



# Marine High Risk Site Surveillance

Annual report for all ports and marinas 2014–15  
(Project 12099)

MPI Technical Paper No: 2015/23

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

ISBN No: 978-1-77665-019-4 (online)

ISSN No: 2253-3923 (online)

June 2015

## Disclaimer

While every effort has been made to ensure the information in this publication is accurate, the Ministry for Primary Industries does not accept any responsibility or liability for error of fact, omission, interpretation or opinion that may be present, nor for the consequences of any decisions based on this information.

Requests for further copies should be directed to:

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

Email: [brand@mpi.govt.nz](mailto:brand@mpi.govt.nz)

Telephone: 0800 00 83 33

Facsimile: 04-894 0300

This publication is also available on the Ministry for Primary Industries website at <http://www.mpi.govt.nz/news-and-resources/publications/>

**© Crown Copyright - Ministry for Primary Industries**

<b>Executive Summary</b>	<b>1</b>
<b>Introduction</b>	<b>3</b>
Objectives of the Marine High-Risk Site surveillance programme	4
Target species	4
<b>Dates of surveys</b>	<b>4</b>
<b>MPI Biosecurity New Zealand: contacts</b>	<b>4</b>
<b>The surveillance team: contact person and personnel</b>	<b>4</b>
<b>Results</b>	<b>6</b>
Sample collection	6
Target species collection	7
Number of specimens collected and sent to MITS	7
Distribution of target and non-target species	14
Environmental data collection	19
<b>Conclusions</b>	<b>20</b>
<b>Recommendations</b>	<b>21</b>
<b>Acknowledgements</b>	<b>22</b>
<b>References</b>	<b>23</b>
<b>Appendix 1. Summary of sampling methods, target species and habitats.</b>	<b>24</b>
<b>Appendix 2. Summaries of achieved versus target sample numbers for Winter 2014 and Summer 2014–15</b>	<b>30</b>
<b>Appendix 3. Maps showing locations sampled in Winter 2014 and Summer 2014–15.</b>	<b>35</b>
Auckland (Waitemata) Harbour	35
Bluff Harbour	41
Lyttelton Harbour	47
Nelson Harbour	53
Opuā	59
Otago Harbour	65
Picton/Havelock	71
Port Taranaki	85
Tauranga Harbour	91
Wellington Harbour	97
Whangarei Harbour	103
<b>Appendix 4. Distribution maps for target and selected non-target species in Winter 2014 and Summer 2014–15.</b>	<b>109</b>
<i>Acentrogobius pflaumii</i>	109
<i>Arcuatula senhousia</i>	110
<i>Arenigobius bifrenatus</i>	112
<i>Botrylloides giganteum</i>	113

<i>Charybdis japonica</i>	115
<i>Clavelina lepadiformis</i>	117
<i>Conopeum seurati</i>	118
<i>Didemnum vexillum</i>	119
<i>Distaplia viridis</i>	120
<i>Ectopleura crocea</i>	121
<i>Eudistoma elongatum</i>	122
<i>Grateloupia turuturu</i>	124
<i>Limaria orientalis</i>	127
<i>Metapenaeus bennettiae</i>	129
<i>Nassarius burchardi</i>	131
<i>Pyromaia tuberculata</i>	132
<i>Sabella spallanzanii</i>	135
<i>Schizymenia apoda</i>	139
<i>Stictyosiphon soriferus</i>	140
<i>Striaria attenuata</i>	141
<i>Styela clava</i>	142
<i>Theora lubrica</i>	149
<i>Undaria pinnatifida</i>	157

---

<b>List of Figures</b>	<b>Page</b>
------------------------	-------------

---

Figure 1: Locations of the 11 ports and marinas covered by the Marine High Risk Site Surveillance Programme.	3
--	---

---



---

<b>List of Tables</b>	<b>Page</b>
-----------------------	-------------

---

Table 1: Dates and contact person/field team leader for the Winter 2014 and Summer 2014–15 surveys	5
Table 2: Summary of target and achieved numbers of locations sampled in each port in each survey	6
Table 3: Summary of numbers and types of specimens collected from each location and sent to MITS during the Winter 2014 round of surveys	9
Table 4: Summary of numbers and types of specimens collected from each location and sent to MITS during the Summer 2014–15 round of surveys	10
Table 5: Specimens collected and sent to MITS from each location during the Winter 2014 survey	11
Table 6: Specimens collected and sent to MITS from each location during the Summer 2014–15 survey	12
Table 7: Stakeholders observing the Winter 2014 and Summer 2014–15 surveys	21

---

## Executive Summary

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

This annual report details the targeted surveillance surveys in the 11 ports and marinas covered by the programme during the periods May–September 2014 (the Winter 2014 round of surveys) and November 2014–March 2015 (the Summer 2014–15 round of surveys).

Numbers of locations sampled met the target on all surveys apart from the summer surveys of Nelson and Wellington harbours (99% of target achieved for both locations).

Numbers of specimens sent to the Marine Invasives Taxonomic Service (MITS) per survey ranged from none to 13, and the total numbers of specimens sent were 32 for the Winter 2014 round of surveys and 72 for the Summer 2014–15 round.

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: Auckland (Winter 2014, Summer 2014–15), Whangarei (Winter 2014, Summer 2014–15).
- *Eudistoma elongatum* was recorded during the following surveys: Opua (Winter 2014, Summer 2014–15), Whangarei (Winter 2014, Summer 2014–15).
- *Sabella spallanzanii* was recorded during the following surveys: Auckland (Winter 2014, Summer 2014–15), Nelson (Summer 2014–15), Tauranga (Winter 2014, Summer 2014–15), Wellington (Summer 2014–15), Whangarei (Winter 2014, Summer 2014–15).
- *Styela clava* was recorded during the following surveys: Auckland (Winter 2014, Summer 2014–15), Lyttelton (Winter 2014, Summer 2014–15), Nelson (Winter 2014, Summer 2014–15), Opua (Winter 2014, Summer 2014–15), Otago (Winter 2014, Summer 2014–15), Picton (Summer 2014–15), Wellington (Summer 2014–15), Whangarei (Winter 2014, Summer 2014–15).

Three of the 32 specimens sent to MITS from the Winter 2014 surveys were NIS, including:

- the red alga *Grateloupia turuturu* (Picton – **range extension**);
- the Mediterranean fanworm *Sabella spallanzanii* (Tauranga);
- the colonial ascidian *Distaplia viridis* (Whangarei – **new record for New Zealand**).

Twenty-four of the 72 specimens sent to MITS from the Summer 2014–15 surveys were NIS, including:

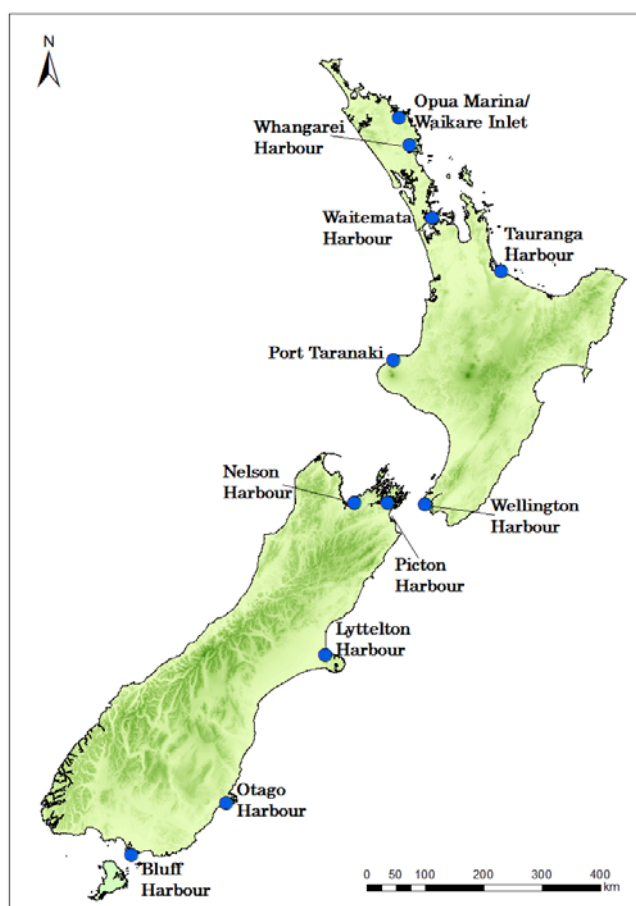
- the colonial ascidian *Botrylloides giganteum* (Auckland, Tauranga and Whangarei – **range extensions** for the former two locations);
- *S. spallanzanii* (Wellington);
- the red alga *Schizymenia apoda* (Otago and Picton – **range extension for the latter location**);
- the brown alga *Stictyosiphon soriferus* (Wellington – **new record for New Zealand**);
- the solitary ascidian *Styela clava* (Wellington).

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

## Introduction

The Marine High Risk Site Surveillance (MHRSS) Programme of targeted surveillance for non-indigenous marine species (NIS) is part of the Ministry for Primary Industries' (MPI) wider marine biosecurity programme. The targeted surveillance programme, currently delivered by NIWA under contract to MPI, repeats surveillance work developed and undertaken in 2002–04, 2005–06 and 2008–present, also by NIWA, at 11 major ports and marinas around the country (Figure 1). The surveillance is designed to detect the presence of a group of non-indigenous and potentially invasive marine flora and fauna that MPI has identified as presenting a significant risk of arriving and establishing in New Zealand. It also aims to allow changes in the distribution of established marine non-indigenous or pest species to be monitored. The majority of marine pests targeted by the surveillance programme are listed on the New Zealand register of Unwanted Organisms under the Biosecurity Act 1993.

This annual report details the targeted surveillance in the 11 ports and marinas covered by the programme in the winter of 2014 and summer of 2014–15.



**Figure 1: Locations of the 11 ports and marinas covered by the Marine High Risk Site Surveillance Programme.**

## OBJECTIVES OF THE MARINE HIGH-RISK SITE SURVEILLANCE PROGRAMME

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

The secondary objectives are to:

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

## TARGET SPECIES

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

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

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

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

## Dates of surveys

The targeted surveillance surveys of the 11 ports and marinas covered by the programme took place during the periods May–September 2014 (the Winter 2014 round) and November 2014–March 2015 (the Summer 2014–15 round). Dates for each survey are given in Table 1.

## MPI Biosecurity New Zealand: contacts

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

The MPI contact person for all marine surveillance activity is Tim Riding (Email [tim.riding@mpi.govt.nz](mailto:tim.riding@mpi.govt.nz)). Alternatively, the Biosecurity Surveillance Group Manager can be contacted at the following Email address: [NZBiosecuritySurveillance@mpi.govt.nz](mailto:NZBiosecuritySurveillance@mpi.govt.nz).

## The surveillance team: contact person and personnel

The surveillance programme was designed by Drs Graeme Inglis (NIWA, Christchurch) and Don Morrissey (ex- NIWA, Nelson), and implemented by the personnel listed in the *Communications logs and field team lists* submitted to MPI prior to each survey. NIWA Project Managers for the surveillance programme are Drs Chris Woods (NIWA, Christchurch) and Graeme Inglis.

---

<sup>1</sup> *Didemnum* sp. was removed from the list of secondary target species by MPI in December 2008. *Sabella spallanzanii* was moved from the primary to the secondary list in June 2011.

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

**Table 1: Dates and contact person/field team leader for the Winter 2014 and Summer 2014–15 surveys**

Port	Dates for Winter 2014 surveys	Dates for Summer 2014–15 surveys
Auckland (Waitemata) Harbour	18–29 August 2014	19–29 January 2015
Bluff Harbour	1–5 September 2014	23–27 February 2015
Lyttelton Harbour	9–13 June 2014	24–28 November 2014
Nelson Harbour	15–19 September 2014	16–20 March 2015
Opua	29 September–3 October 2014	16–20 February 2015
Otago Harbour	11–15 August 2014	9–13 February 2015
Picton/Havelock	26–30 May 2014	23–27 March 2015
Port Taranaki	4–8 August 2014	1–5 December 2014
Tauranga Harbour	26–30 May 2014	23–27 March 2015
Wellington Harbour	21–25 July, 30–31 July & 5 August 2014*	17–21 November & 3 December 2014*
Whangarei Harbour	9–13 & 25–26 June 2014*	15–19 December 2014 & 13 January 2015*

\*Survey interrupted by unfavourable weather

# Results

## SAMPLE COLLECTION

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

Total numbers of locations surveyed in each survey round (Winter 2014 and Summer 2014–15) in each port are shown in Table 2. Numbers of locations sampled met the target on all surveys apart from the summer surveys of Nelson and Wellington harbours (99% of target achieved for each) due to sampling count error in the former, and unfavourable weather in the latter preventing some trap deployments. Numbers of locations sampled with each method in each port are shown in Appendix 2, by sampling round. The sample locations for each technique are shown in Appendix 3.

**Table 2: Summary of target and achieved numbers of locations sampled in each port in each survey**

Location	Sampling round	Target number of locations	Actual number of locations	% of target achieved
Auckland (Waitemata) Harbour	Winter 2014	486	499	103
	Summer 2014–15	486	494	102
Bluff Harbour*	Winter 2014	225	225	100
	Summer 2014–15	225	225	100
Lyttelton Harbour	Winter 2014	243	243	100
	Summer 2014–15	243	243	100
Nelson Harbour	Winter 2014	243	242	100
	Summer 2014–15	243	241	99
Opuā	Winter 2014	248	248	100
	Summer 2014–15	248	249	100
Otago Harbour	Winter 2014	243	243	100
	Summer 2014–15	243	243	100
Picton/Havelock	Winter 2014	243	244	100
	Summer 2014–15	243	242	100
Port Taranaki	Winter 2014	243	243	100
	Summer 2014–15	243	244	100
Tauranga Harbour	Winter 2014	243	254	105
	Summer 2014–15	243	245	101
Wellington Harbour	Winter 2014	243	243	100
	Summer 2014–15	243	240	99
Whangarei Harbour	Winter 2014	243	246	101
	Summer 2014–15	243	245	101

\* By agreement with MPI, target numbers of locations in Bluff Harbour have been reduced compared to earlier surveys (from 243 down to 225), due to the presence of an active sub-surface oyster farm lease 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 sites 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 now allocated to the oyster farming lease area.

Sample locations for crab box trap lines, epibenthic tows, and diver searches were pre-assigned prior to the survey by using a grid overlaid on the survey area in GIS. Where a pre-allocated sampling point was not accessible at the time the survey was done (for example, because a berth was occupied by a vessel), the sample was moved to a nearby location and the new coordinates recorded on the data sheet (or notepad computer, as appropriate). Field teams

also noted any sampling locations that were not appropriate so that these could be removed from the grid of potential sampling locations for future surveys. Such locations included areas where high vessel traffic makes diving too hazardous or deployment of traps impossible, areas that are not suitable for trapping because they dry at low tide, and cable zones and other restricted areas.

## TARGET SPECIES COLLECTION

**Primary target species detected<sup>2</sup>:** None

**Secondary target species detected<sup>3</sup>:** *Eudistoma elongatum*, *Arcuatula senhousia*, *Sabella spallanzanii* and *Styela clava* were recorded during both rounds of surveys (see below).

- *Arcuatula senhousia* was recorded during the following surveys: Auckland (Winter 2014, Summer 2014–15), Whangarei (Winter 2014, Summer 2014–15).
- *Eudistoma elongatum* was recorded during the following surveys: Opuia (Winter 2014, Summer 2014–15), Whangarei (Winter 2014, Summer 2014–15).
- *Sabella spallanzanii* was recorded during the following surveys: Auckland (Winter 2014, Summer 2014–15), Nelson (Summer 2014–15), Tauranga (Winter 2014, Summer 2014–15), Wellington (Summer 2014–15), Whangarei (Winter 2014, Summer 2014–15).
- *Styela clava* was recorded during the following surveys: Auckland (Winter 2014, Summer 2014–15), Lyttelton (Winter 2014, Summer 2014–15), Nelson (Winter 2014, Summer 2014–15), Opuia (Winter 2014, Summer 2014–15), Otago (Winter 2014, Summer 2014–15), Picton (Summer 2014–15), Wellington (Summer 2014–15), Whangarei (Winter 2014, Summer 2014–15).

## NUMBER OF SPECIMENS COLLECTED AND SENT TO MITS

Numbers of specimens sent to the Marine Invasives Taxonomic Service (MITS) per survey ranged from none to 13, and the total numbers of specimens sent were 32 for the Winter 2014 round and 72 for the Summer 2014–15 round (Table 3 and Table 4).

The higher number of specimens submitted for the Summer 2014–15 round is largely attributable to an increased number of ascidian samples being collected in this survey round (30 ascidian samples collected in Summer 2014–15 vs four in Winter 2014). Following strong evidence for the presence of the non-indigenous colonial ascidian *Botrylloides giganteum* in Whangarei Harbour, it was agreed with MPI that samples of colonial ascidians resembling the widespread cryptogenic colonial ascidian *B. leachii* (*B. giganteum* is morphologically very similar to *B. leachii*) were to be collected to clarify whether this NIS ascidian is potentially more widespread.

Six of the 32 specimens sent to MITS from the Winter 2014 survey were NIS (Table 5), including the red alga *Grateloupia turuturu* (Picton), the Mediterranean fanworm *Sabella spallanzanii* (Tauranga) and a new-to-New Zealand species, the colonial ascidian *Distaplia viridis* (Whangarei).

- The record of *G. turuturu* from Picton represents a **range extension** (previously known from Lyttelton, Nelson, Port Taranaki, Tauranga and Wellington harbours), and was communicated to MPI through the MITS reporting procedure.

---

<sup>2</sup> *Asterias amurensis*, *Carcinus maenas*, *Caulerpa taxifolia*, *Eriocheir sinensis*, *Potamocorbula amurensis*

<sup>3</sup> *Eudistoma elongatum*, *Arcuatula senhousia*, *Sabella spallanzanii*, *Styela clava*

- The record of *S. spallanzanii* in Tauranga was the first from this location during a MHRSS survey, and was communicated to MPI through the post-sampling reporting procedure. The first record from this location was made in 2013 (MITS reference 70809).
- The record of *D. viridis* (**new-to-New Zealand**) was communicated to MPI through the MITS reporting procedure.

Twenty-four of the 72 specimens sent to MITS from the Summer 2014–15 survey were NIS (Table 6), including the colonial ascidian *Botrylloides giganteum* (Auckland, Tauranga and Whangarei), the solitary ascidian *Ciona intestinalis* (Wellington), the bryozoan *Conopeum seurati* (Opuā), the colonial ascidian *Didemnum vexillum* (Whangarei), the hydroid *Ectopleura crocea* (Picton), *G. turuturu* (Nelson, Picton and Port Taranaki), the bivalve *Limaria orientalis* (Wellington), *S. spallanzanii* (Wellington), the red alga *Schizymenia apoda* (Otago and Picton), the brown algae *Stictyosiphon soriferus* and *Striaria attenuata* (both from Wellington), the solitary ascidian *Styela clava* (Wellington), and the bryozoan *Watersipora subatra* (Opuā).

- The records of *B. giganteum* from Auckland and Tauranga represent southern **range extensions**, and were communicated to MPI through the MITS reporting procedure. The records from Whangarei confirm the detection of *B. giganteum* there during the Summer 2013–14 survey (in Marsden Cove Marina).
- The record of *S. spallanzanii* from Wellington was communicated to MPI directly in-the-field at the time of detection. The first record from this location was made in 2013 (MITS reference 70827).
- The record for *S. apoda* in Picton represents a **range extension** (previously known only from Wellington and Otago harbours), and was communicated to MPI through the MITS reporting procedure.
- The record of *S. soriferus* (**new-to-New Zealand**) in Wellington Harbour was communicated to MPI through the MITS reporting procedure.

**Table 3: Summary of numbers and types of specimens collected from each location and sent to MITS during the Winter 2014 round of surveys**

Taxon group	Auckland	Bluff	Lyttelton	Nelson	Opuā	Otago	Picton/Havelock	Port Taranaki	Tauranga	Wellington	Whangarei	Total	% of total
Algae							2		3		3	8	25
Amphipods												0	0
Ascidians	2				1						1	4	12.5
Barnacles												0	0
Bivalves					3					3		6	18.8
Bryozoans												0	0
Crabs				1								1	3.1
Decapods												0	0
Echinoderms							1					1	3.1
Fish		3						1				4	12.5
Gastropods											1	1	3.1
Hydroids												0	0
Hard corals												0	0
Nudibranchs												0	0
Sea anemones												0	0
Sponges												0	0
Worms									3		4	7	21.9
<b>Total</b>	2	3	0	1	4	0	3	1	6	3	9	32	100

**Table 4: Summary of numbers and types of specimens collected from each location and sent to MITS during the Summer 2014–15 round of surveys**

Taxon group	Auckland	Bluff	Lyttelton	Nelson	Opuā	Otago	Picton/Havelock	Port Taranaki	Tauranga	Wellington	Whangarei	Total	% of total
Algae		5		1		3		2	3	2	3	19	26.4
Amphipods												0	0.0
Ascidians	6	8			2	1			3	2	7	29	40.3
Barnacles												0	0.0
Bivalves					7					1	1	9	12.5
Bryozoans					2							2	2.8
Crabs					1							1	1.4
Decapods											1	1	1.4
Echinoderms						1						1	1.4
Fish												0	0.0
Gastropods								1				1	1.4
Hydroids							1		2			3	4.2
Hard corals					1							1	1.4
Nudibranchs												0	0.0
Sea anemones											1	1	1.4
Sponges	1								1			2	2.8
Worms								1		1		2	2.8
<b>Total</b>	<b>7</b>	<b>13</b>	<b>0</b>	<b>1</b>	<b>13</b>	<b>5</b>	<b>3</b>	<b>5</b>	<b>8</b>	<b>7</b>	<b>10</b>	<b>72</b>	<b>100</b>

**Table 5: Specimens collected and sent to MITS from each location during the Winter 2014 survey (non-indigenous species in bold type).** Specimens are ordered alphabetically by location and then by 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.; IS = indeterminate species. 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

Location	Taxon group	Taxon name	Biosecurity status	Sample number	MITS code	Date	Method
Auckland	Ascidian	<i>Botrylloides leachii</i>	C1	AKL19070	71049	25/08/2014	Benthic sled
Auckland	Ascidian	<i>Botrylloides leachii</i>	C1	AKL19459	71048	18/08/2014	Shore search
Bluff	Fish	<i>Grahamichthys radiata</i>	Native	BLU19127	71042	2/09/2014	Crab trap
Bluff	Fish	<i>Nemadactylus macropterus</i>	Native	BLU19130	71043	2/09/2014	Crab trap
Bluff	Fish	<i>Auchenoceros punctatus</i>	Native	BLU19155	71044	1/09/2014	Crab trap
Nelson	Crab	<i>Halicarcinus varius</i>	Native	NSN19031	71051	17/09/2014	Benthic sled
Opuā	Bivalve	<i>Corbula zelandica</i>	Native	OPX19091	71066	30/09/2014	Benthic sled
Opuā	Bivalve	<i>Ennucula strangei</i>	Native	OPX19095	71065	30/09/2014	Benthic sled
Opuā	Bivalve	<i>Musculus impactus</i>	Native	OPX19212	71067	30/09/2014	Diver search
Opuā	Ascidian	<i>Microcosmus squamiger</i>	C1	OPX19212	71068	30/09/2014	Diver search
Picton	Echinoderm	<i>Sclerasterias mollis</i>	Native	PCN19012	70927	26/05/2014	Benthic sled
Picton	Algae	<b><i>Grateloupia turuturu</i></b>	NIS	PCN19183	70926	26/05/2014	Diver search
Picton	Algae	<b><i>Grateloupia turuturu</i></b>	NIS	PCN19207	70925	27/05/2014	Diver search
Port Taranaki	Fish	<i>Tewara cranwellae</i>	Native	NPL19003	71040	5/08/2014	Benthic sled
Tauranga	Algae	<i>Plocamium angustum</i>	Native	TRG19006	70929	27/05/2014	Benthic sled
Tauranga	Algae	<i>Gigartina atropurpurea</i>	Native	TRG19006	70949	27/05/2014	Benthic sled
Tauranga	Worm	<b><i>Sabella spallanzanii</i></b>	NIS	TRG19197	70931	28/05/2014	Diver search
Tauranga	Worm	<b><i>Sabella spallanzanii</i></b>	NIS	TRG19198	70932	28/05/2014	Diver search
Tauranga	Worm	<b><i>Sabella spallanzanii</i></b>	NIS	TRG19209	70933	28/05/2014	Diver search
Tauranga	Algae	<i>Anotrichium crinitum</i>	Native	TRG19231	70930	27/05/2014	Shore search
Wellington	Bivalve	<i>Corbula zelandica</i>	Native	WLG19074	71006	24/07/2014	Benthic sled
Wellington	Bivalve	<i>Ennucula strangei</i>	Native	WLG19093	71007	24/07/2014	Benthic sled
Wellington	Bivalve	<i>Pratulum pulchellum</i>	Native	WLG19097	71008	24/07/2014	Benthic sled
Whangarei	Algae	<i>Valeriemaya</i> sp.	IS	WRE19096	70987	11/06/2014	Benthic sled
Whangarei	Algae	<i>Griffithsia</i> sp.	IS	WRE19096	71004	11/06/2014	Benthic sled
Whangarei	Algae	<i>Callithamnion</i> sp.	IS	WRE19096	71005	11/06/2014	Benthic sled
Whangarei	Gastropod	<i>Tonnoidea</i>	IS	WRE19140	70990	11/06/2014	Crab trap
Whangarei	Worm	<i>Parasabella aberrans</i>	Native	WRE19202	70984	12/06/2014	Diver search
Whangarei	Ascidian	<b><i>Distaplia viridis</i></b>	NIS	WRE19203	70989	12/06/2014	Diver search
Whangarei	Worm	<i>Megalomma suspiciens</i>	Native	WRE19204	70985	12/06/2014	Diver search
Whangarei	Worm	Sabellidae	IS	WRE19205	70988	12/06/2014	Diver search
Whangarei	Worm	<i>Megalomma suspiciens</i>	Native	WRE19206	70986	12/06/2014	Diver search

**Table 6: Specimens collected and sent to MITS from each location during the Summer 2014–15 survey (non-indigenous species in bold type).** Specimens are ordered alphabetically by location and then by 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.; IS = indeterminate species. 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

Location	Taxon group	Taxon name	Biosecurity status	Sample number	MITS code	Date	Method
Auckland	Ascidian	<i>Botrylloides leachii</i>	C1	AKL20114	71229	20/01/2015	Benthic sled
Auckland	Ascidian	<i>Aplidium thomasi</i>	Native	AKL20370	71233	21/01/2015	Diver search
Auckland	Ascidian	<i>Botrylloides leachii</i>	C1	AKL20372	71230	21/01/2015	Diver search
Auckland	Ascidian	<i>Botrylloides leachii</i>	C1	AKL20378	71231	21/01/2015	Diver search
Auckland	Sponge	<i>Clathrina coriacea</i>	Native	AKL20382	71232	21/01/2015	Diver search
Auckland	Ascidian	<i>Molgula mortenseni</i>	Native	AKL20384	71234	21/01/2015	Diver search
Auckland	Ascidian	<b><i>Botrylloides giganteum</i></b>	NIS	AKL20407	71235	28/01/2015	Diver search
Bluff	Algae	<i>Plocamium</i> sp.	IS	BLU20201	71249	24/02/2015	Diver search
Bluff	Algae	<i>Pugetia delicatissima</i>	Native	BLU20201	71269	24/02/2015	Diver search
Bluff	Ascidian	<i>Botrylloides leachii</i>	C1	BLU20204	71252	24/02/2015	Diver search
Bluff	Ascidian	<i>Botrylloides leachii</i>	C1	BLU20205	71253	24/02/2015	Diver search
Bluff	Ascidian	<i>Botrylloides leachii</i>	C1	BLU20206	71254	24/02/2015	Diver search
Bluff	Ascidian	<i>Botrylloides leachii</i>	C1	BLU20207	71255	24/02/2015	Diver search
Bluff	Ascidian	<i>Botrylloides</i> cf. <i>magnicoecum</i>	Native	BLU20208	71256	24/02/2015	Diver search
Bluff	Algae	<i>Centroceras clavulatum</i>	Native	BLU20209	71250	24/02/2015	Diver search
Bluff	Ascidian	<i>Botrylloides leachii</i>	C1	BLU20209	71257	24/02/2015	Diver search
Bluff	Algae	<i>Kallymeniaceae</i>	IS	BLU20210	71251	24/02/2015	Diver search
Bluff	Algae	<i>Callophyllis hombroniana</i>	Native	BLU20210	71270	24/02/2015	Diver search
Bluff	Ascidian	<i>Botrylloides leachii</i>	C1	BLU20248	71258	24/02/2015	Diver search
Bluff	Ascidian	<i>Botrylloides leachii</i>	C1	BLU20252	71259	24/02/2015	Diver search
Nelson	Algae	<b><i>Grateloupia turuturu</i></b>	NIS	NSN20243	71273	18/03/2015	Shore search
Opuā	Bivalve	<i>Maorimactra ordinaria</i>	Native	OPX20015	71237	16/02/2015	Benthic sled
Opuā	Bivalve	<i>Corbula zelandica</i>	Native	OPX20033	71241	17/02/2015	Benthic sled
Opuā	Bivalve	<i>Corbula zelandica</i>	Native	OPX20035	71240	17/02/2015	Benthic sled
Opuā	Bivalve	<i>Ennucula strangei</i>	Native	OPX20087	71239	17/02/2015	Benthic sled
Opuā	Bivalve	<i>Maorimactra ordinaria</i>	Native	OPX20087	71248	17/02/2015	Benthic sled
Opuā	Bivalve	<i>Corbula zelandica</i>	Native	OPX20095	71238	17/02/2015	Benthic sled
Opuā	Bryozoan	<b><i>Conopeum seurati</i></b>	NIS	OPX20201	71244	18/02/2015	Diver search
Opuā	Ascidian	<i>Microcosmus squamiger</i>	C1	OPX20214	71236	18/02/2015	Diver search
Opuā	Bivalve	<i>Musculus impactus</i>	Native	OPX20214	71243	18/02/2015	Diver search
Opuā	Bryozoan	<b><i>Watersipora subatra</i></b>	NIS	OPX20214	71245	18/02/2015	Diver search
Opuā	Hard coral	<i>Culicia rubeola</i>	Native	OPX20214	71246	18/02/2015	Diver search
Opuā	Ascidian	<i>Microcosmus squamiger</i>	C1	OPX20215	71247	18/02/2015	Diver search

Location	Taxon group	Taxon name	Biosecurity status	Sample number	MIT code	Date	Method
Opuā	Crab	<i>Heterozius rotundifrons</i>	Native	OPX20240	71242	17/02/2015	Shore search
Otago	Ascidian	<i>Botrylloides cf. magnicoecum</i>	Native	DUD20012	71263	11/02/2015	Benthic sled
Otago	Echinoderm	<i>Chiridota nigra</i>	Native	DUD20111	71260	9/02/2015	Crab trap
Otago	Algae	<i>Schizymenia apoda</i>	NIS	DUD20195	71261	9/02/2015	Diver search
Otago	Algae	<i>Rhodoglossum cf. latissimum</i>	Native	DUD20195	71271	9/02/2015	Diver search
Otago	Algae	<i>Schizymenia apoda</i>	NIS	DUD20207	71262	10/02/2015	Diver search
Picton	Algae	<i>Grateloupia turuturu</i>	NIS	PCN20200	71297	24/03/2015	Diver search
Picton	Algae	<i>Schizymenia apoda</i>	NIS	PCN20203	71298	24/03/2015	Diver search
Picton	Hydroid	<i>Ectopleura crocea</i>	NIS	PCN20220	71296	23/03/2015	Shore search
Port Taranaki	Worm	<i>Boccardia syrtis</i>	Native	NPL20092	71178	4/12/2014	Benthic sled
Port Taranaki	Algae	<i>Polysiphonia</i> sp.	IS	NPL20200b	71179	3/12/2014	Diver search
Port Taranaki	Algae	<i>Grateloupia turuturu</i>	NIS	NPL20200b	71180	3/12/2014	Diver search
Port Taranaki	Algae	<i>Rhodymenia</i> sp.	IS	NPL20200b	71181	3/12/2014	Diver search
Port Taranaki	Gastropod	Gastropoda	IS	NPL20211	71177	1/12/2014	Crab condo
Tauranga	Algae	<i>Plocamium angustum</i>	Native	TRG20010	71300	24/03/2015	Benthic sled
Tauranga	Ascidian	<i>Botrylloides leachii</i>	C1	TRG20190	71303	25/03/2015	Diver search
Tauranga	Ascidian	<i>Polyandrocarpa</i> sp. ( <i>cf. robusta</i> )	IS	TRG20197	71304	25/03/2015	Diver search
Tauranga	Hydroid	<i>Aglaophenia cf. laxa</i>	IS	TRG20197	71305	25/03/2015	Diver search
Tauranga	Hydroid	<i>Clytia hemisphaerica</i>	C1	TRG20197	71311	25/03/2015	Diver search
Tauranga	Algae	<i>Schizoseris</i> sp.	IS	TRG20204	71302	25/03/2015	Diver search
Tauranga	Ascidian	<i>Botrylloides giganteum</i>	NIS	TRG20205	71301	25/03/2015	Diver search
Tauranga	Sponge	<i>Chelonaplysilla violacea</i>	Native	TRG20225	71299	23/03/2015	Shore search
Wellington	Bivalve	<i>Limaria orientalis</i>	NIS	WLG20016	71161	20/11/2014	Benthic sled
Wellington	Algae	<i>Striaria attenuata</i>	NIS	WLG20105	71159	19/11/2014	Crab trap
Wellington	Ascidian	<i>Styela clava</i>	NIS	WLG20106	71158	19/11/2014	Crab trap
Wellington	Algae	<i>Gloioderma saccatum</i>	Native	WLG20189	71182	19/11/2014	Diver search
Wellington	Algae	<i>Stictyosiphon soriferus</i>	NIS	WLG20194	71160	19/11/2014	Diver search
Wellington	Worm	<i>Sabella spallanzanii</i>	NIS	WLG20201	71157	17/11/2014	Diver search
Wellington	Ascidian	<i>Ciona intestinalis</i>	NIS	WLG20219	71156	17/11/2014	Shore search
Whangarei	Decapod	<i>Pariliacantha georgeorum</i>	Native	WRE20030	71188	18/12/2014	Benthic sled
Whangarei	Bivalve	<i>Pratulum pulchellum</i>	Native	WRE20053	71187	18/12/2014	Benthic sled
Whangarei	Sea anenome	<i>Epiactis thompsoni</i>	Native	WRE20202	71185	17/12/2014	Diver search
Whangarei	Ascidian	<i>Botrylloides giganteum</i>	NIS	WRE20202	71186	17/12/2014	Diver search
Whangarei	Ascidian	<i>Didemnum vexillum</i>	NIS	WRE20203b	71189	17/12/2014	Diver search
Whangarei	Ascidian	<i>Botrylloides giganteum</i>	NIS	WRE20203a	71190	17/12/2014	Diver search
Whangarei	Ascidian	<i>Botrylloides giganteum</i>	NIS	WRE20207a	71191	17/12/2014	Diver search
Whangarei	Ascidian	<i>Botrylloides giganteum</i>	NIS	WRE20207b	71192	17/12/2014	Diver search

Location	Taxon group	Taxon name	Biosecurity status	Sample number	MITS code	Date	Method
Whangarei	Ascidian	<i>Botrylloides giganteum</i>	NIS	WRE20208a	71193	17/12/2014	Diver search
Whangarei	Ascidian	<i>Botrylloides giganteum</i>	NIS	WRE20208b	71194	17/12/2014	Diver search

## DISTRIBUTION OF TARGET AND NON-TARGET SPECIES

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

Species plotted (and the methods by which they might be collected) are: *Acentrogobius bifrenatus* (crab trap, epibenthic sled, diver search); *Arcuatula senhousia* (epibenthic sled, crab trap, shore search); *Arenigobius bifrenatus* (crab trap, epibenthic sled, diver search); *Botrylloides giganteum* (epibenthic sled, diver search, shore search); *Charybdis japonica* (epibenthic sled, crab trap, crab condos, diver search, shore search); *Clavelina lepadiformis* (diver search, shore search); *Conopeum seurati* (epibenthic sled, diver search, shore search); *Didemnum vexillum* (epibenthic sled, diver search, shore search); *Distaplia viridis* (epibenthic sled, diver search, shore search); *Ectopleura crocea* (epibenthic sled, diver search, shore search); *Eudistoma elongatum* (epibenthic sled, diver search, shore search); *Grateloupia turuturu* (epibenthic sled, diver search, shore search); *Limaria orientalis* (epibenthic sled); *Metapenaeus bennettiae* (epibenthic sled, crab trap, diver search); *Nassarius burchardi* (epibenthic sled); *Pyromaia tuberculata* (epibenthic sled, crab trap); *Sabella spallanzanii* (epibenthic sled, crab trap, diver search, shore search); *Schizymenia apoda* (epibenthic sled, diver search, shore search); *Stictyosiphon soriferus* (epibenthic sled, diver search, shore search); *Striaria attenuata* (epibenthic sled, diver search, shore search); *Styela clava* (epibenthic sled, diver search, shore search); *Theora lubrica* (epibenthic sled); and *Undaria pinnatifida* (epibenthic sled, crab trap, diver search, shore search). Records are shown for the Winter 2014 and Summer 2014–15 surveys.

### Secondary target non-indigenous species

#### *Arcuatula senhousia*

*A. senhousia* was recorded (predominantly in epibenthic sled tows) during both surveys of Auckland and Whangarei harbours. Distributions within each location were as follows:

- Auckland: recorded at four sites in the upper harbour during the winter survey, and at two sites mid-harbour in the summer survey. This reflects a continued limited distribution compared to earlier surveys.
- Whangarei: recorded at seven sites during the winter survey, from the town basin to mid-harbour, and at three sites during the summer survey, from Limestone Island to mid-harbour in the summer survey. This reflects a more limited distribution compared to previous winter and summer surveys in Whangarei Harbour, with no detections in the lower harbour or Marsden Cove Marina.

#### *Eudistoma elongatum*

*E. elongatum* was recorded (predominantly during dive and shore searches) during both surveys of Opua and Whangarei Harbour. Distributions within each location were as follows:

- Opua: recorded at three locations along the breakwater of the marina during the winter survey, and at numerous locations at the Town Wharf and marina as well as on either side

of the Veronica Channel and lower reach of the Waikare Inlet during the summer survey. This reflects a similar distribution compared to earlier surveys.

- Whangarei: recorded at the Portland Arm and near Limestone Island during both surveys. This reflects a continued limited distribution compared to earlier surveys.

### *Sabella spallanzanii*

*S. spallanzanii* was recorded (predominantly during dive searches) during both surveys of Auckland (Waitemata), Tauranga and Whangarei harbours, and the summer surveys of Nelson and Wellington harbours. Distributions within each location were as follows:

- Auckland: recorded throughout the port, Bayswater, Orakei, Westhaven and Westpark marinas, Devonport, the channel between the Harbour Bridge and Kauri Point and in the upper harbour. Recorded at 103 locations during the winter survey, and at 100 locations during the summer survey. It was abundant at all locations where it occurred, with multiple cohorts and population densities similar to previous surveys.
- Nelson: a single specimen was found on a pontoon in the Nelson Marina during the summer survey. This is the same as the previous summer survey (Summer 2013–14), where the detection of a single worm (also in the marina) was the first record of the range extension of *S. spallanzanii* to Nelson.
- Tauranga: a single *S. spallanzanii* tube was recorded at one location (tugs and pilot boat berth) during the winter survey. During the summer survey, single specimens were recorded at two locations in the Tauranga (Sulphur Point) Marina and one location in the Tauranga Bridge Marina during the winter survey. First recorded from Tauranga Harbour in 2013, at low abundance, these are the first MHRSS surveys to detect *S. spallanzanii* in Tauranga Harbour.
- Wellington: a single specimen was found as biofouling on a recreational yacht in Chaffers Marina during the summer survey.
- Whangarei: recorded at four locations at Port Nikau and 10 locations in Marsden Cove Marina during the winter survey. During the summer survey, *S. spallanzanii* was recorded at 11 locations in Marsden Cove Marina. Distributions are similar to recent surveys, although abundances in the Marsden Cove Marina during the summer survey were generally higher compared to previous surveys. Divers did note that at Port Nikau, Golden Bay/Portland Wharf and in the Hatea River, all the piles were covered in a very thick layer of *Zoobotryon verticillatum*, which made efficient searching difficult and *S. spallanzanii* could have gone undetected at these locations during the summer survey.

