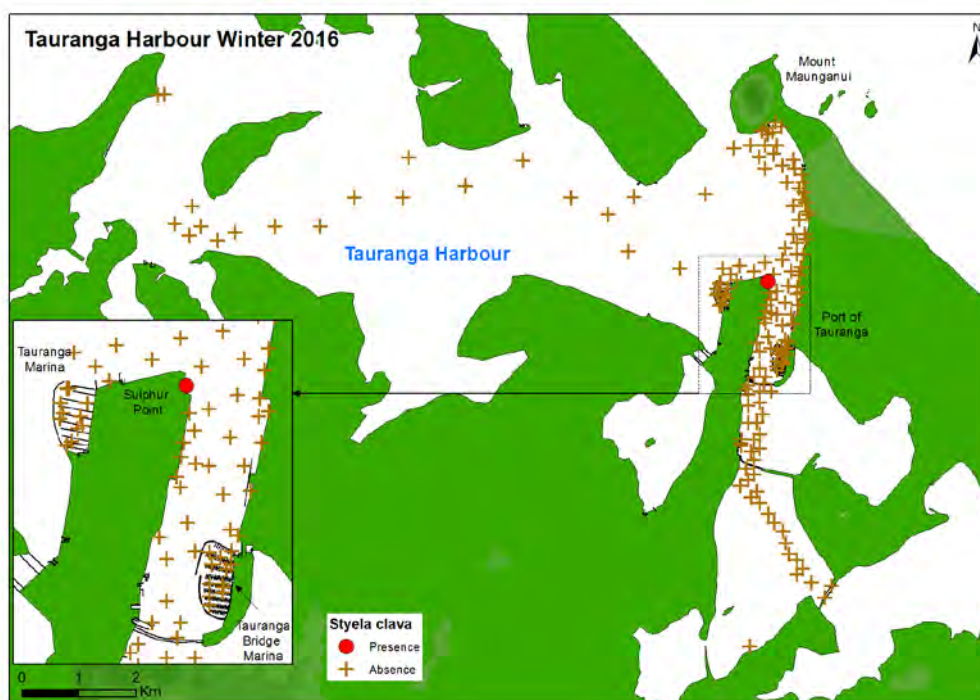
Picton Harbour Winter 2016



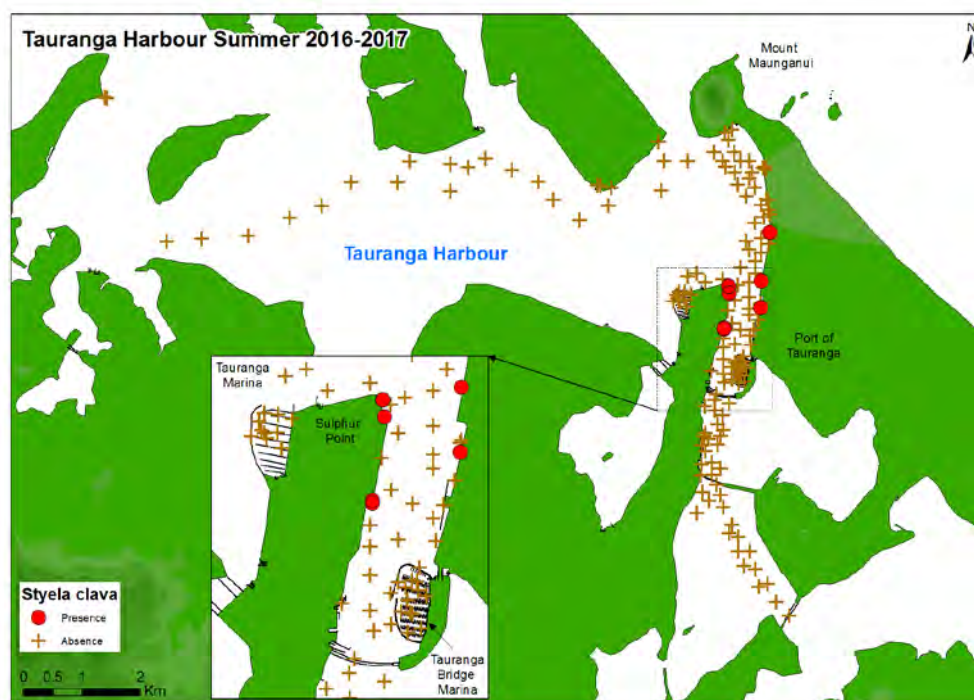
Picton Harbour Summer 2016–17



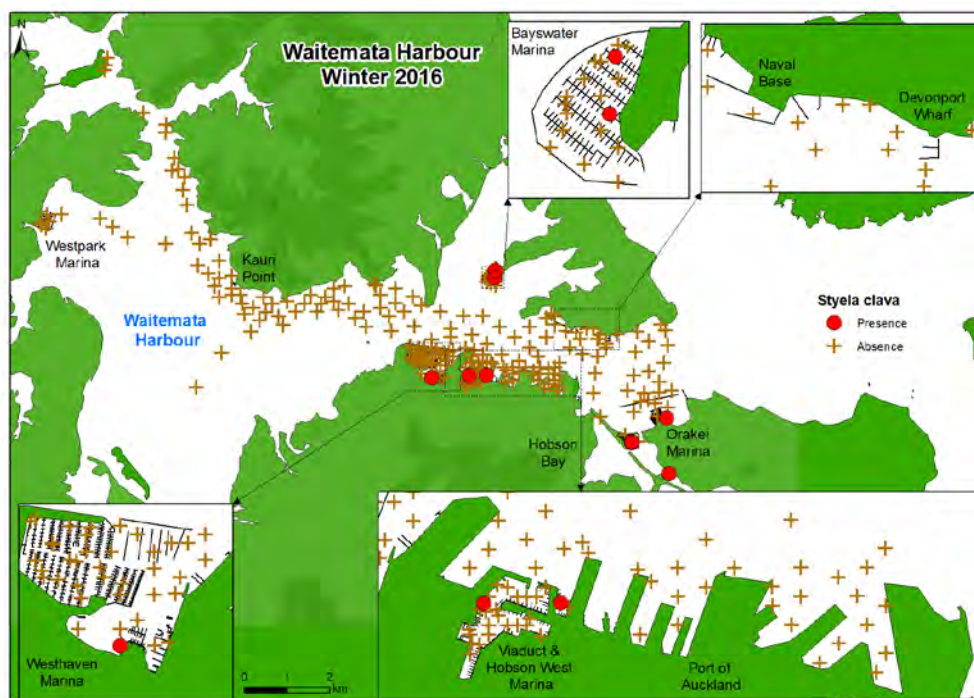
Tauranga Harbour Winter 2016



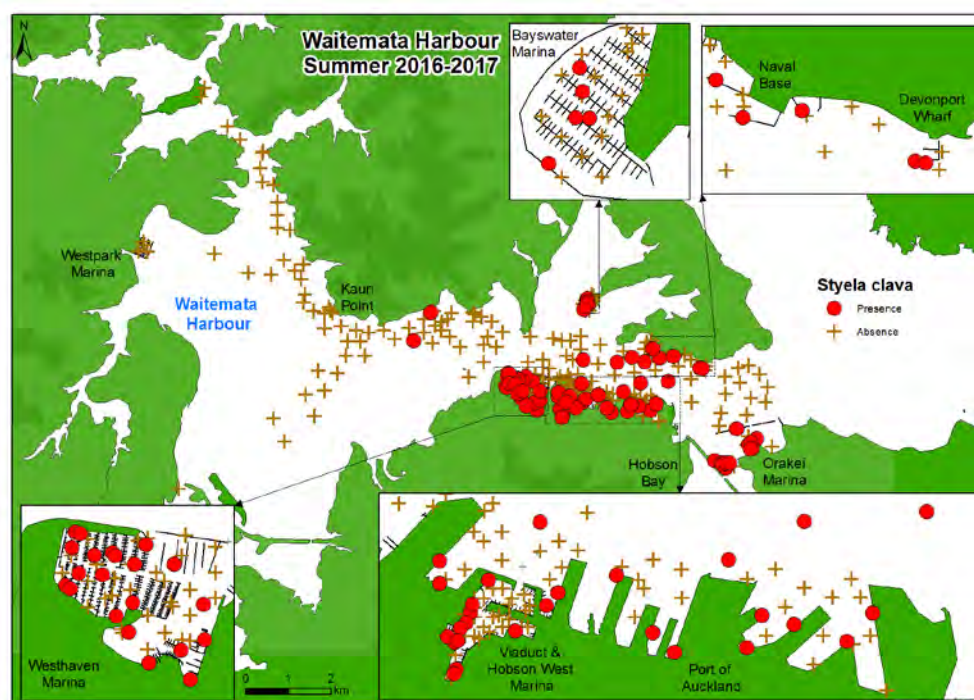
Tauranga Harbour Summer 2016–17



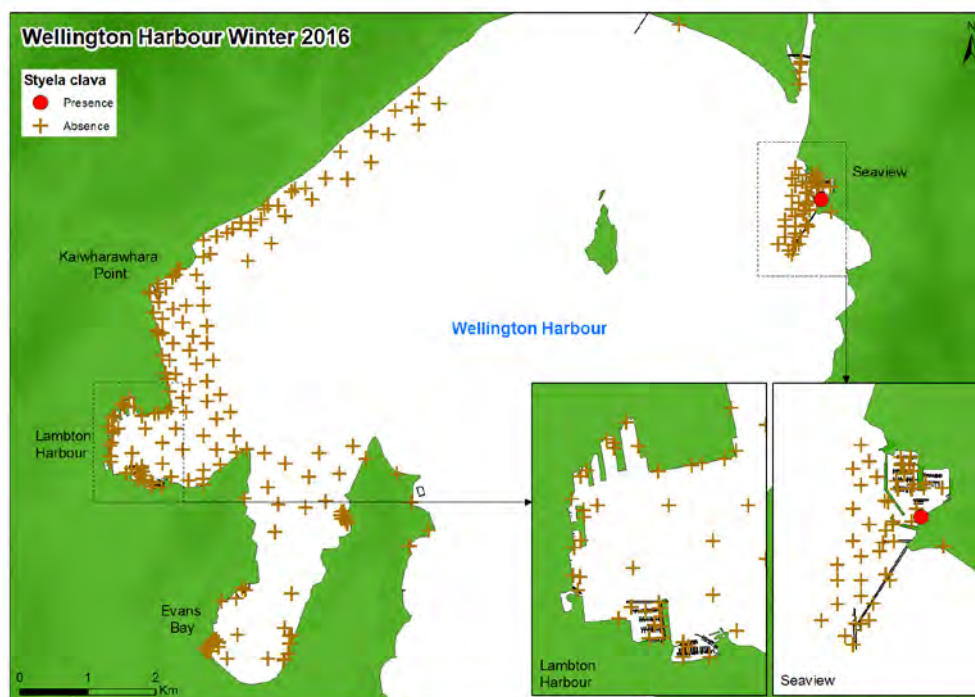
Waitemata Harbour Winter 2016



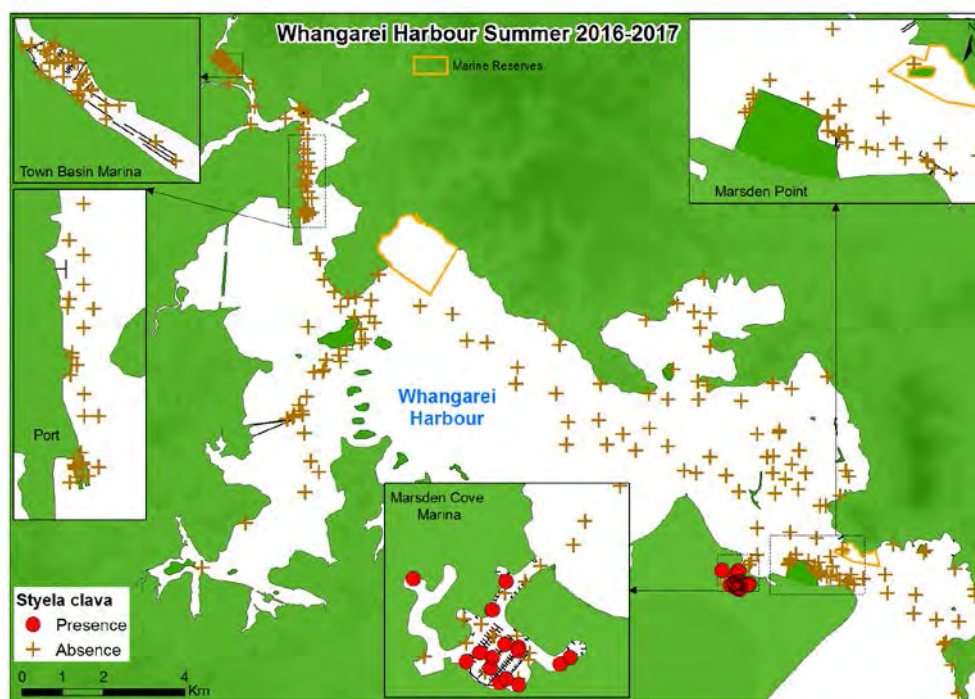
Waitemata Harbour Summer 2016–17