### *Styela clava*

*S. clava* was recorded (predominantly during dive and shore searches) during both surveys of Auckland, Lyttelton, Nelson, Opuia, Otago and Whangarei harbours, and during the summer surveys of Picton and Wellington Harbour. Distributions within each location were as follows:

- Auckland: recorded throughout the port, Bayswater, Orakei, Westhaven and Westpark (but not in the winter survey) marinas, Devonport, the channel between the Harbour Bridge and Kauri Point and both the upper and lower harbour. Recorded at 55 locations during the winter survey, and 99 locations during the summer survey. Distribution and abundance are similar to recent surveys, although the incidence of detection during shore searches was markedly higher during the summer survey.
- Lyttelton: recorded at 14 locations in the port and two locations at Magazine Bay Marina during the winter survey, and 11 locations in the port, two locations in Corsair Bay, and single locations at Cashin Quay, Magazine Bay Marina, Governors Bay and Diamond Harbour during the summer survey. Distribution and abundance are similar to recent surveys.

- Nelson: recorded from the Main Wharf, the Slipway Basin, the Nelson Marina, off Haulashore Island, and in the main channel north of the port/marina area during both surveys. Recorded from 18 locations during the winter survey, and 25 locations during the summer survey. Compared to recent surveys, *S. clava* appears to be increasing in its distribution and abundance in Nelson Harbour.
- Opuā: recorded at six locations on the wharf and in the marina and two locations near Russell during the winter survey, and at 12 locations on the wharf and in the marina, two locations near Russell, and single locations at Ōkiato, Te Wahapu and Waitangi during the summer survey. Distribution and abundance are similar to recent surveys.
- Otago: recorded at 11 locations in Port Otago during the winter survey and nine locations in Port Otago, and one location in the Leith Marina during the summer survey. *S. clava* appears to be increasing in abundance around the Town Basin area, with multiple cohorts noted. A total of 289 individuals were removed during the dive searches in the Town Basin before the process became too time consuming and the decision was made not to continue with removal from this area.
- Picton: a single specimen was recorded from the Waikawa Marina (previously recorded from the marina as vessel biofouling) at an epibenthic sled site. First recorded as a range extension in the Winter 2014 survey from Picton Harbour, *S. clava* was subject to a subsequent delimitation survey in June 2014, commissioned by Marlborough District Council and MPI, in the Picton Marina.
- Wellington: a single small, dead specimen was recorded attached to a masking crab (*Notomithrax* sp.) caught in a crab trap at Seaview Marina. *S. clava* has previously been recorded as vessel biofouling, and during a dive survey (unattached to any substratum) from Chaffers Marina, Wellington Harbour, but has not yet been recorded on natural substratum or fixed infrastructure in the harbour.
- Whangarei: recorded at 11 locations within Marsden Cove Marina, and single sites in the marina channel and at the Northport Berth during the winter survey, and at 14 locations within Marsden Cove Marina, and single sites at One Tree Point and the Northport Berth during the summer. Distribution and abundance are similar to recent surveys.

## Non-target, non-indigenous species

### *Acentrogobius pflaumii*

Recorded in Auckland (Waitemata) Harbour at one location in the port near Westhaven Marina during the winter survey.

### *Arenigobius bifrenatus*

Recorded in Whangarei Harbour at one location in the Town Basin during the winter survey.

### *Botrylloides giganteum*

Recorded in Auckland (Waitemata), Tauranga and Whangarei harbours during the summer surveys.

- Auckland: one location at the Devonport Naval Base (**southern range extension**).
- Tauranga: one location at the Mount Maunganui South region of the commercial port area near the Tauranga Bridge Marina (**southern range extension**).
- Whangarei: four locations at Marsden Cove Marina and one location at One Tree Point. This species, previously known from California, Brazil, Italy and Senegal (Carmela Gissi, University of Milan, pers. comm. to Graeme Inglis and Mike Page, NIWA), is morphologically very similar to the widespread cryptogenic colonial ascidian *B. leachii*, and is subject to ongoing work to better understand its identity and distribution in New Zealand.

### *Charybdis japonica*

Recorded in Auckland and Whangarei harbours during the winter and summer surveys. All specimens were destroyed.

- Auckland: throughout the port, at Devonport, in Orakei, Bayswater, Westhaven and Westpark marinas, and in the channels in the upper, middle and lower harbour. No native paddle crabs, *Ovalipes catharus*, were captured during either survey.
- Whangarei: around the Town Wharf, Limestone Island, Portland Arm, Parua and Munro bays and Marsden Cove Marina.

### *Clavelina lepadiformis*

Recorded in the Nelson Marina at multiple locations during winter and summer surveys, but appeared more widespread in the summer survey.

### *Conopeum seurati*

Recorded in Opuia at one location in the Opuia Marina and one location at Russell during the summer survey.

### *Didemnum vexillum*

Recorded in Otago and Whangarei harbours during the summer surveys.

- Otago: one location in the Town Basin and one location near the LPG berth.
- Whangarei: one location near One Tree Point.

### *Distaplia viridis*

Recorded in Whangarei Harbour (**first record** for New Zealand – considered native to South Australia) at one location in the Marsden Cove Marina during the winter survey.

### *Ectopleura crocea*

Recorded at two locations in the Waikawa Marina during the Picton summer survey.

### *Grateloupia turuturu*

Recorded in Lyttelton Harbour and Picton during the winter surveys, and in Nelson Harbour, Picton and Port Taranaki during the summer surveys.

- Lyttelton: one location near No. 7 Wharf in the port.
- Nelson: one location in the marina.
- Picton: multiple locations in the Picton Marina and two locations in the Waikawa Marina (**range extension** – previously known from Lyttelton, Nelson, Port Taranaki, Tauranga and Wellington harbours).
- Port Taranaki: one location on the Lee Breakwater.

### *Limaria orientalis*

Recorded in Auckland (Waitemata) Harbour during the winter and summer surveys, and in Wellington Harbour during the summer survey.

- Auckland: multiple locations in the main channel in the outer and middle harbours, including the port.
- Wellington: one location near the Overseas Passenger Terminal.

### *Metapenaeus bennettiae*

Recorded in Auckland (Waitemata) and Whangarei harbours during the winter and summer surveys.

- Auckland: one location each in Westpark and Westhaven marinas, several locations in the upper harbour and in the port.

- Whangarei: multiple locations in the Town Basin and Port Nikau, but sparsely distributed at Kaiwaka Point, Limestone Island, Portland Reach and Parua Bay. It appeared to be more widespread in the winter survey.

#### *Nassarius burchardi*

Recorded in Whangarei Harbour during the winter and summer surveys. It was recorded at multiple locations in Port Nikau, and fewer locations near Kaiwaka Point, Limestone Island, Portland Reach, Tamaterau Reach and within Marsden Cove Marina. It appeared to be more widespread in the summer survey.

#### *Pyromaia tuberculata*

Recorded in Auckland (Waitemata) and Whangarei harbours during both surveys, and in Opuia during the summer survey.

- Auckland: multiple locations in the main channel of the upper, middle and lower harbour, two locations in Devonport and single locations in the Bayswater Marina and the port.
- Opuia: five locations around Hermione Rock.
- Whangarei: multiple locations in the Tamaterau Reach and one location in Parua Bay.

#### *Schizymeria apoda*

Recorded in Otago and Picton (**range extension** – previously known only from Wellington and Otago harbours) harbours during the summer surveys.

- Otago: one location in the Town Basin and one location at the Leith Marina.
- Picton: one location in the Port (Waitohi Wharf).

#### *Stictyosiphon soriferus*

Recorded in Wellington Harbour (**first record** for New Zealand – known from Australia, Japan, Korea and Atlantic coast of USA) at one location (Thorndon Container Terminal) during the summer survey.

#### *Striaria attenuata*

Recorded in Wellington Harbour at two locations at the Seaview Marina during the summer survey.

#### *Theora lubrica*

Recorded in Auckland, Lyttelton, Nelson, Opuia, Picton and Havelock, Port Taranaki, Wellington and Whangarei in soft, muddy sediments during both surveys at these locations.

- Auckland: throughout the port, Viaduct, Bayswater, Orakei, Westhaven and Westpark marinas, Devonport, and the upper harbour.
- Lyttelton: throughout the port, area immediately outside the port, and Magazine Bay to Governors Bay in the upper harbour.
- Nelson: throughout the marina, port and inside the Boulder Bank to Haulshore Island.
- Opuia: throughout the marina, off the Town Wharf, through the Veronica Channel, as well as off Russell, around Hermione Rock and off Waitangi.
- Picton/Havelock: throughout the Picton port and marina, Waimahana Wharf (Shakespeare Bay) and Waikawa Marina. Throughout the Havelock Marina and channel immediately leading to the marina.
- Port Taranaki: only at a very limited distribution (one location in winter and two locations in summer) within the port.
- Wellington: throughout Evans Bay, the port and from Kaiwharawhara past Ngauranga, as well as the Seaview Marina and around Seaview Wharf/Terminal.

- Whangarei: throughout the Town Basin Marina, Port Nikau, off Kawaka Point, south of Portland Wharf, Marsden Cove Marina, Parua Bay and near Munro Bay.

#### *Undaria pinnatifida*

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

- Auckland: throughout the port, Viaduct, Bayswater, Orakei and Westhaven marinas, Devonport, and the upper harbour off Hobsonville. Not detected in the Bayswater Marina during the summer survey.
- Bluff: throughout the port, around Tiwai Wharf and western side of the harbour.
- Lyttelton: throughout the port, western mole to Magazine and Governors bays in the upper harbour, Diamond Harbour, Quail and Ripapa islands.
- Nelson: throughout the marina, port and inside the Boulder Bank to Haulashore Island and Tahunanui Beach. Distribution and abundance were markedly lower in the summer survey, with only small plants observed.
- Otago: throughout Port Otago, Port Chalmers, and the lower harbour to the mole at Aramoana.
- Picton: throughout the Picton port and marina, Waimahana Wharf (Shakespeare Bay) and Waikawa Marina. Not present in Havelock.
- Port Taranaki: throughout the port, the reclamation and inside the Lee Breakwater, and one shoreline location north-east of New Plymouth.
- Tauranga: at the base of Mount Maunganui facing the harbour, the port and Tauranga (Sulphur Point) Marina.
- Wellington: throughout Evans Bay, the port, Chaffers Marina, Clyde Quay Boat Harbour, as well as the Seaview Marina and around Seaview Wharf/Terminal.

## ENVIRONMENTAL DATA COLLECTION

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

## Conclusions

The Winter 2014 and Summer 2014–15 rounds of marine high-risk site surveillance surveys met the project objectives in terms of the target numbers of locations sampled, apart from the summer surveys of Nelson and Wellington harbours (99% of target achieved for each location) due to sampling count error in the former, and unfavourable weather in the latter preventing some trap deployments. One hundred and four specimens were collected and sent to MITS for identification. No primary target species were detected during the survey, but the four secondary target species were all recorded: *Arcuatula senhousia* (Auckland and Whangarei); *Eudistoma elongatum* (Opuā and Whangarei); *Sabella spallanzanii* (Auckland, Nelson, Tauranga, Wellington and Whangarei); and *Styela clava* (Auckland, Lyttelton, Nelson, Opuā, Otago, Picton, Wellington and Whangarei). All of these target species have been recorded at the respective locations during previous surveys

Non-target, non-indigenous species recorded during the surveys included: *Acentrogobius pflaumii*; *Arenigobius bifrenatus*; *Botrylloides giganteum*; *Charybdis japonica*; *Clavelina lepadiformis*; *Conopeum seurati*; *Didemnum vexillum*; *Distaplia viridis* (**new record** for New Zealand); *Ectopleura crocea*; *Grateloupia turuturu*; *Limaria orientalis*; *Metapenaeus bennettiae*; *Nassarius burchardi*; *Pyromaia tuberculata*; *Schizymenia apoda*; *Stictyosiphon soriferus* (**new record** for New Zealand); *Striaria attenuata*; *Theora lubrica*; and *Undaria pinnatifida*.

All *Charybdis* specimens caught in crab traps were euthanized. All *Sabella spallanzanii* found in Lyttelton, Nelson and Wellington were enclosed in bags, removed and disposed of to landfill. All *Styela clava* found in Nelson, Picton and Port Otago were collected, and either preserved and sent to MITS or disposed of to landfill in the winter surveys. However, due to the increasing proliferation of *S. clava* in Nelson and Port Otago, collection and disposal at these locations was discontinued during the summer surveys.

### Problems encountered:

#### *Problems during sampling*

##### Winter surveys

Strong winds and rough seas delayed completion of shore searching during the Wellington survey until several weeks after the main survey. Very heavy rain during the Whangarei Harbour survey meant that some of the diving work had to be postponed until several weeks after the main survey, when underwater visibility had improved.

##### Summer surveys

Gale-force winds and rough seas all week affected the Wellington Harbour survey, preventing some crab traps from being deployed and delaying completion of diving until several weeks later. Two condo lines were cut (probably) by boat propeller during the Auckland (Waitemata) Harbour survey resulting in loss of the traps. The Whangarei Harbour survey experienced very stormy conditions during the main part of the survey, delaying completion of diving until one month later (after the Christmas break).

#### *Difficulties encountered in meeting minimum monitoring requirements*

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

#### *Problems encountered in reporting surveillance results*

None.

### *Management actions taken to reduce problems*

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

A working solution to sampling within the marine farming area to the north of Tikore Island in Bluff Harbour has been arrived at with the farm's owner. As in the Winter 2014 and Summer 2014–15 surveys, future surveys will not trap or sled in the area, but diver searches will be allocated there.

With respect to the summer survey of Nelson, where a sampling count error occurred, the roles and responsibilities for NIWA field team leaders and Quality Assurance/Quality Control in the MHRSS Programme were re-iterated to all field team staff (via Woods and Morrissey, 2015).

### **Stakeholder engagement, public awareness and media contact:**

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

During surveillance surveys, individuals representing various stakeholders with vested interest in survey locations sometimes accompanied the field teams to observe sampling activities. These instances of stakeholder observation of survey activity are listed in Table 7.

**Table 7: Stakeholders observing the Winter 2014 and Summer 2014–15 surveys**

Port	Winter 2014 surveys	Summer 2014–15 surveys
Auckland (Waitemata) Harbour		
Bluff Harbour		Environment Southland
Lyttelton Harbour		
Nelson Harbour		Ministry for Primary Industries
Opuha		Northland Regional Council
Otago Harbour		
Picton/Havelock		Marlborough District Council
Port Taranaki		
Tauranga Harbour	University of Waikato	
Wellington Harbour	Ministry for Primary Industries	
Whangarei Harbour	Northland Regional Council	Northland Regional Council

Richard Robinson, photographer for New Zealand Geographic, joined the Waitemata (Auckland) Harbour Winter 2014 survey to obtain in situ images of *S. spallanzanii* for use in the *Sea Change* special feature of New Zealand Geographic, vol. 130.

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

## **Recommendations**

- Electronic data recording is still being trialled whenever possible, but problems of reliability, and speed of operation of the tablet computers continue.

- A set of models of the primary target species (excluding *Potamocorbula amurensis*) has been purchased. We have also compiled a set of preserved specimens of target and selected non-target, non-indigenous species and native species that appear similar to them. The models and specimens have been circulated around all the field teams to refresh members' recognition skills for the target species. This will be done periodically prior to future surveys.
- The distribution of sampling effort in Opuā, as proposed in the revised design report (Morrissey et al, 2012a) and based on stochastic scenario tree modelling (Morrissey et al, 2012b), will be used in future rounds of Opuā surveys. This optimisation approach may be applied to other ports in the future, pending decisions on potential review of target ports and species by MPI.

## Acknowledgements

We thank the stakeholders with vested interest at each location surveyed for facilitating the surveys. Thank you to the other survey field team leaders (Stephen Brown, Megan Carter, Crispin Middleton, Kate Neil, Matt Smith, and Leigh Tait) for organising and running field surveys, and the enthusiastic and efficient field team members. Thank you to Leigh Tait for reviewing a draft version of this report.

## References

- Ruis, M; Teske, P R (2013) Cryptic diversity in coastal Australasia: a morphological and mitonuclear genetic analysis of habitat-forming sibling species. *Zoological Journal of the Linnean Society* 168: 597–611.
- Morrisey, D; Inglis, G; Seaward, K; Middleton, C; Peacock, L (2012a) National Marine High Risk Site Surveillance Programme – 12099. Revised design report for Opuā Marina and Waikare Inlet. MAF Technical Paper prepared for the Ministry of Agriculture and Forestry by NIWA.
- Morrisey, D; Inglis, G; Peacock, L; Seaward, K (2012b) Stochastic Scenario Tree modelling for the Marine High Risk Site Surveillance programme SOW12099 – Innovation Milestone 17. NIWA Client Report prepared for the Ministry for Primary Industries.
- Woods, C; Morrisey, D (2015) Marine High Risk Site Surveillance: summary of requirements for NIWA field team leaders. NIWA Client Report prepared for Ministry for Primary Industries.

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

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

Method	Target species	Non-target species	Habitat	Spatial coverage	Effectiveness	Cost effectiveness	Feasibility	Previous surveillance in NZ?	Previous surveillance overseas?
Epibenthic sled tows	<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 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 50 m tow length and high replication (100+ per location) enables a reasonably large area to be sampled (ca 2500 m <sup>2</sup> per location).	Reliable sample collection including asteroides, 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?
Box (crab) traps	<i>Asterias amurensis</i> <i>Carcinus maenas</i> <i>Eriocheir sinensis</i>	<i>Acentrogobius pflaumii</i> <u><i>Charybdis 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> sp., <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 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 sites (shallow water, deep mud, private land).	Yes	Yes (Veldhuizen, 2000)

Method	Target species	Non-target species	Habitat	Spatial coverage	Effectiveness	Cost effectiveness	Feasibility	Previous surveillance in NZ?	Previous surveillance overseas?
Shoreline searches	<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 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>Chaetopterus</i> sp.</u> <u><i>Charybdis japonica</i></u> <u><i>Clavelina lepadiformis</i></u> <u><i>Didemnum</i> sp.</u> <u><i>Grateloupia turuturu</i></u> <i>Hypnea</i> sp. <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



- Hewitt, C L; Martin, R B (2001) *Revised protocols for baseline surveys for introduced marine species: survey design, sampling protocols and specimen handling*. Technical Report Number 22. Centre for Research on Introduced Marine Pests, CSIRO Marine Research, Hobart, Tasmania.
- May, J T; Brown, L R (2001) *Chinese mitten crab surveys of San Joaquin River Basin and Suisun Marsh, California, 2000*. Open-File Report 01-396 Prepared for the U.S. Geological Survey in Cooperation with the Interagency Ecological Program, Sacramento, California.
- Thresher, R E; Proctor, C; Ruiz, G M; Gurney, R; MacKinnon, C; Walton, W; Rodriguez, L; Bax, N (2003) Invasion dynamics of the European shore crab, *Carcinus maenas*, in Australia. *Marine Biology* 142: 867–876.
- Veldhuizen, T C (2000) Gear type selection for the Chinese Mitten Crab habitat use study. *IEP Newsletter* 13(1): 10.
- Yamada S B; Dumbauld, B R; Kalin, A; Hunt, C E; Figlar-Barnes, R; Randall, A (2005) Growth and persistence of a recent invader *Carcinus maenas* in estuaries of the northeastern Pacific. *Biological Invasions* 7: 309–321.

## Appendix 2. Summaries of achieved versus target sample numbers for Winter 2014 and Summer 2014–15

### AUCKLAND (WAITEMATA) HARBOUR

Sampling method	Target number of locations	Actual number of locations	% of target achieved
<b>AUCKLAND WINTER 2014</b>			
Crab condo lines	16	16	100
Crab (box) trap lines	160	160	100
Epibenthic sled tows	200	201	100
Diver searches	60	61	102
Shore searches	50	61	122
<b>Sample total</b>	<b>486</b>	<b>499</b>	<b>103</b>
<b>AUCKLAND SUMMER 2014–15</b>			
Crab condo lines	16	14	87.5*
Crab (box) trap lines	160	161	101
Epibenthic sled tows	200	200	100
Diver searches	60	60	100
Shore searches	50	59	118
<b>Sample total</b>	<b>486</b>	<b>494</b>	<b>102</b>

\*Two condo lines cut by boat propeller

### BLUFF HARBOUR

Sampling method	Target number of locations	Actual number of locations	% of target achieved
<b>WINTER 2014</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	68	68	100
Epibenthic sled tows	84	84	100
Diver searches	40	40	100
Shore searches	25	25	100
<b>Sample total</b>	<b>225</b>	<b>225</b>	<b>100</b>
<b>SUMMER 2014–15</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	68	68	100
Epibenthic sled tows	84	84	100
Diver searches	40	42	100
Shore searches	25	25	100
<b>Sample total</b>	<b>225</b>	<b>225</b>	<b>100</b>

## LYTTELTON HARBOUR

Sampling method	Target number of locations	Actual number of locations	% of target achieved
<b>WINTER 2014</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
<b>Sample total</b>	<b>243</b>	<b>243</b>	<b>100</b>
<b>SUMMER 2014–15</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
<b>Sample total</b>	<b>243</b>	<b>243</b>	<b>100</b>

## NELSON HARBOUR

Sampling method	Target number of locations	Actual number of locations	% of target achieved
<b>WINTER 2014</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	99	100
Diver searches	30	30	100
Shore searches	25	25	100
<b>Sample total</b>	<b>243</b>	<b>242</b>	<b>100</b>
<b>SUMMER 2014–15</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	98	98*
Diver searches	30	30	100
Shore searches	25	25	100
<b>Sample total</b>	<b>243</b>	<b>241</b>	<b>99</b>

\*Sampling count error in the field

## OPUA

Sampling method	Target number of locations	Actual number of locations	% of target achieved
<b>WINTER 2014</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	105	105	100
Diver searches	30	30	100
Shore searches	25	25	100
<b>Sample total</b>	<b>248</b>	<b>248</b>	<b>100</b>
<b>SUMMER 2014–15</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	105	106	101
Diver searches	30	30	100
Shore searches	25	25	100
<b>Sample total</b>	<b>248</b>	<b>249</b>	<b>100</b>

## OTAGO HARBOUR

Sampling method	Target number of locations	Actual number of locations	% of target achieved
<b>WINTER 2014</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
<b>Sample total</b>	<b>243</b>	<b>243</b>	<b>100</b>
<b>SUMMER 2014–15</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
<b>Sample total</b>	<b>243</b>	<b>243</b>	<b>100</b>

## PICTON/HAVELOCK

Sampling method	Target number of locations	Actual number of locations	% of target achieved
<b>WINTER 2014</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	26	104
<b>Sample total</b>	<b>243</b>	<b>244</b>	<b>100</b>
<b>SUMMER 2014–15</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	79	99*
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
<b>Sample total</b>	<b>243</b>	<b>242</b>	<b>100</b>

\*Lost trap line

## PORT TARANAKI

Sampling method	Target number of locations	Actual number of locations	% of target achieved
<b>WINTER 2014</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
<b>Sample total</b>	<b>243</b>	<b>243</b>	<b>100</b>
<b>SUMMER 2014–15</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	101	101
Diver searches	30	30	100
Shore searches	25	25	108
<b>Sample total</b>	<b>243</b>	<b>244</b>	<b>100</b>

## TAURANGA HARBOUR

Sampling method	Target number of locations	Actual number of locations	% of target achieved
<b>WINTER 2014</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	109	109
Diver searches	30	30	100
Shore searches	25	27	108
<b>Sample total</b>	<b>243</b>	<b>254</b>	<b>105</b>
<b>SUMMER 2014–15</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100

Sampling method	Target number of locations	Actual number of locations	% of target achieved
Shore searches	25	27	108
<b>Sample total</b>	<b>243</b>	<b>245</b>	<b>101</b>

## WELLINGTON HARBOUR

Sampling method	Target number of locations	Actual number of locations	% of target achieved
<b>WINTER 2014</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	30	100
Shore searches	25	25	100
<b>Sample total</b>	<b>243</b>	<b>243</b>	<b>100</b>
<b>SUMMER 2014–15</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	75	94*
Epibenthic sled tows	100	100	100
Diver searches	30	32	107
Shore searches	25	25	100
<b>Sample total</b>	<b>243</b>	<b>240</b>	<b>99</b>

\*Unfavourable weather (gale-force winds over several days) prevented some trap deployments

## WHANGAREI HARBOUR

Sampling method	Target number of locations	Actual number of locations	% of target achieved
<b>WINTER 2014</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	31	103
Shore searches	25	27	108
<b>Sample total</b>	<b>243</b>	<b>246</b>	<b>101</b>
<b>SUMMER 2014–15</b>			
Crab condo lines	8	8	100
Crab (box) trap lines	80	80	100
Epibenthic sled tows	100	100	100
Diver searches	30	31	103
Shore searches	25	26	100
<b>Sample total</b>	<b>243</b>	<b>245</b>	<b>101</b>

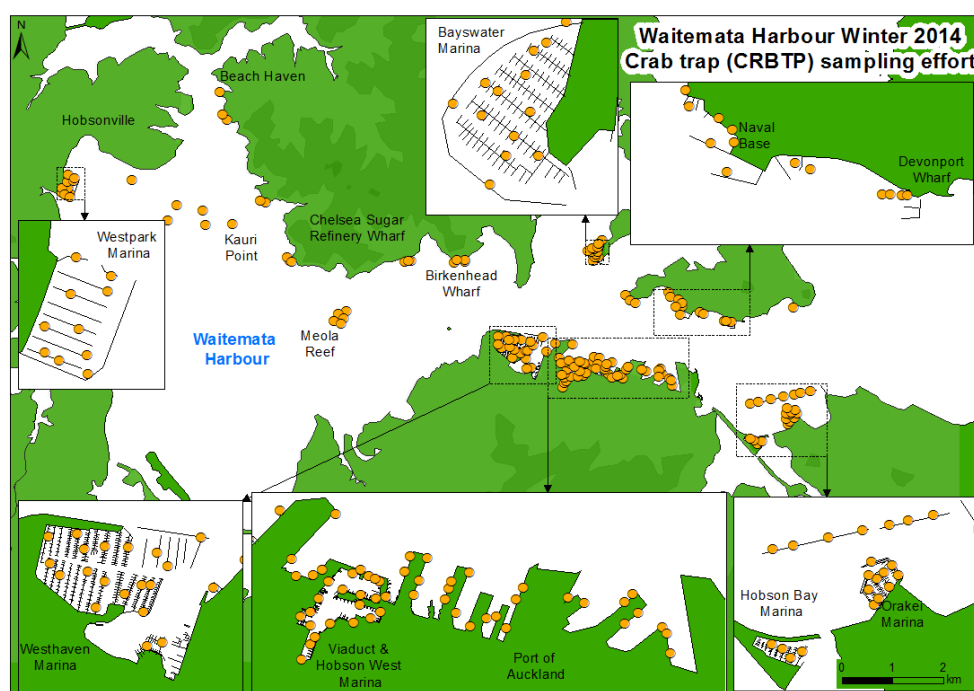
## Appendix 3. Maps showing locations sampled in Winter 2014 and Summer 2014–15.

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

### AUCKLAND (WAITEMATA) HARBOUR

Winter 2014

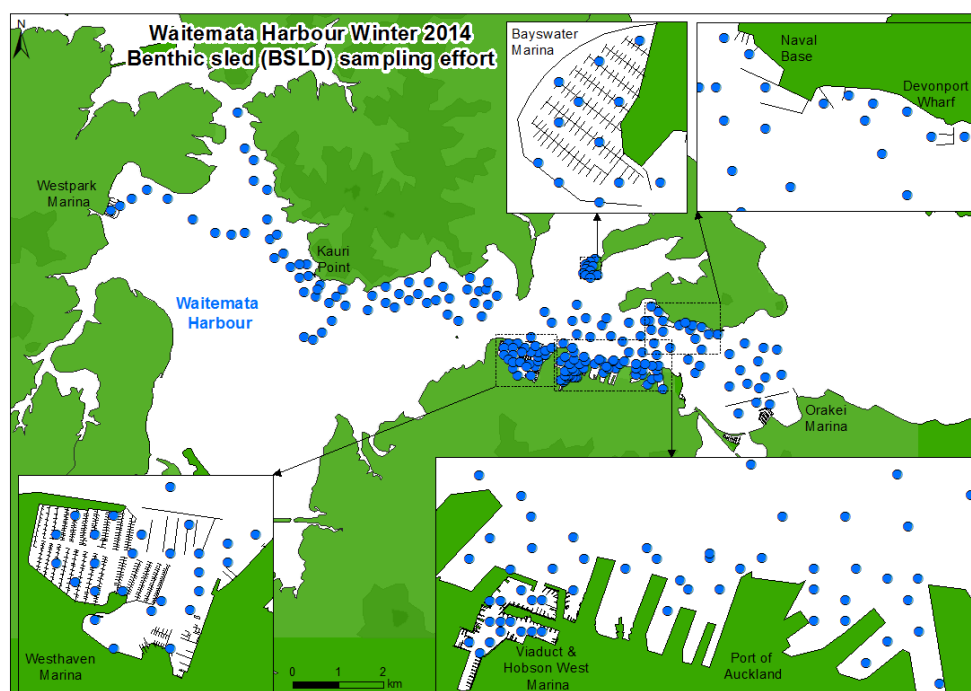
Crab (box) trapping locations



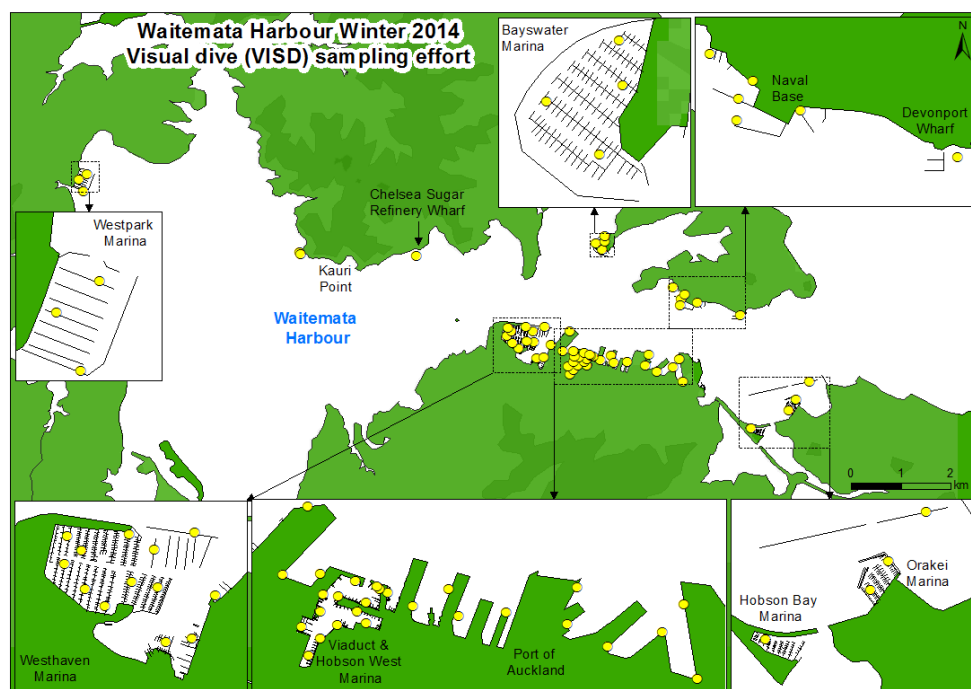
## Crab condo locations



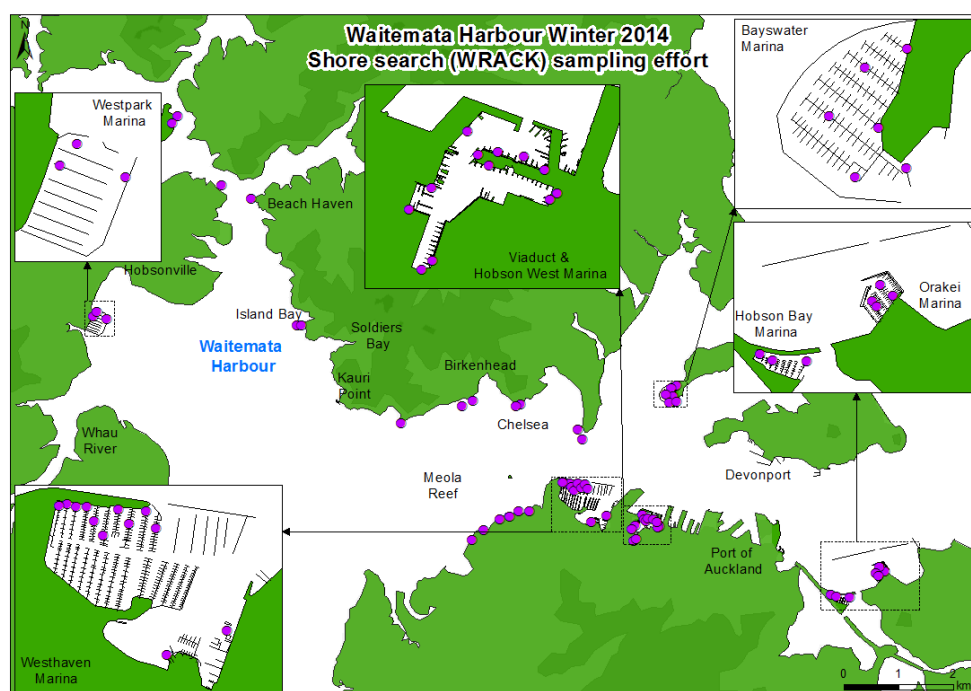
## Sledding locations



## Dive search locations

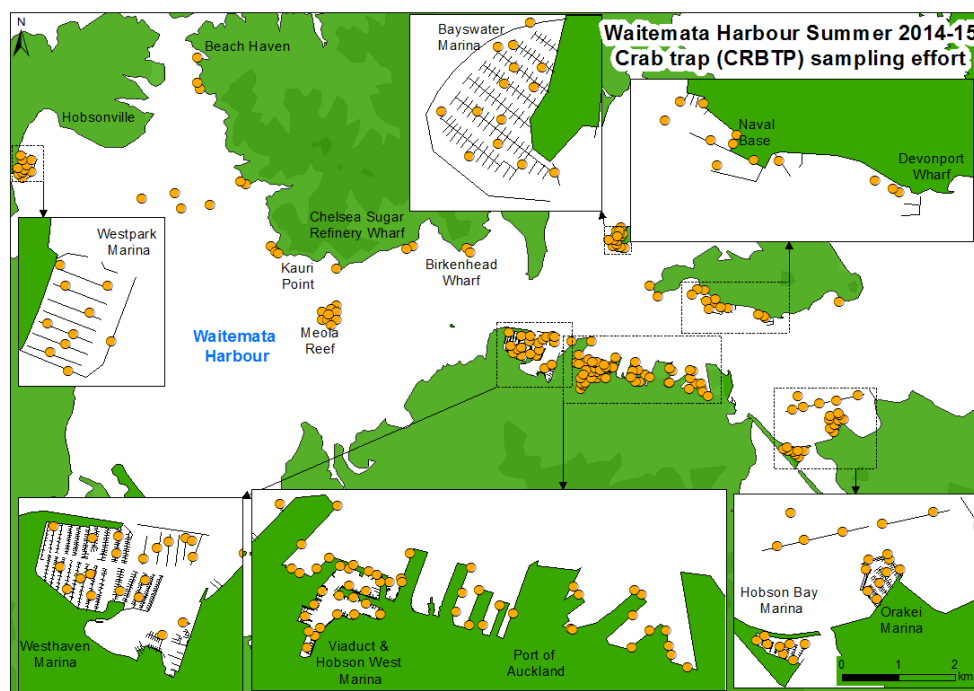


## Shore search locations

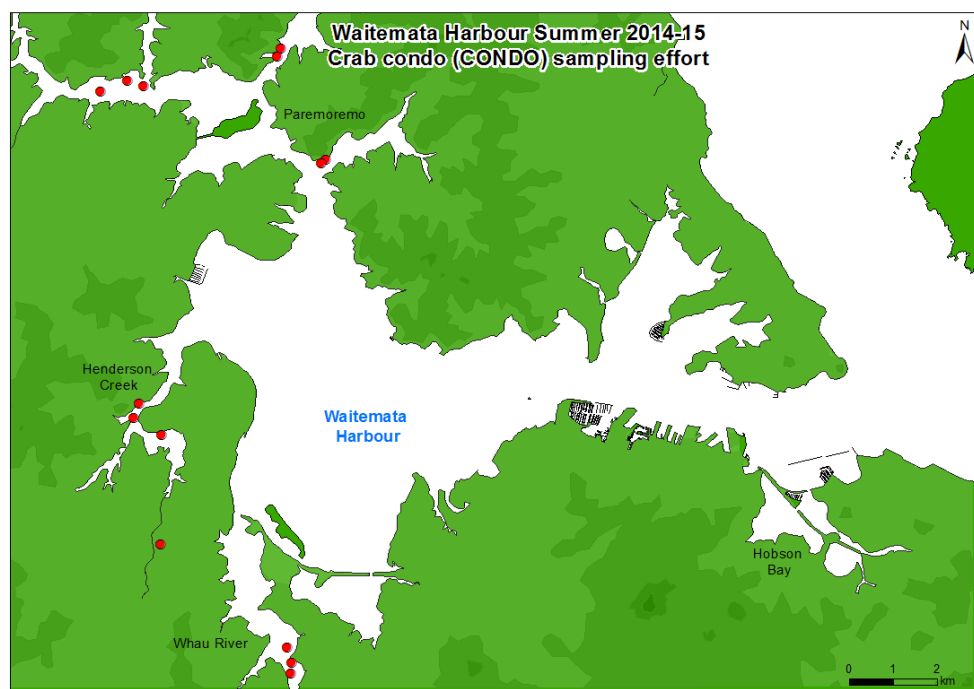


Summer 2014–15

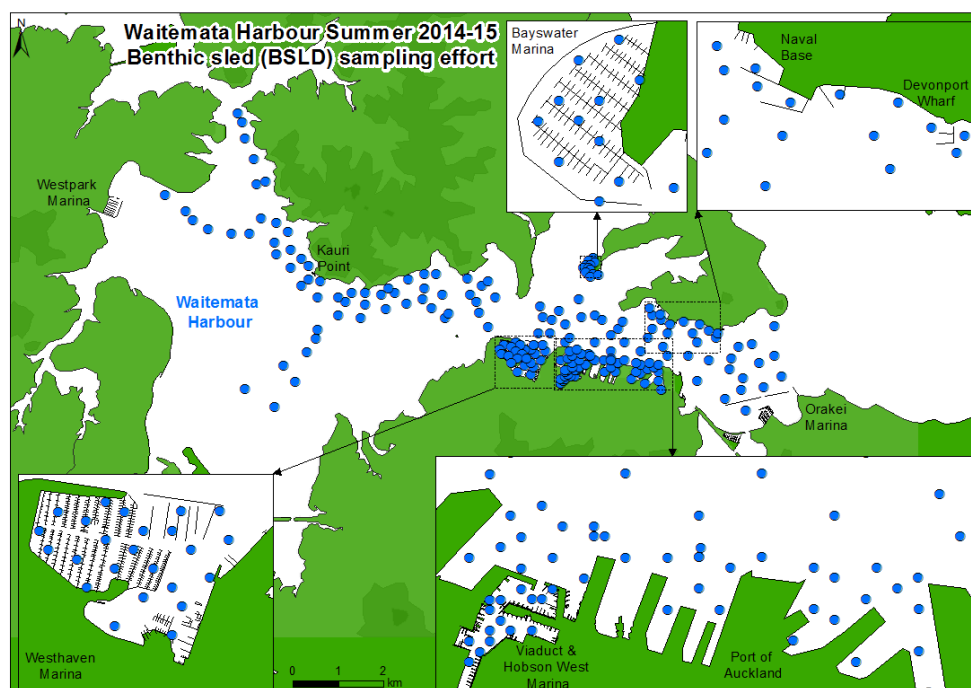
### Crab (box) trapping locations



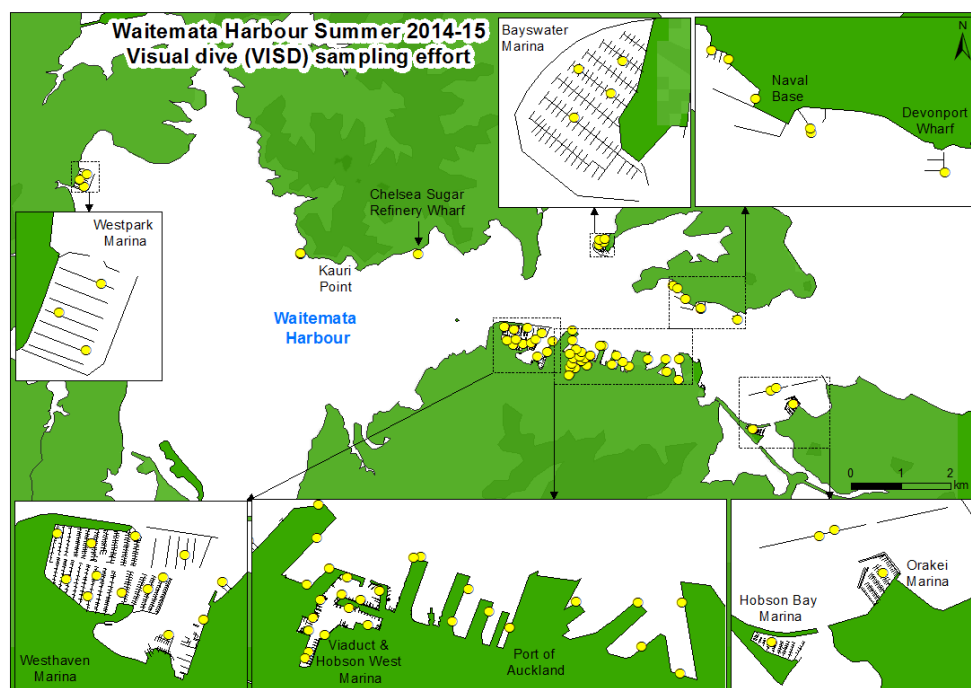
### Crab condo locations



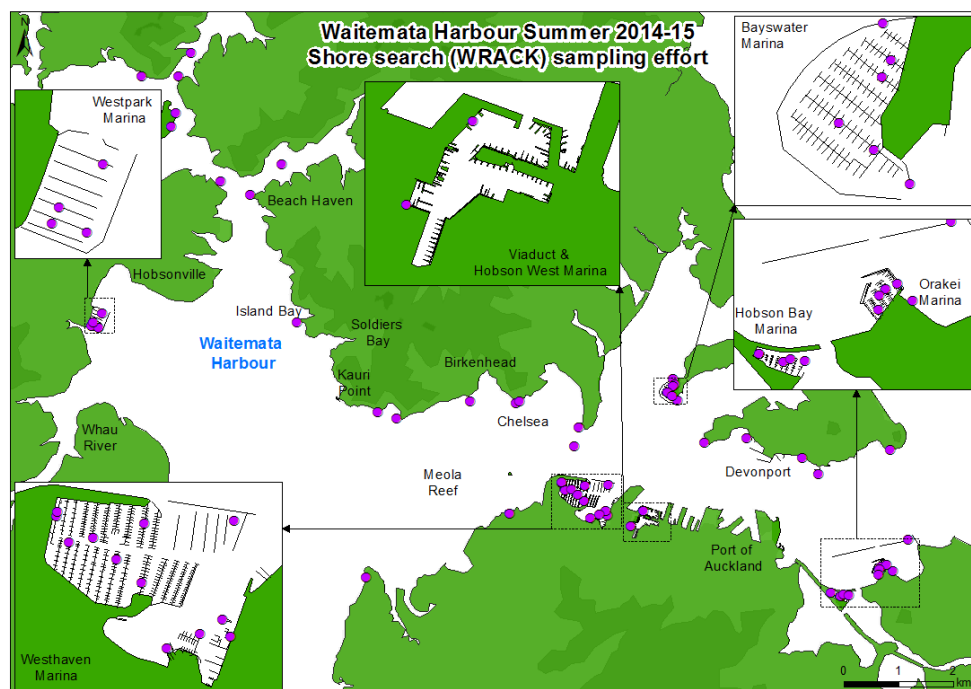
## Sledding locations



## Dive search locations



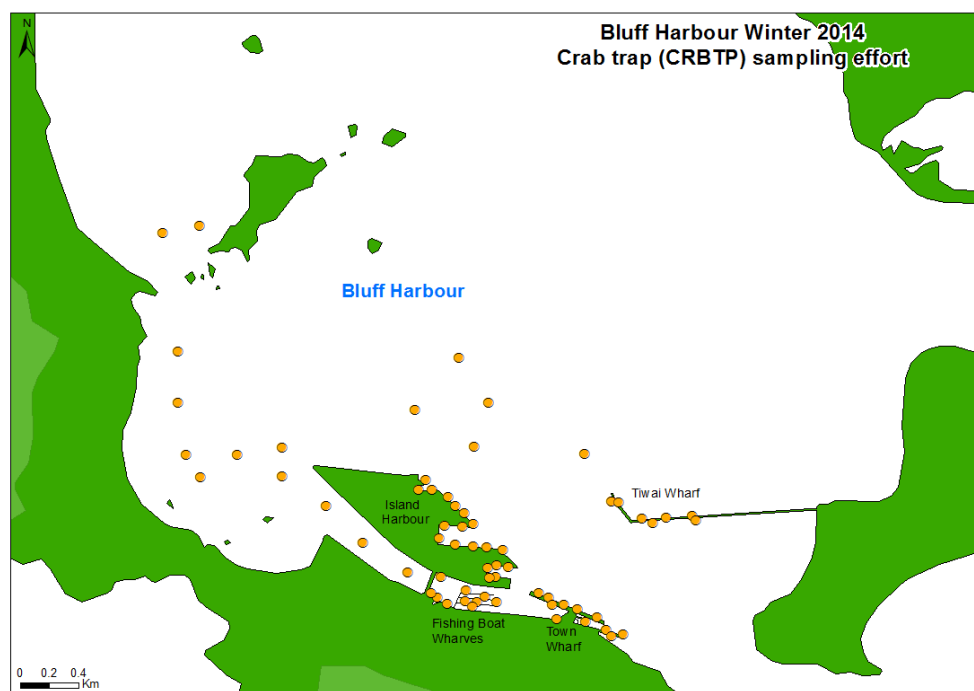
## Shore search locations



## BLUFF HARBOUR

Winter 2014

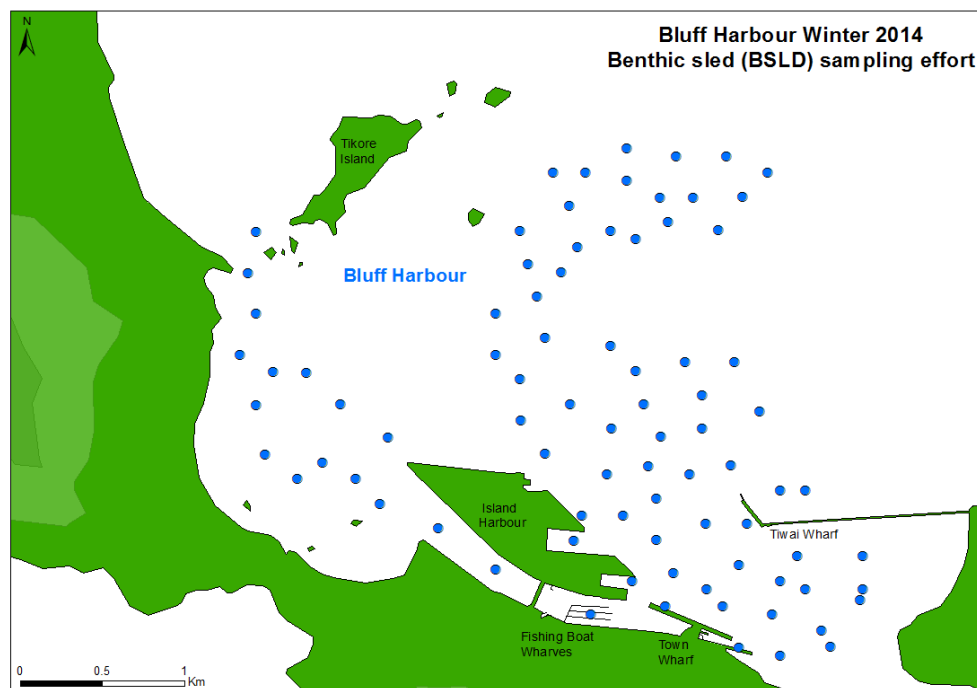
### Crab (box) trapping locations



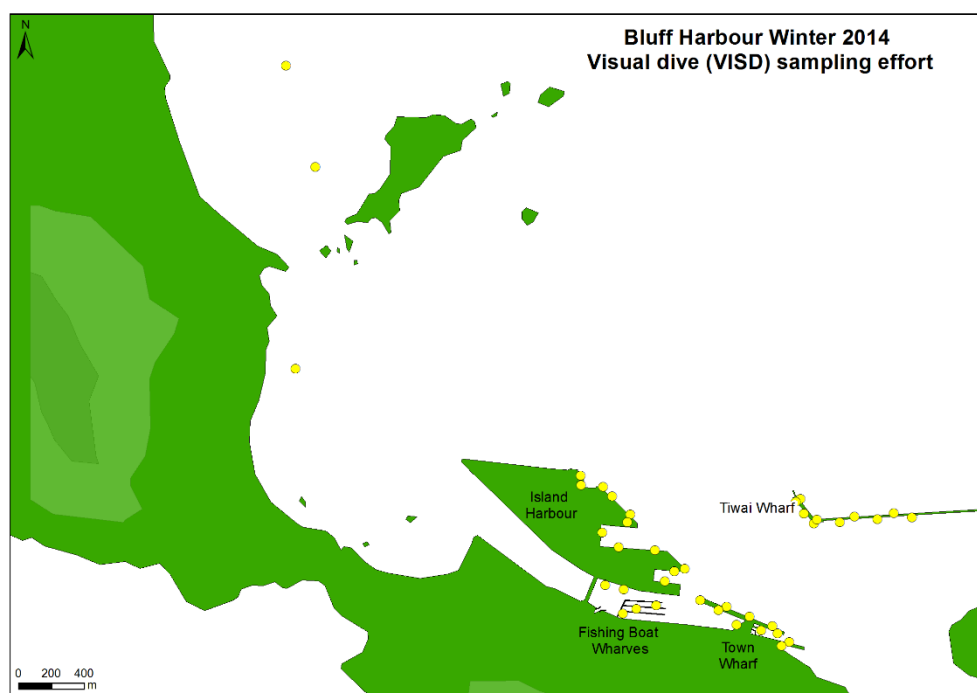
### Crab condo locations



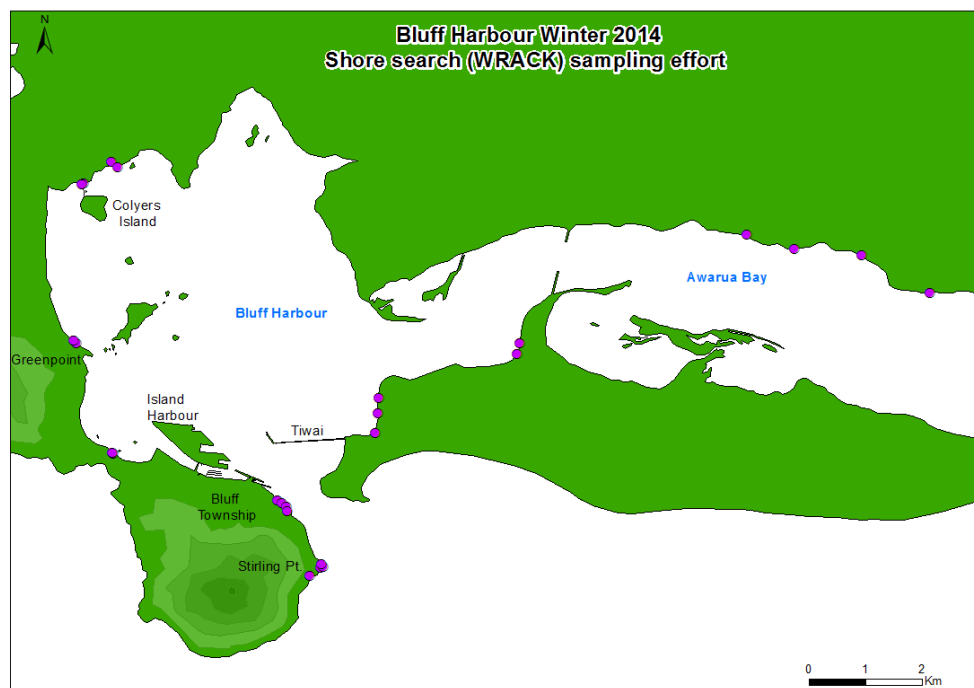
## Sledding locations



## Dive search locations

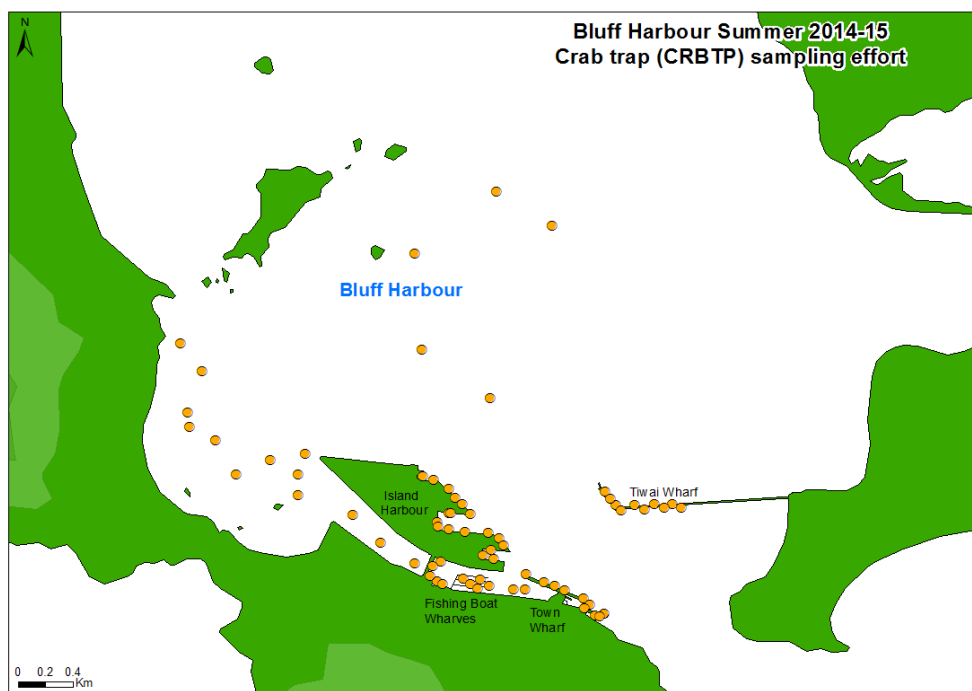


## Shore search locations

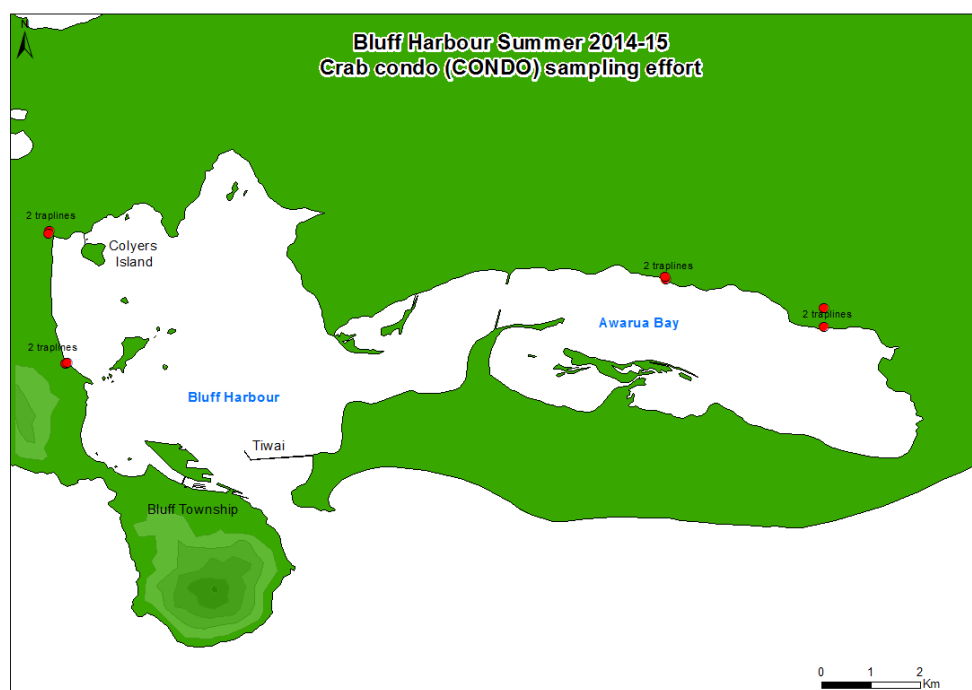


Summer 2014-15

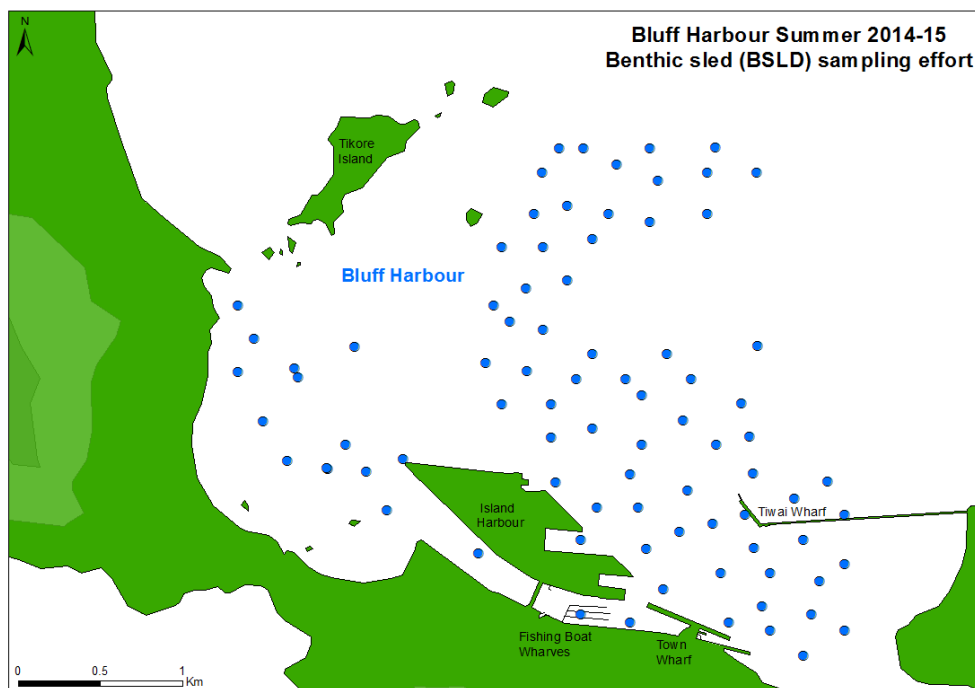
### Crab (box) trapping locations



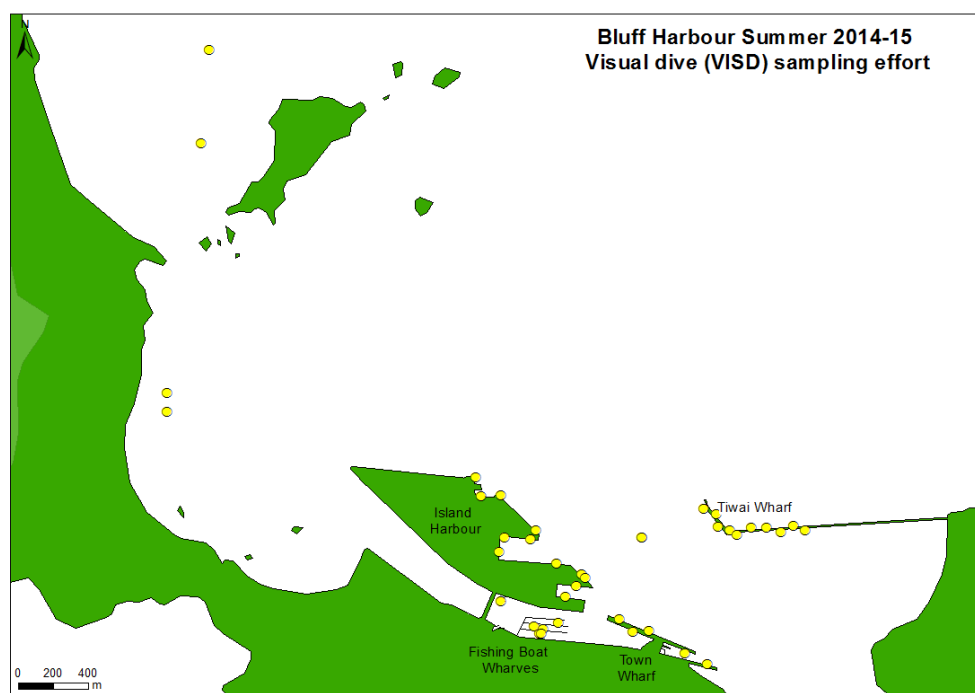
### Crab condo locations



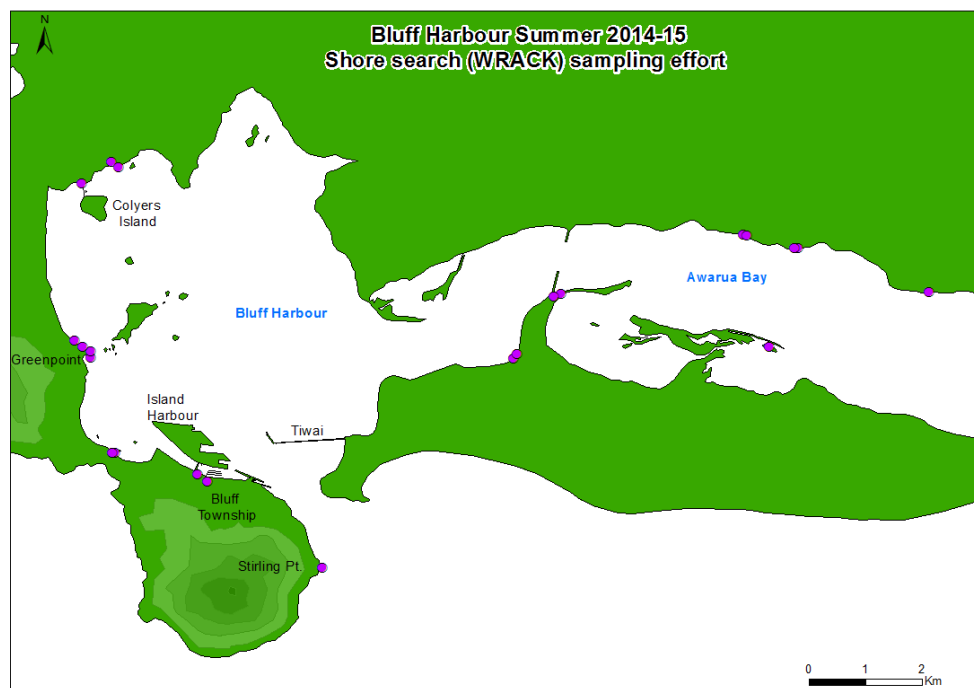
## Sledding locations



## Dive search locations



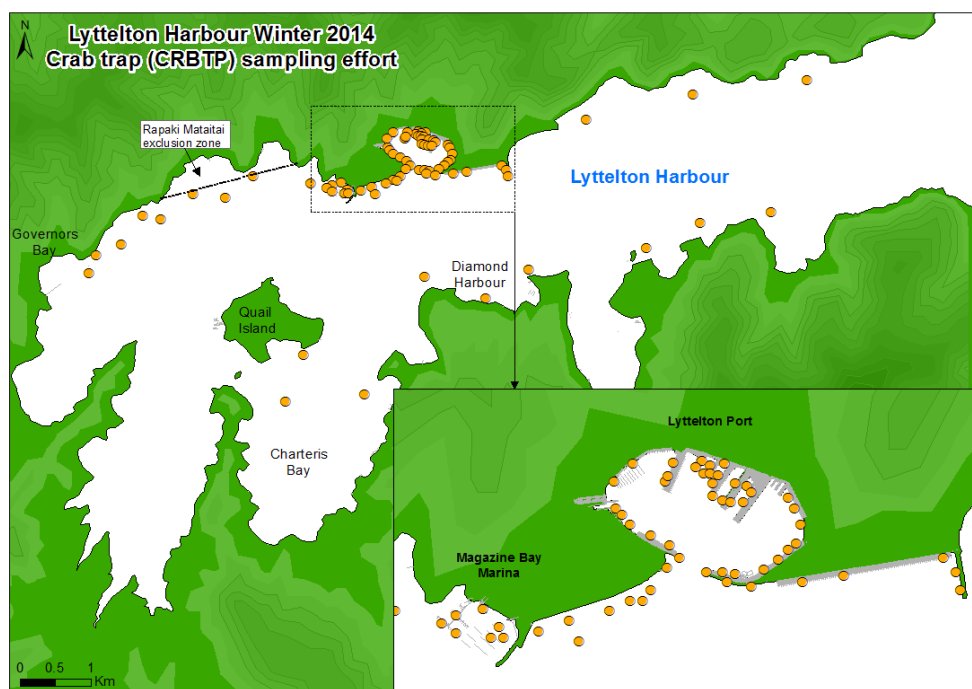
## Shore search locations



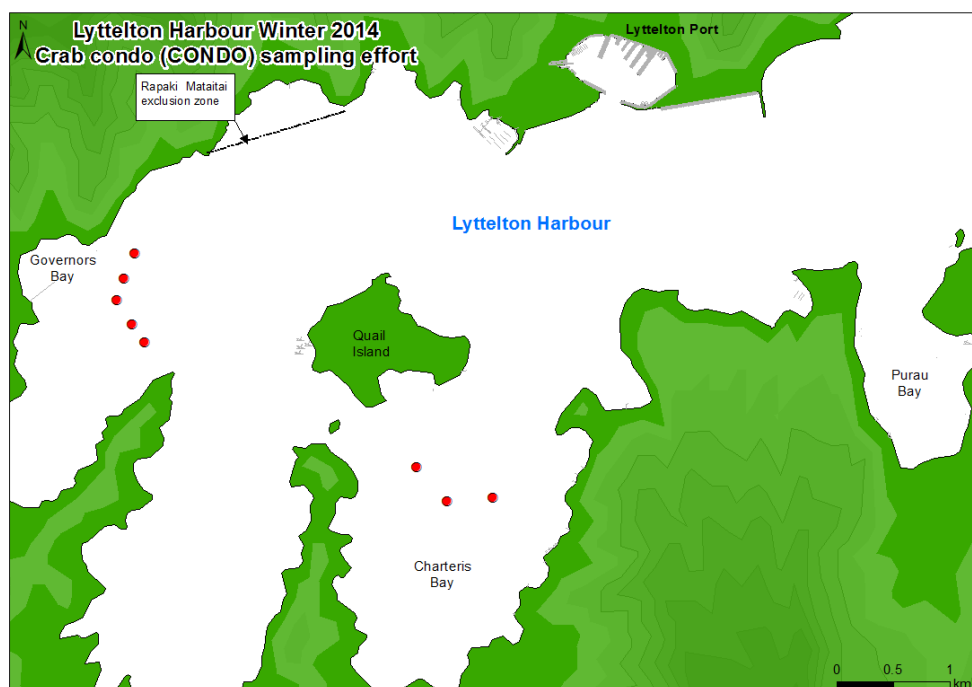