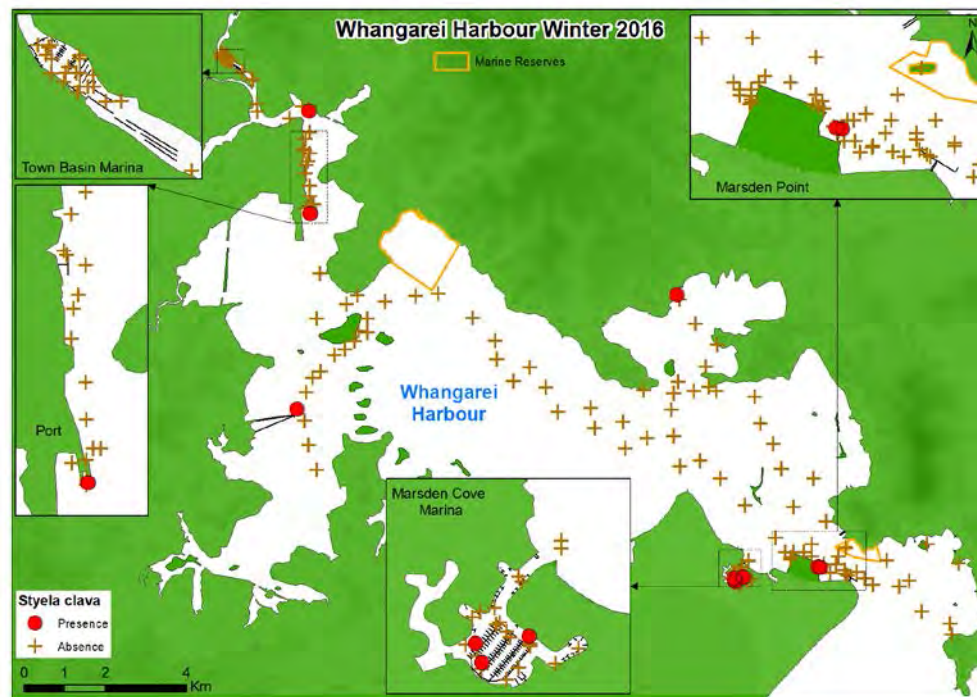
Wellington Harbour Winter 2016



Whangarei Harbour Winter 2016

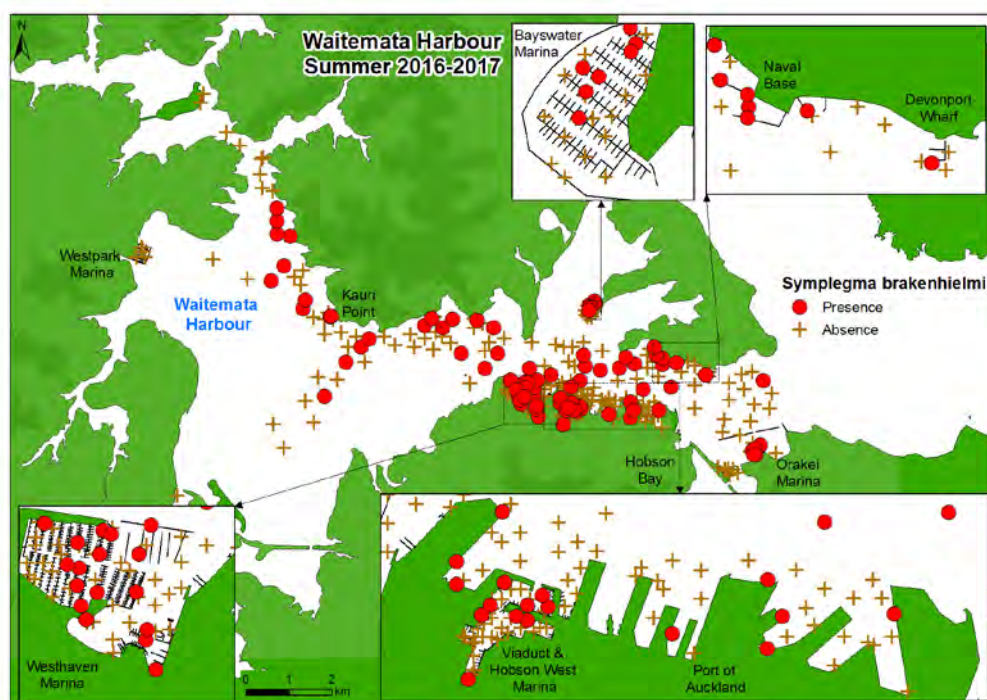


Whangarei Harbour Summer 2016–17

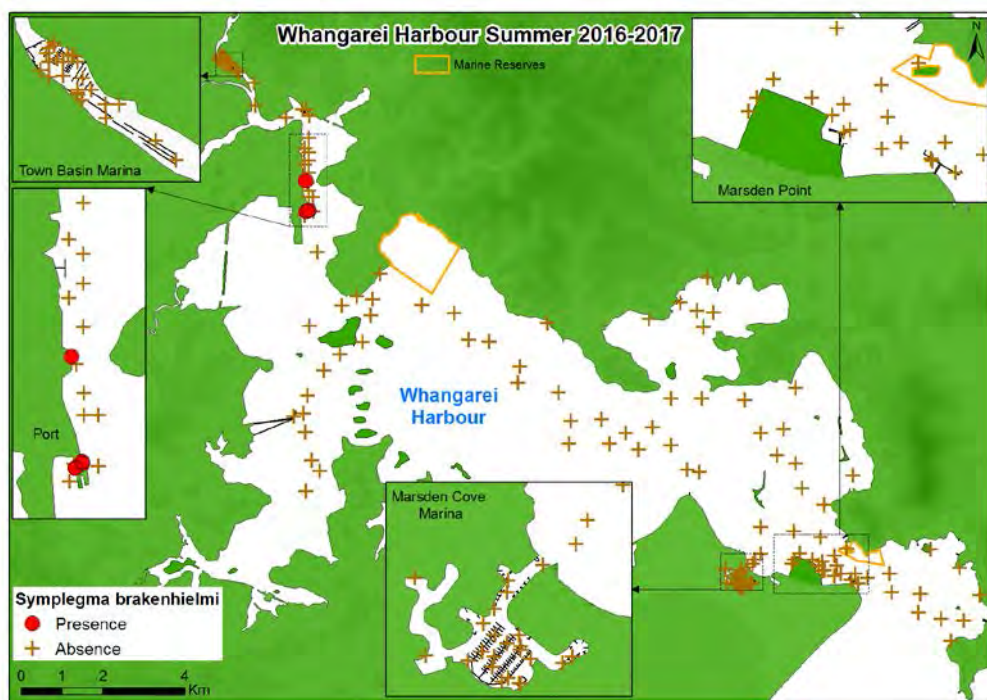


Symplegma brakenhielmi

Waitemata Harbour Summer 2016–17

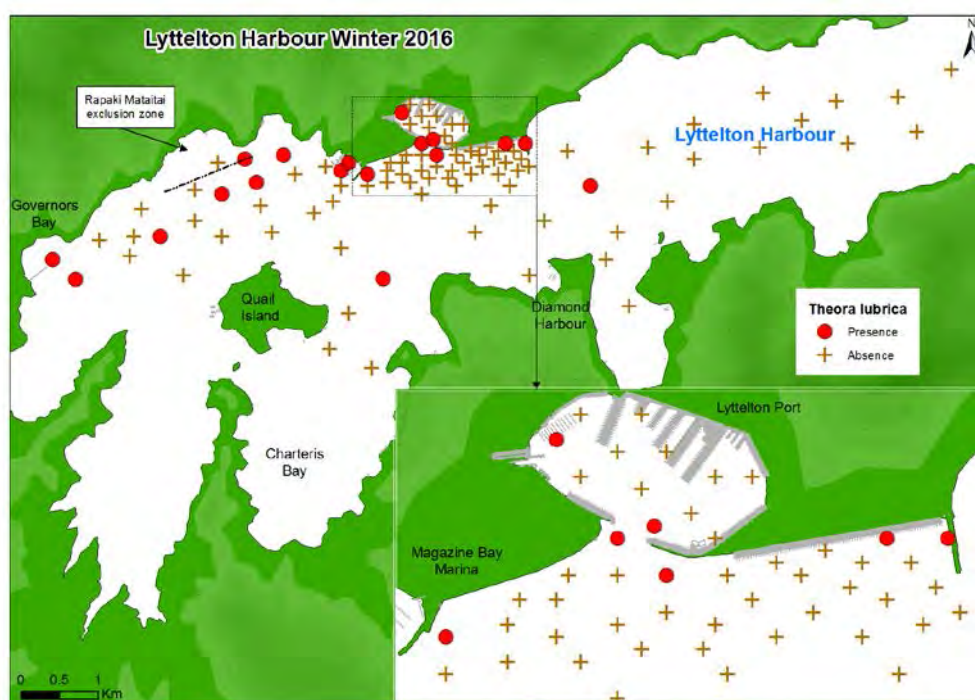


Whangarei Harbour Summer 2016–17

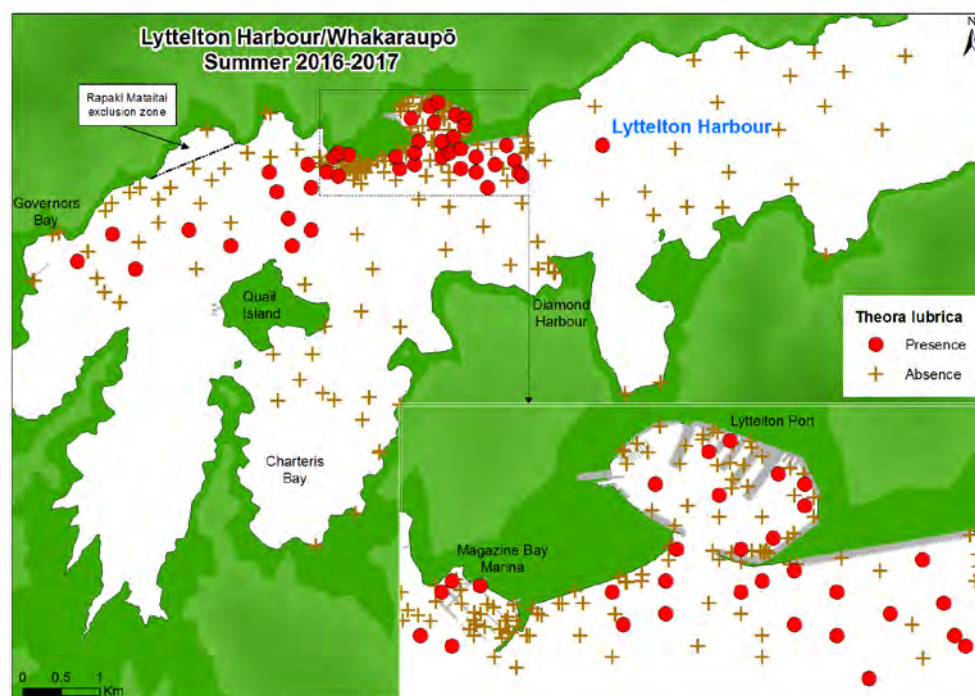


Theora lubrica