## LYTTELTON HARBOUR

Winter 2014

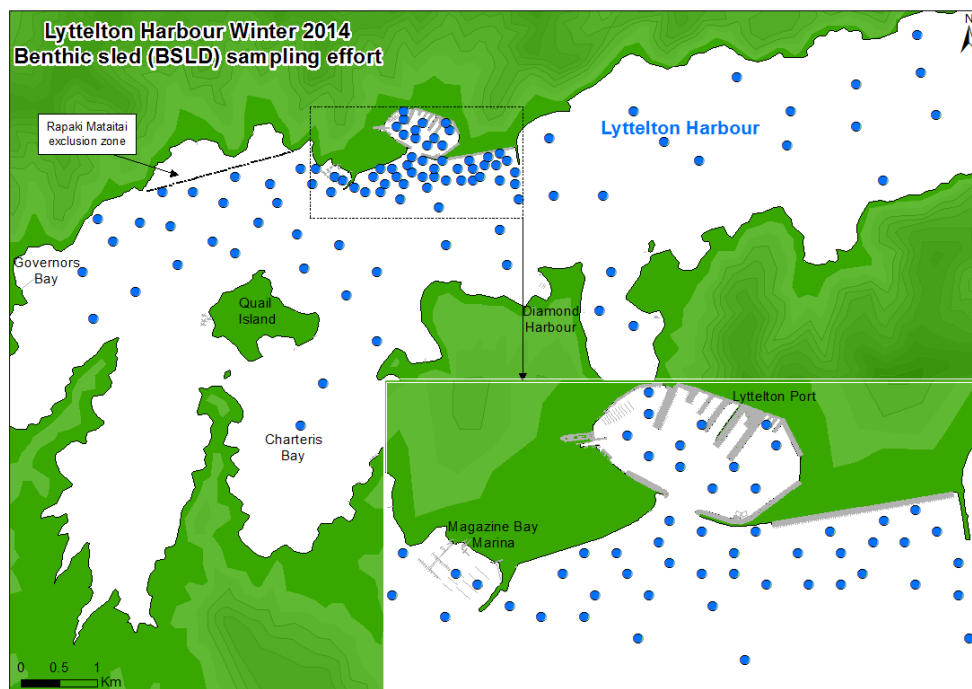
### Crab (box) trapping locations



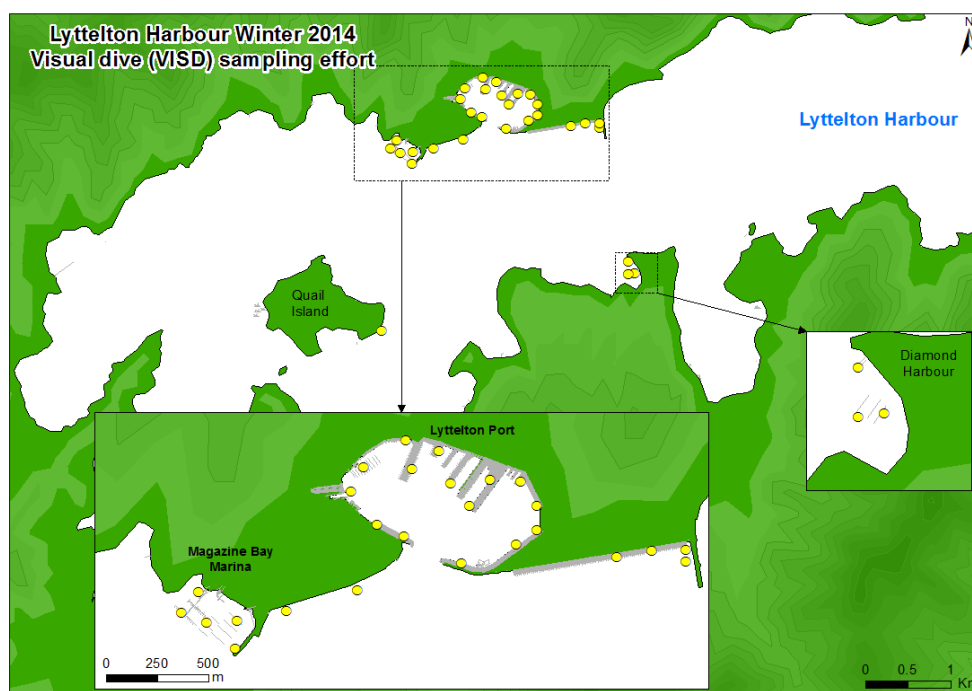
### Crab condo locations



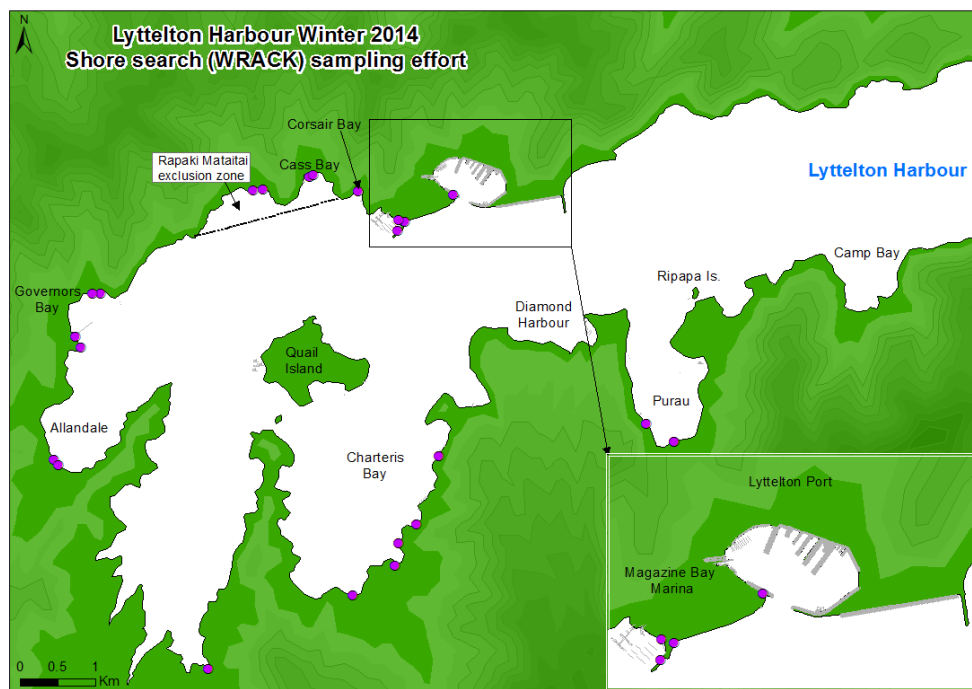
## Sledding locations



## Dive search locations

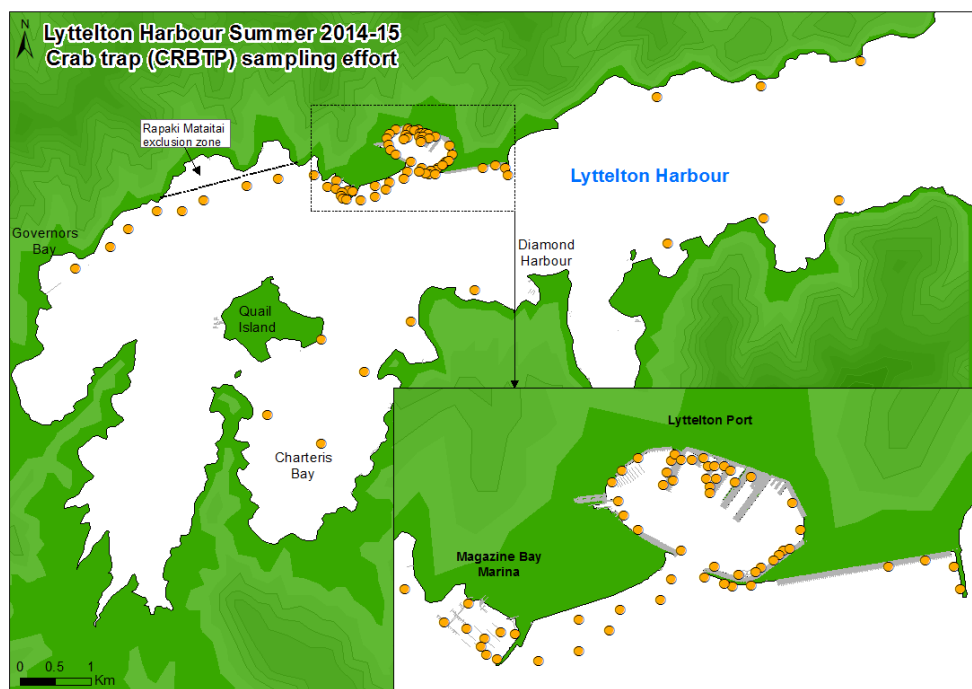


## Shore search locations

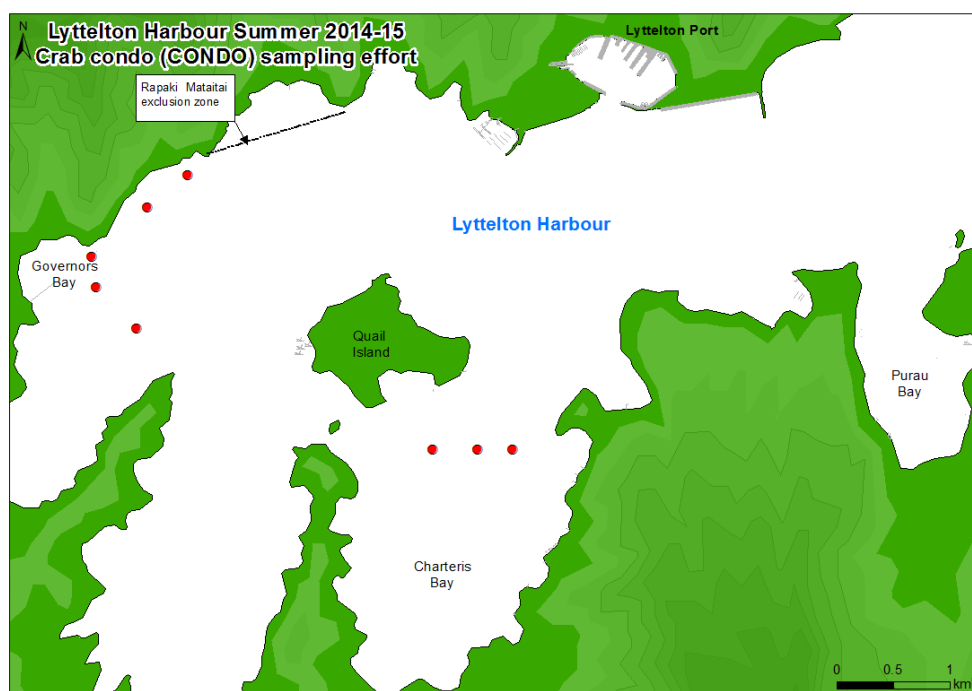


Summer 2014–15

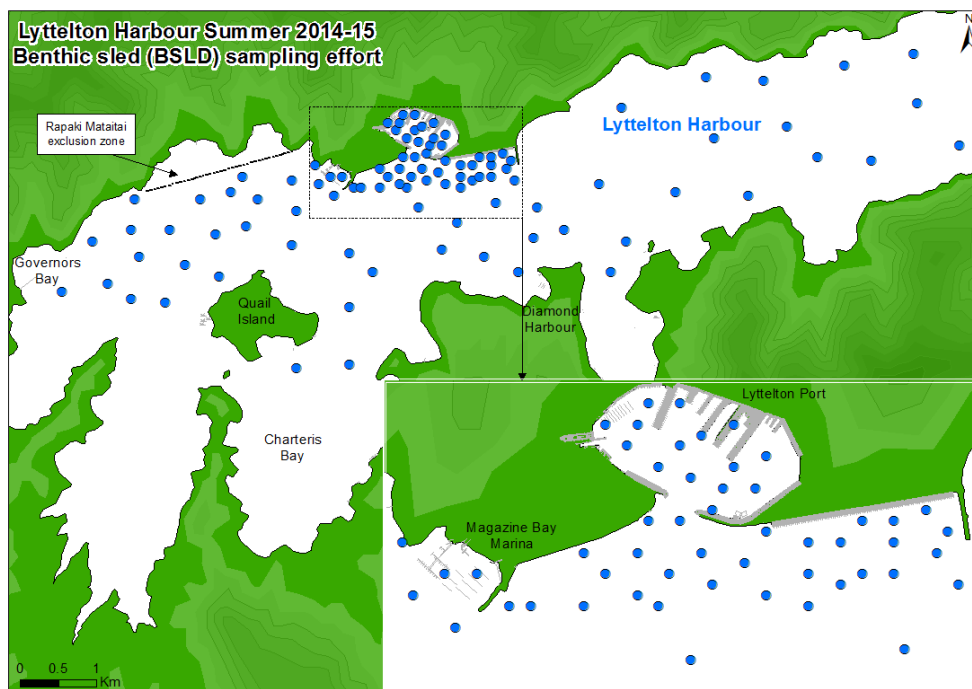
### Crab (box) trapping locations



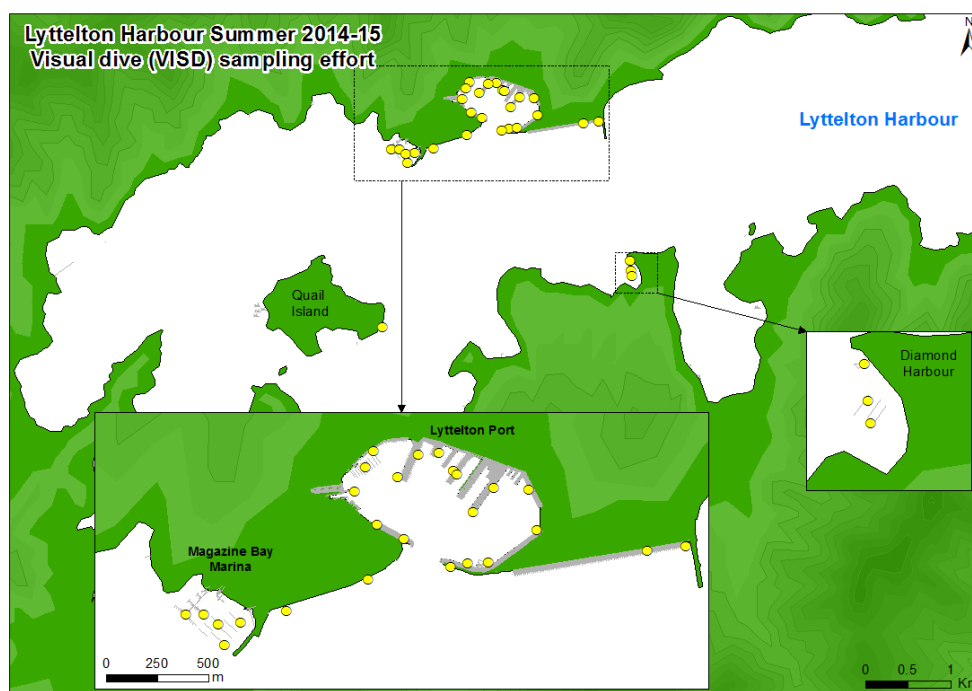
### Crab condo locations



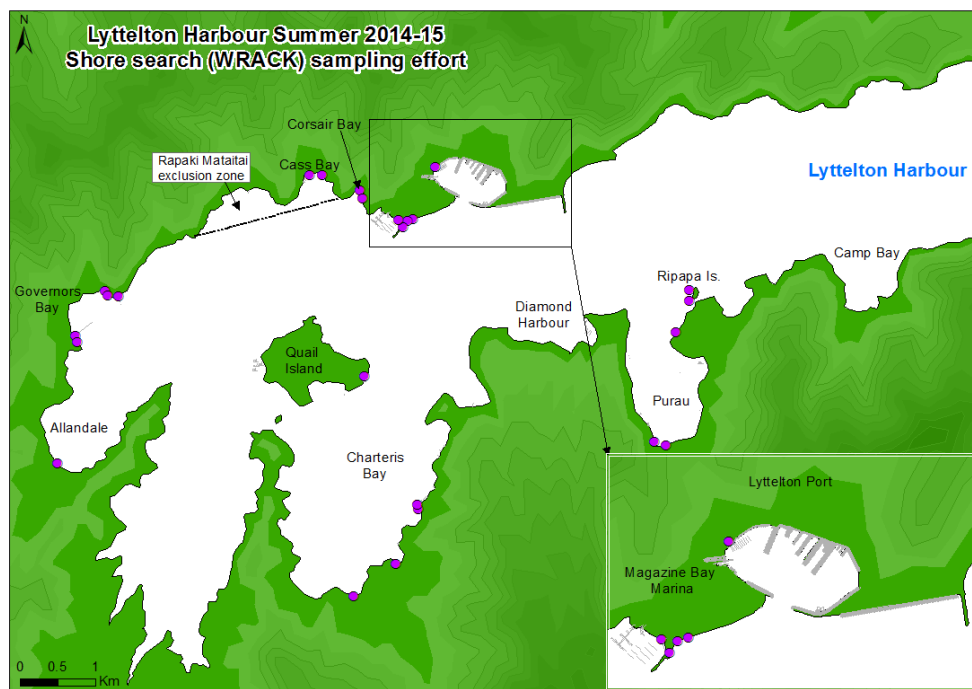
## Sledding locations



## Dive search locations



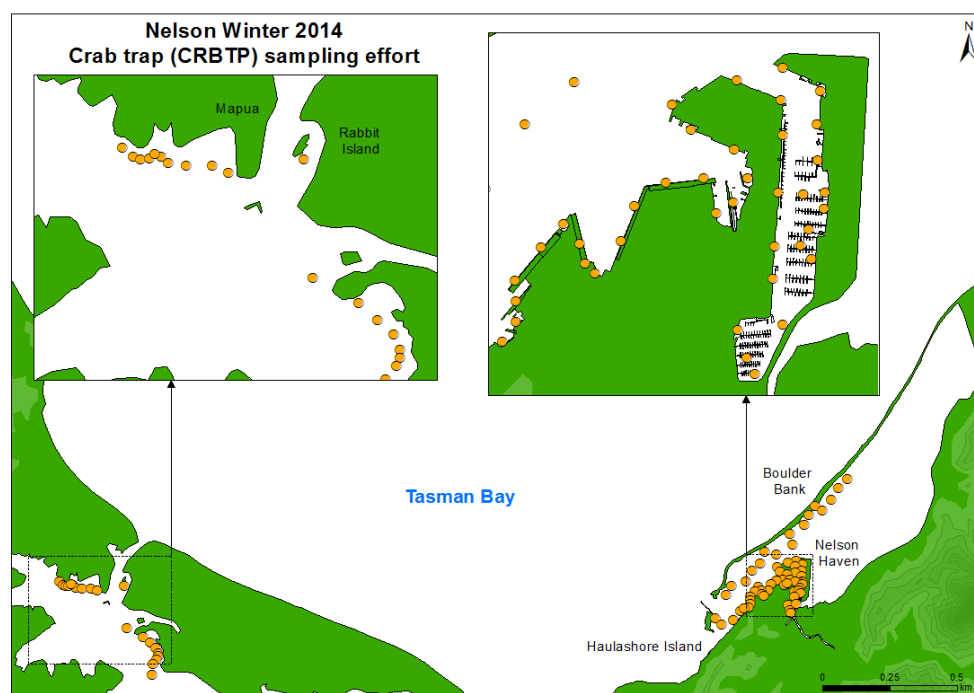
## Shore search locations



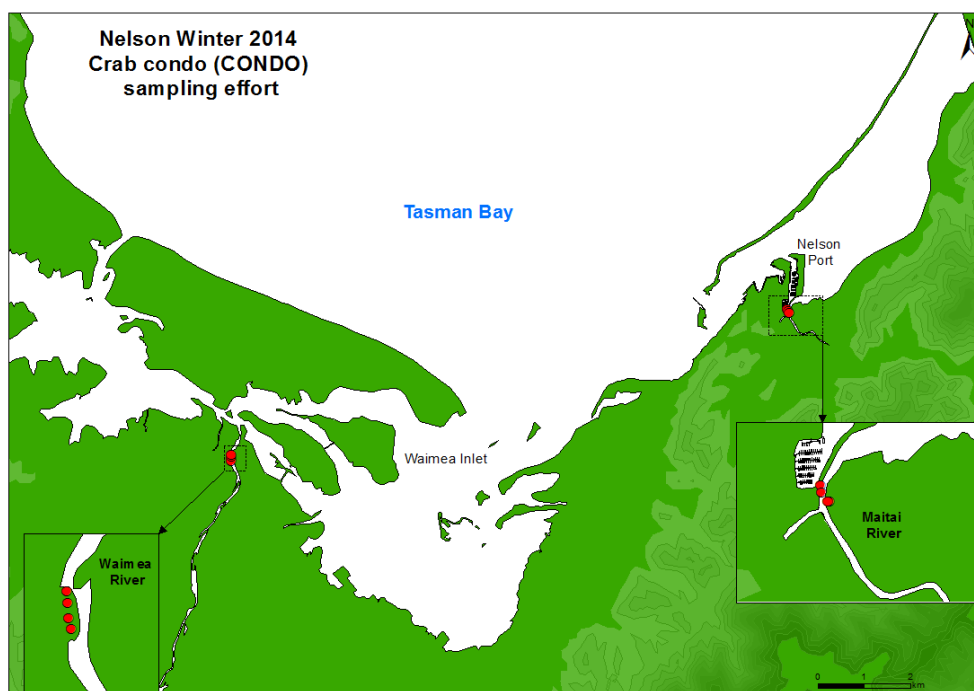
## NELSON HARBOUR

Winter 2014

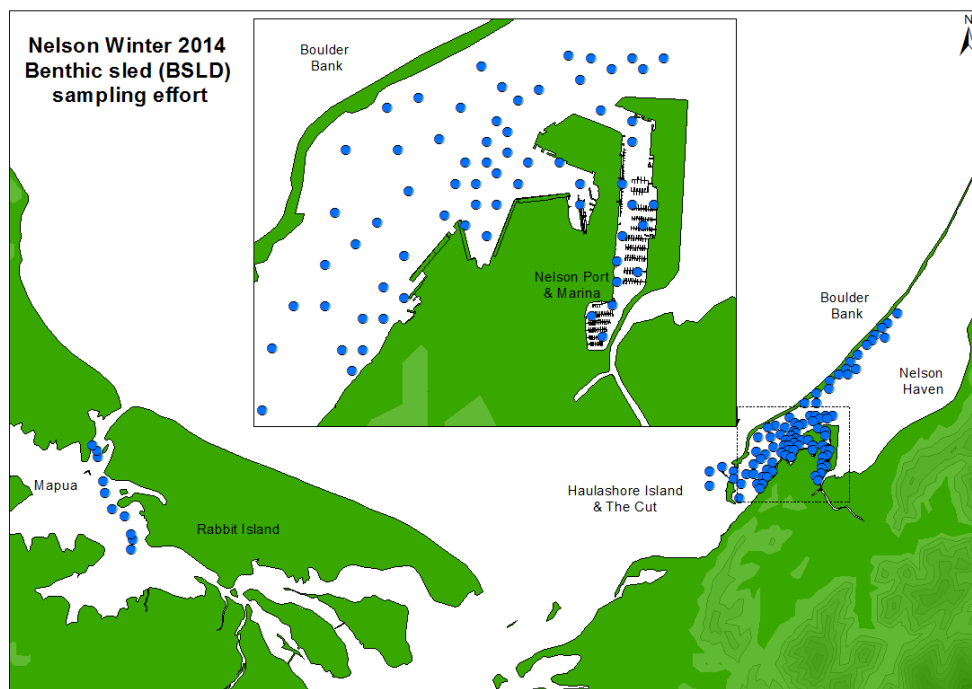
### Crab (box) trapping locations



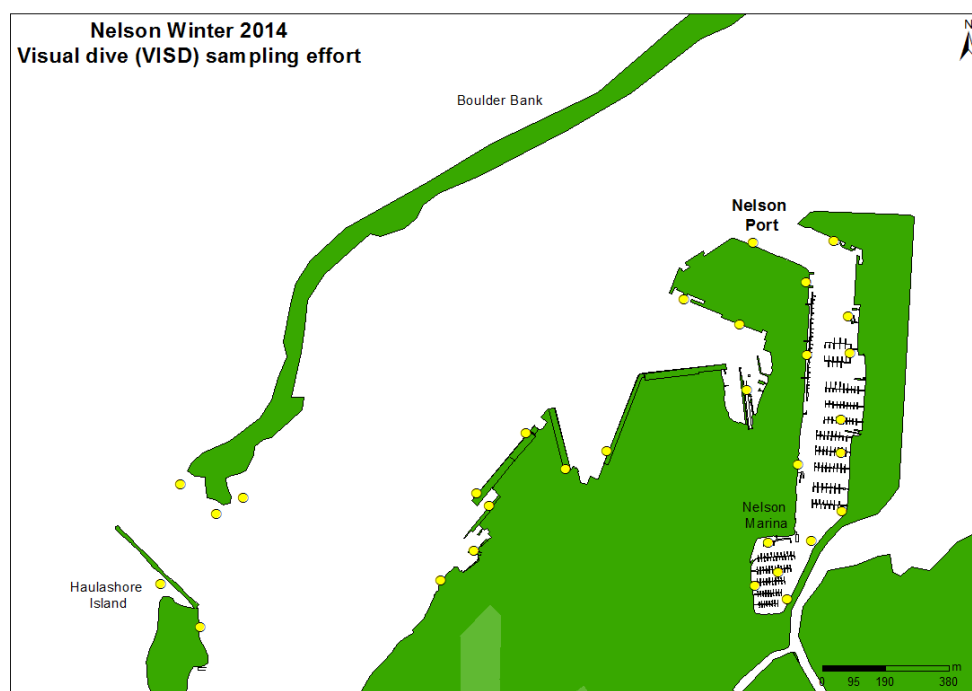
### Crab condo locations



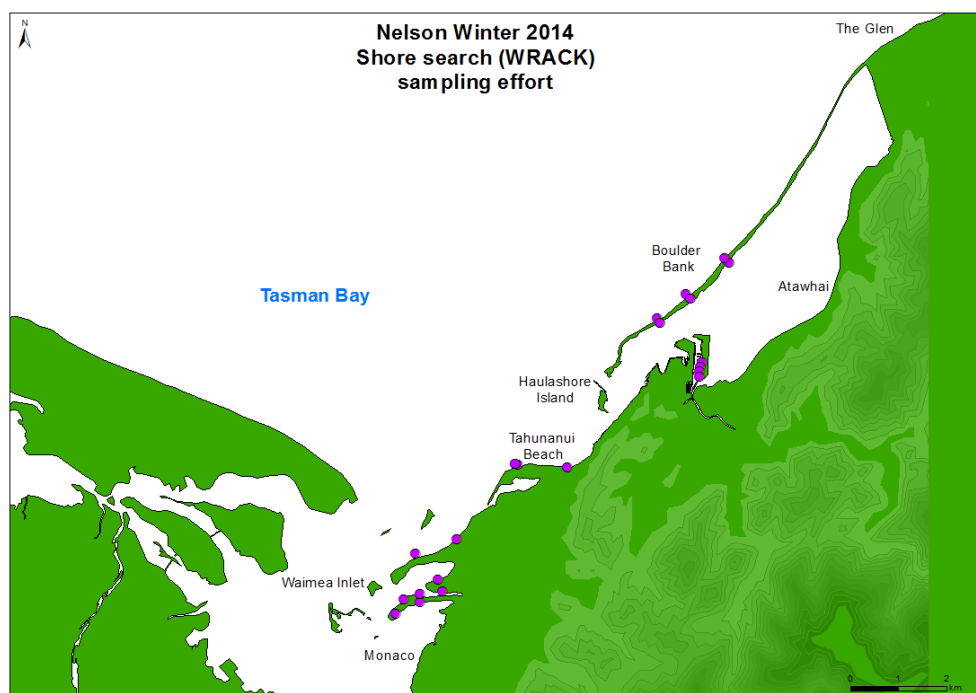
## Sledding locations



## Dive search locations

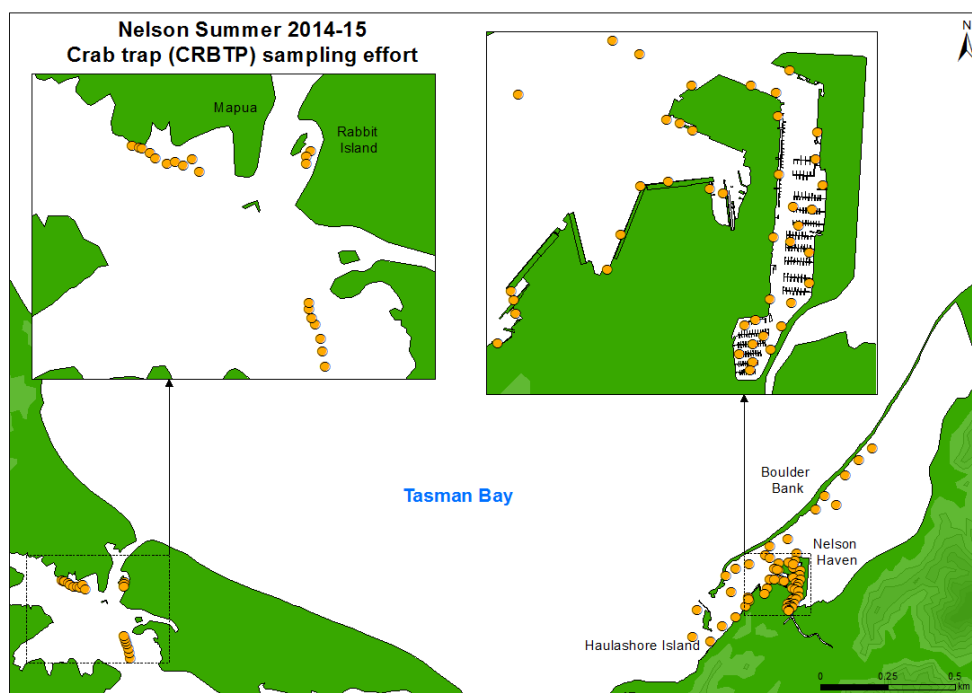


## Shore search locations

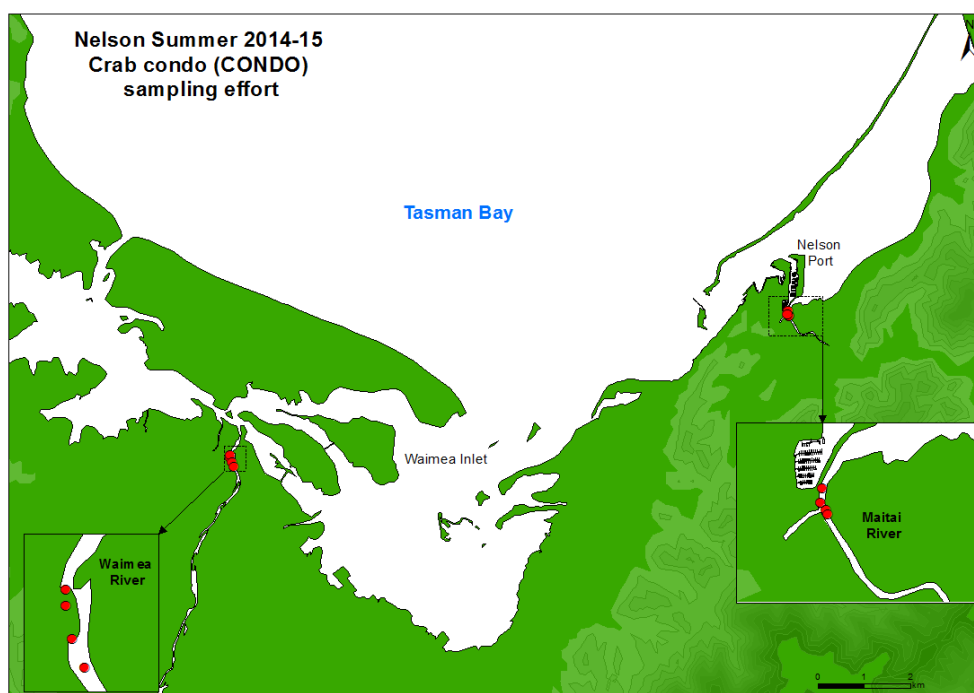


Summer 2014–15

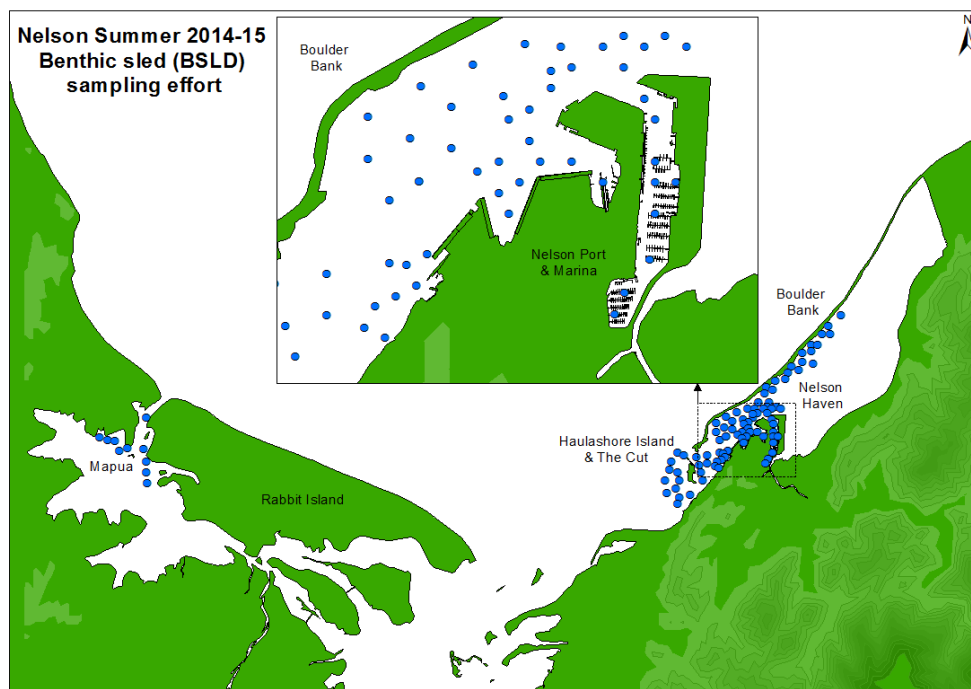
### Crab (box) trapping locations



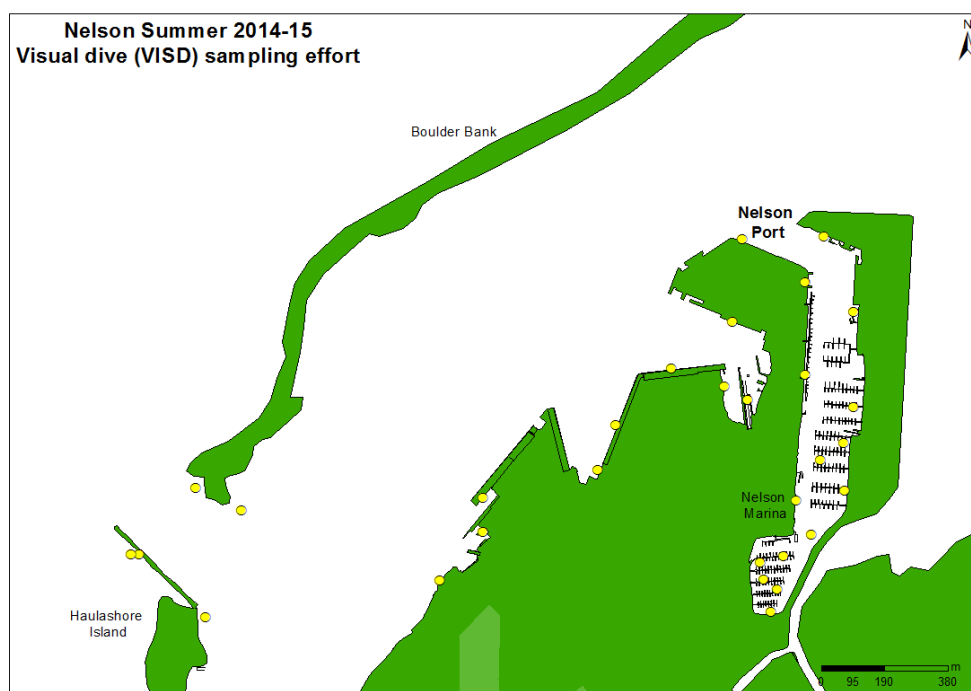
### Crab condo locations



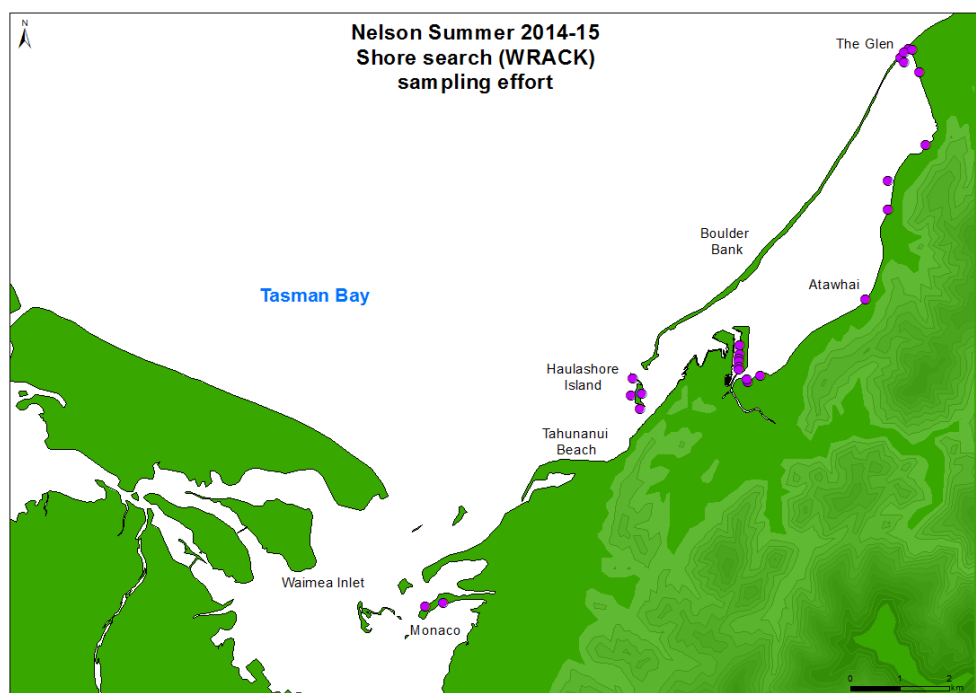
## Sledding locations



## Dive search locations



## Shore search locations



## OPUA

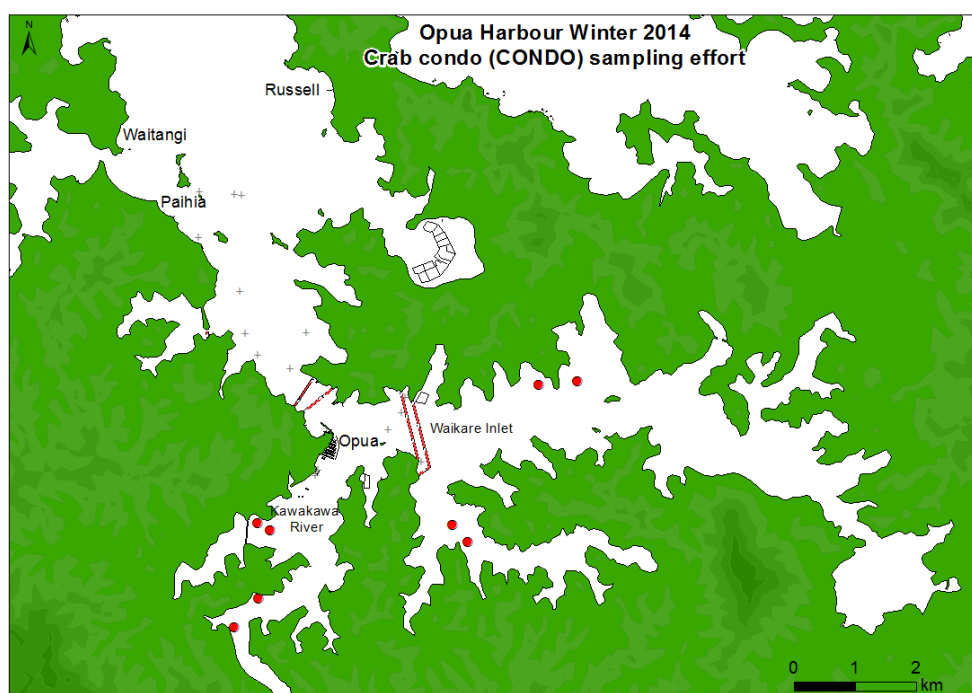
Note: grey crosses indicate navigational markers

Winter 2014

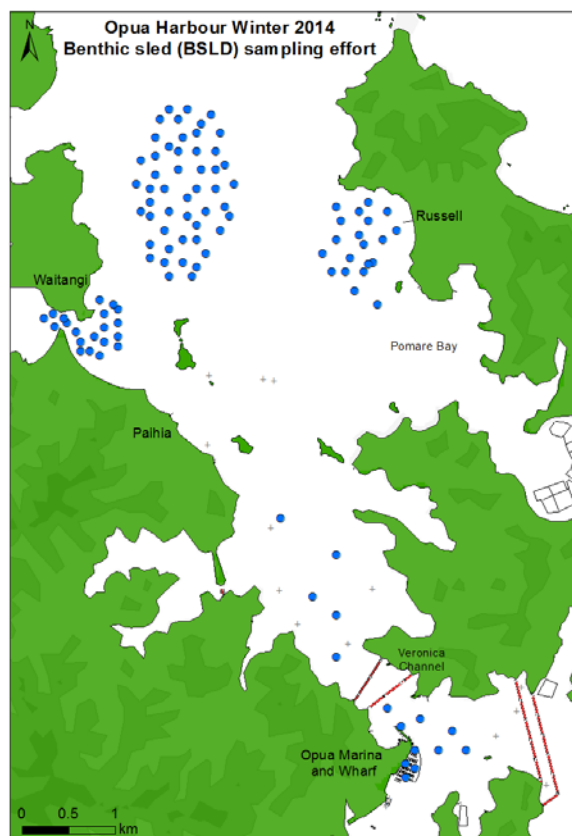
### Crab (box) trapping locations



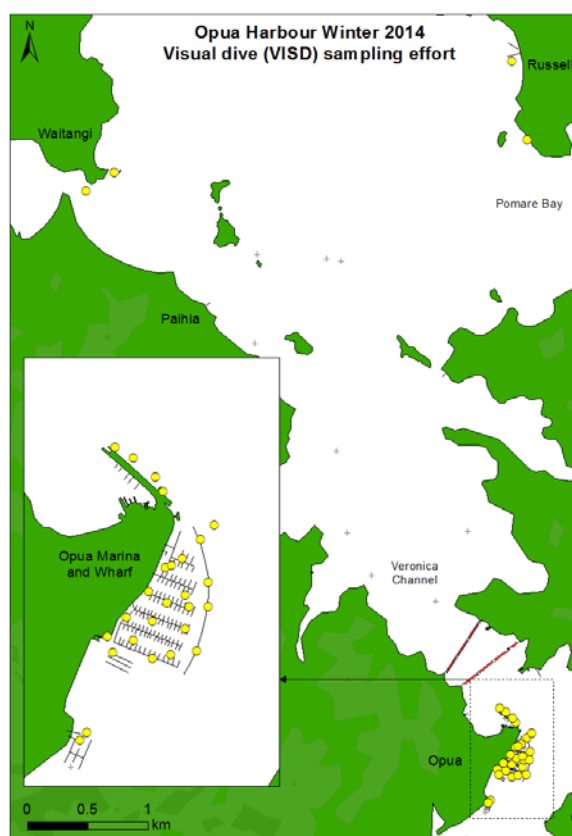
### Crab condo locations



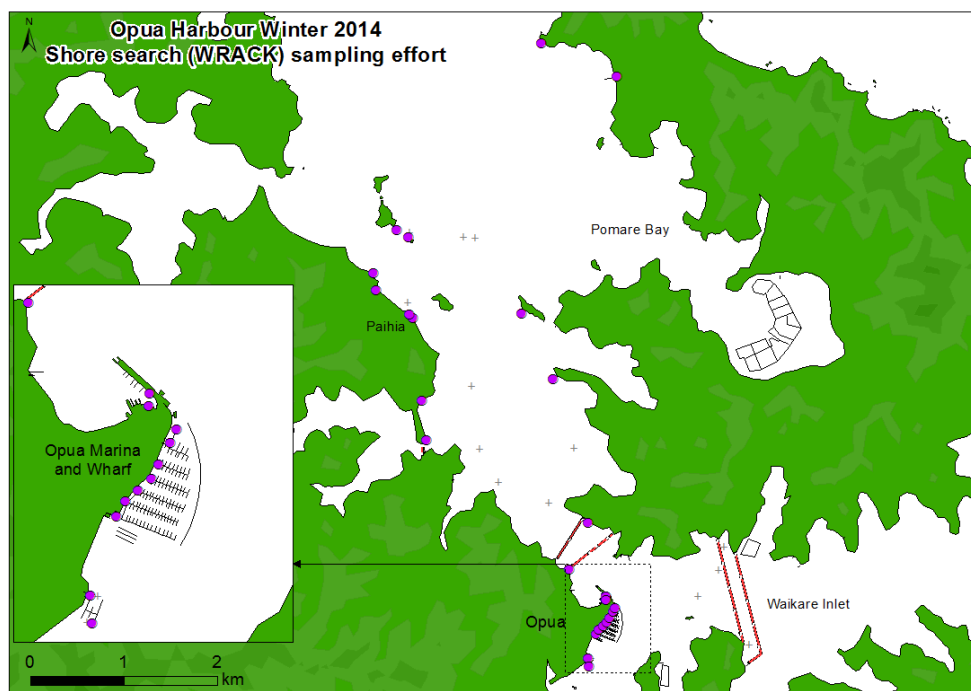
## Sledding locations



## Dive search locations



## Shore search locations

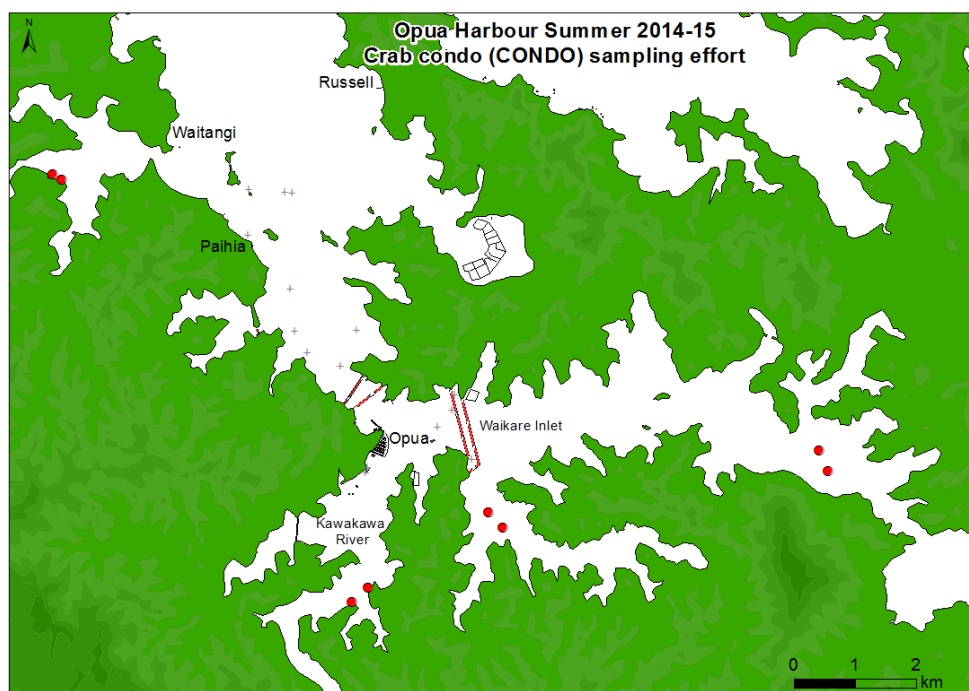


Summer 2014–15

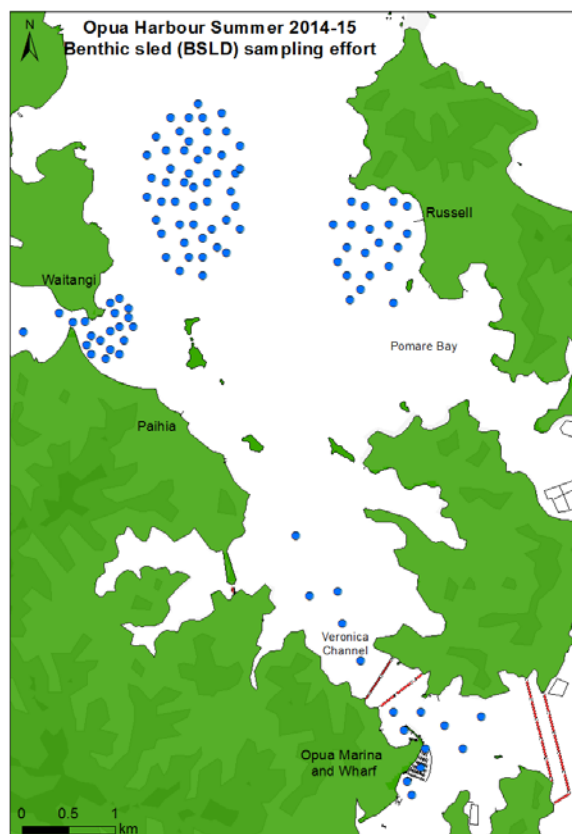
### Crab (box) trapping locations



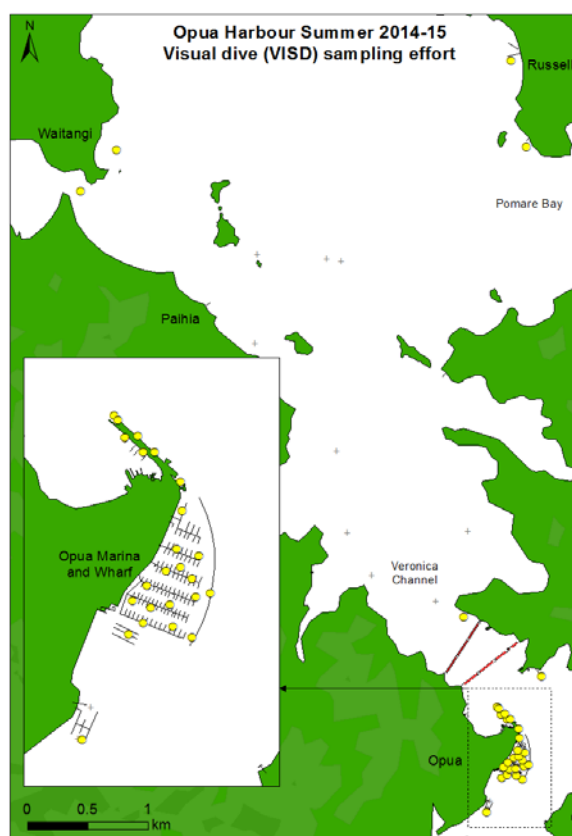
### Crab condo locations



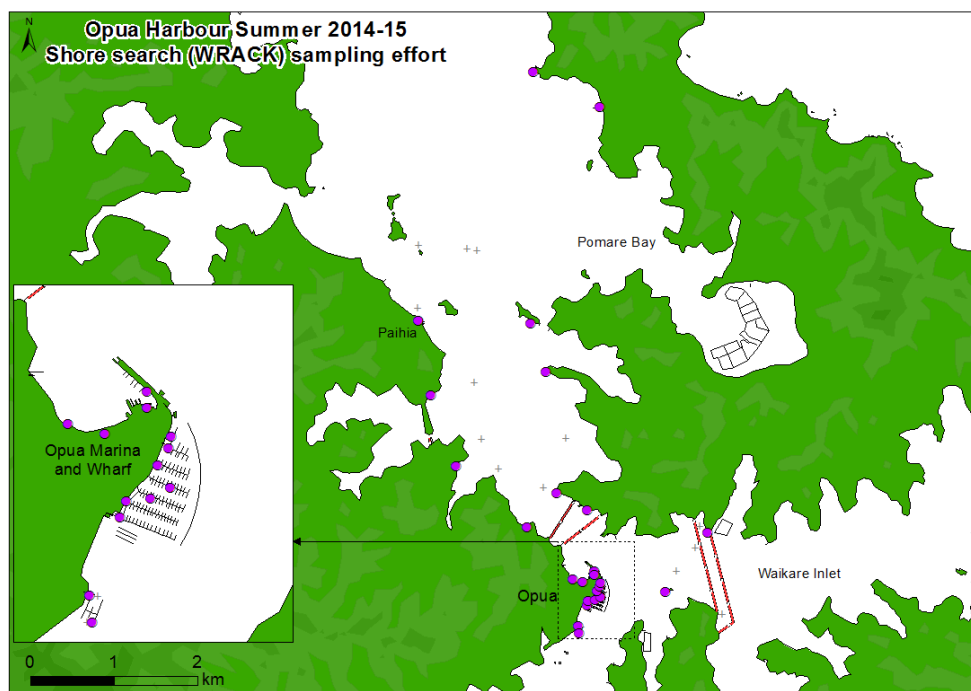
## Sledding locations



## Dive search locations



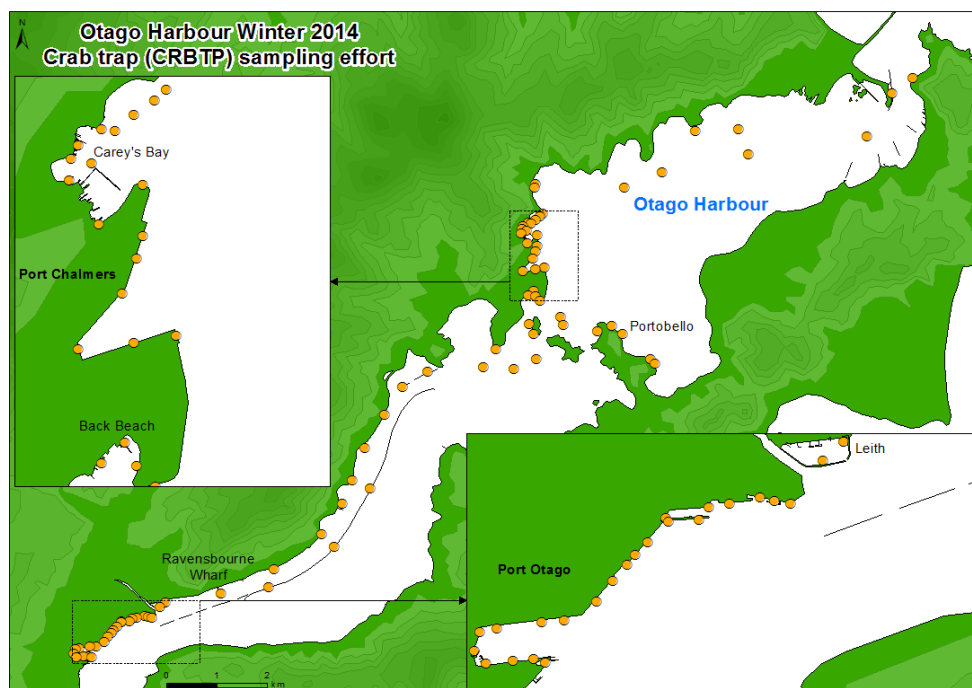
## Shore search locations



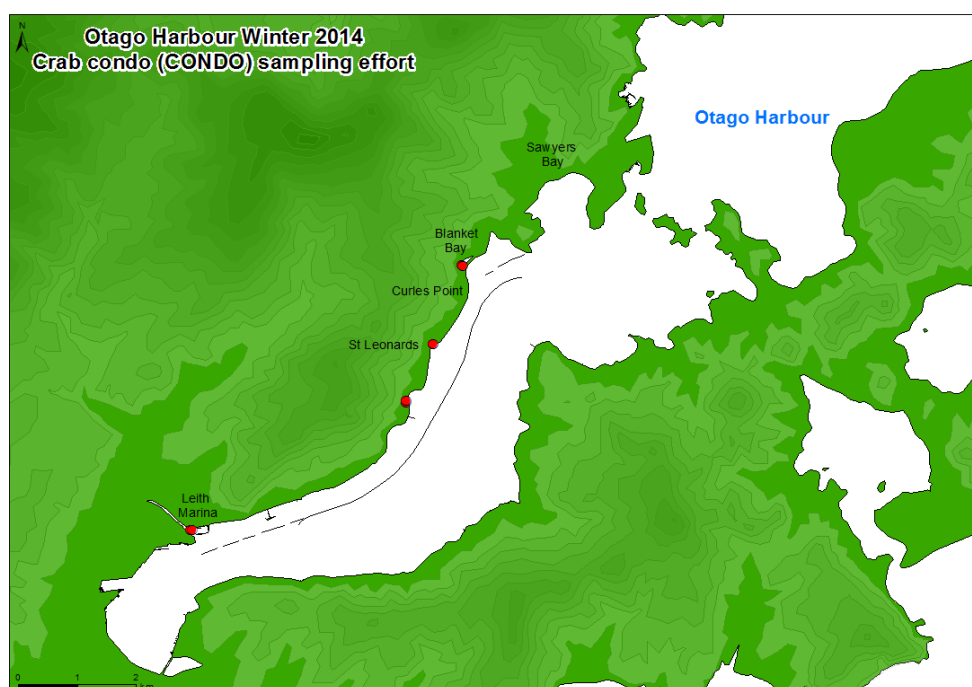
# OTAGO HARBOUR

Winter 2014

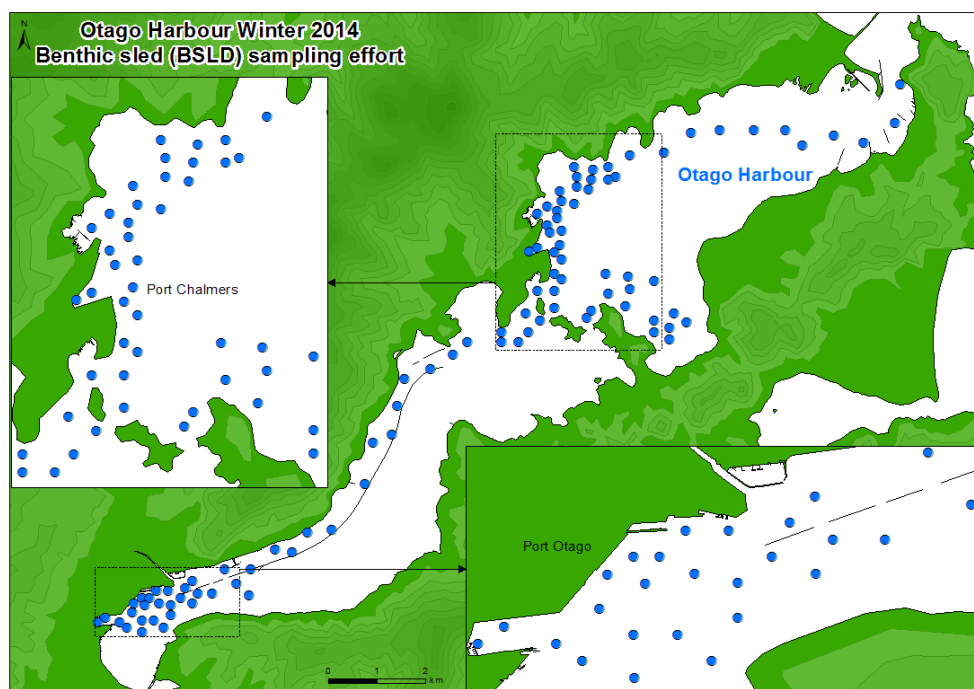
## Crab (box) trapping locations



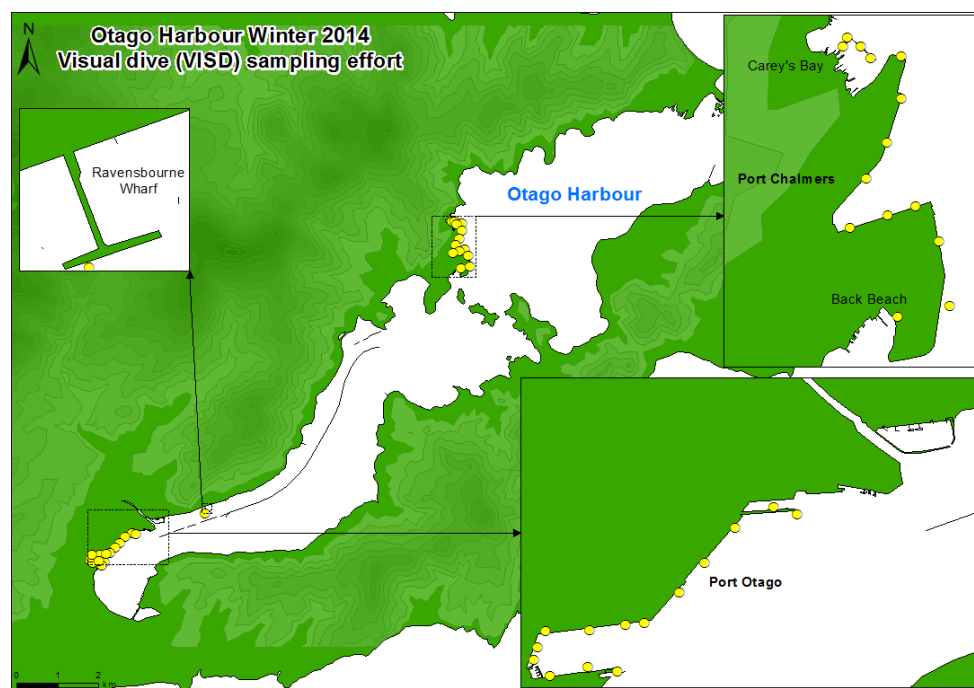
## Crab condo locations



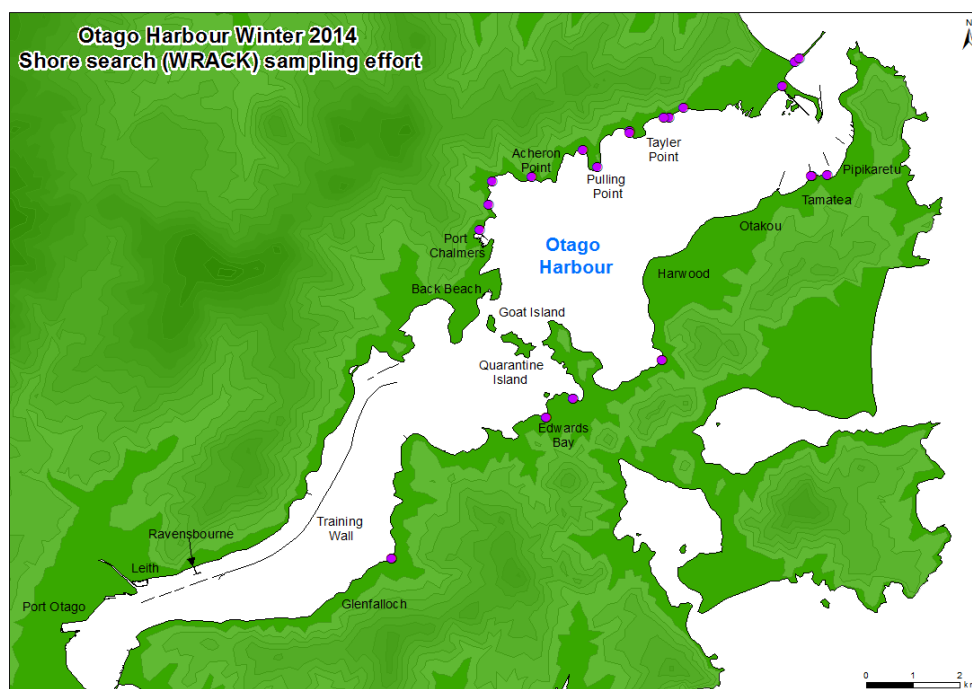
## Sledding locations



## Dive search locations

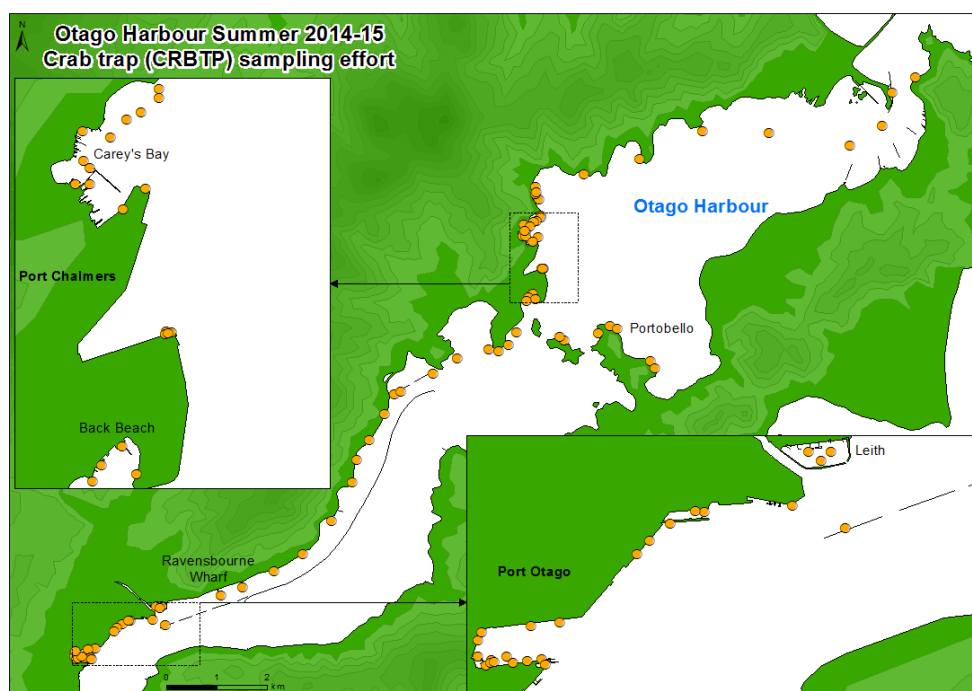


## Shore search locations

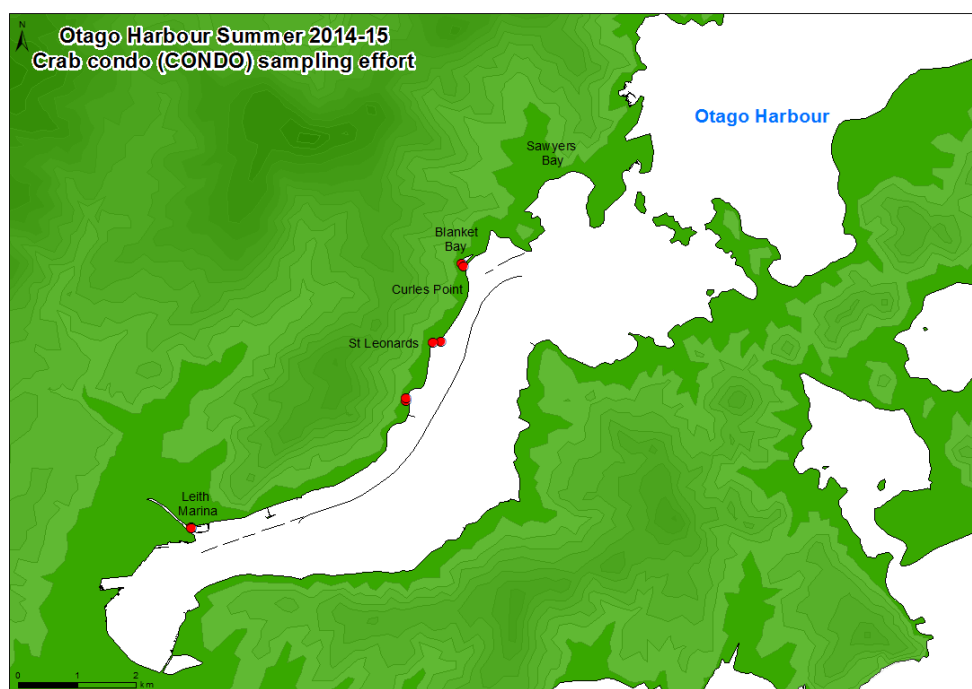


Summer 2014–15

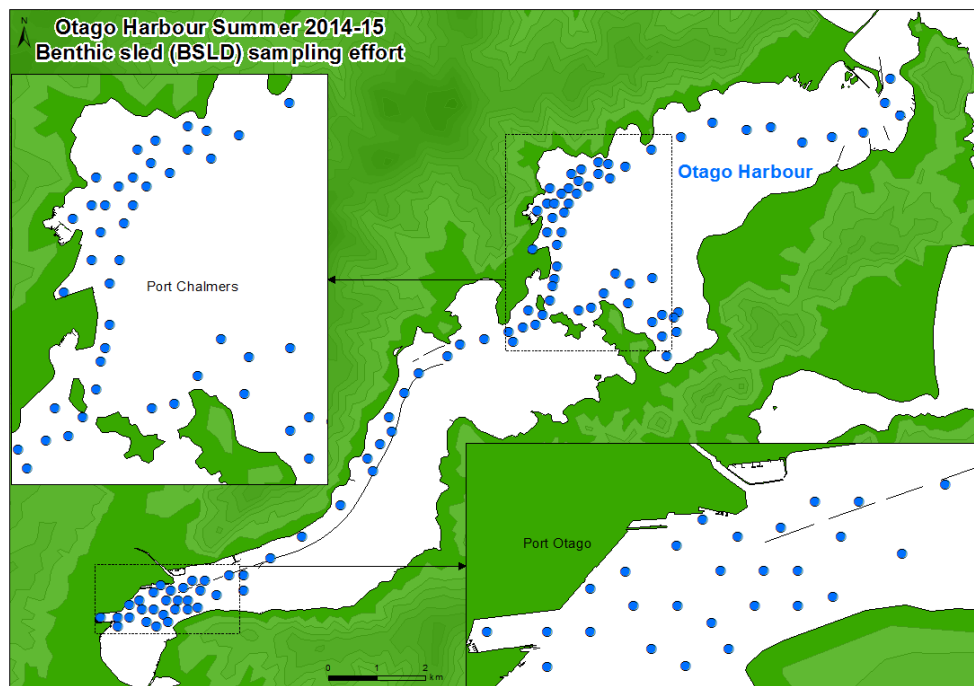
### Crab (box) trapping locations



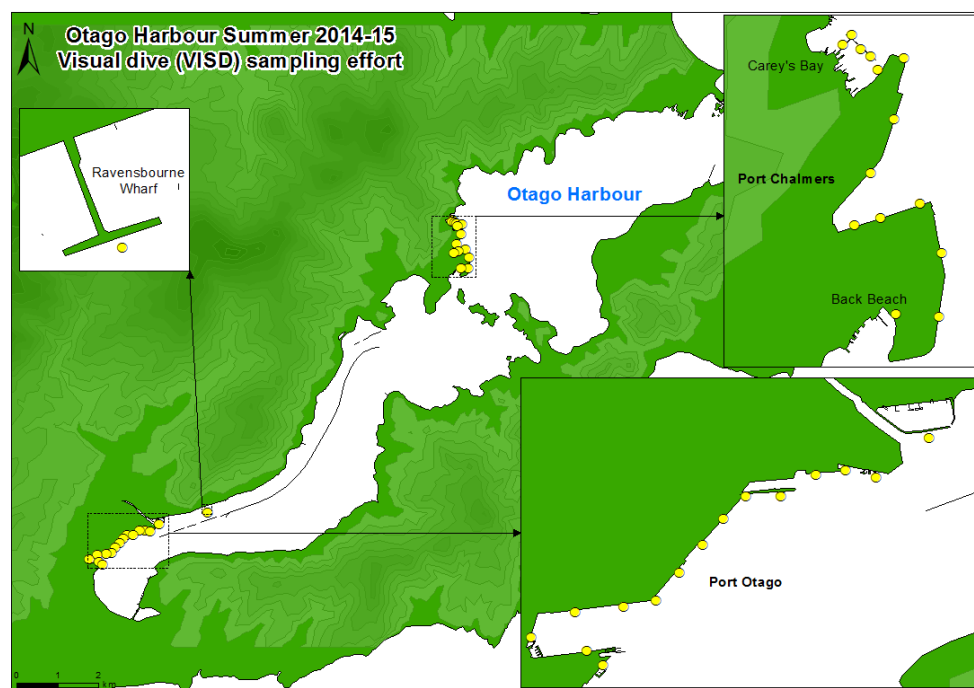
### Crab condo locations



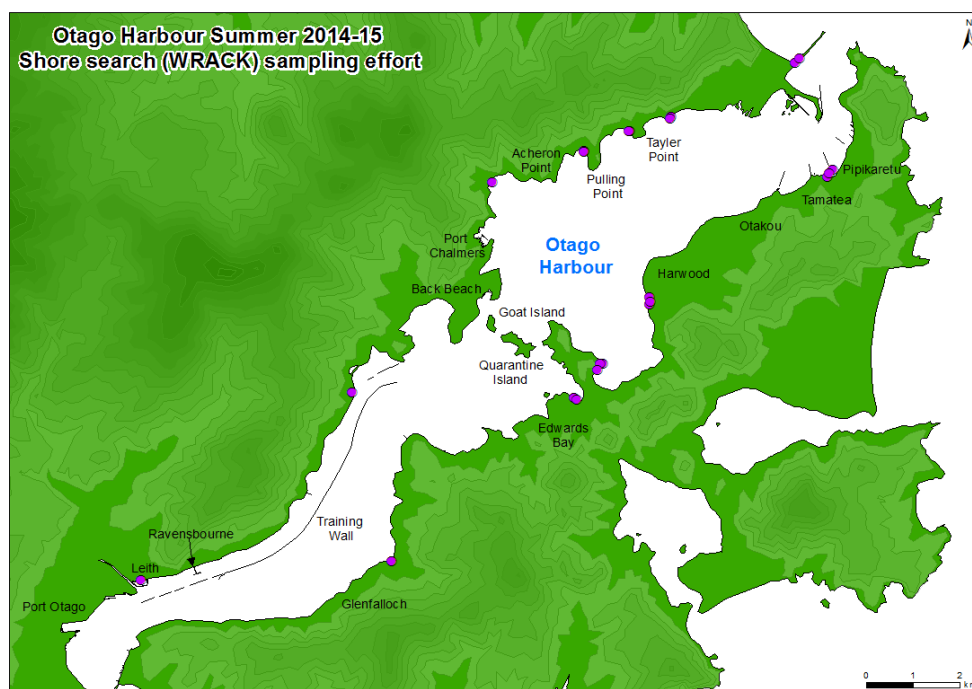
## Sledding locations



## Dive search locations



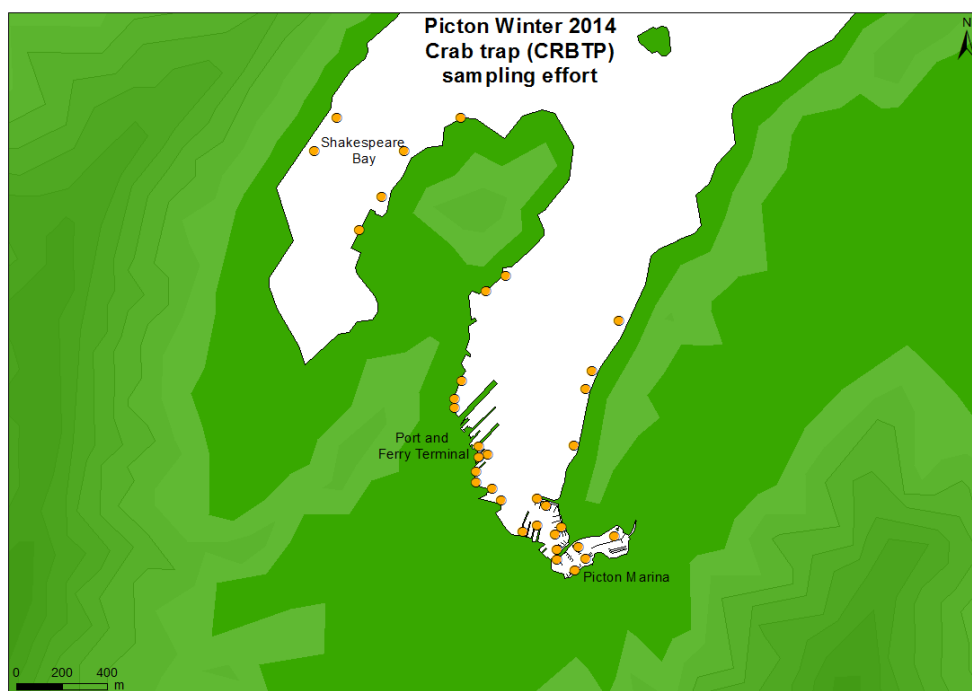
## Shore search locations



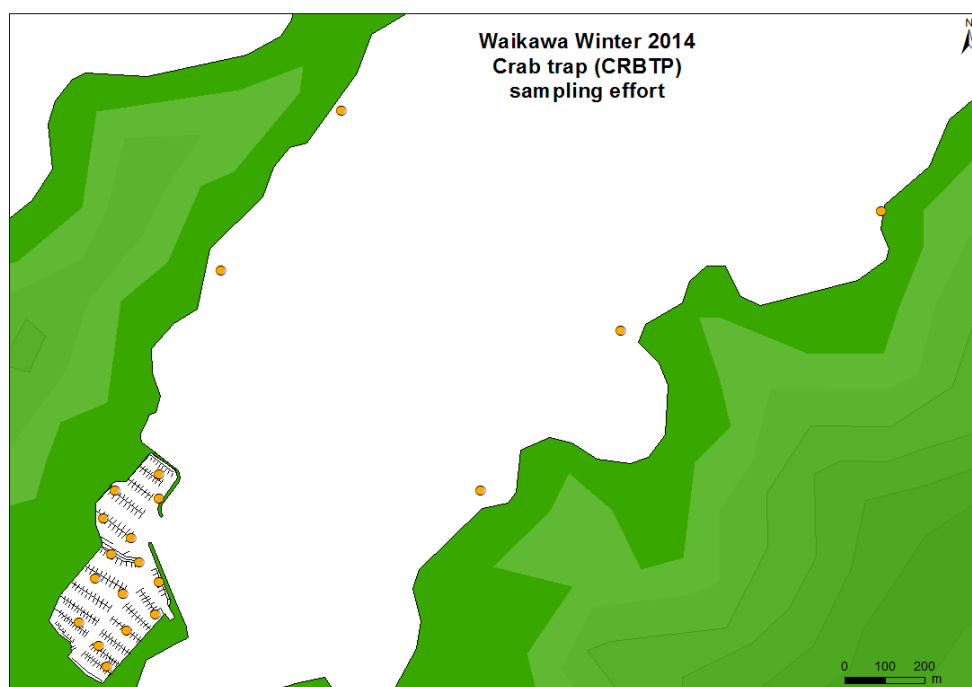
## PICTON/HAVELOCK

Winter 2014

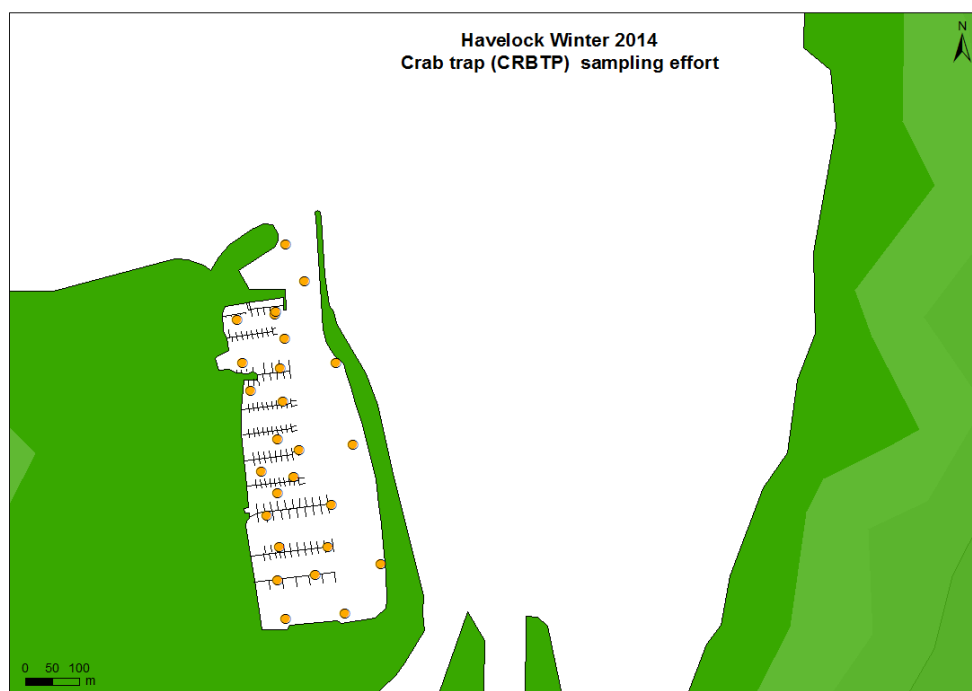
### Crab (box) trapping locations (Picton)



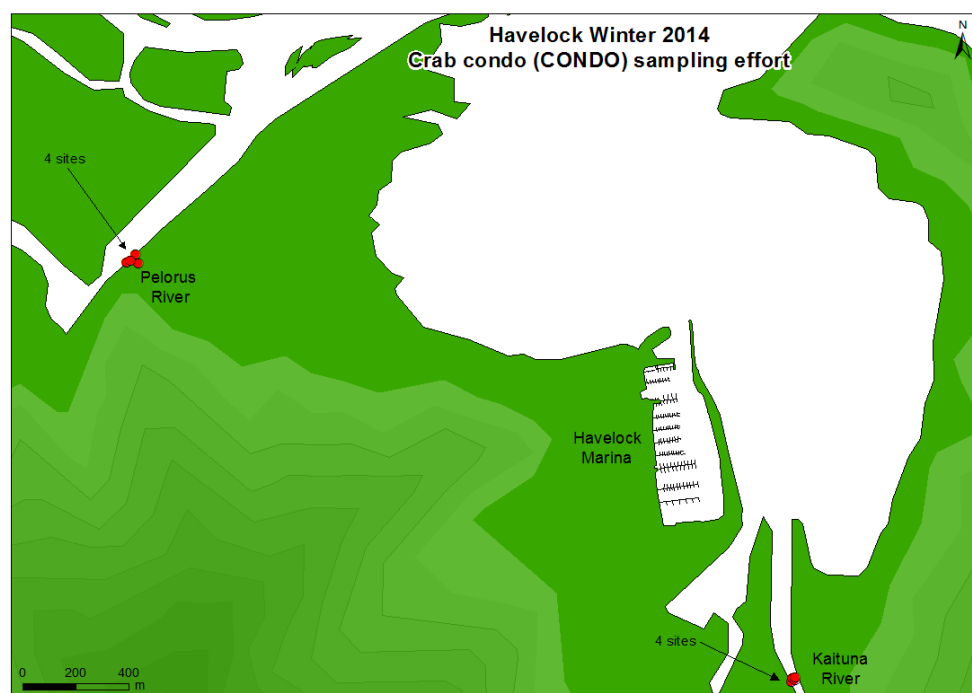
### Crab (box) trapping locations (Waikawa Marina)



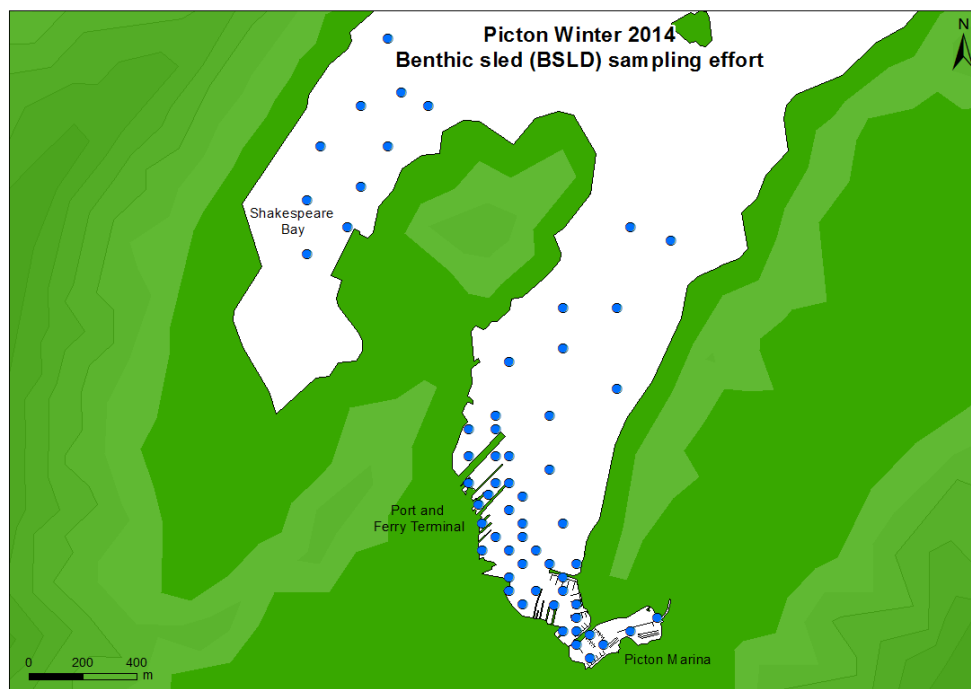
### Crab (box) trapping locations (Havelock Marina)



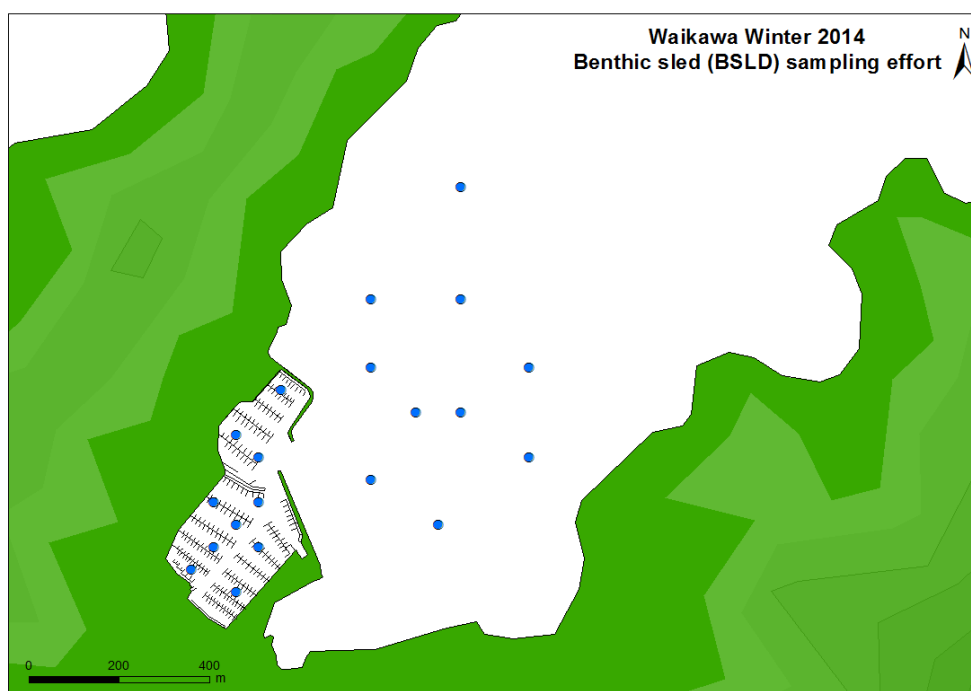
### Crab condo locations (Havelock Marina)



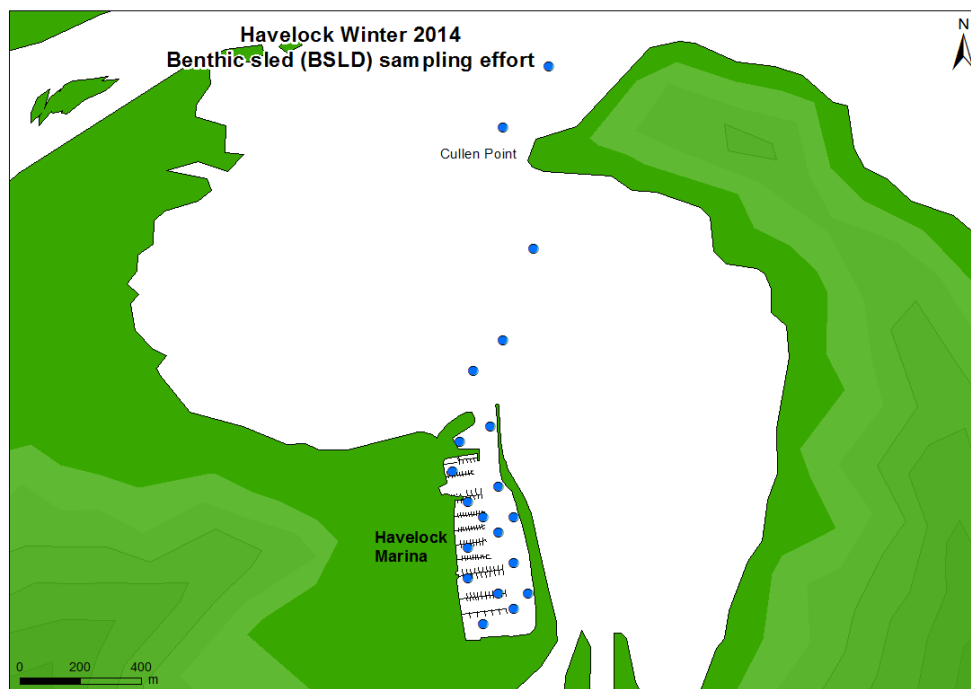
### Sledding locations (Picton)



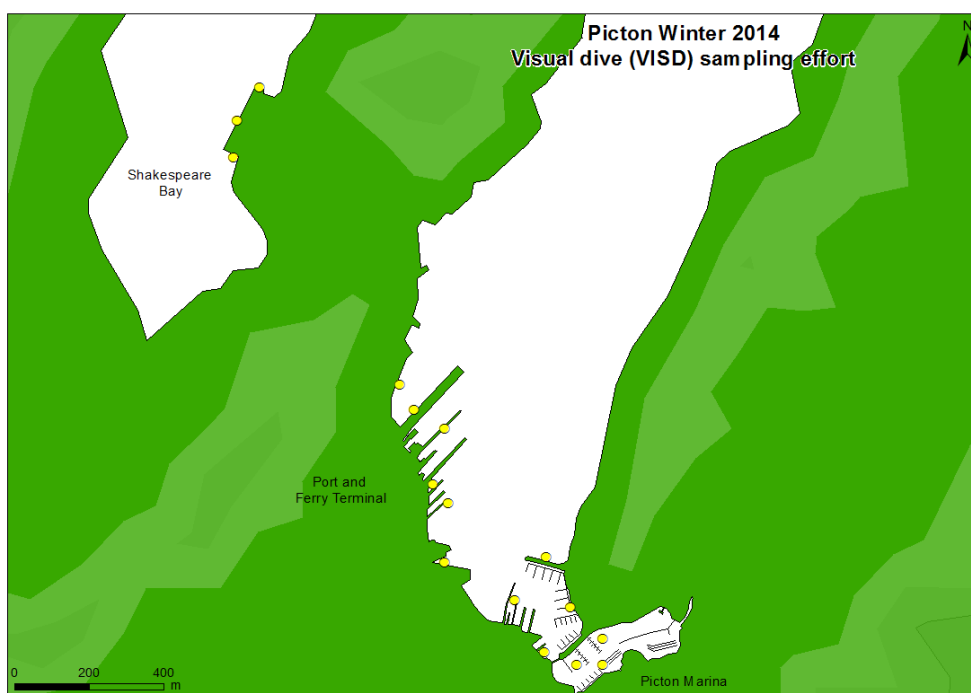
### Sledding locations (Waikawa Marina)



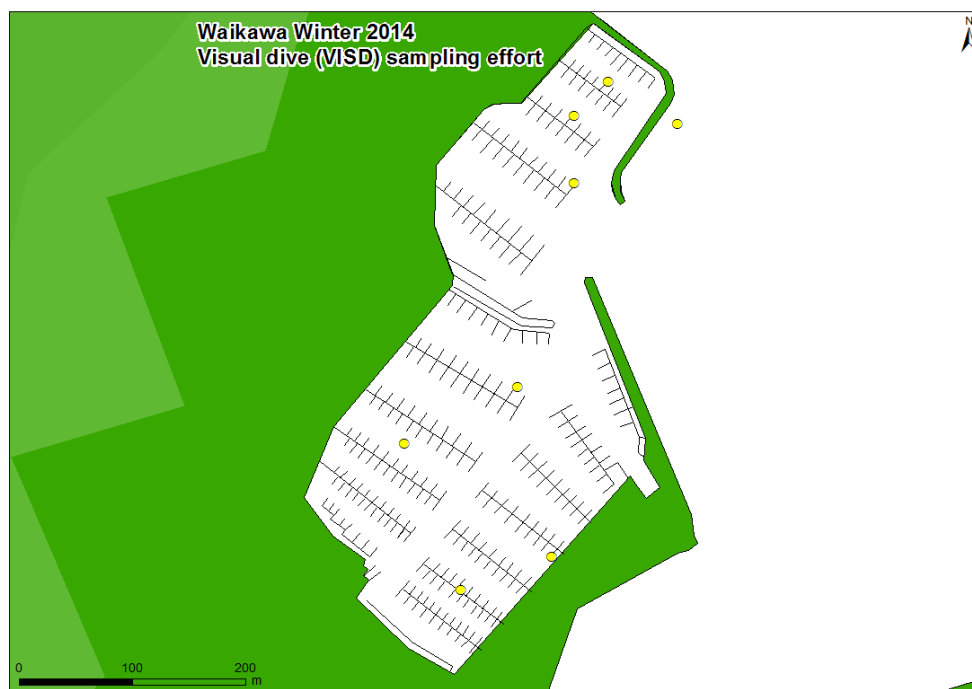
### Sledding locations (Havelock Marina)