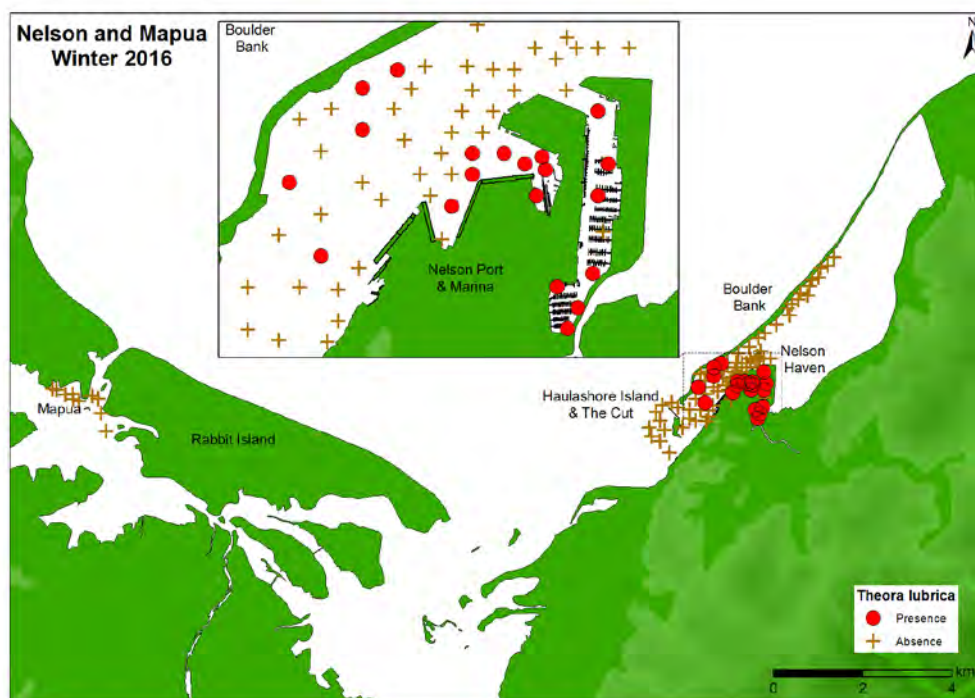
Lyttelton Harbour Winter 2016



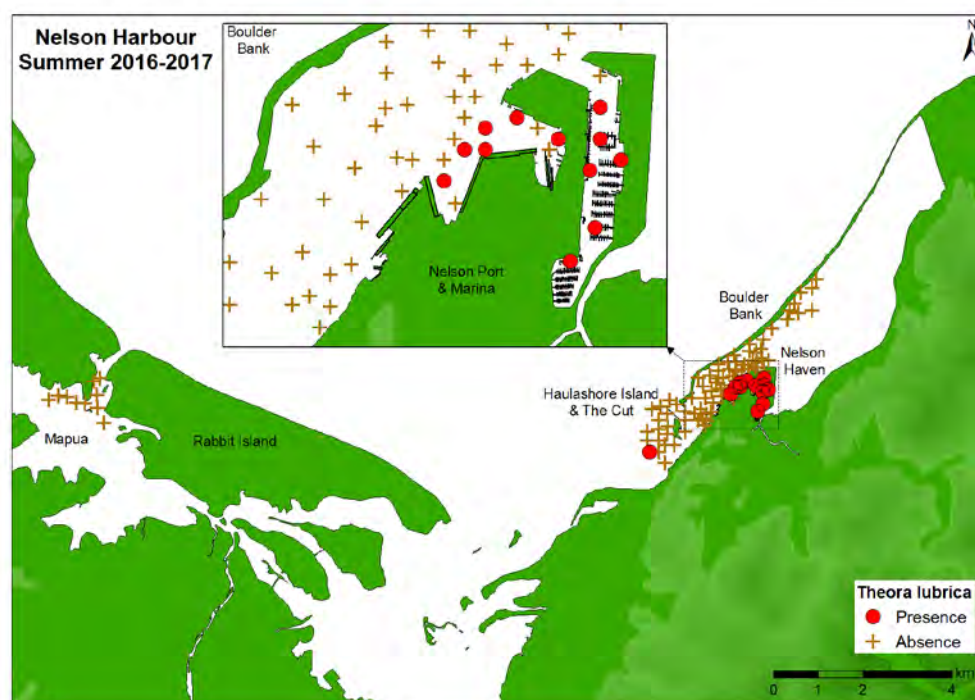
Lyttelton Harbour Summer 2016–17



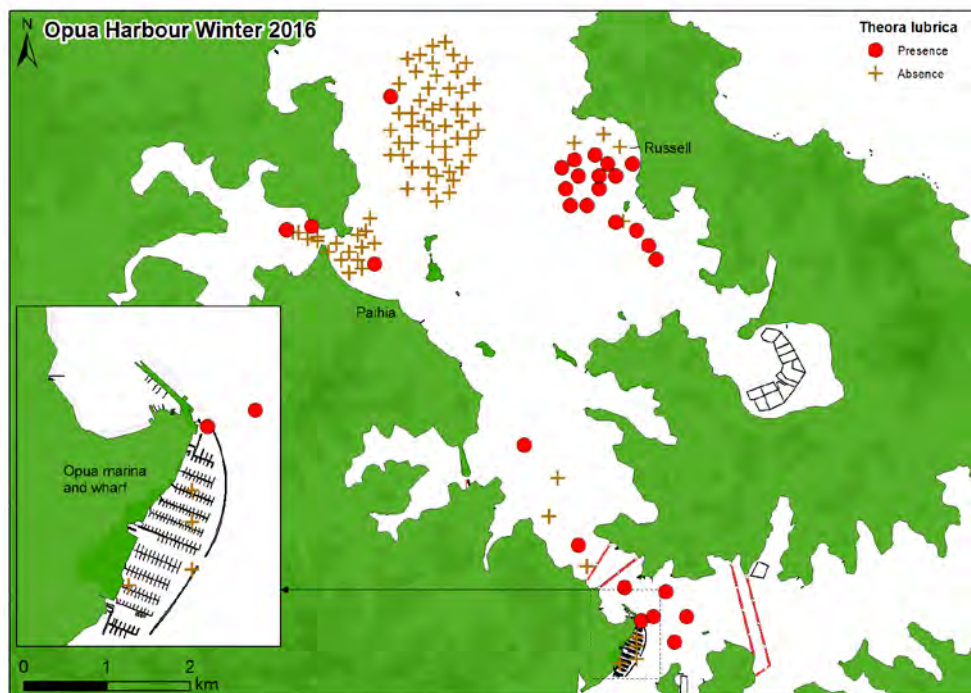
Nelson Harbour Winter 2016



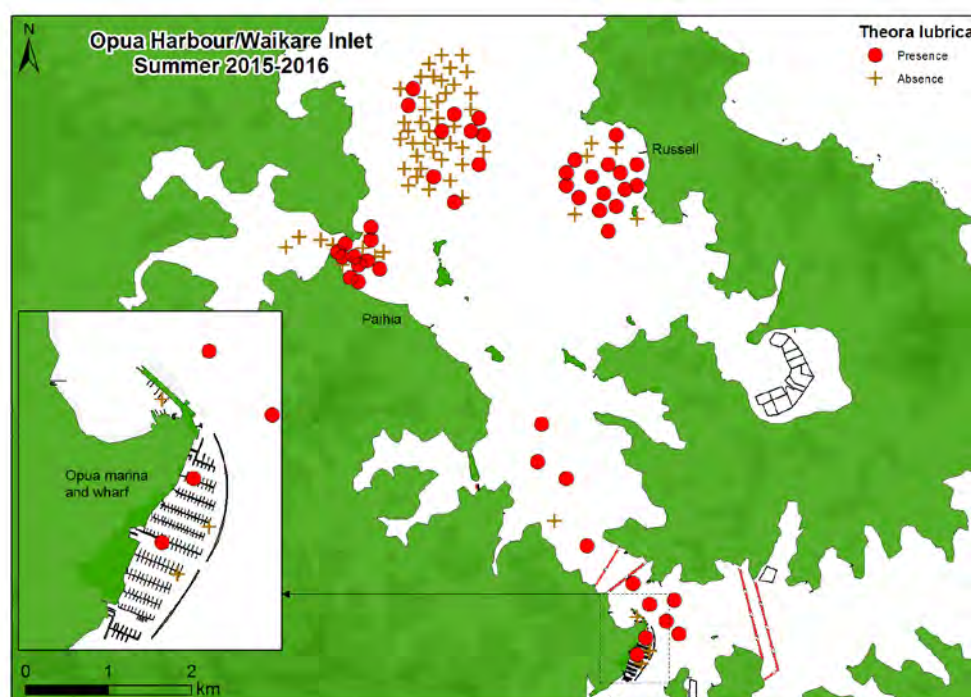
Nelson Harbour Summer 2016–17



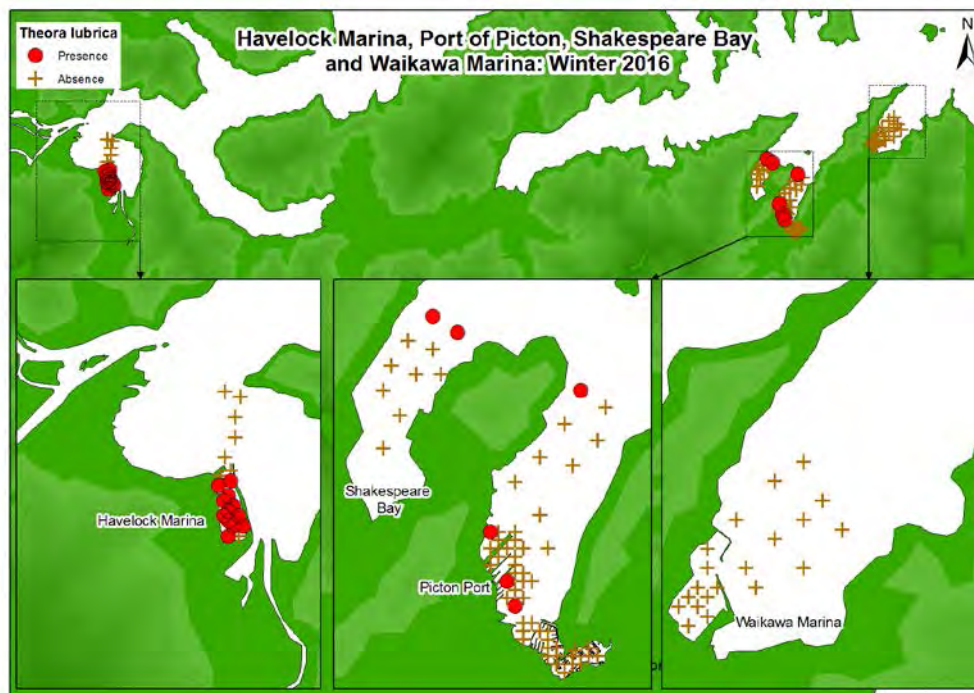
Opua Marina/Waikare Inlet Winter 2016



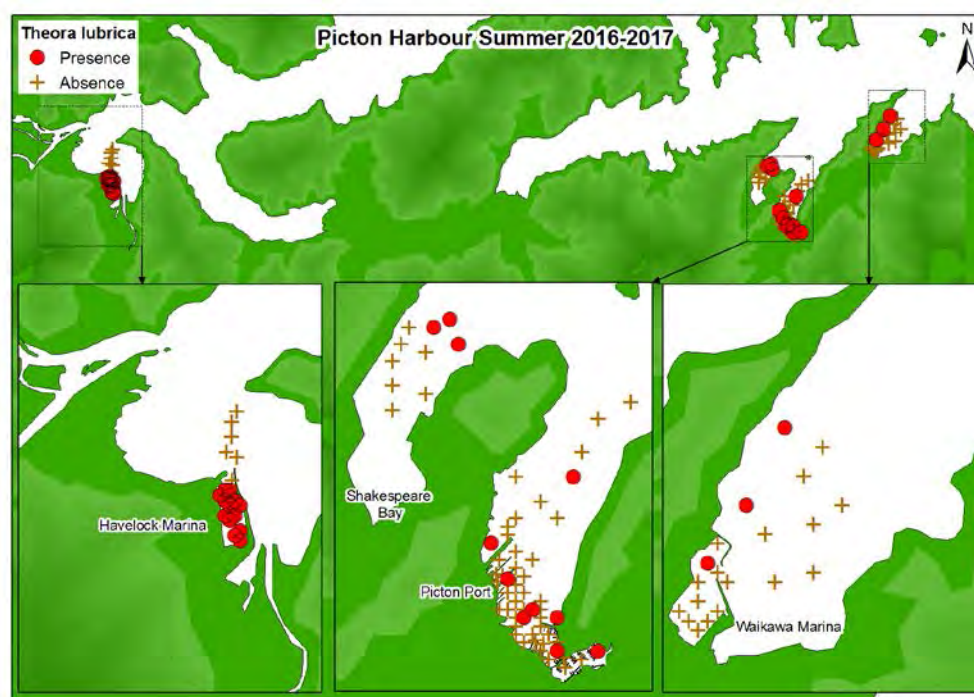
Opua Marina/Waikare Inlet Summer 2016–17