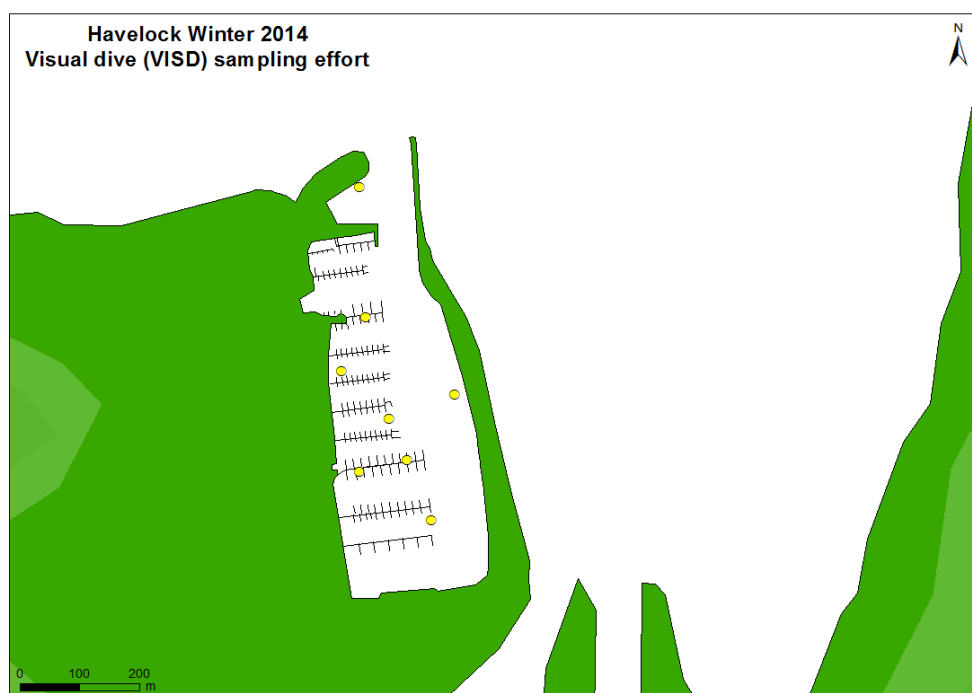
### Dive search locations (Picton)



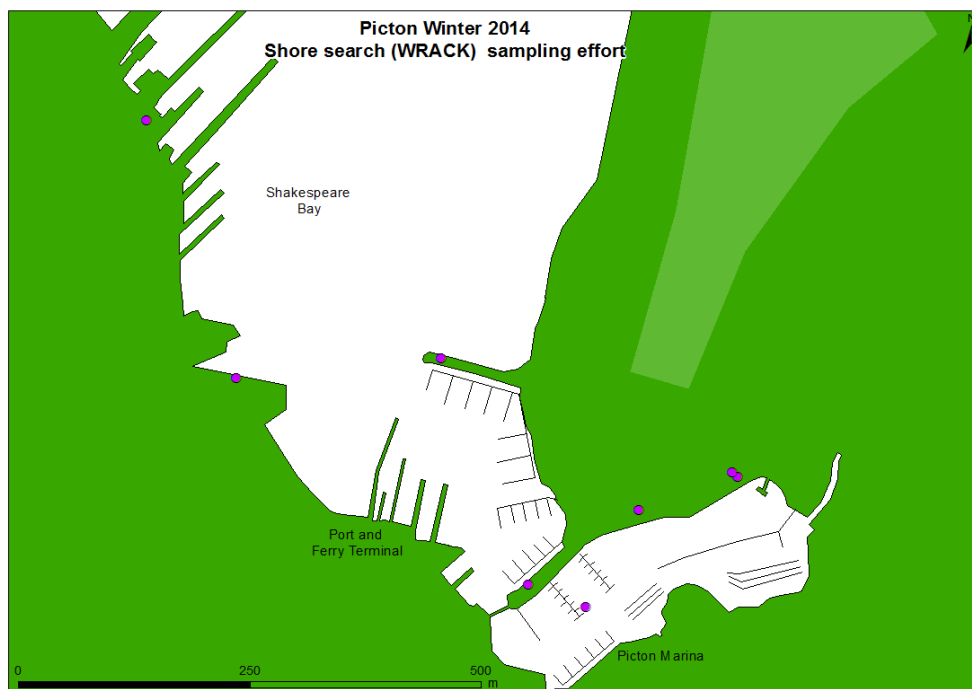
### Dive search locations (Waikawa Marina)



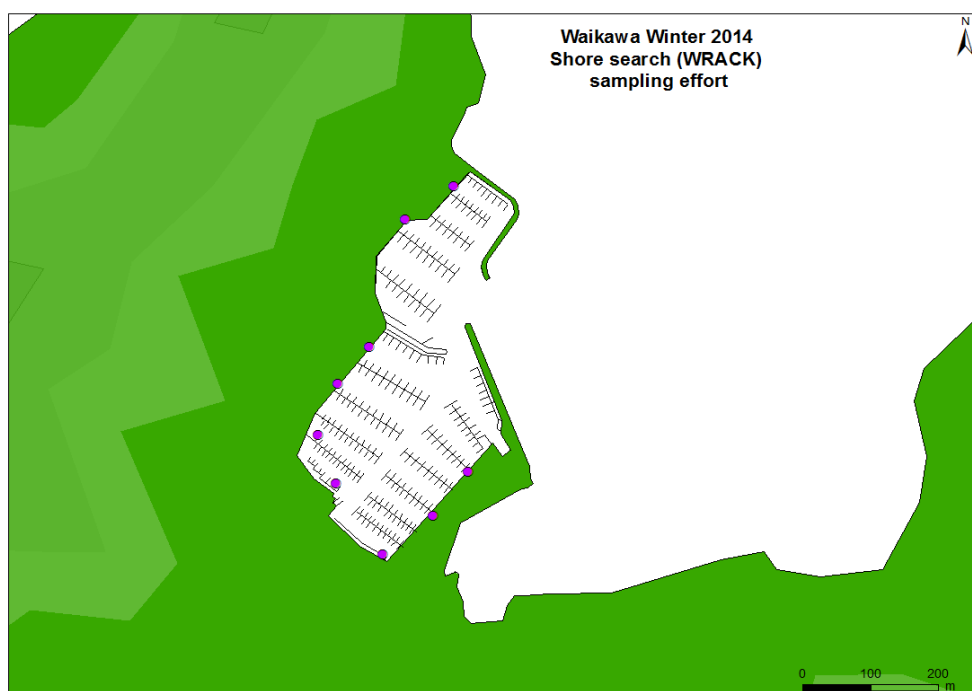
### Dive search locations (Havelock Marina)



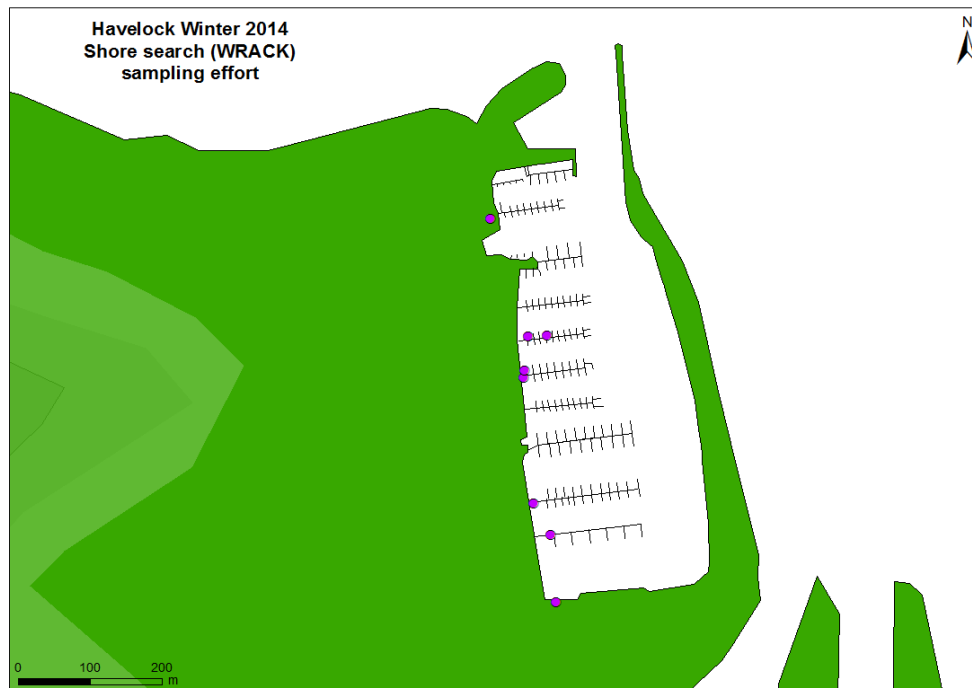
## Shore search locations (Picton)



## Shore search locations (Waikawa Marina)

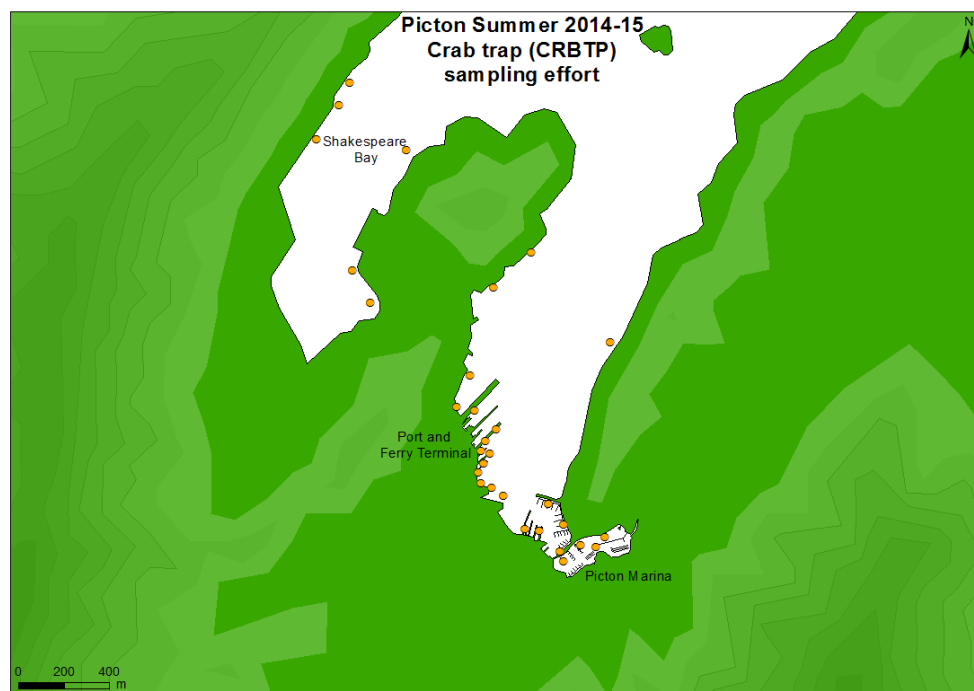


## Shore search locations (Havelock Marina)

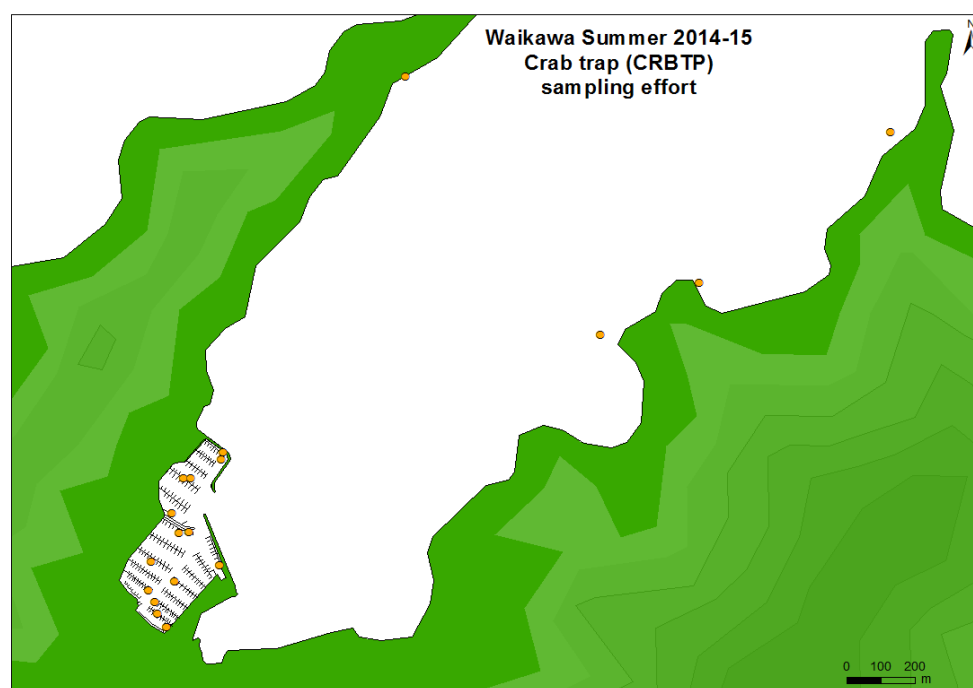


Summer 2014–15

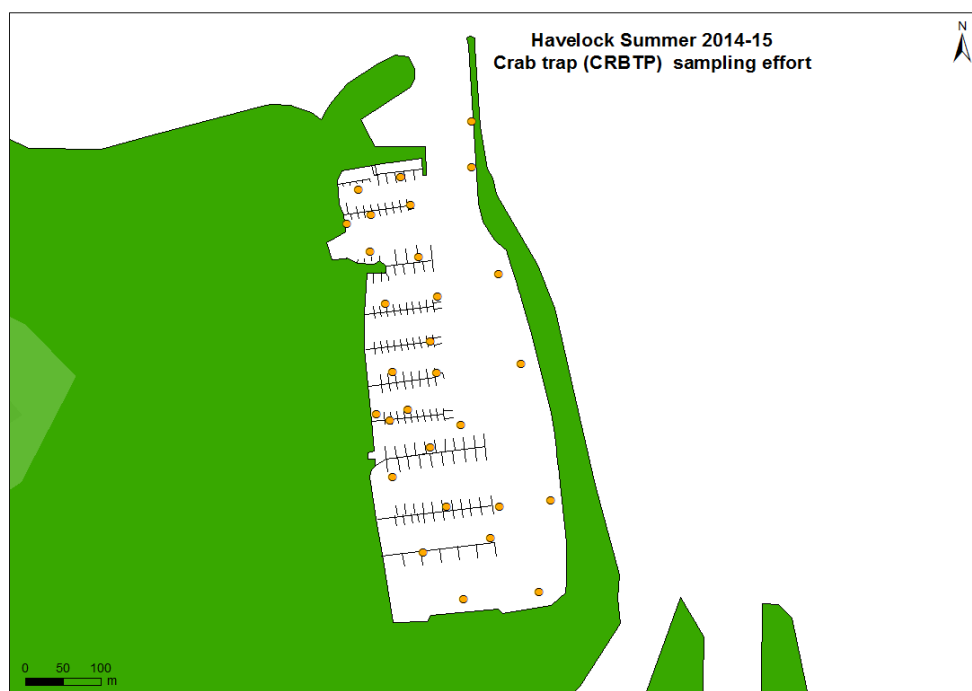
**Crab (box) trapping locations (Picton)**



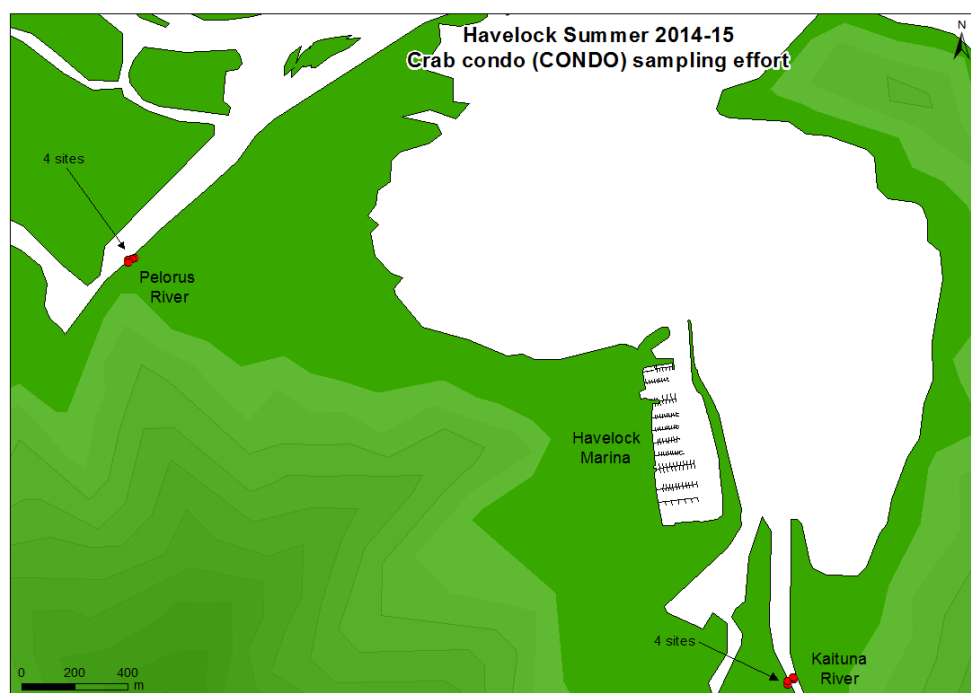
**Crab (box) trapping locations (Waikawa Marina)**



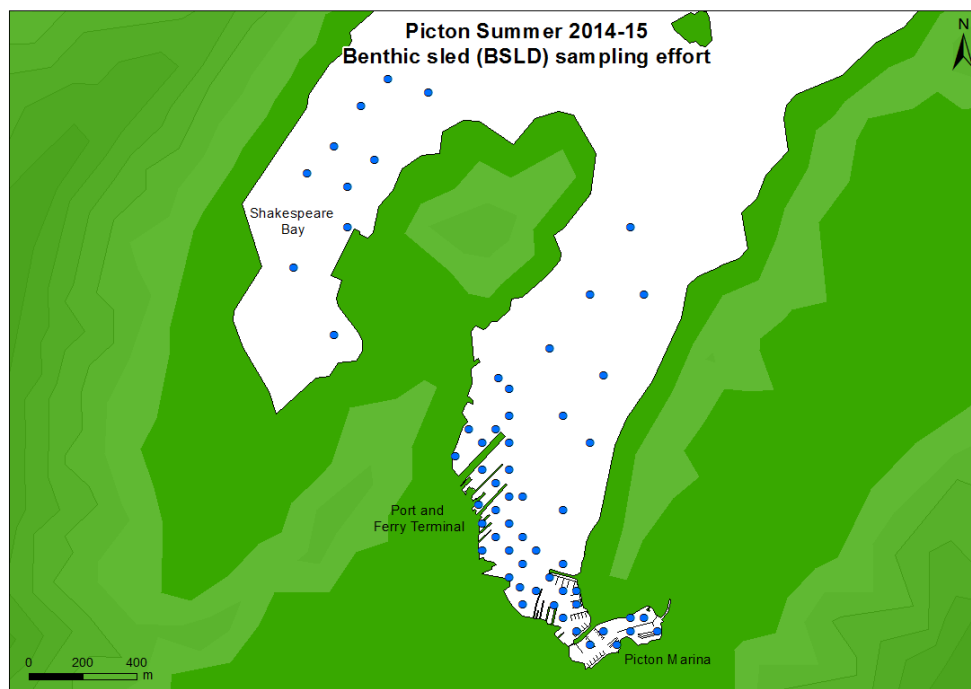
### Crab (box) trapping locations (Havelock Marina)



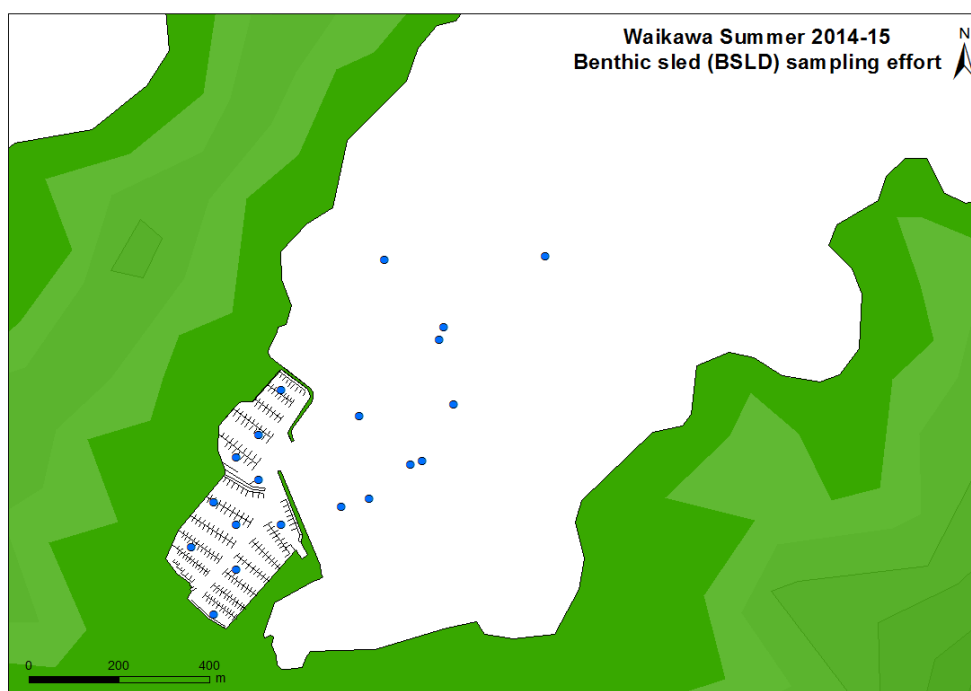
### Crab condo locations (Havelock Marina)



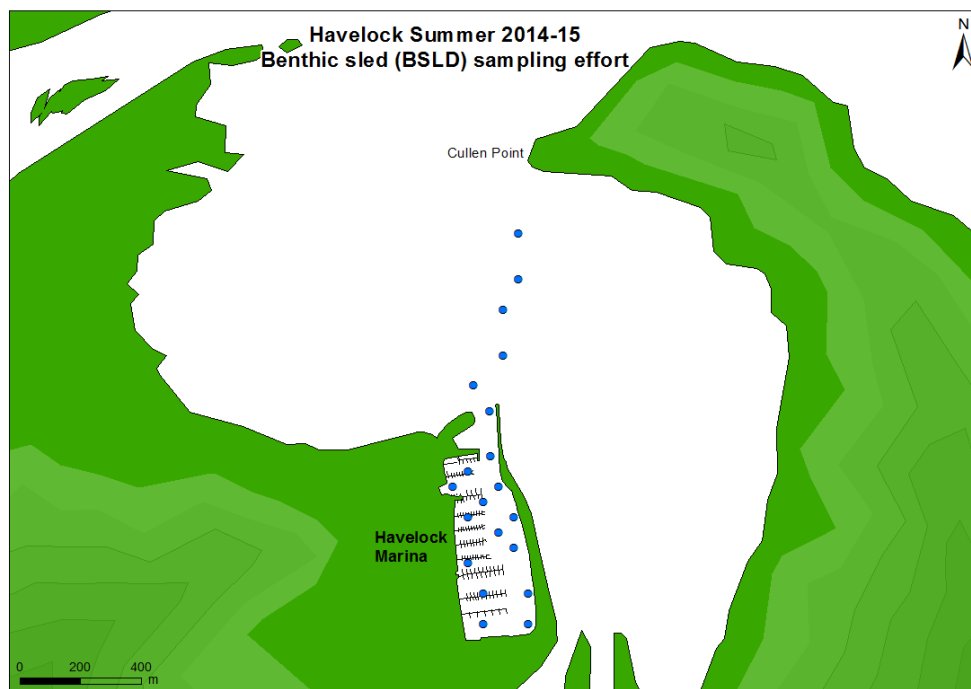
### Sledding locations (Picton)



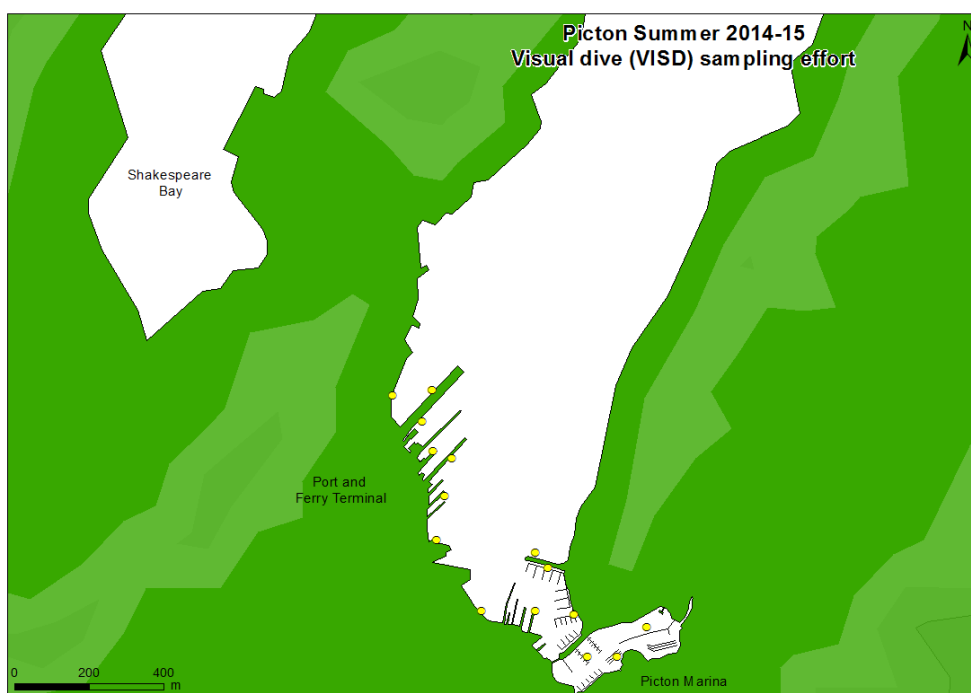
### Sledding locations (Waikawa Marina)



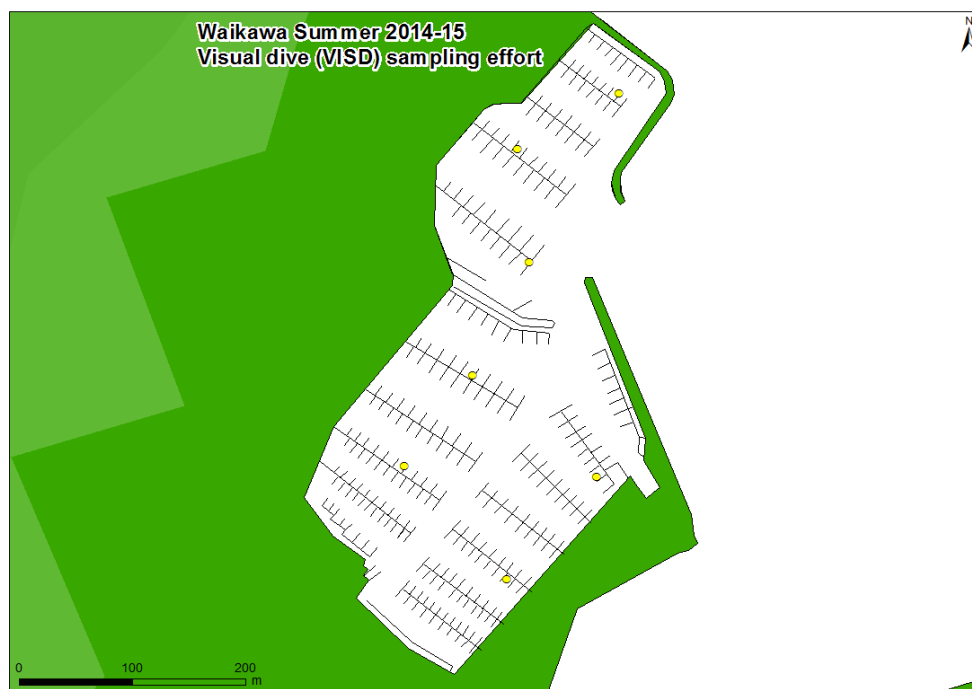
### Sledding locations (Havelock Marina)



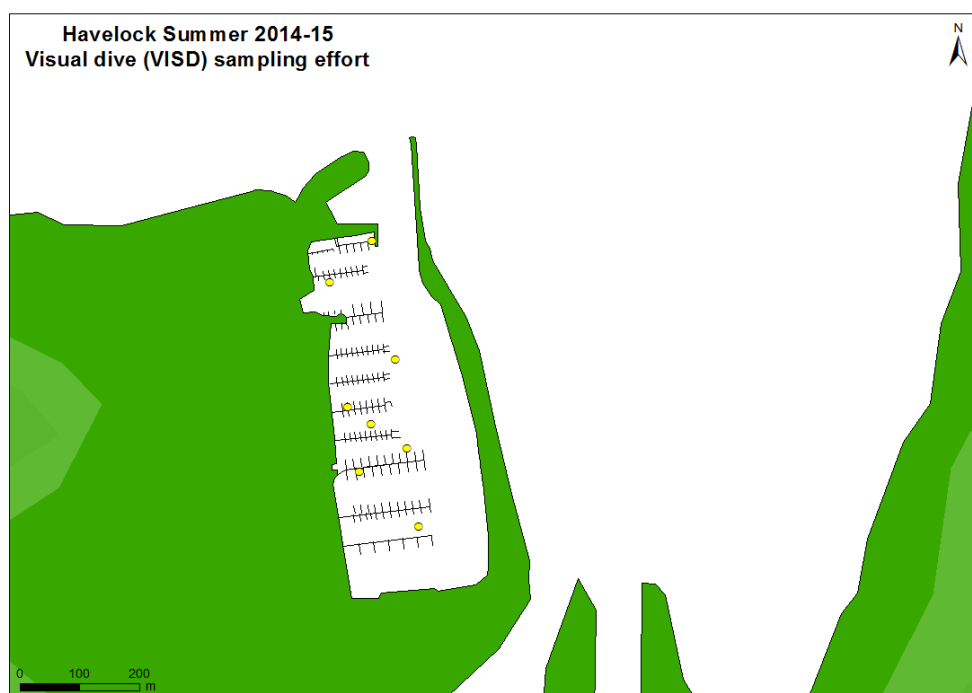
### Dive search locations (Picton)



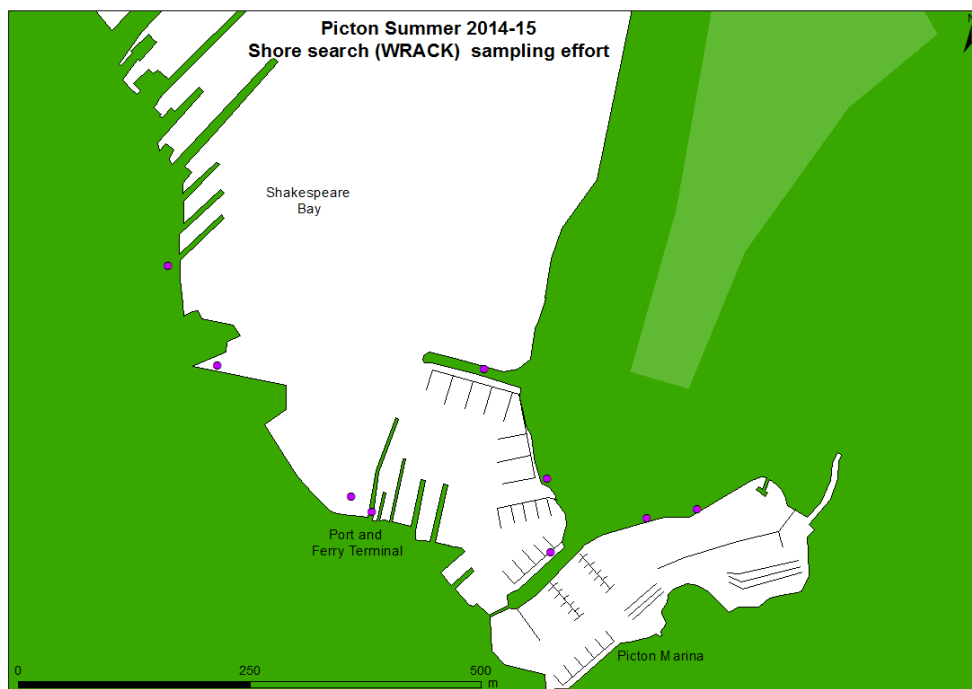
### Dive search locations (Waikawa Marina)



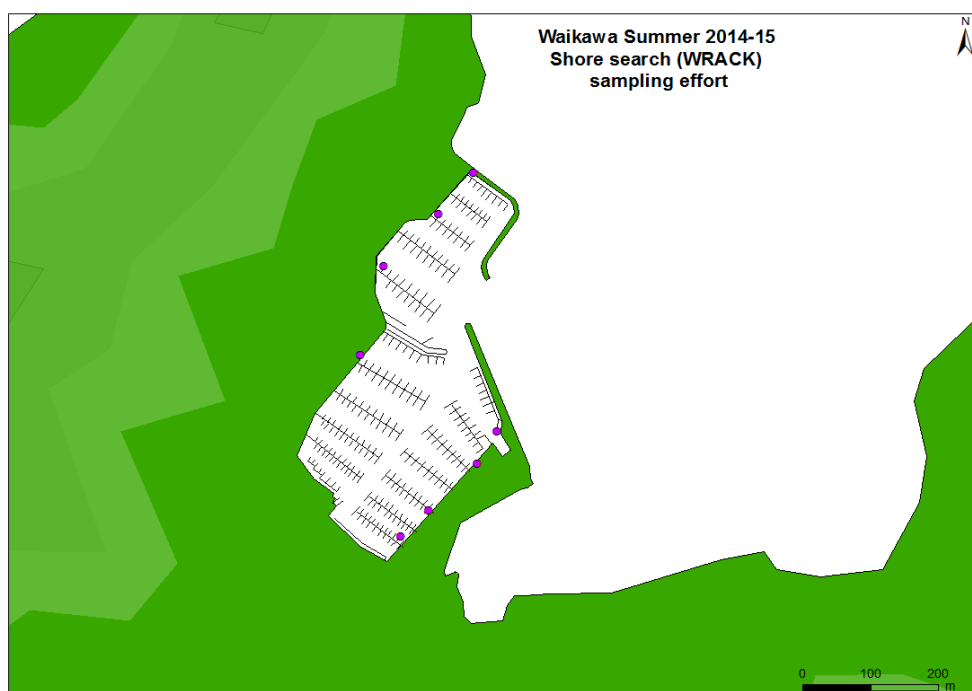
### Dive search locations (Havelock Marina)



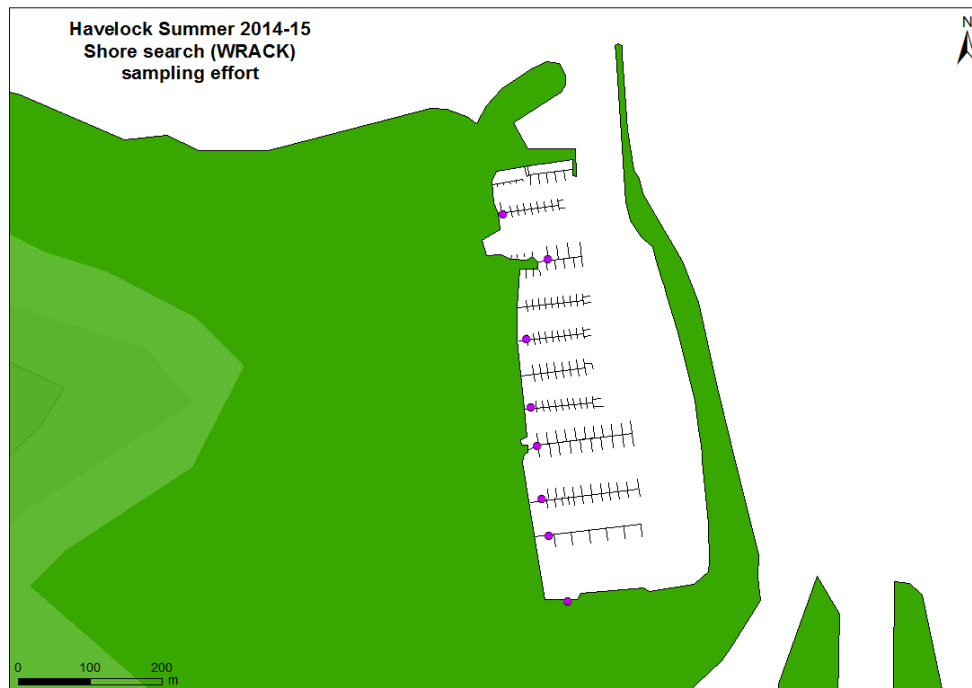
## Shore search locations (Picton)



## Shore search locations (Waikawa Marina)



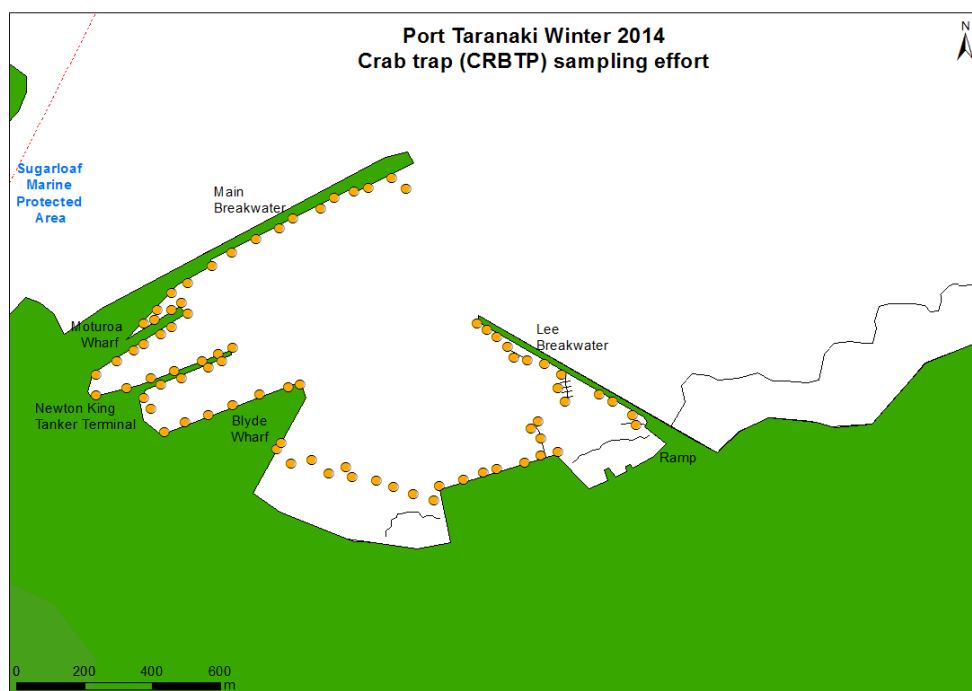
## Shore search locations (Havelock Marina)



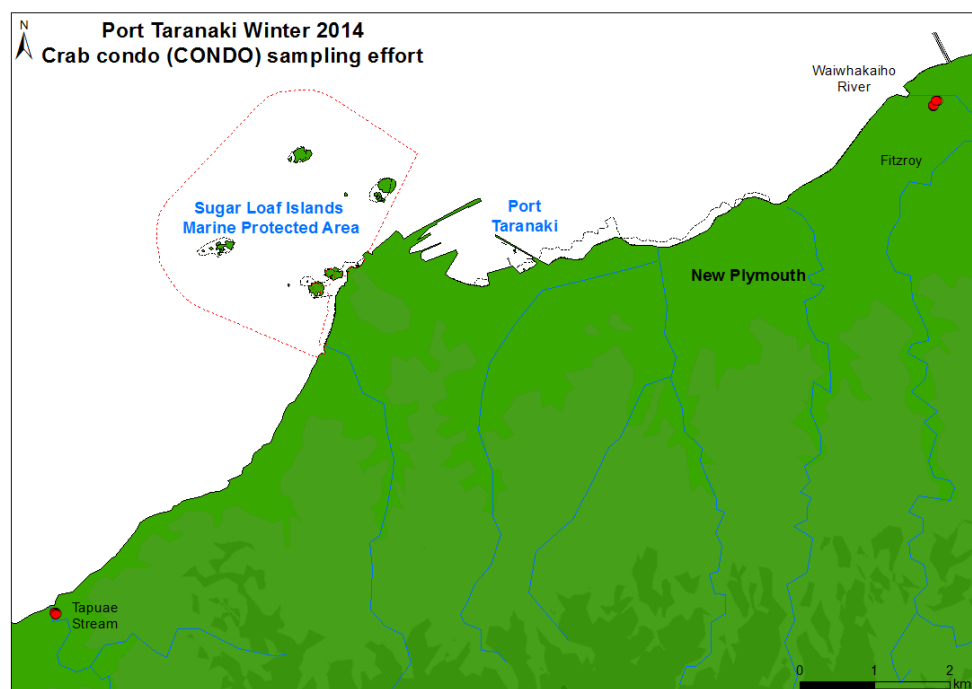
## PORT TARANAKI

Winter 2014

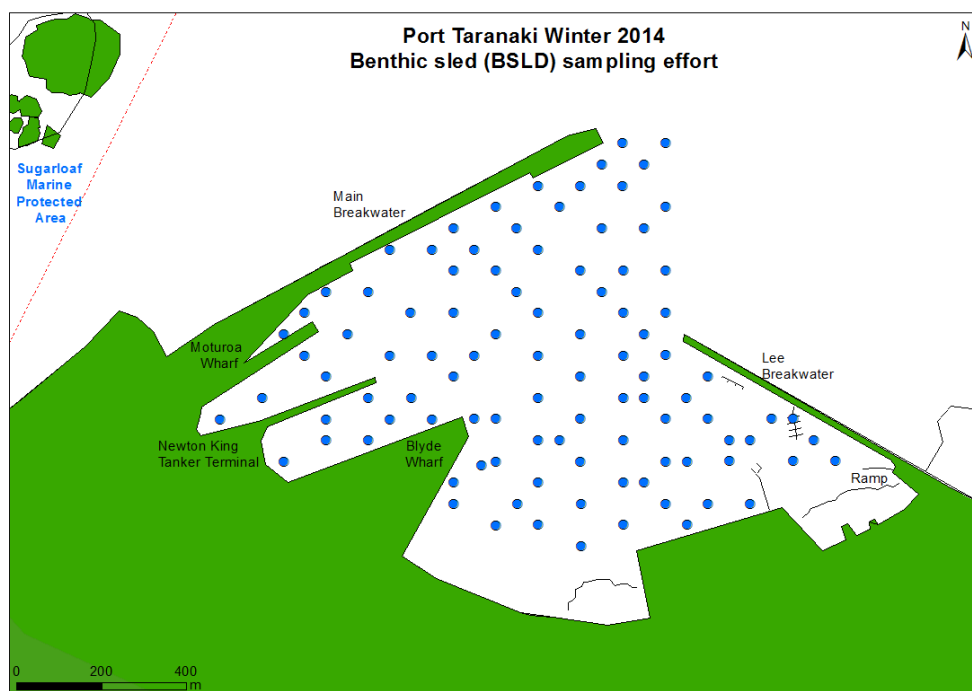
### Crab (box) trapping locations



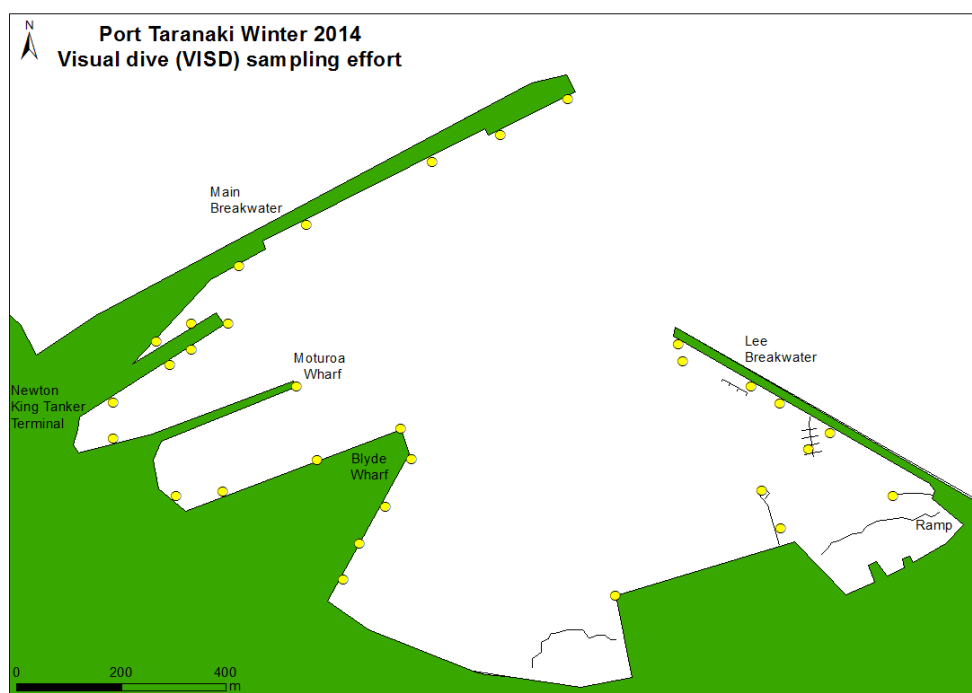
### Crab condo locations



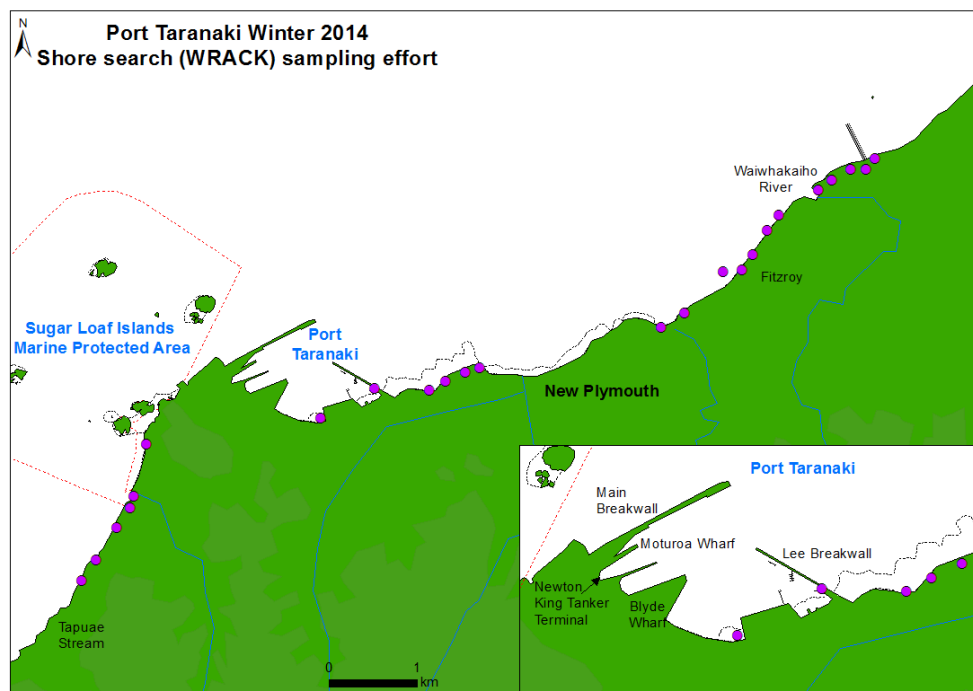
## Sledding locations



## Dive search locations

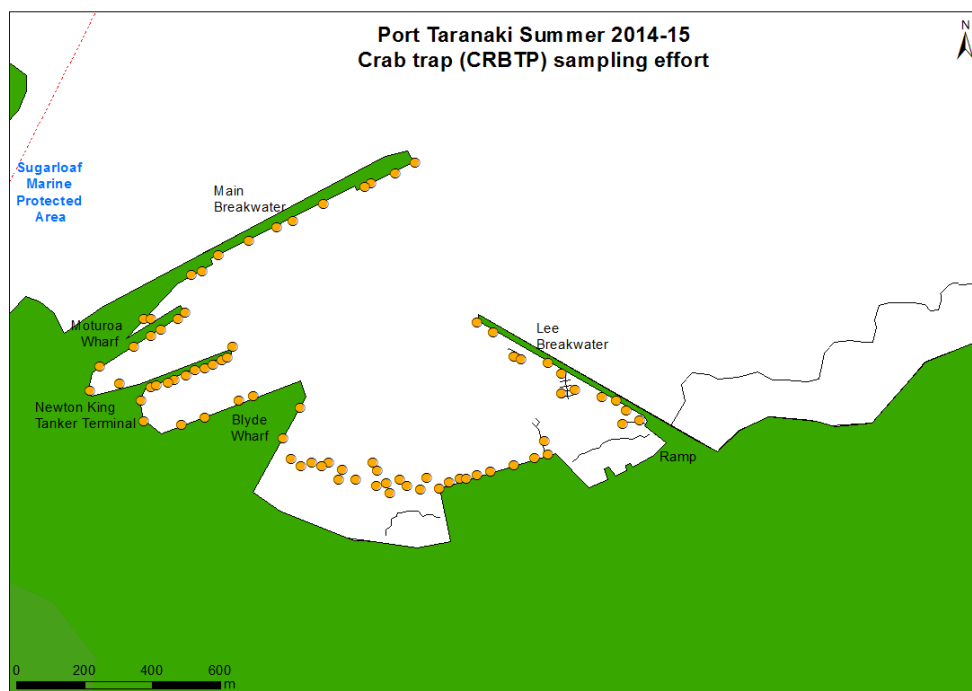


## Shore search locations

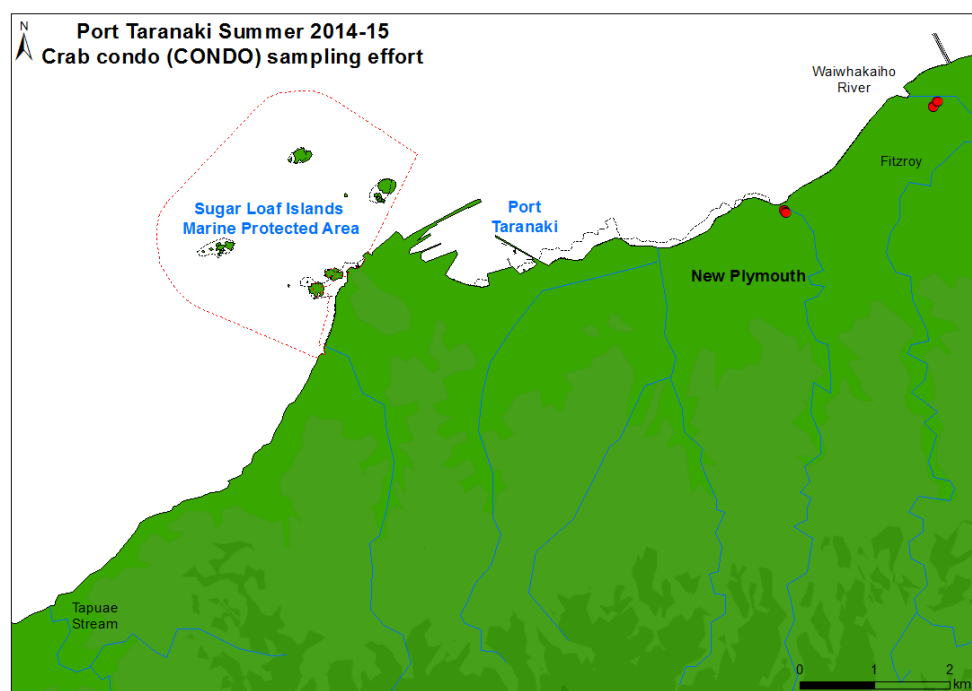


Summer 2014–15

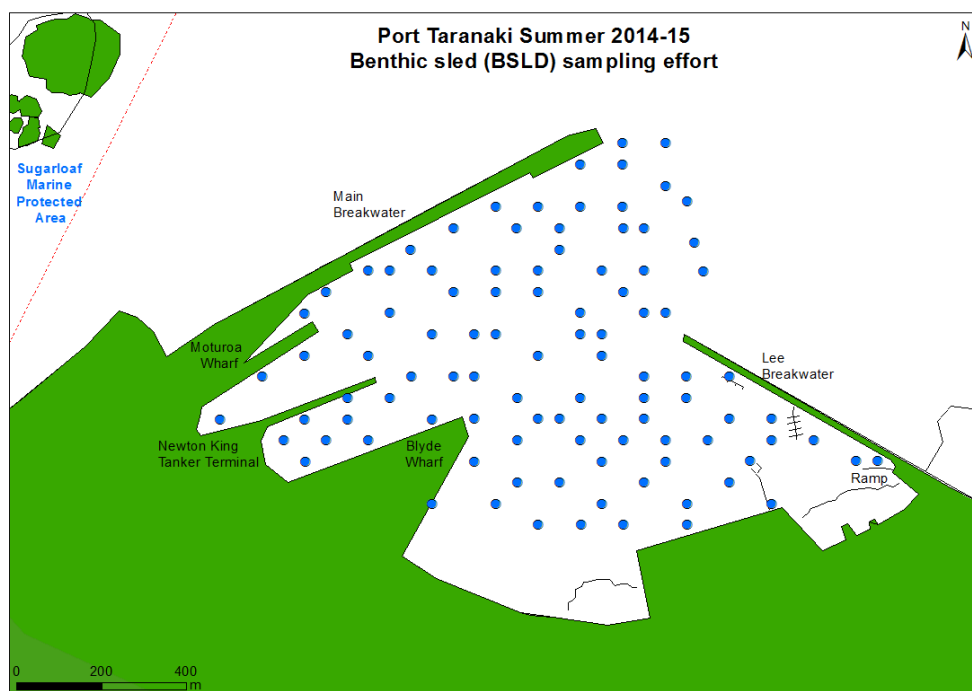
### Crab (box) trapping locations



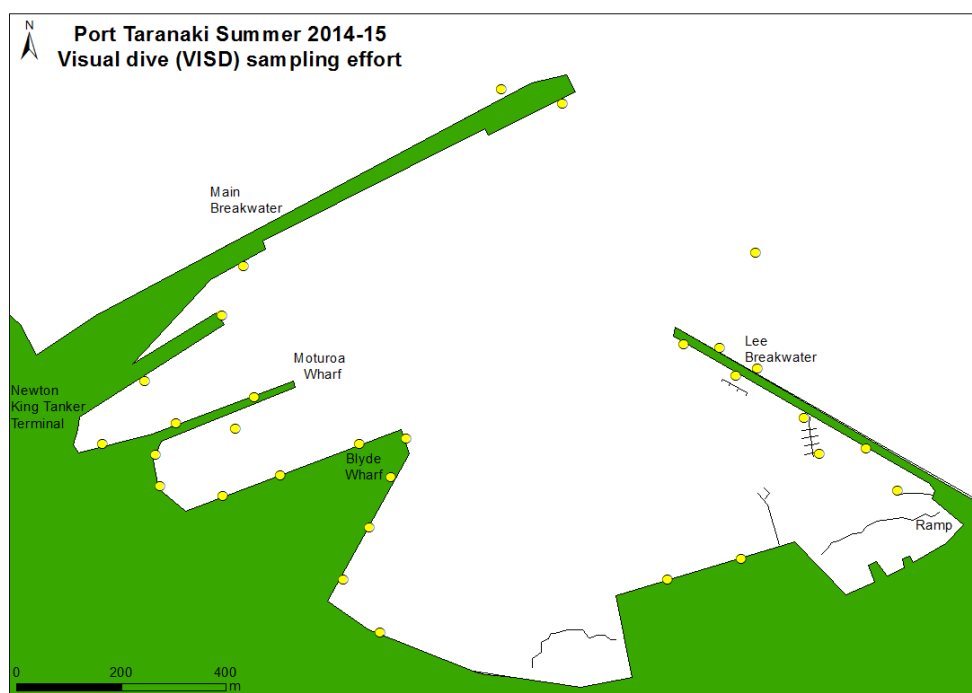
### Crab condo locations



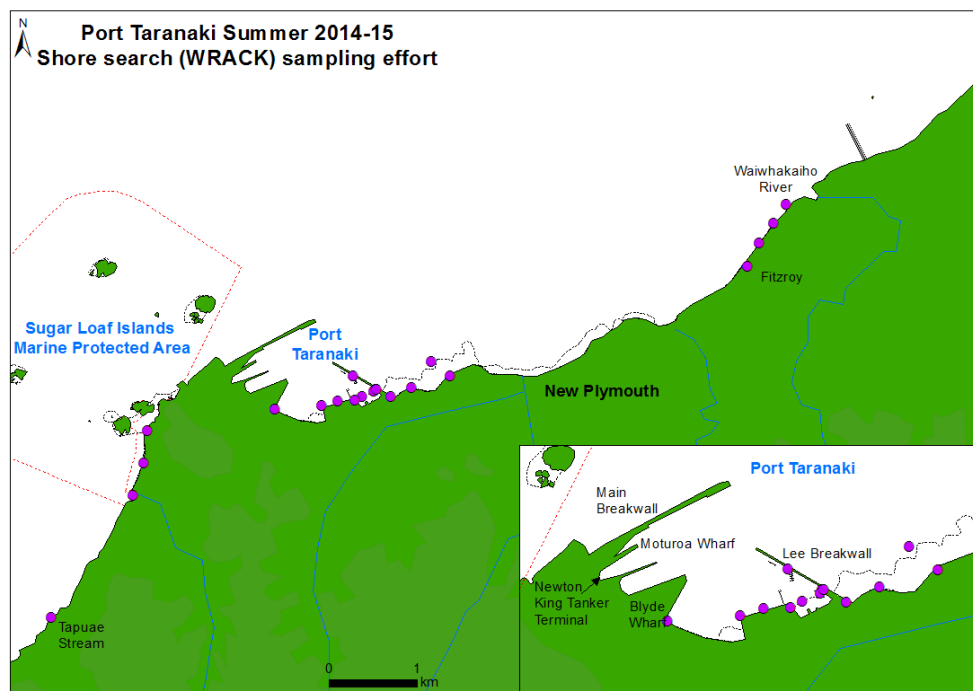
## Sledding locations



## Dive search locations



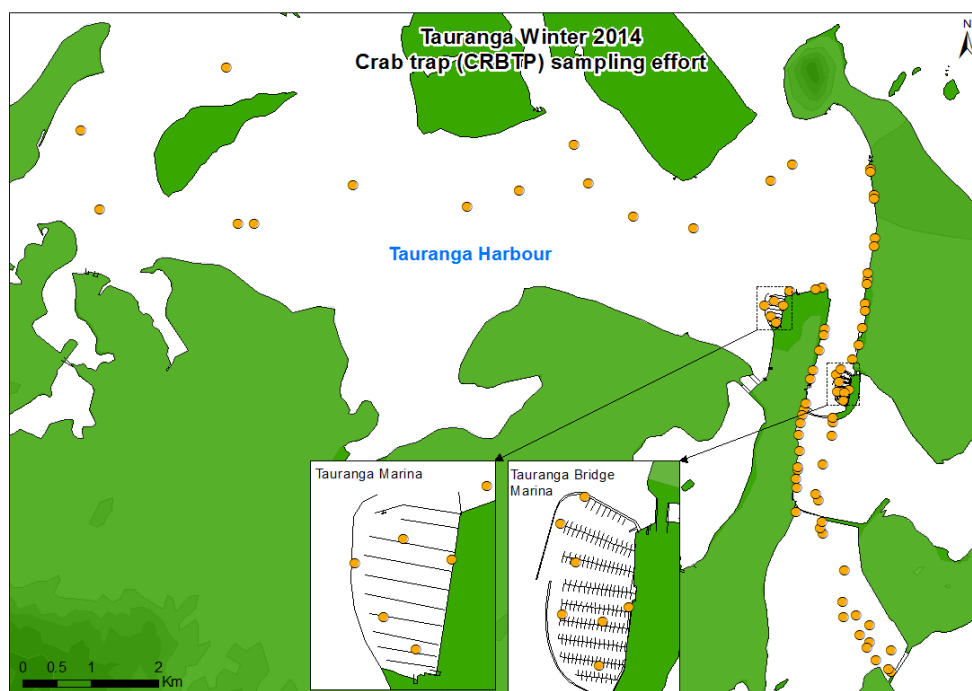
## Shore search locations



## TAURANGA HARBOUR

Winter 2014

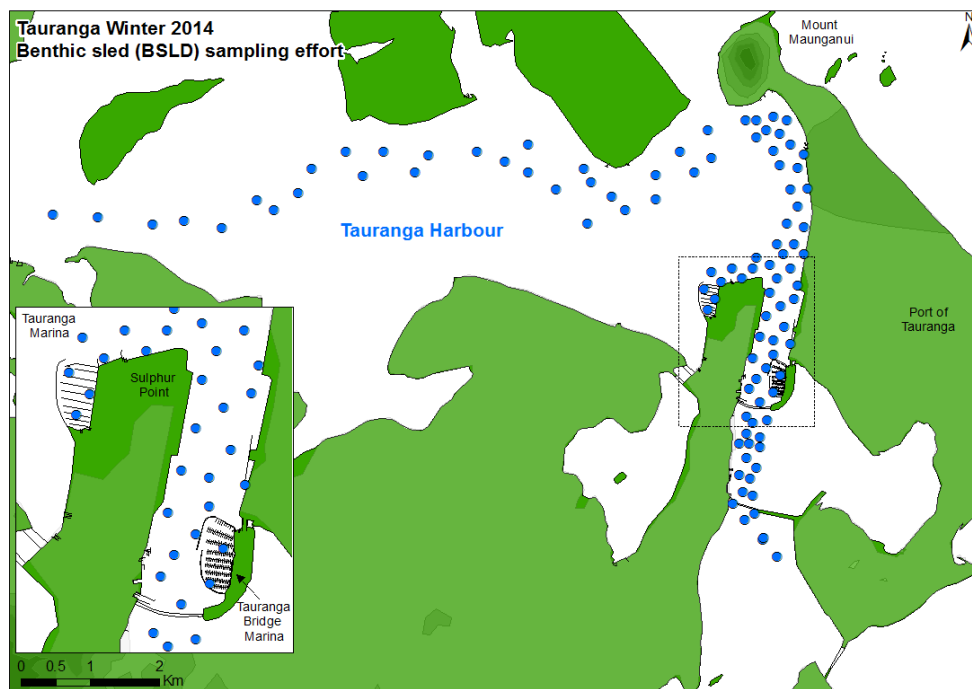
### Crab (box) trapping locations



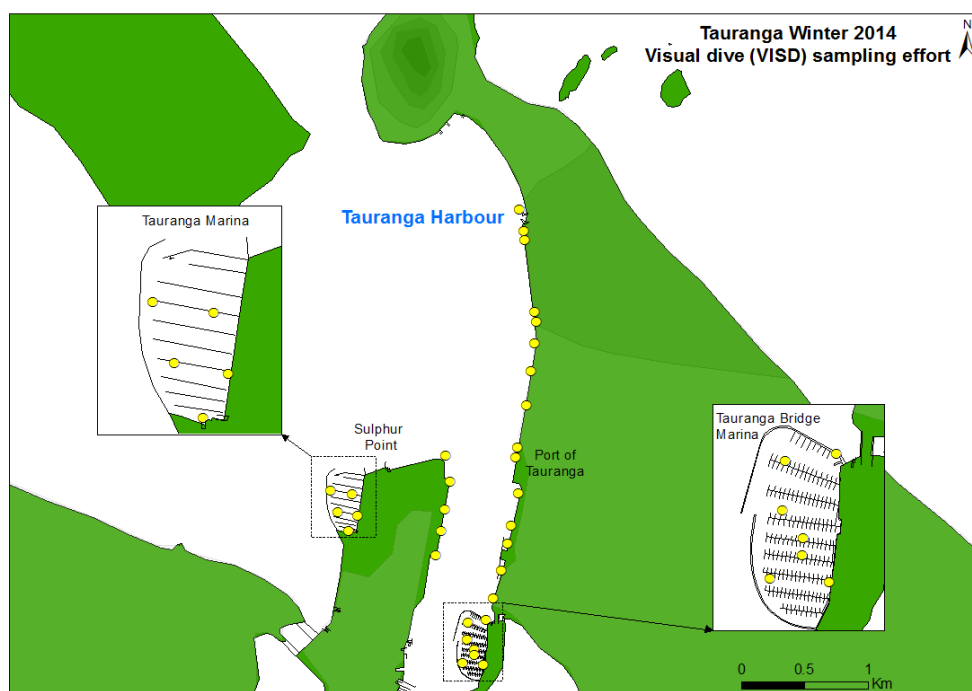
### Crab condo locations



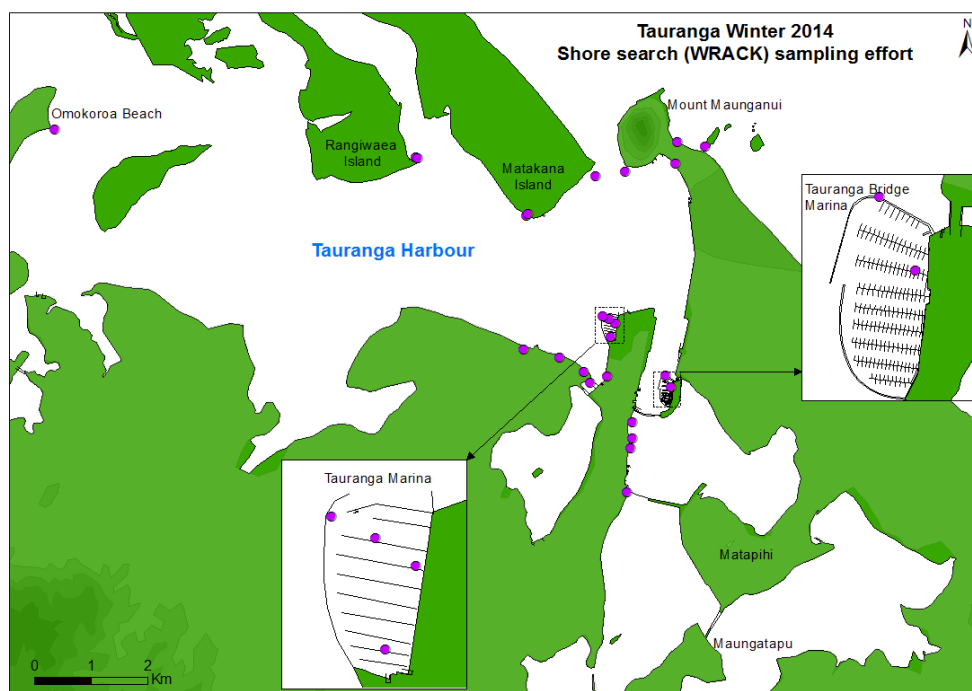
## Sledding locations



## Dive search locations

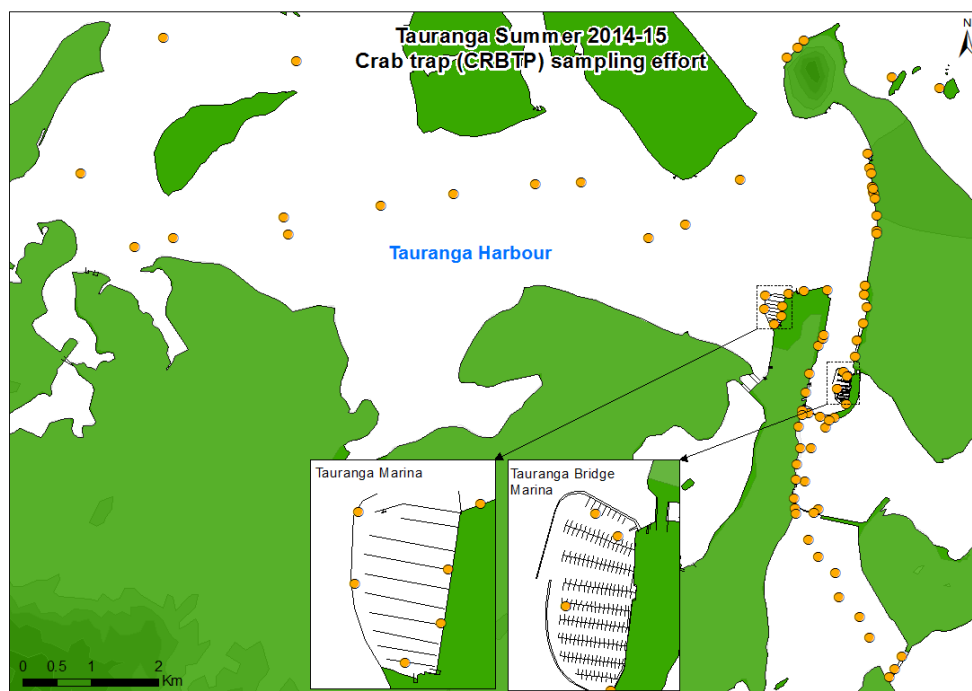


## Shore search locations

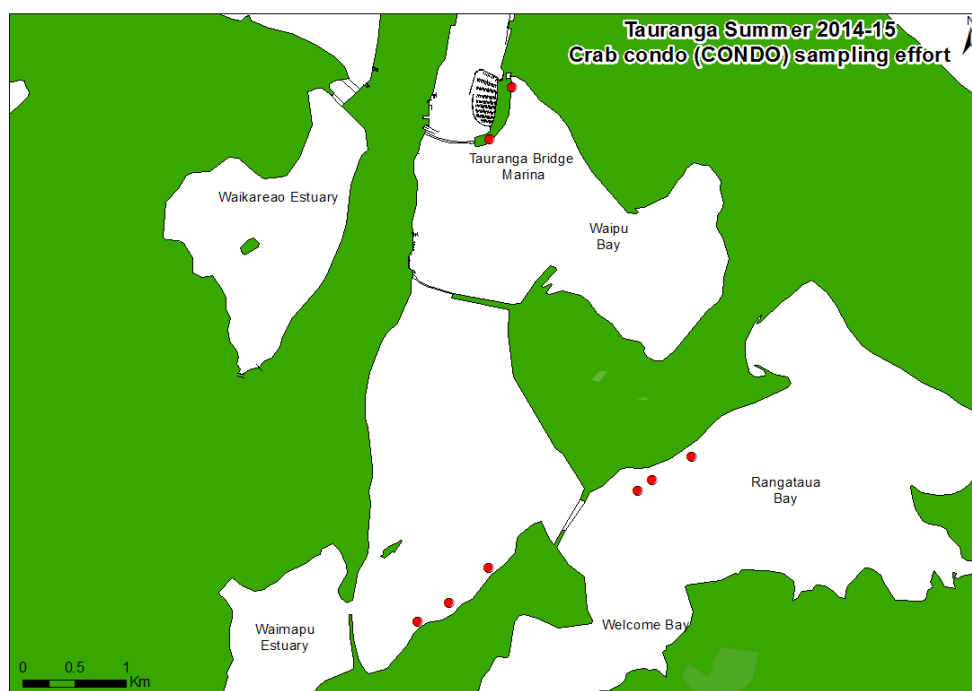


Summer 2014–15

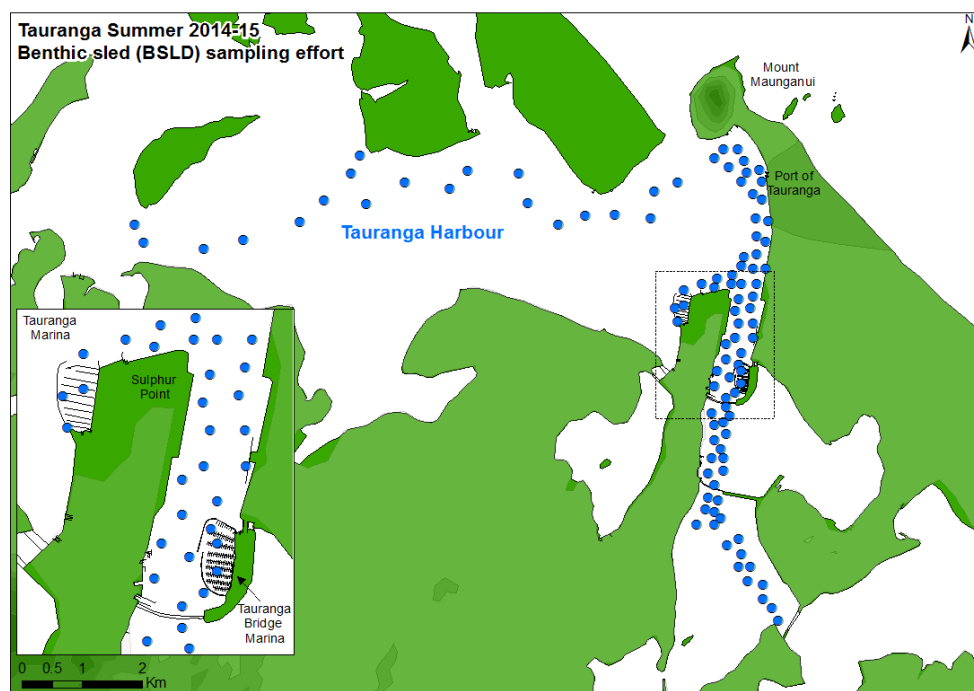
### Crab (box) trapping locations



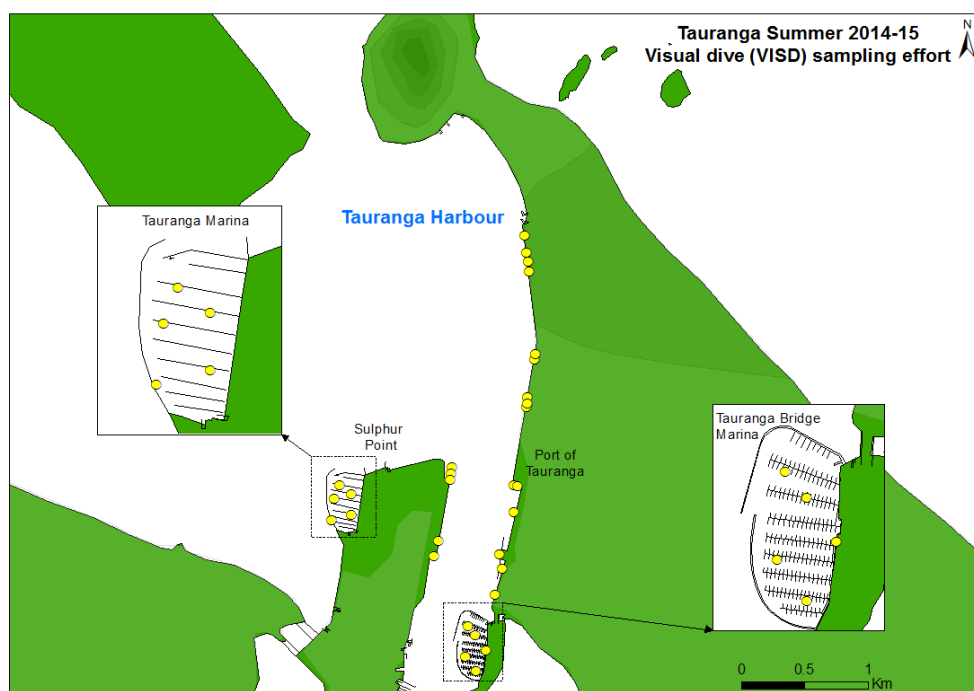
### Crab condo locations



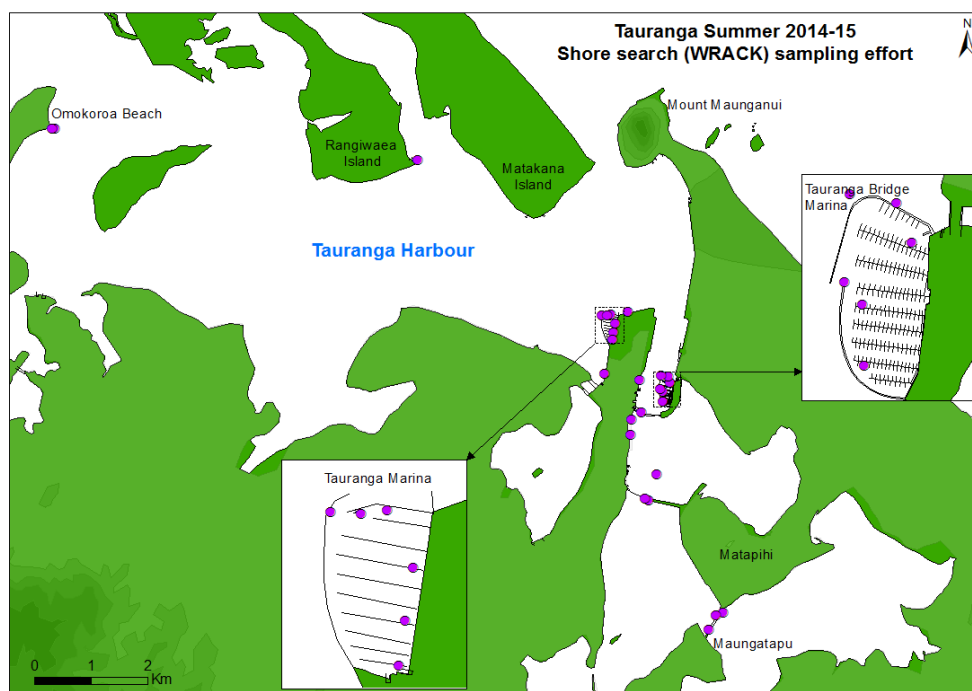
## Sledding locations



## Dive search locations



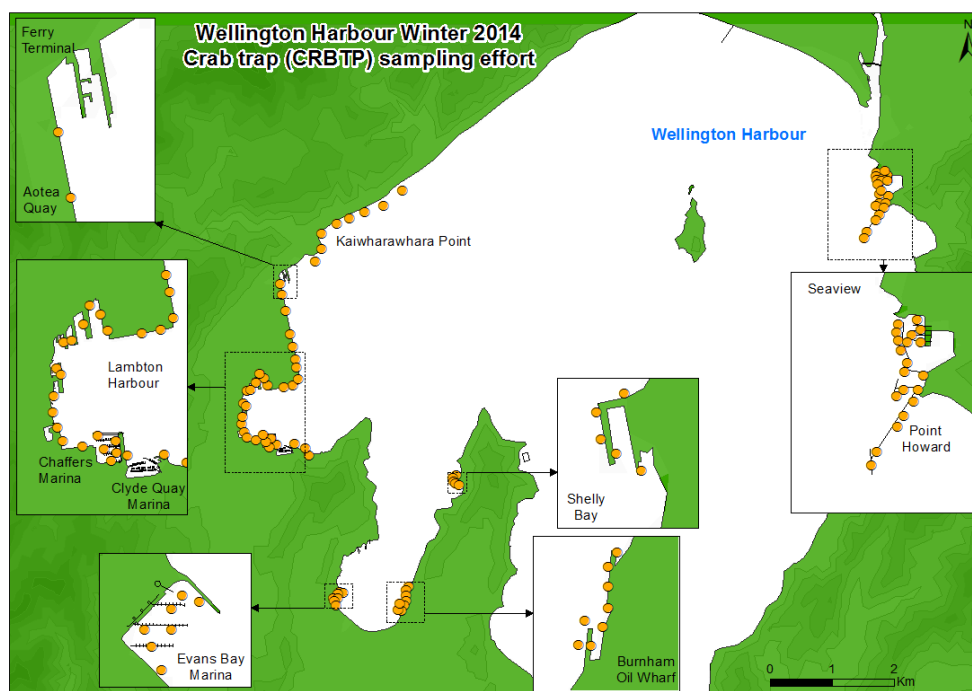
## Shore search locations



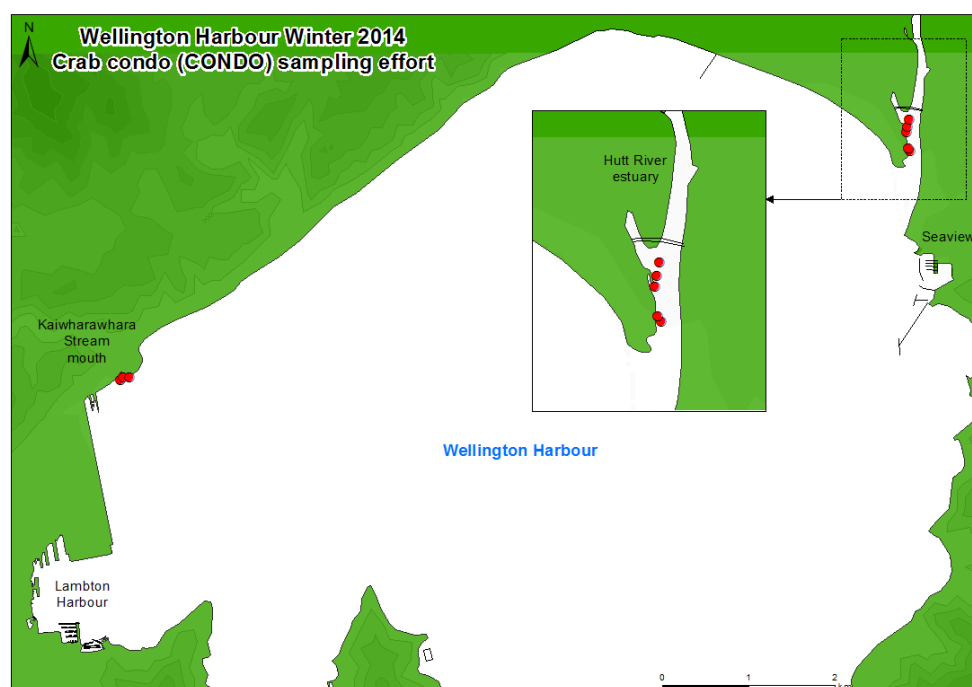
# WELLINGTON HARBOUR

Winter 2014