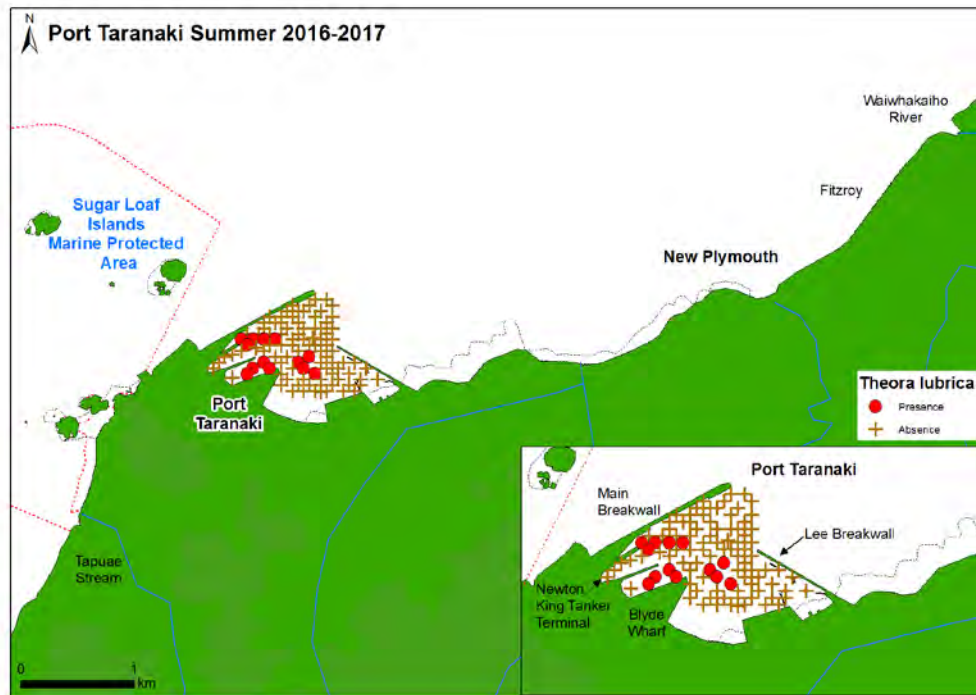
Picton Harbour Winter 2016



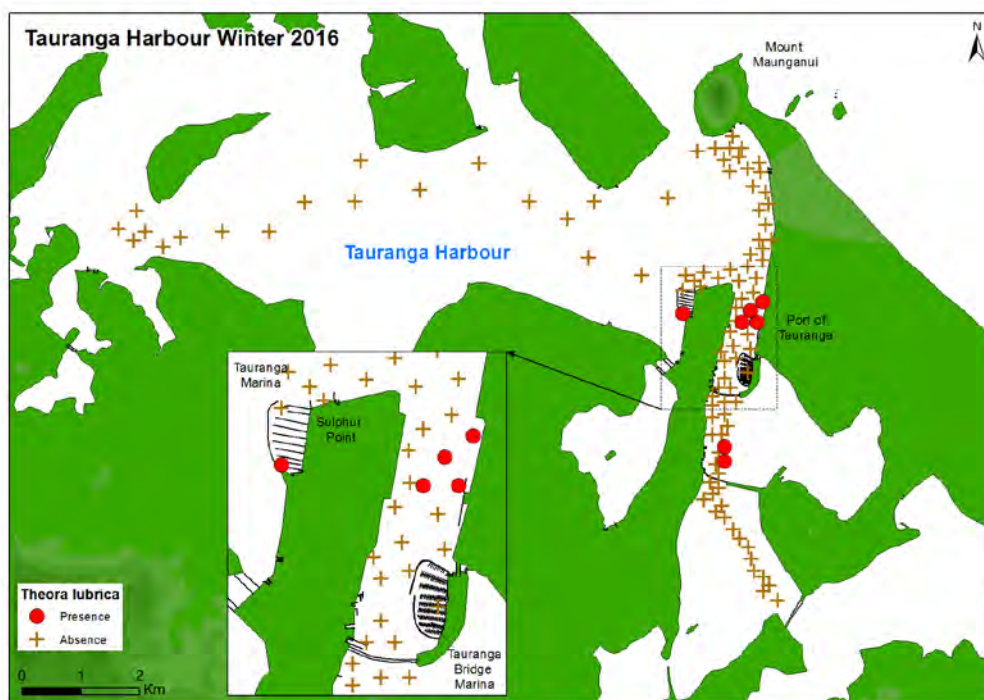
Picton Harbour Summer 2016–17



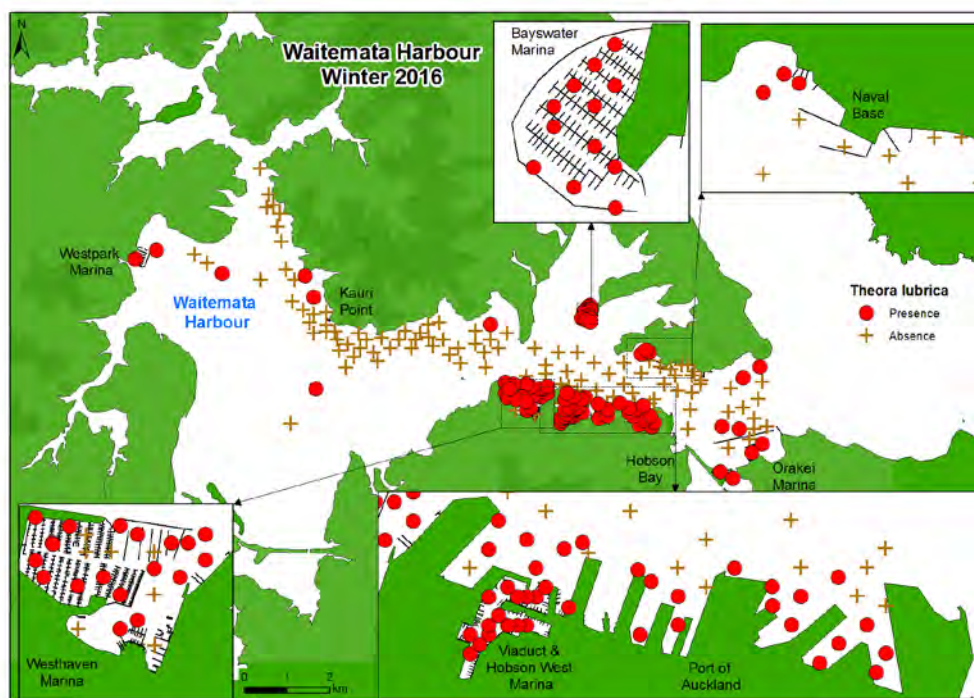
Port Taranaki Summer 2016–17



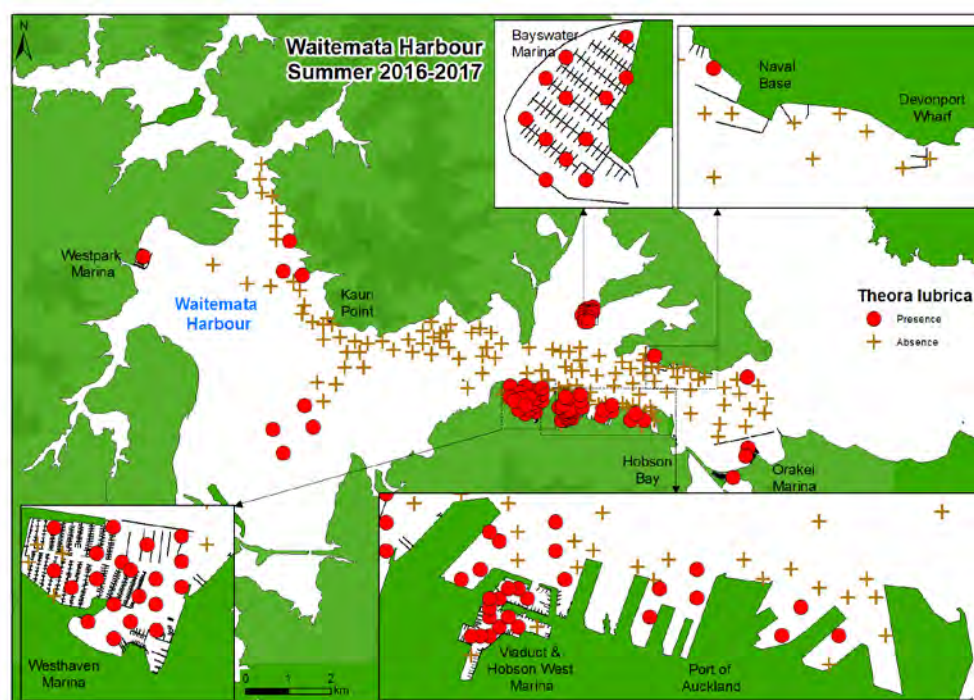
Tauranga Harbour Winter 2016



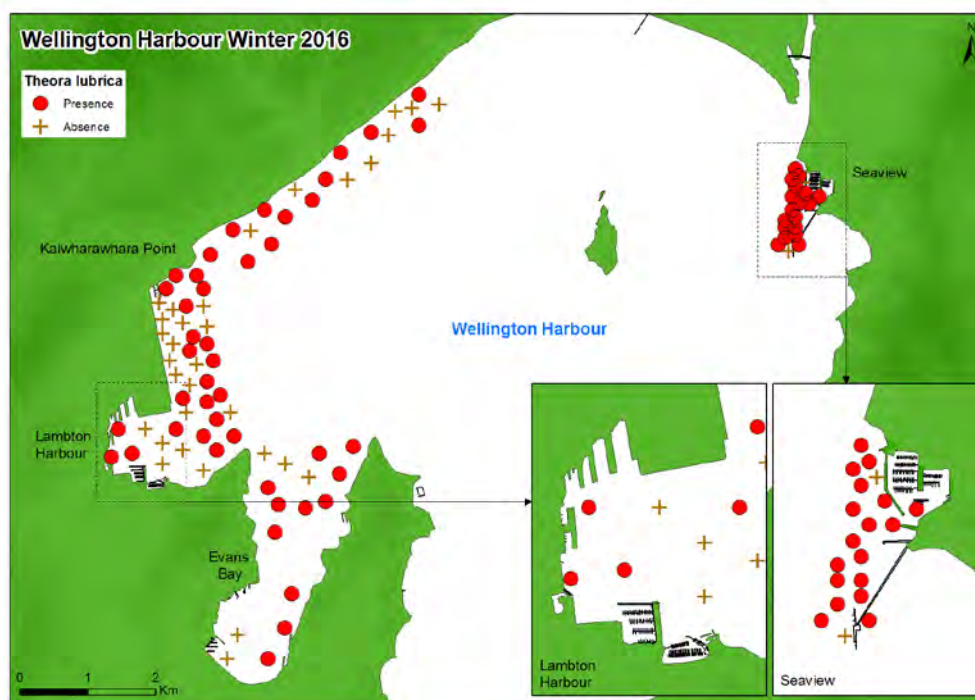
Waitemata Harbour Winter 2016



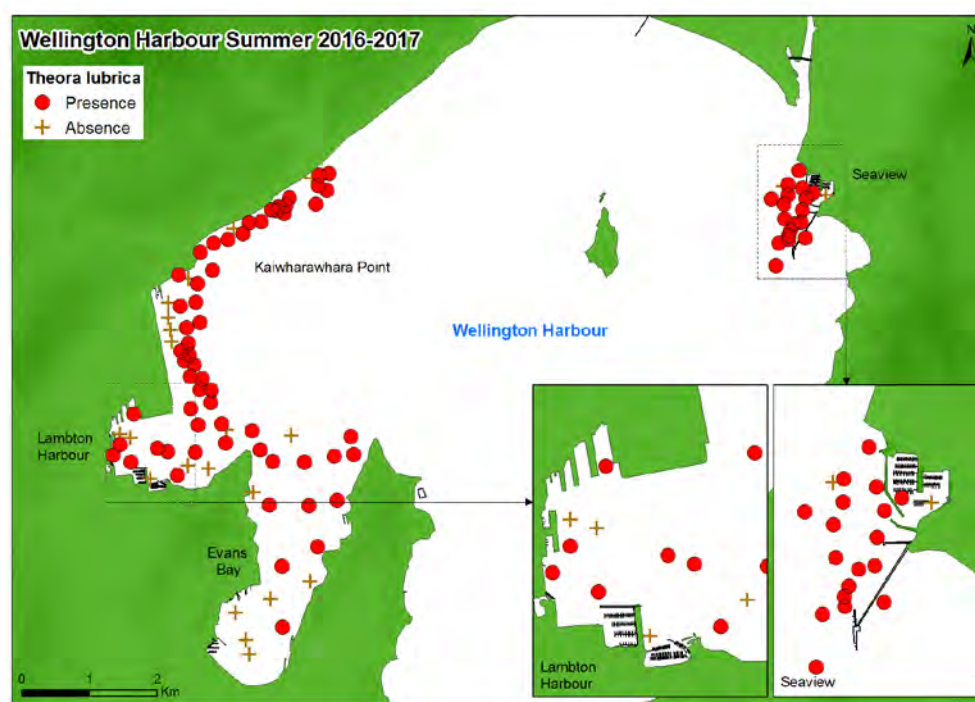
Waitemata Harbour Summer 2016–17



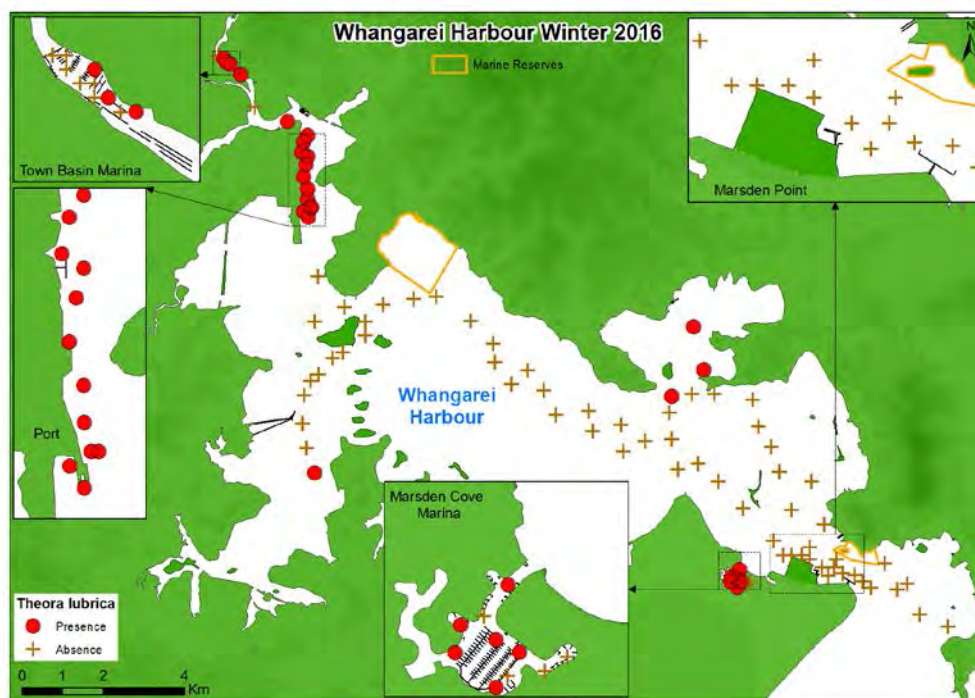
Wellington Harbour Winter 2016



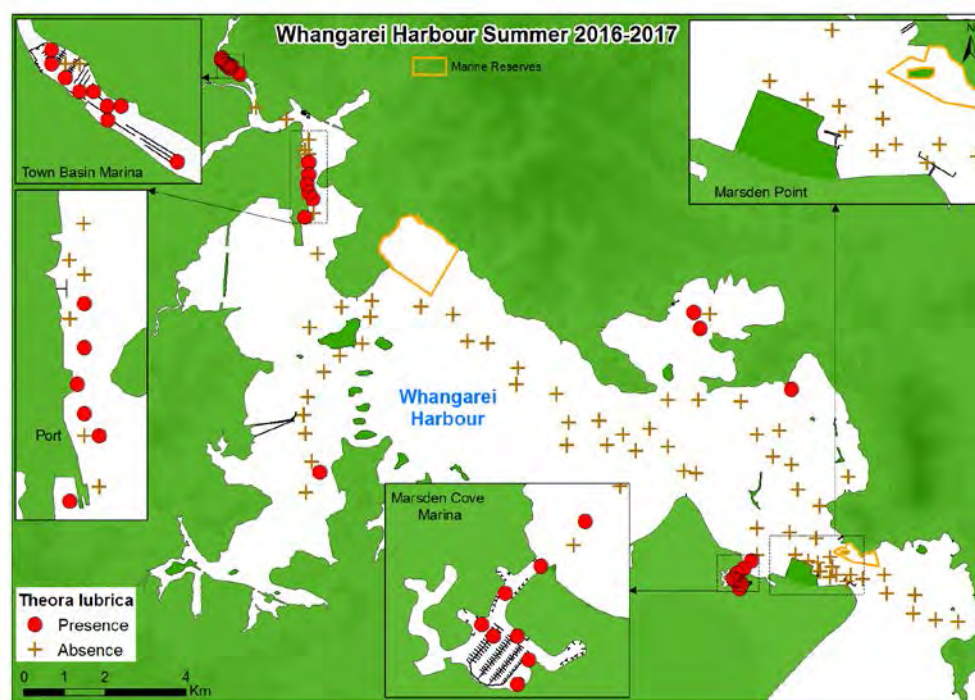
Wellington Harbour Summer 2016–17



Whangarei Harbour Winter 2016

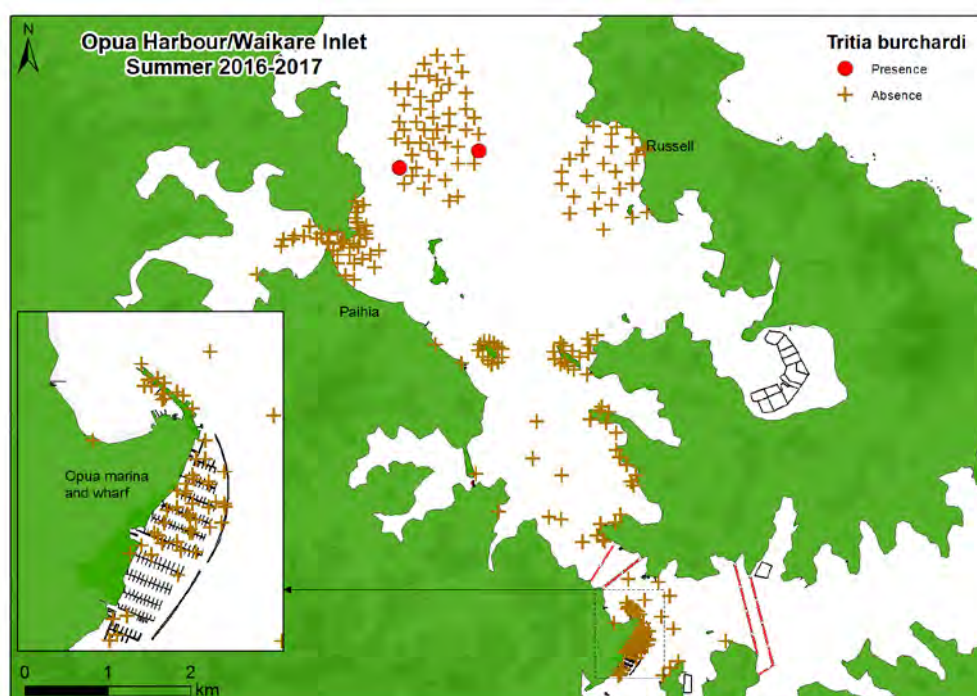


Whangarei Harbour Summer 2016–17

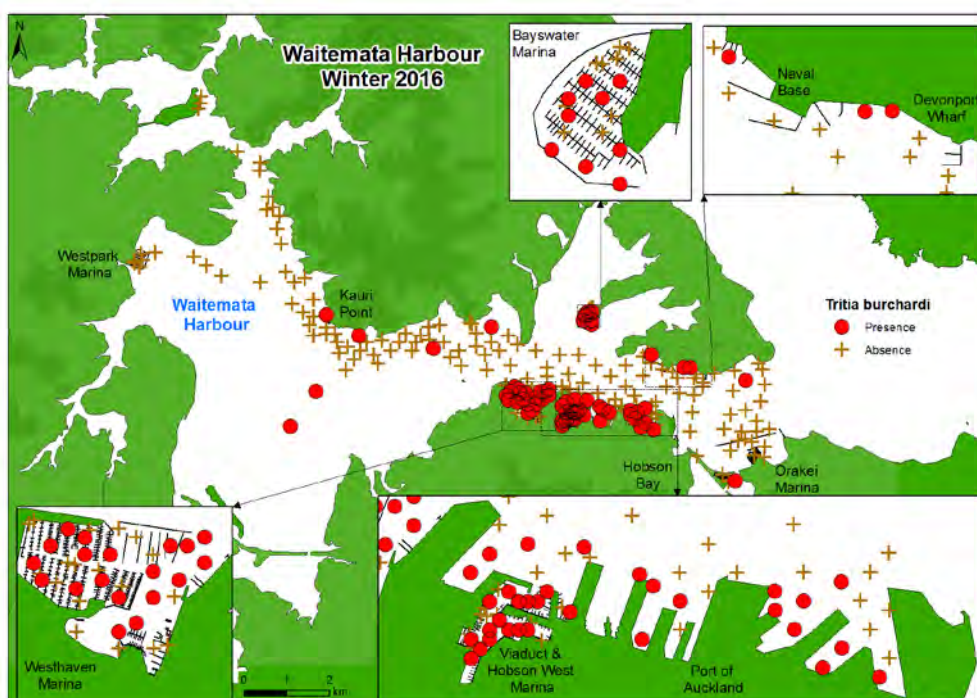


Tritia burchardi

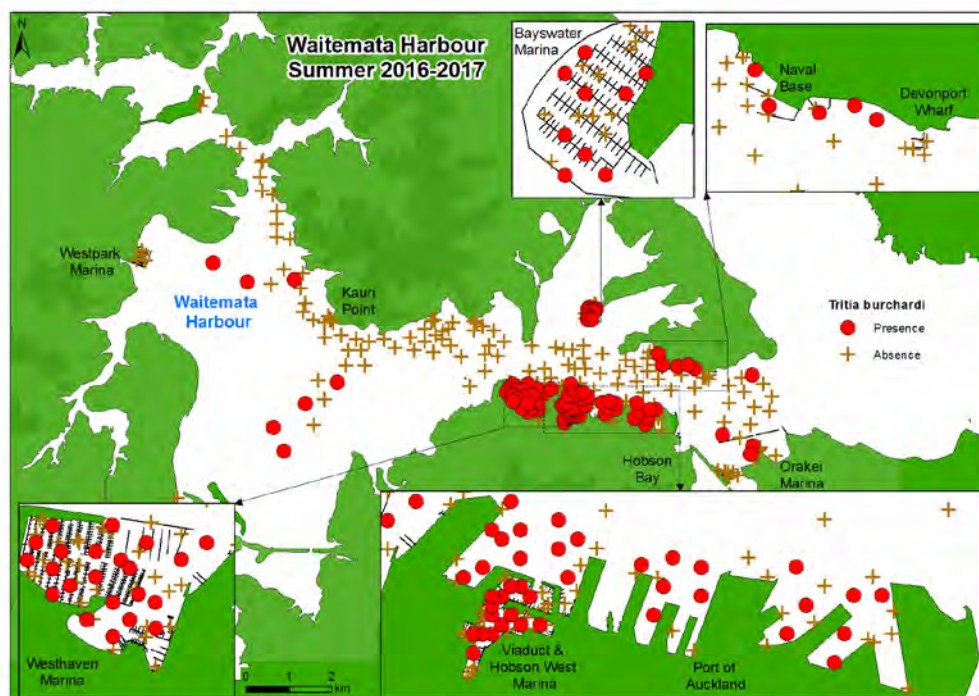
Opua Marina/Waikare Inlet Summer 2016



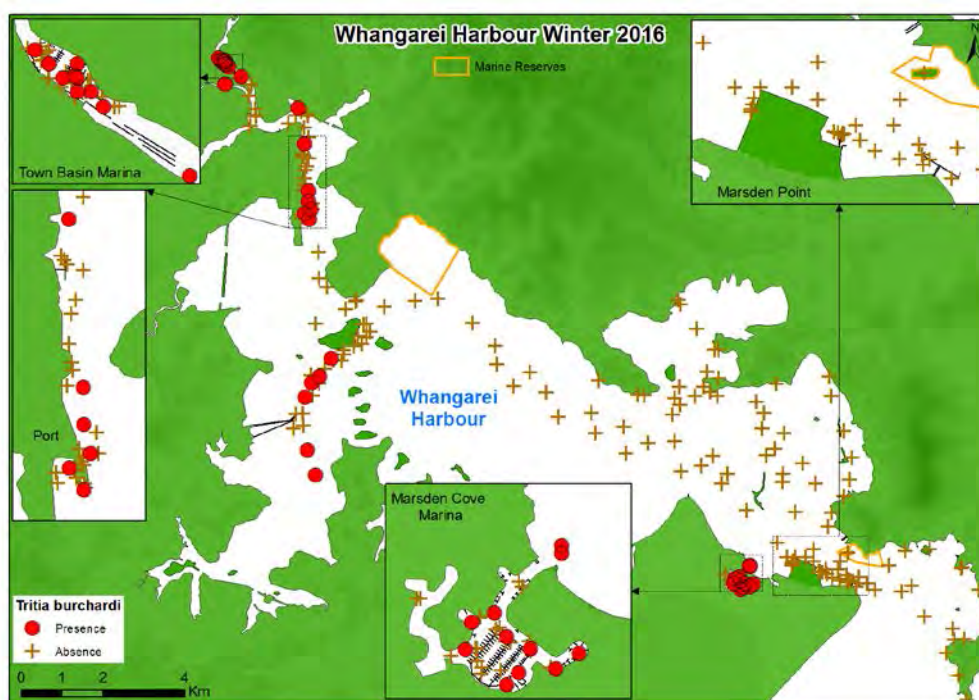
Waitemata Harbour Winter 2016



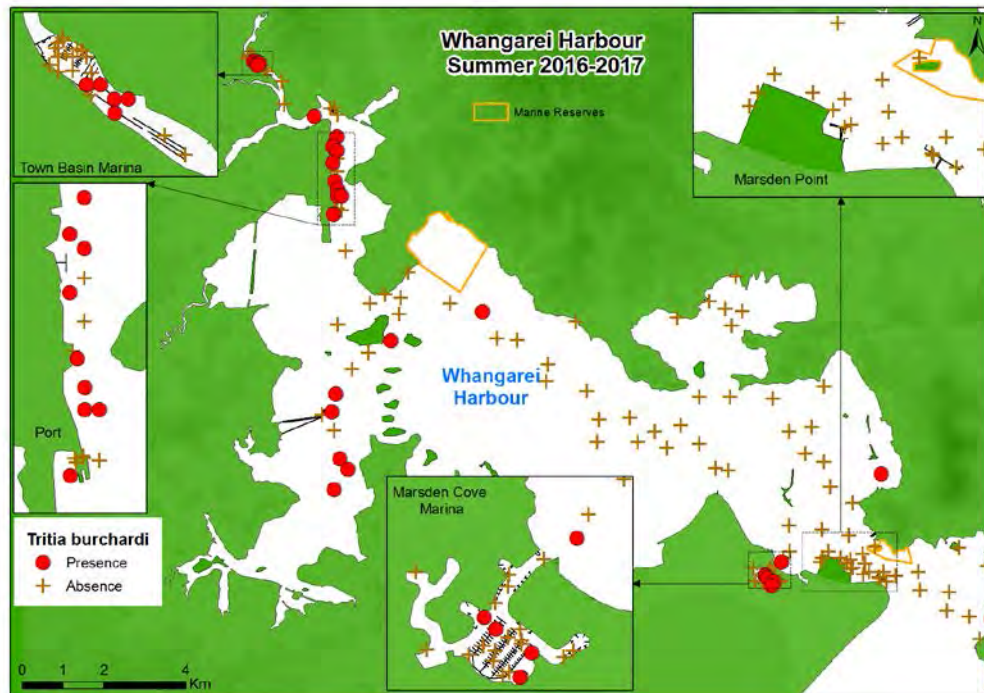
Waitemata Harbour Summer 2016–17



Whangarei Harbour Winter 2016

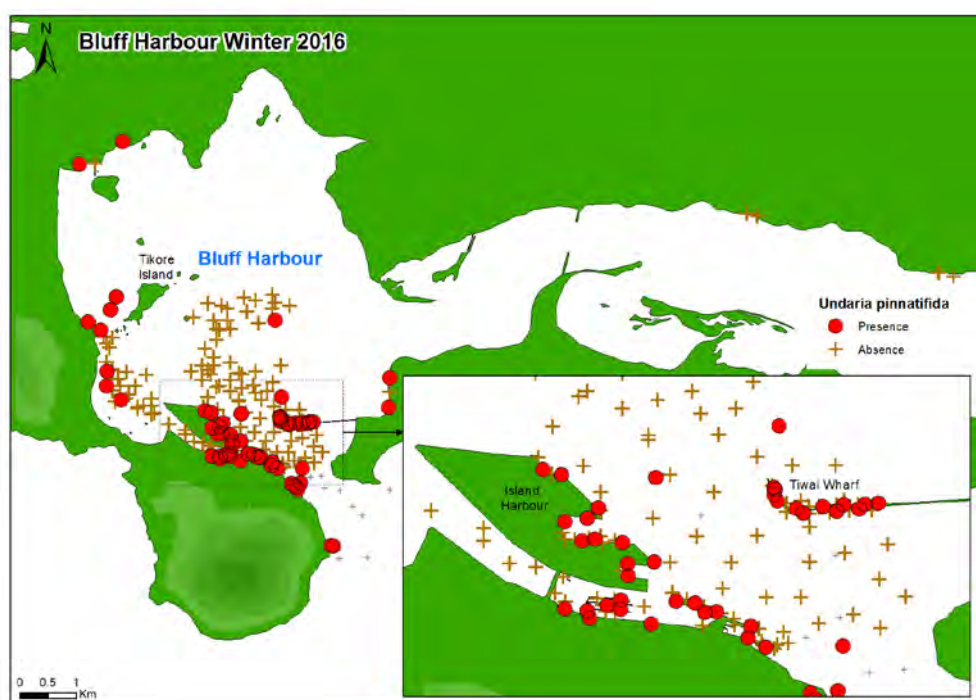


Whangarei Harbour Summer 2016–17

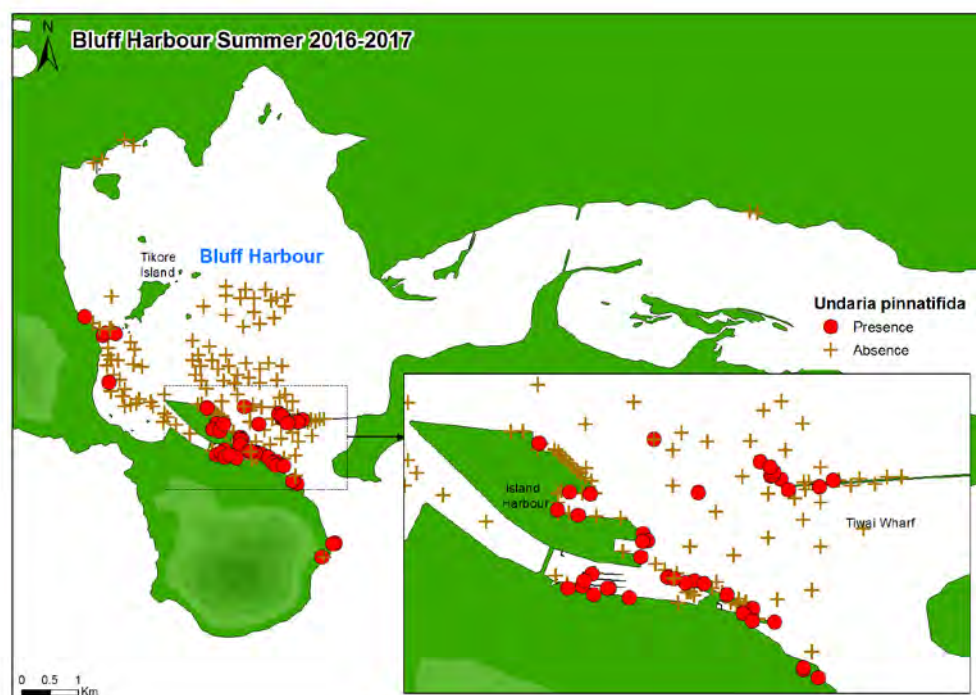


Undaria pinnatifida

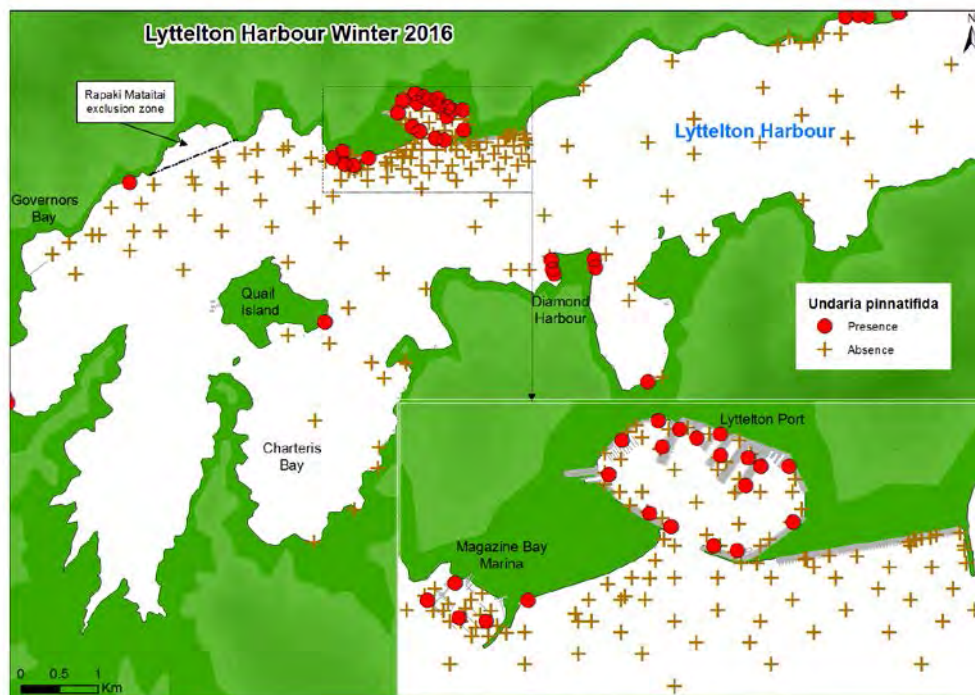
Bluff Harbour Winter 2016



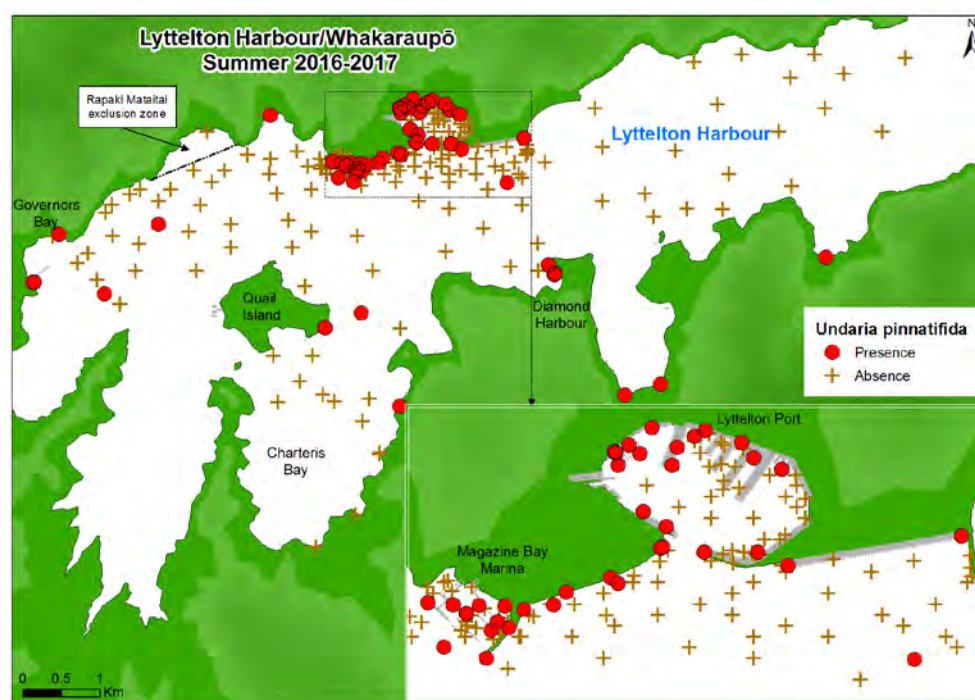
Bluff Harbour Summer 2016–17



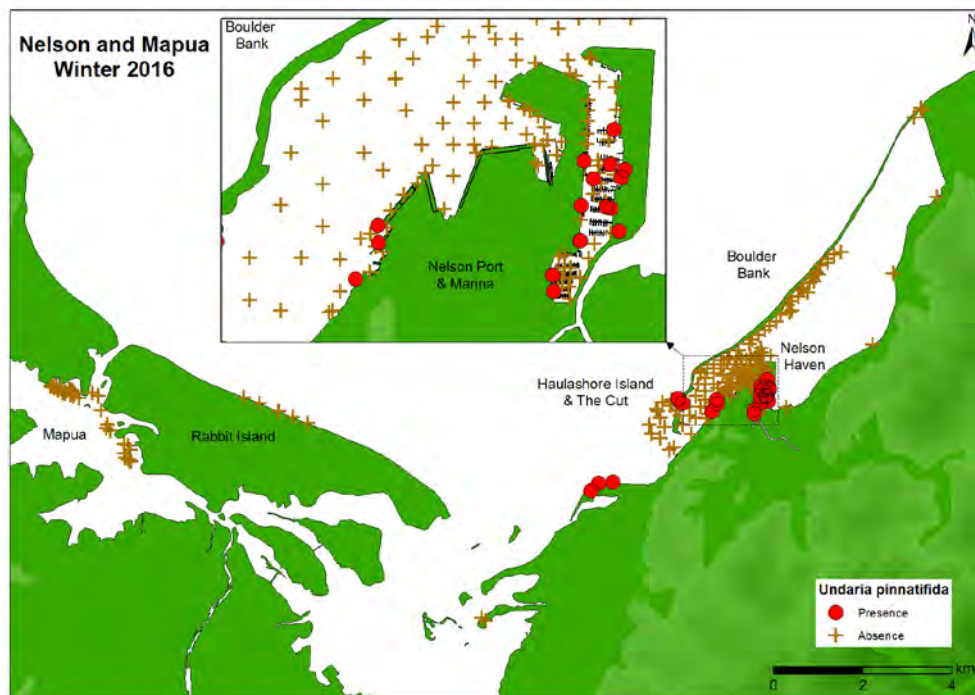
Lyttelton Harbour Winter 2016



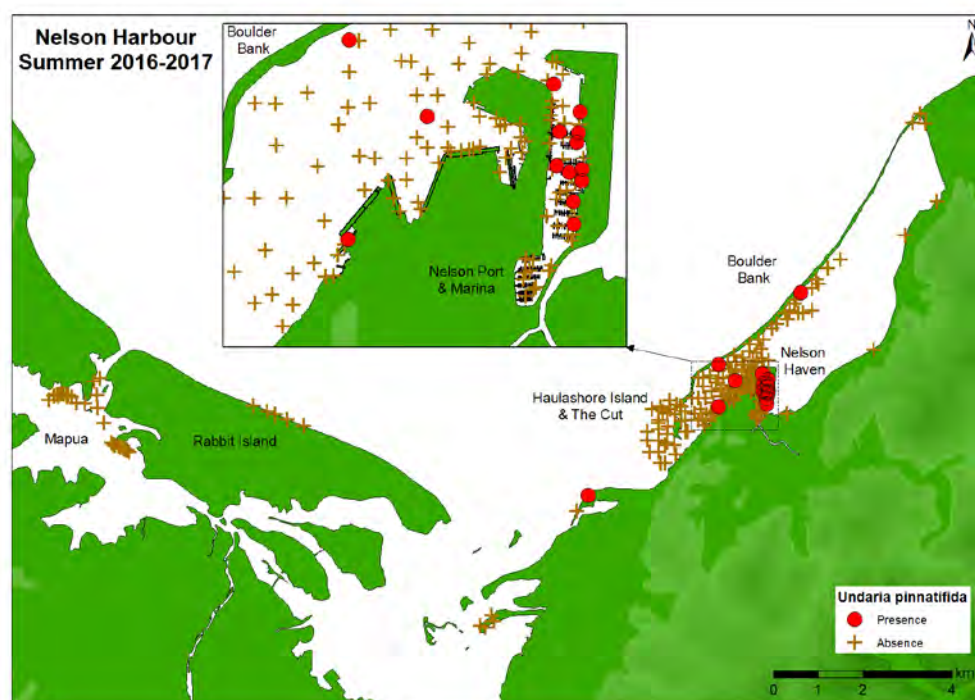
Lyttelton Harbour Summer 2016–17



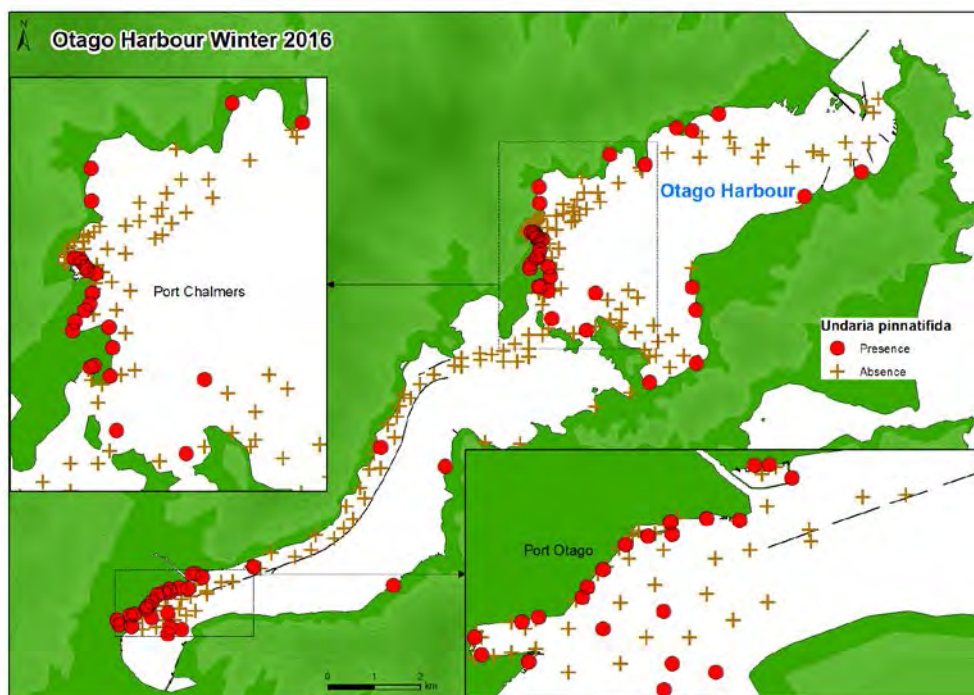
Nelson Harbour Winter 2016



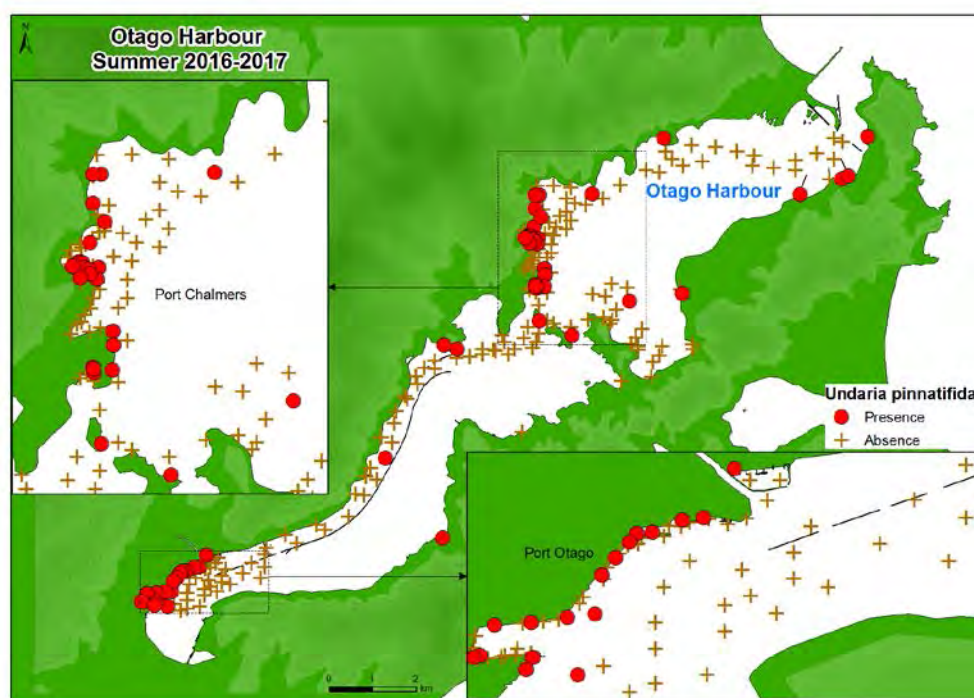
Nelson Harbour Summer 2016–17



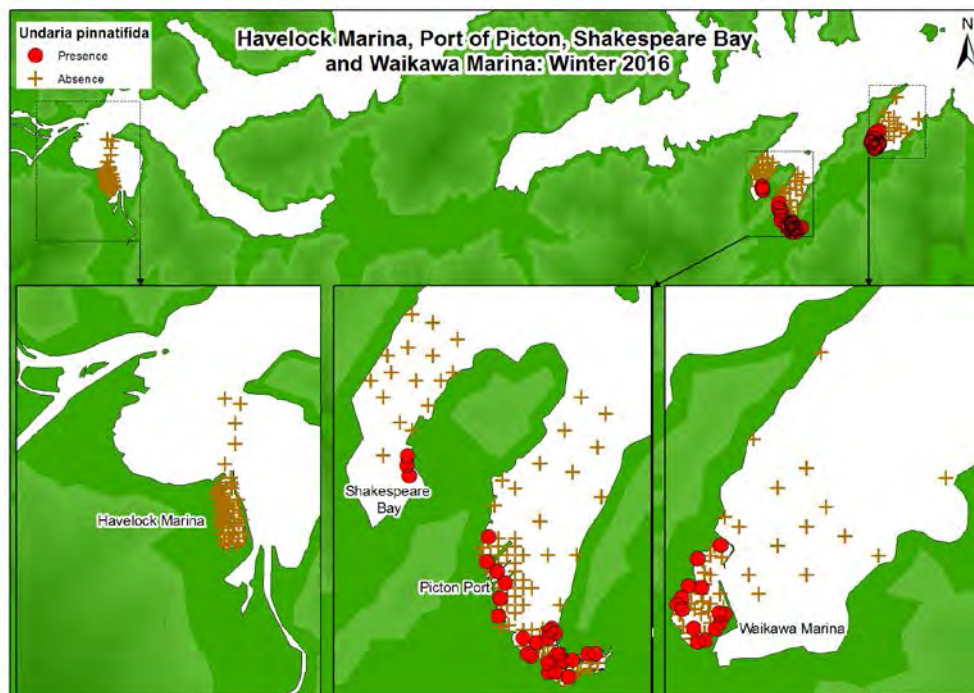
Otago Harbour Winter 2016



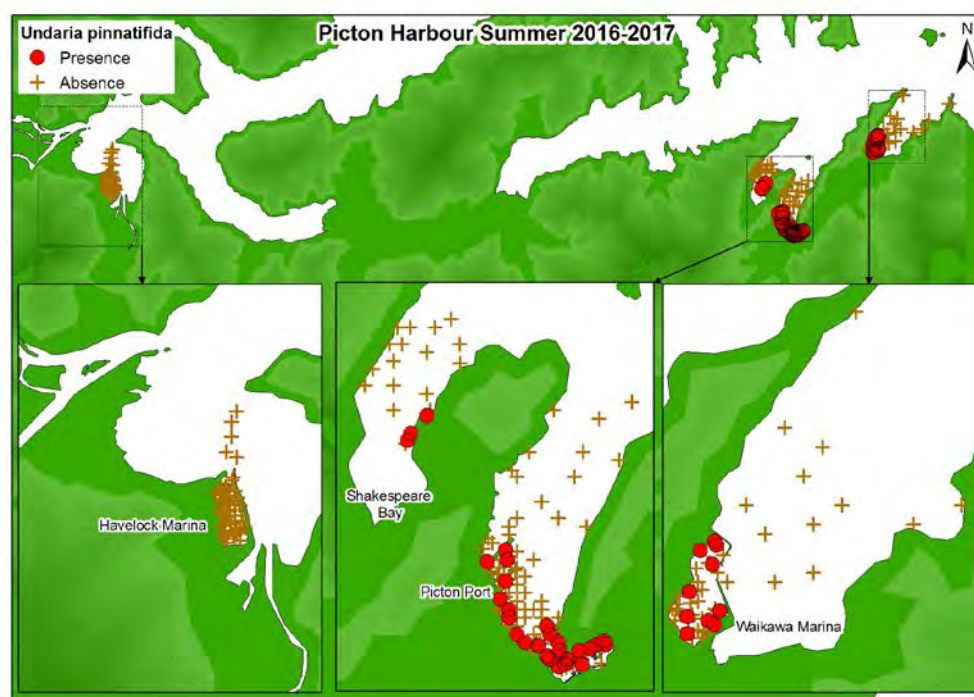
Otago Harbour Summer 2016–17



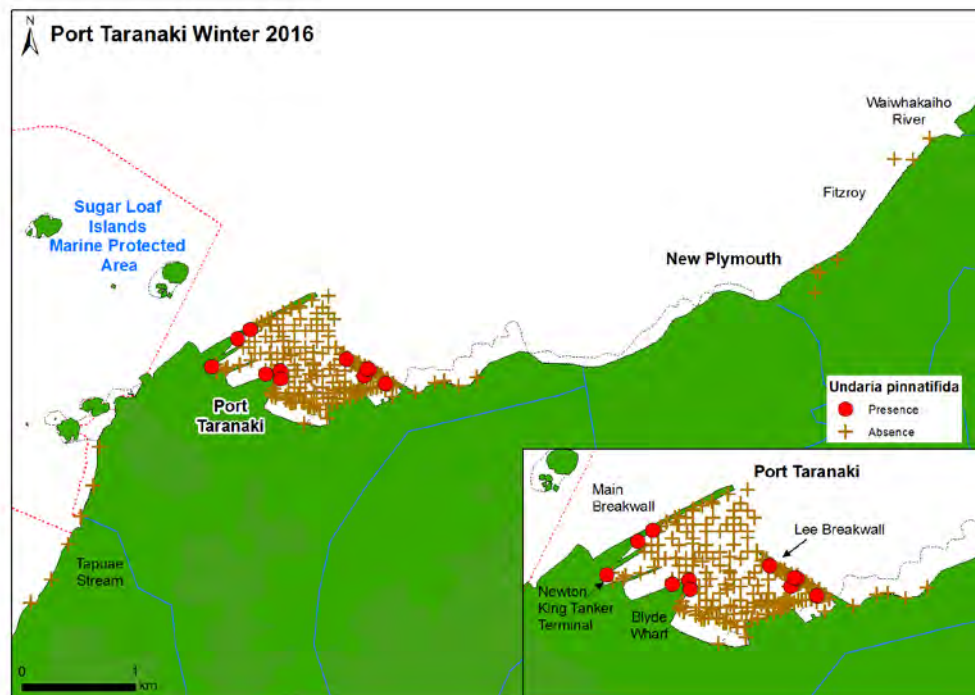
Picton Harbour Winter 2016



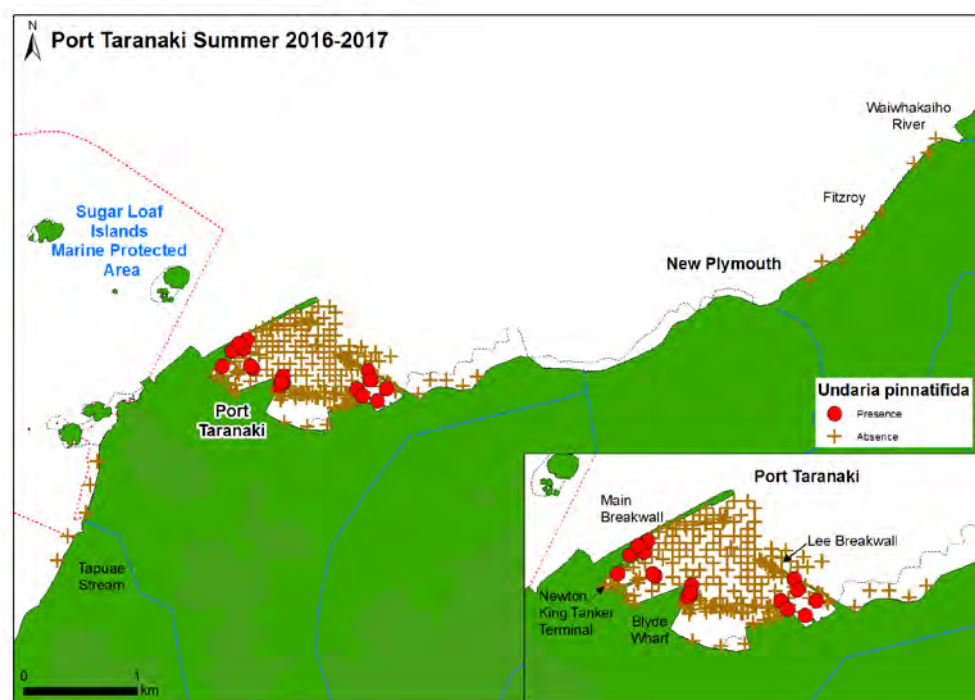
Picton Harbour Summer 2016–17



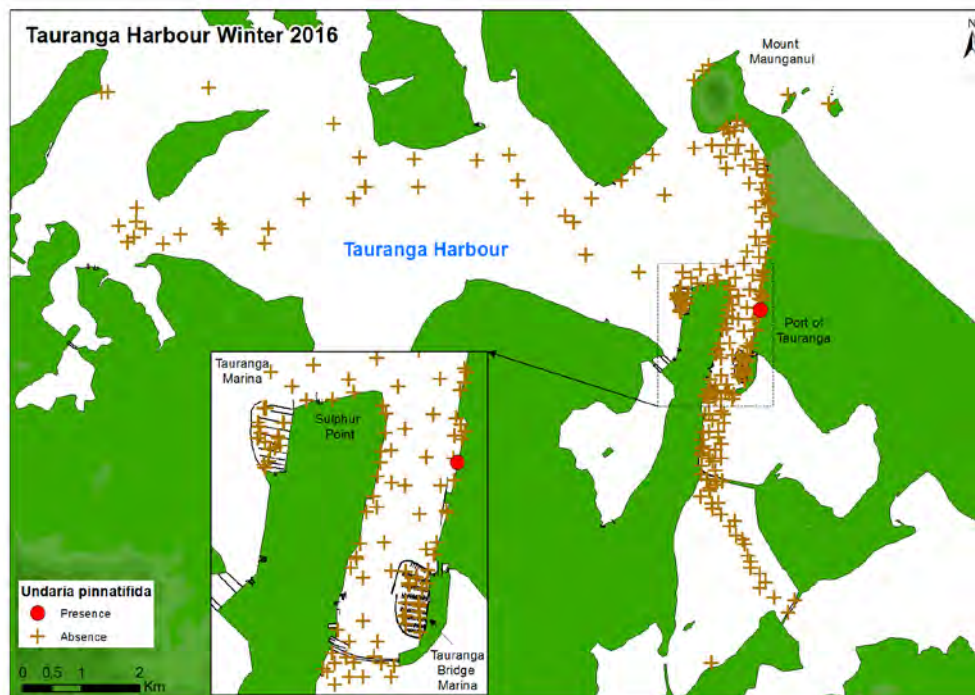
Port Taranaki Winter 2016



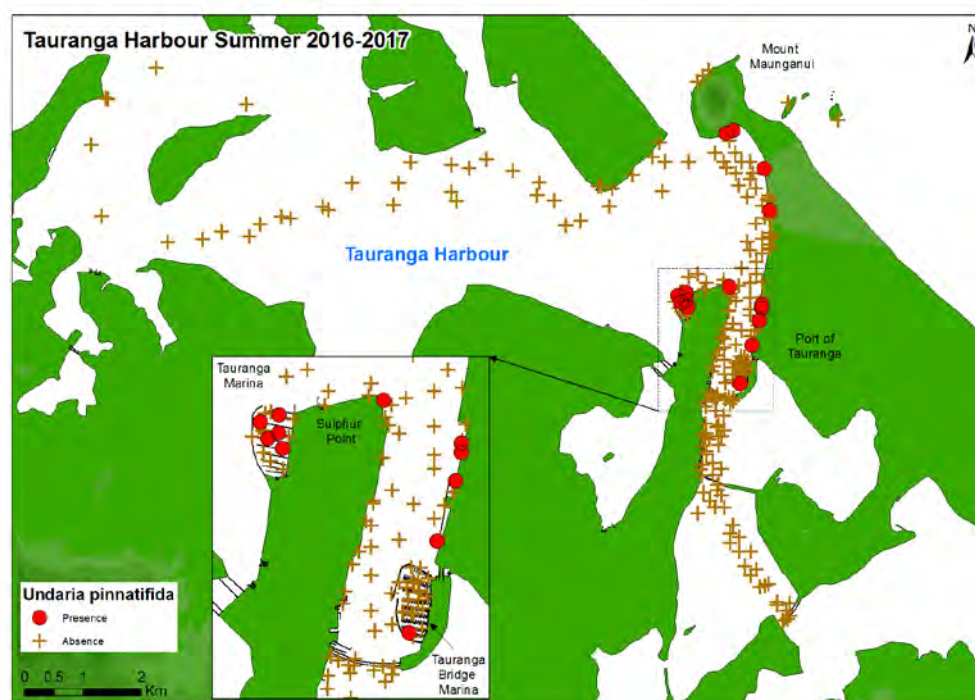
Port Taranaki Summer 2016–17



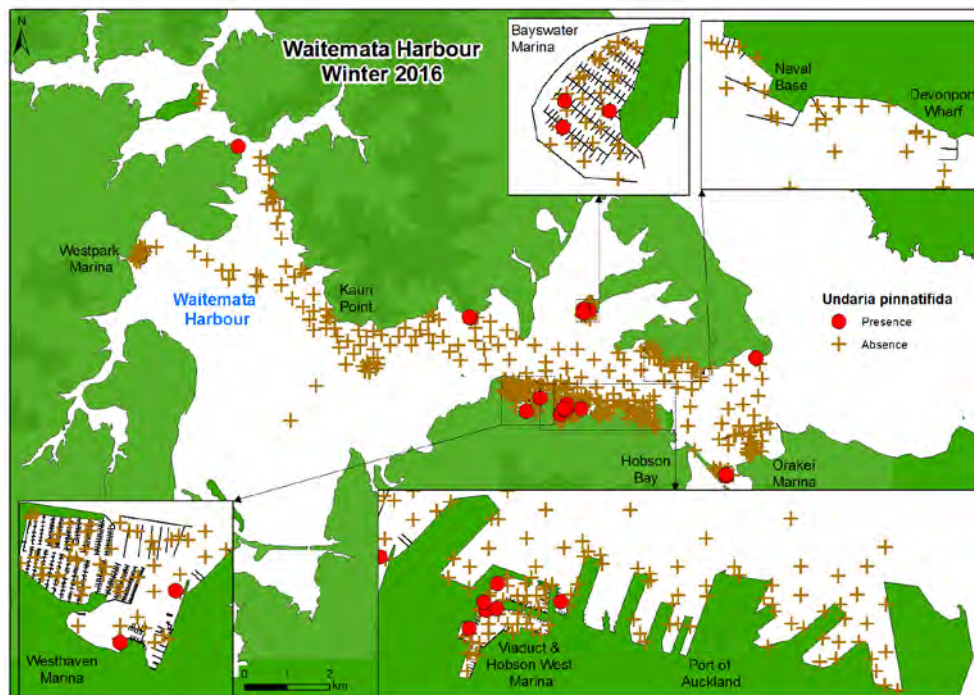
Tauranga Harbour Winter 2016



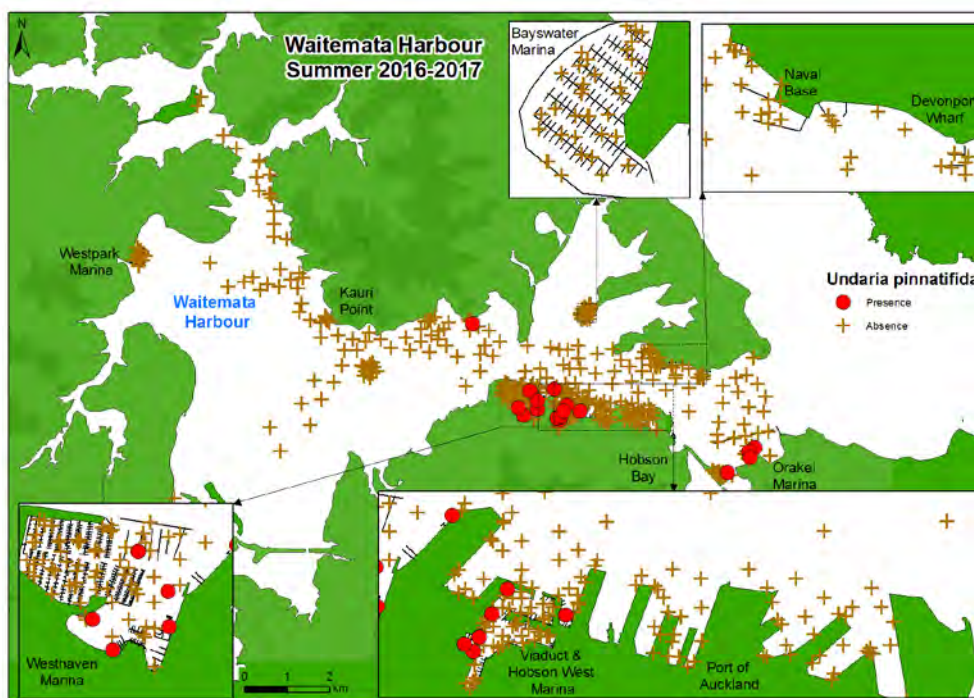
Tauranga Harbour Summer 2016–17



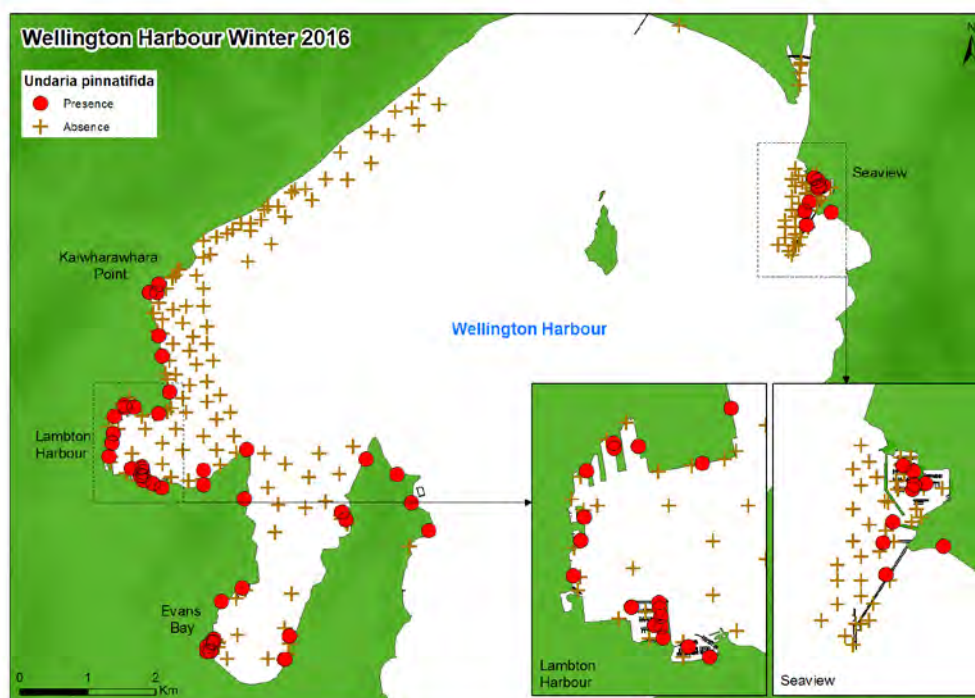
Waitemata Harbour Winter 2016



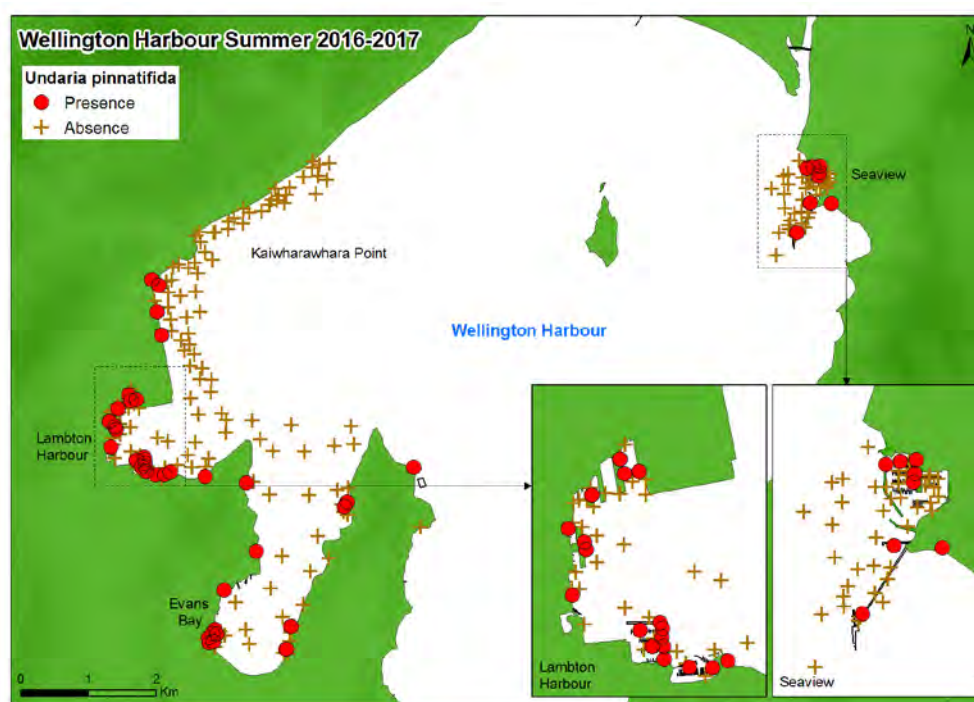
Waitemata Harbour Summer 2016–17



Wellington Harbour Winter 2016



Wellington Harbour Summer 2016–17



Appendix 5. Marine pest survey notification poster sent to stakeholders during the Summer 2016–17 survey round

Ministry for Primary Industries
 Manatū Ahu Matua
 

MARINE PEST SURVEYS COMING TO YOUR HARBOUR SOON

The Ministry for Primary Industries (MPI) conducts regular checks for marine pests in a number of high-risk marine areas around the country and has been doing so since 2002. The focus of this surveillance is the early detection of a number of pests that are not known to be in New Zealand, and we are actively trying to keep out.

WHAT DO WE LOOK FOR?

We target five species that have considerable harmful impacts overseas:

- » Northern Pacific seastar, *Asterias amurensis*
- » Asian clam, *Potamocorbula amurensis*
- » European shore crab, *Carcinus maenas*
- » Chinese mitten crab, *Eriocheir sinensis*
- » Aquarium weed, *Caulerpa taxifolia*

We also look for any and all new species in these locations, and established pests with limited distribution, like the Mediterranean fanworm, *Sabellia spallanzanii*. For more information about what species we specifically target, go to www.biosecurity.govt.nz/pests/salt-freshwater/saltwater.

WHY?

If these pests were to arrive in New Zealand, they could threaten our environment, the economy, our fisheries, native species or our enjoyment of our unique coastal and marine areas.

We undertake the surveys twice a year, so that we maximise the chance of detecting one of these pests early. The faster we find a pest the more chance we have to eradicate it before it becomes established.

HOW?

The National Institute of Water and Atmospheric Research Ltd (NIWA) designed the surveys for MPI. A number of different methods are used to sample a wide range of marine plants and animals, including dive surveys, crab traps, benthic sleds (similar to a to a small scallop dredge),

shoreline searches and crab condos (juvenile fish and invertebrate settlement devices). Both the crab condos and the crab traps are deployed underneath surface buoys; these buoys will be marked **NIWA Research** with a contact phone number.

WHERE?

The program surveys a number of ports, harbours and marinas around the country twice a year, including this one. These locations were chosen because vessels arrive there from overseas, and marine pests are known to hitch a ride to new locations attached to vessels hulls or in ballast water. Within each harbour, potential habitats for the target species are surveyed in pre-selected locations, including wharfs and floating marinas, breakwalls, rocky reefs, aquaculture structures, beaches, sand flats and deeper soft sediment areas.

WHO?

NIWA is contracted to undertake the field work for MPI. A team of 5 – 8 NIWA scientists, divers and boat operators undertake the work at each port, and usually operate out of several small research boats. Key NIWA survey staff are Authorised Persons under the Biosecurity Act 1993 and may physically inspect the hulls of vessels and take samples of organic material or organisms for further inspection and testing, under sections 109 and 121 of the Act. If the person appearing to be in charge of the vessel is present the NIWA staff will identify themselves as authorised persons prior to carrying out these inspections or, if there is no person appearing to be in charge at the time, written notice will be provided following the inspection that an inspection has occurred.

HOW CAN I FIND OUT THE RESULTS?

Email surveillance@mpl.govt.nz stating your port(s) of interest, and you will be added to an email distribution list, and sent results as they become available. The full results for all ports and marinas around the country are available annually, via our website: <http://www.mpl.govt.nz/news-and-resources/publications>.

Questions or concerns Contact MPI: surveillance@mpl.govt.nz or call 0800 00 83 33

The details of the next survey are:

Location	Dates	Contact
		surveillance@mpl.govt.nz or call 0800 00 83 33

ADDITIONAL INFO AND LINKS

To see more about MPI, go to www.mpl.govt.nz.

To see more about NIWA, go to www.niwa.co.nz.

To learn more about the distribution of marine pests in NZ, go to www.marinebiosecurity.org.nz.

To learn more about regional biosecurity measures, go to Northland biosecurity information www.nrc.govt.nz/Environment/Weed-and-pest-control/Marine-pests/

Top of the South marine biosecurity Partnership
www.marinebiosecurity.co.nz

Fjordland marine biosecurity partnership
www.biosecurity.govt.nz/fjordland

Southland marine biosecurity
www.es.govt.nz/environment/pests/marine/

New Zealand Government

To report suspected exotic land, freshwater and marine pests, or exotic diseases in plants or animals, call: **0800 80 99 66**

November 2016