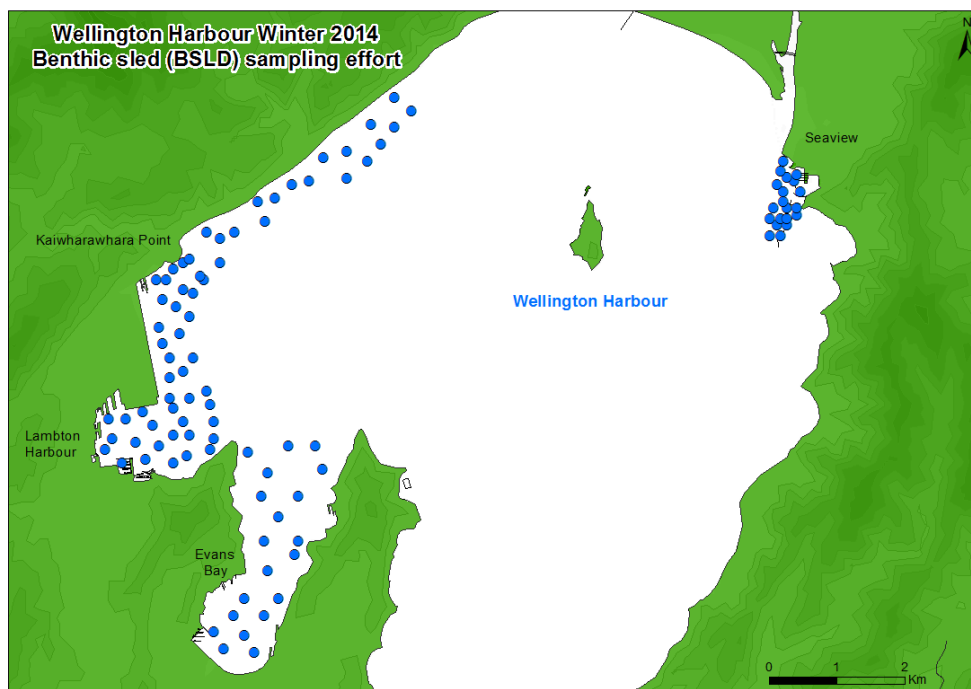
## Crab (box) trapping locations



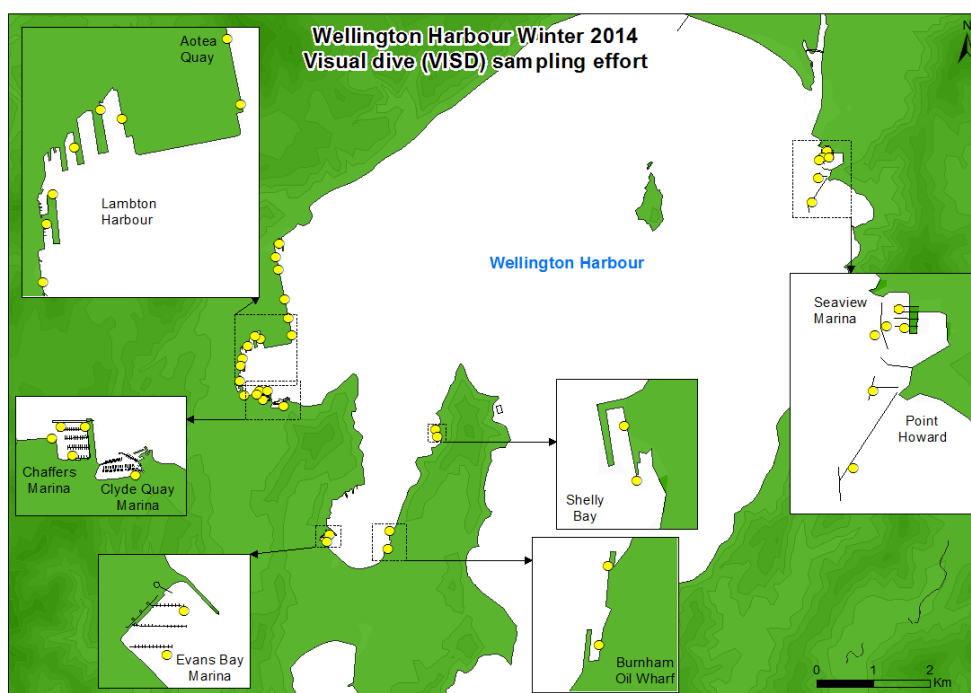
## Crab condo locations



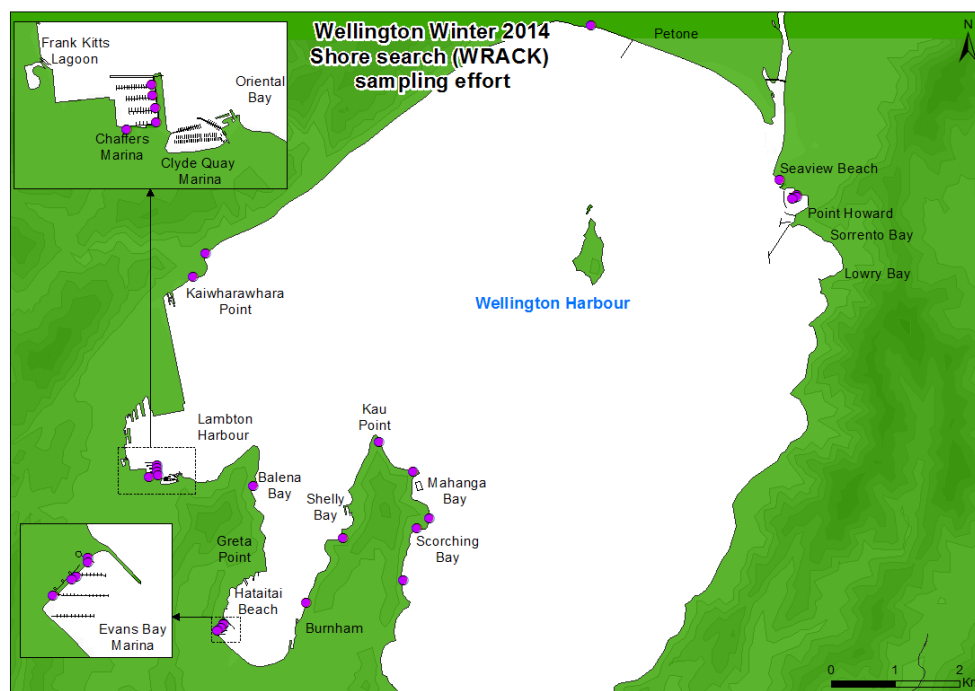
## Sledding locations



## Dive search locations

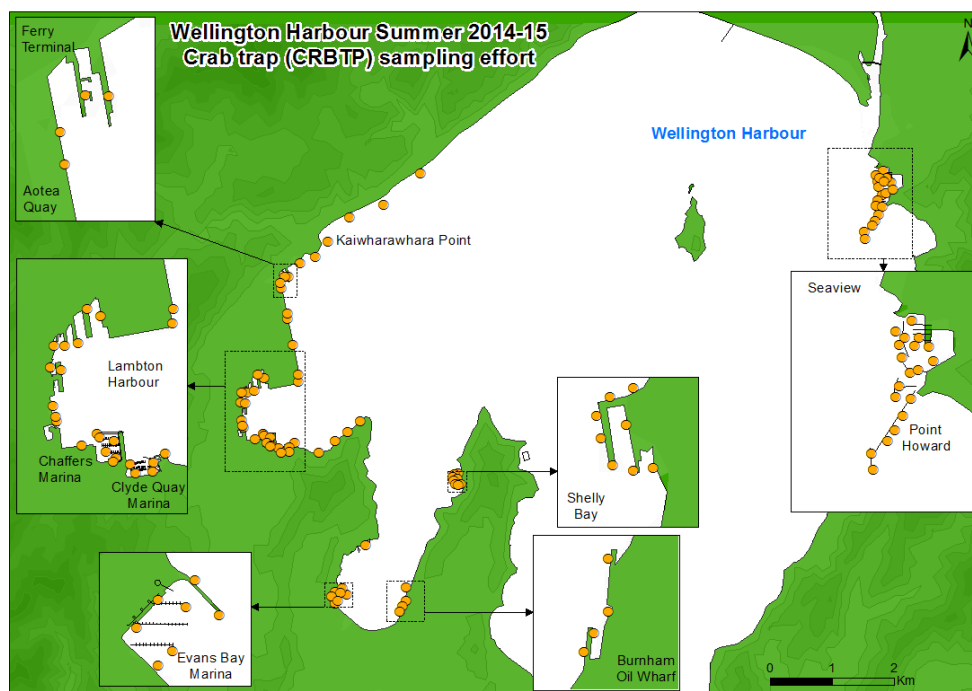


## Shore search locations

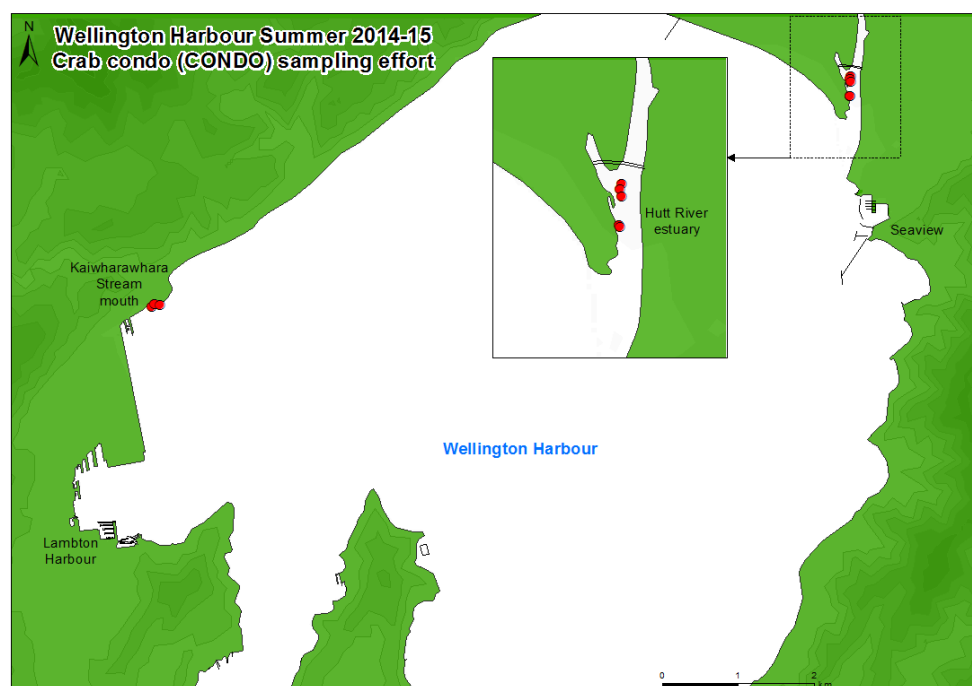


Summer 2014-15

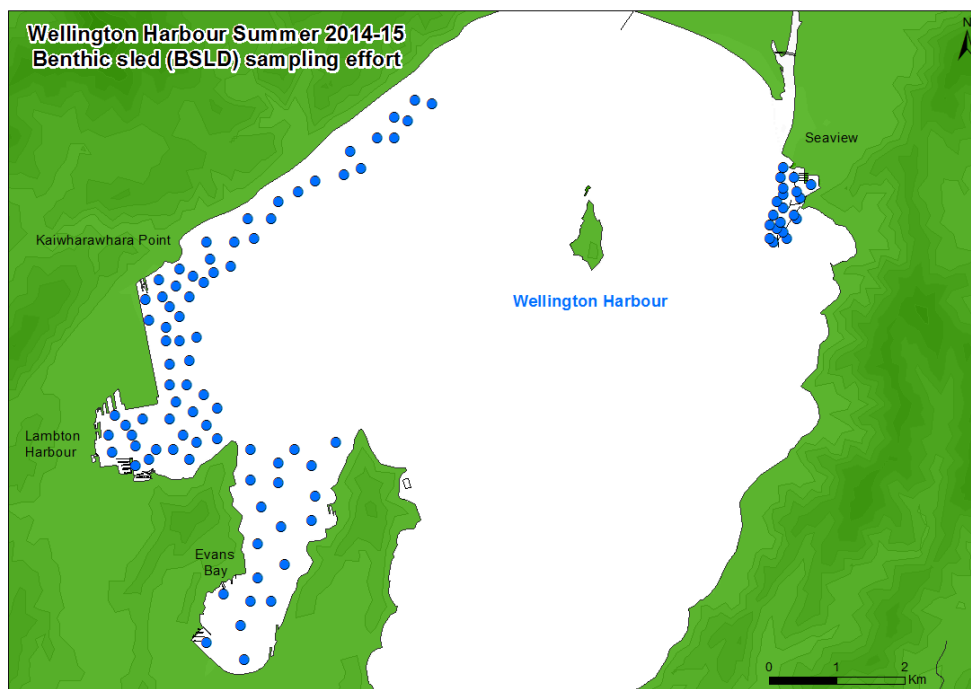
### Crab (box) trapping locations



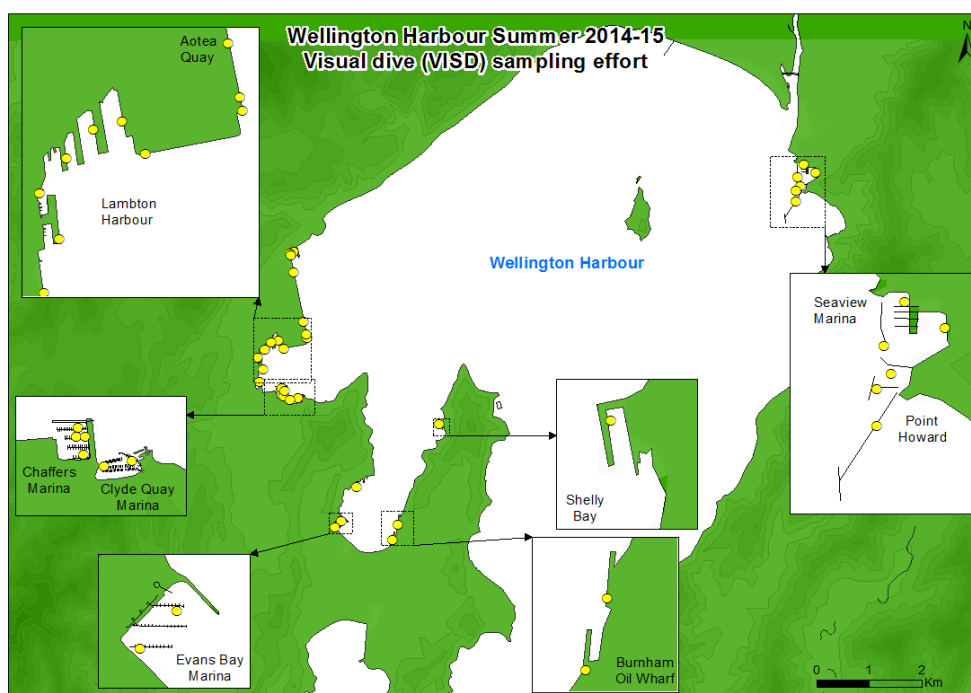
### Crab condo locations



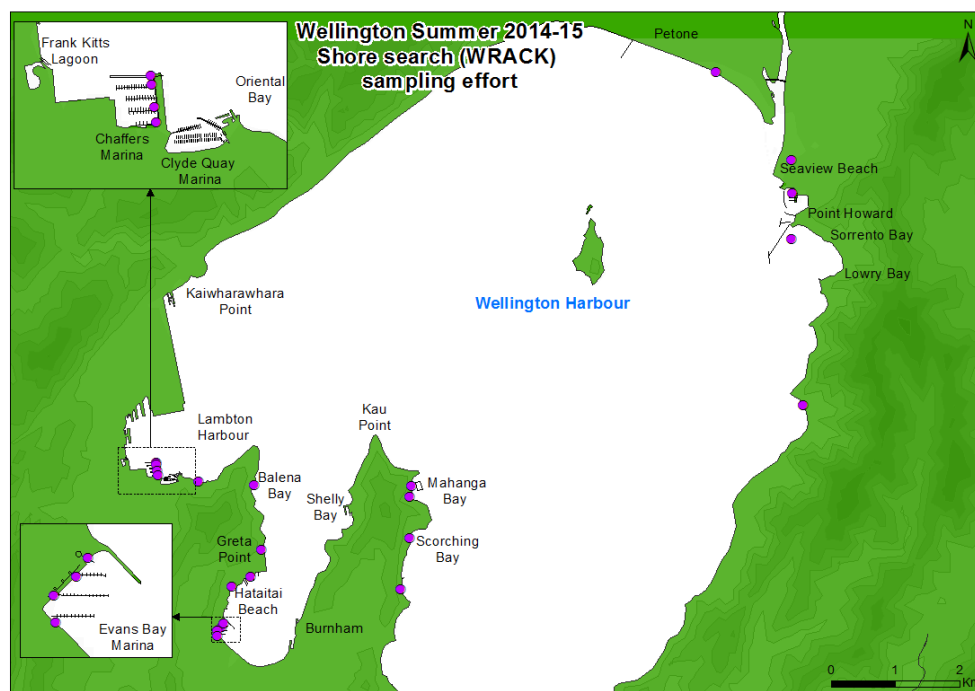
## Sledding locations



## Dive search locations



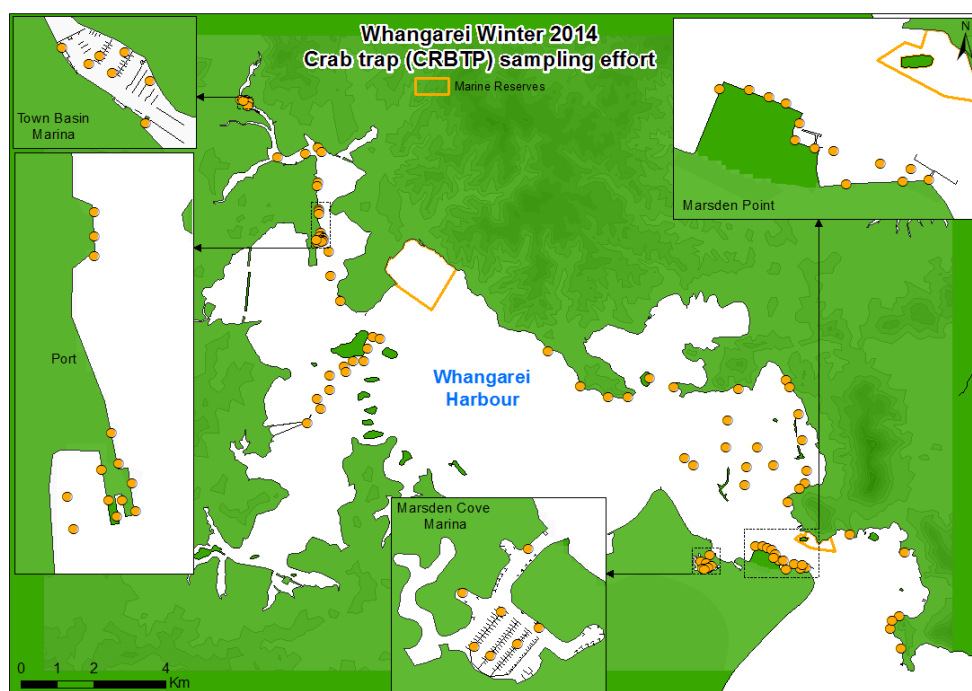
## Shore search locations



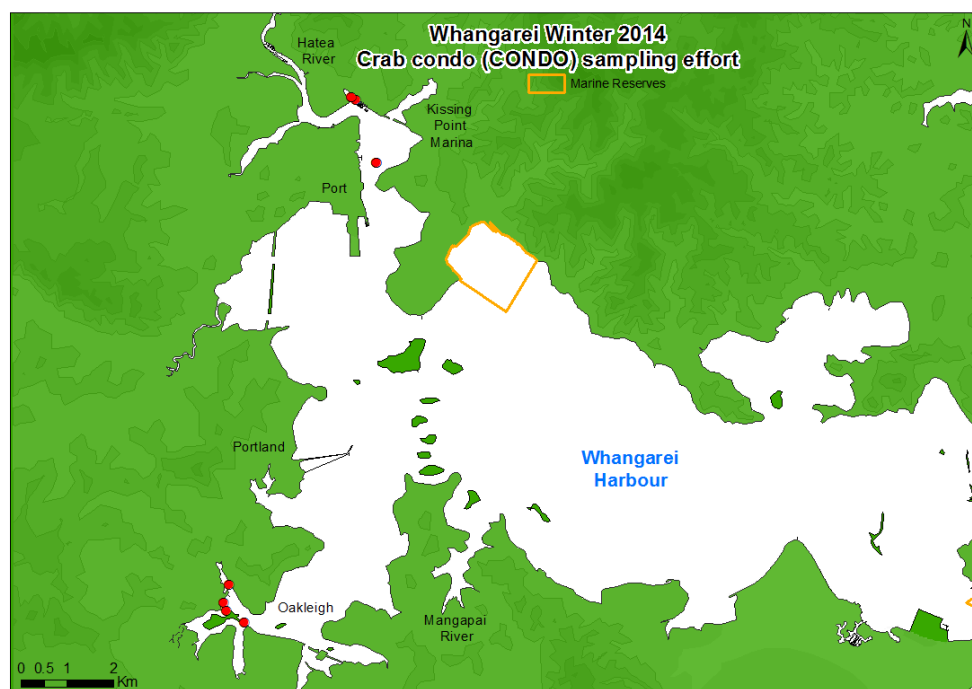
# WHANGAREI HARBOUR

Winter 2014

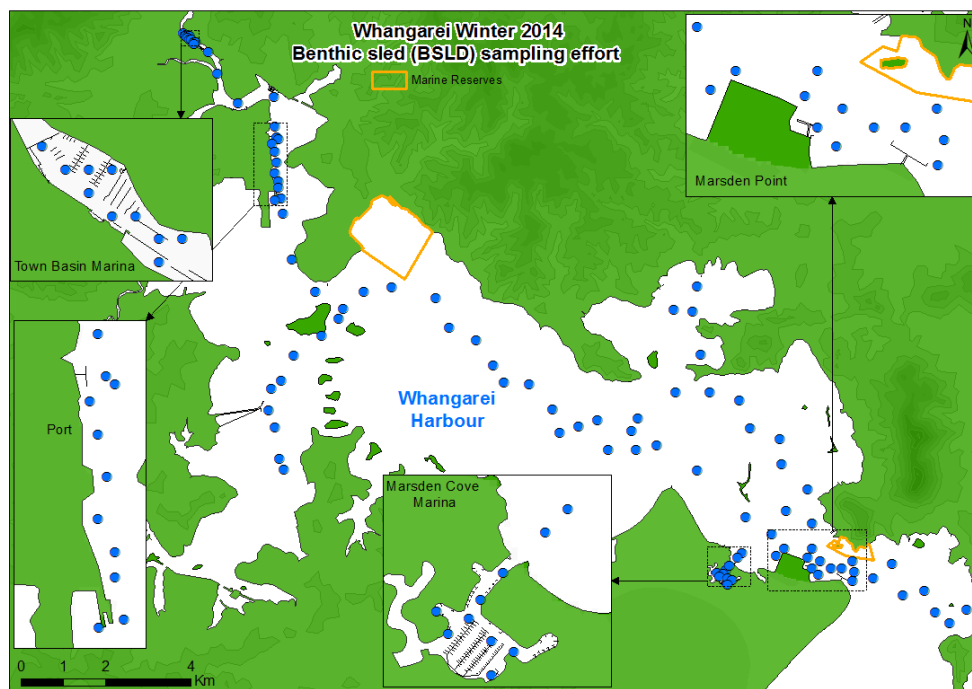
## Crab (box) trapping locations



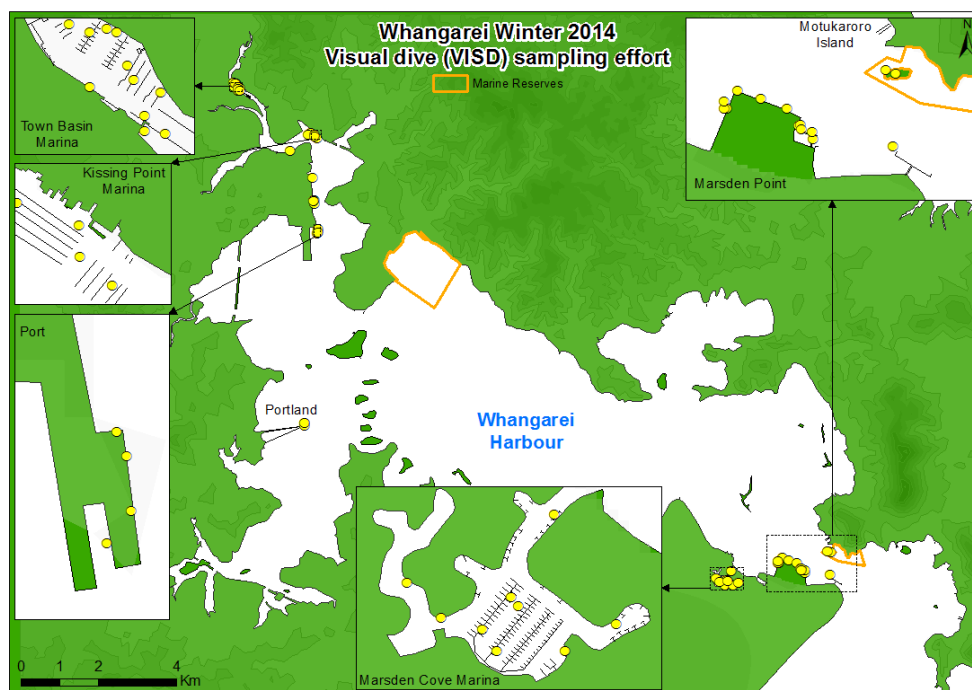
## Crab condo locations



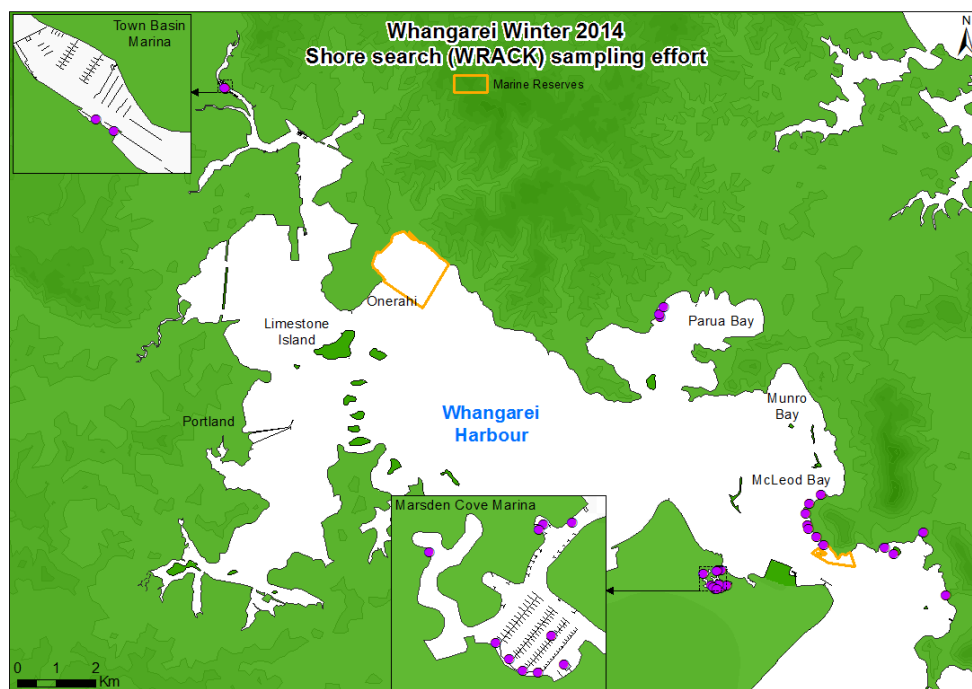
## Sledding locations



## Dive search locations

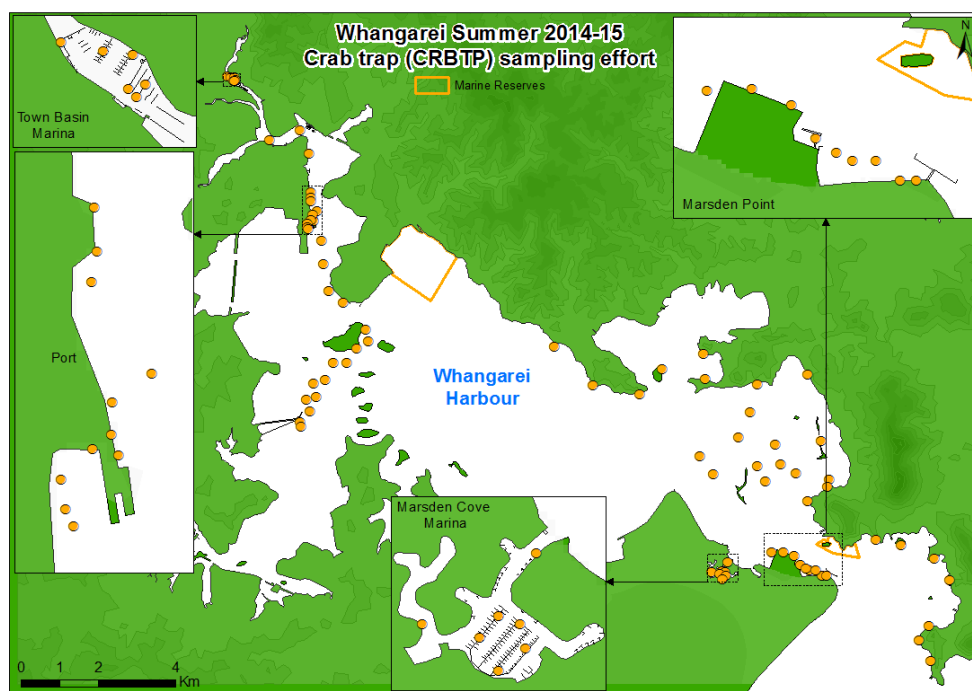


## Shore search locations

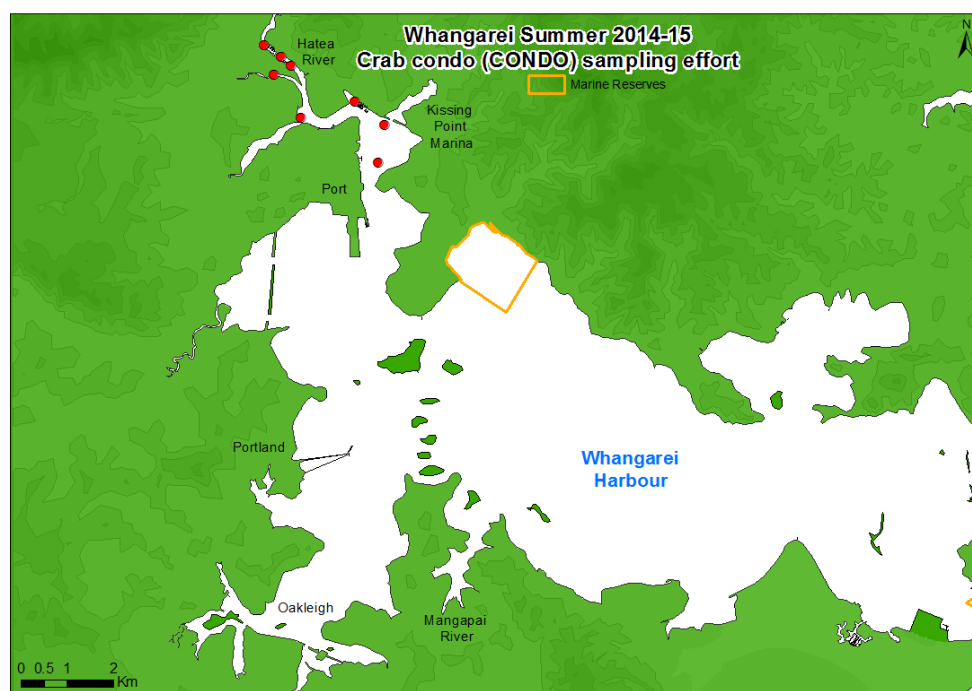


Summer 2014–15

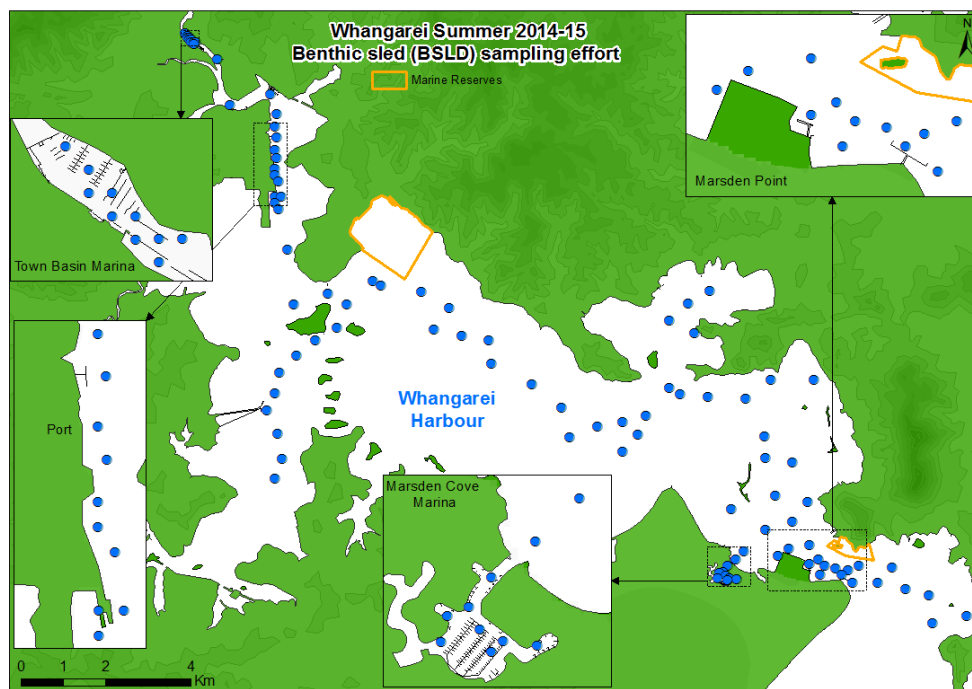
### Crab (box) trapping locations



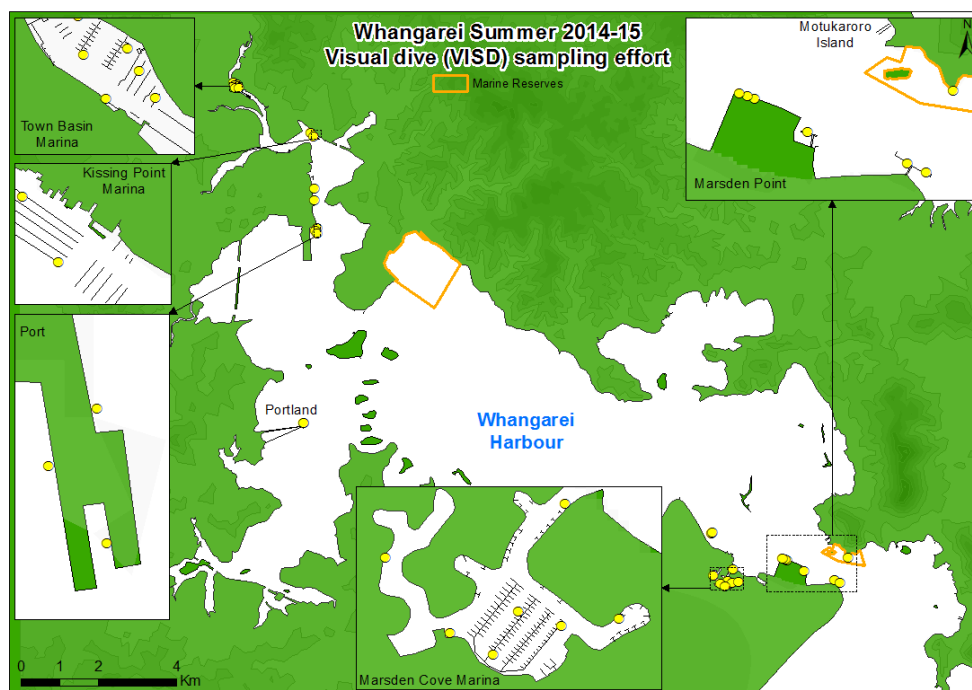
### Crab condo locations



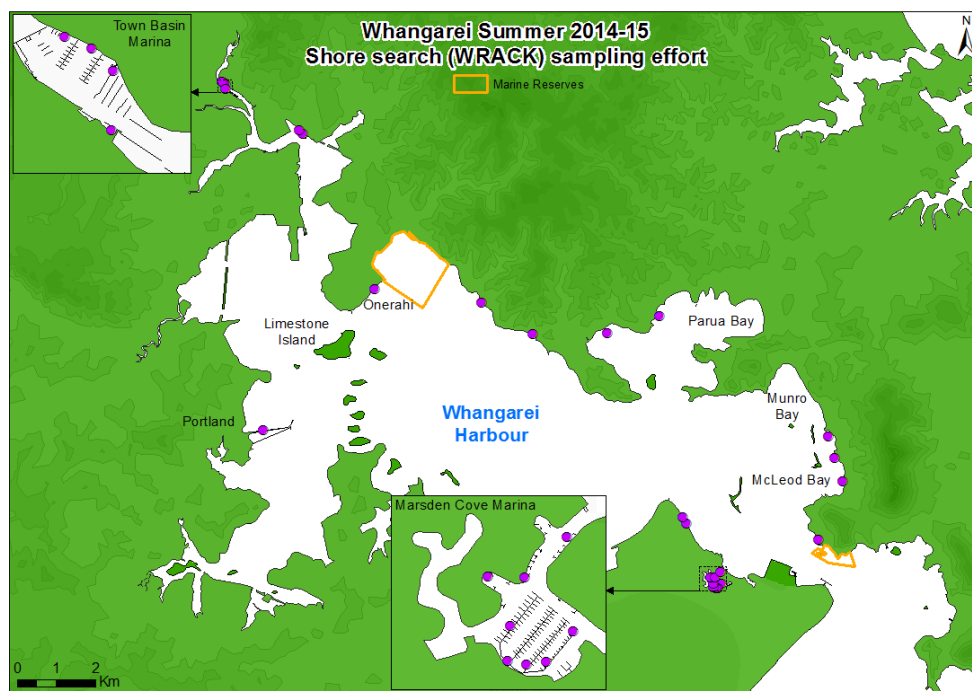
## Sledding locations



## Dive search locations



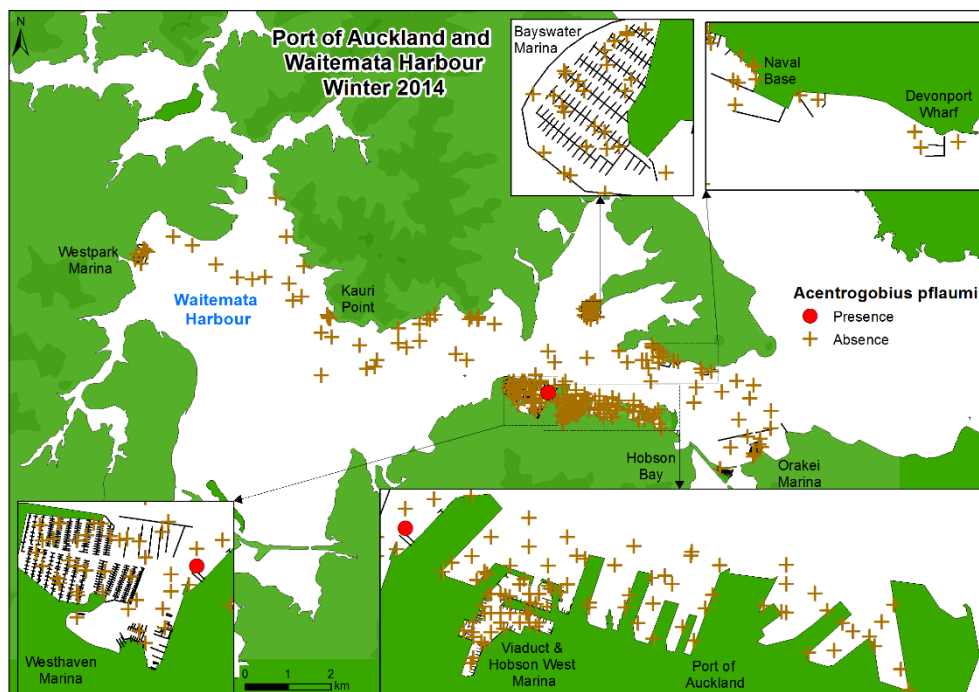
## Shore search locations



## Appendix 4. Distribution maps for target and selected non-target species in Winter 2014 and Summer 2014–15.

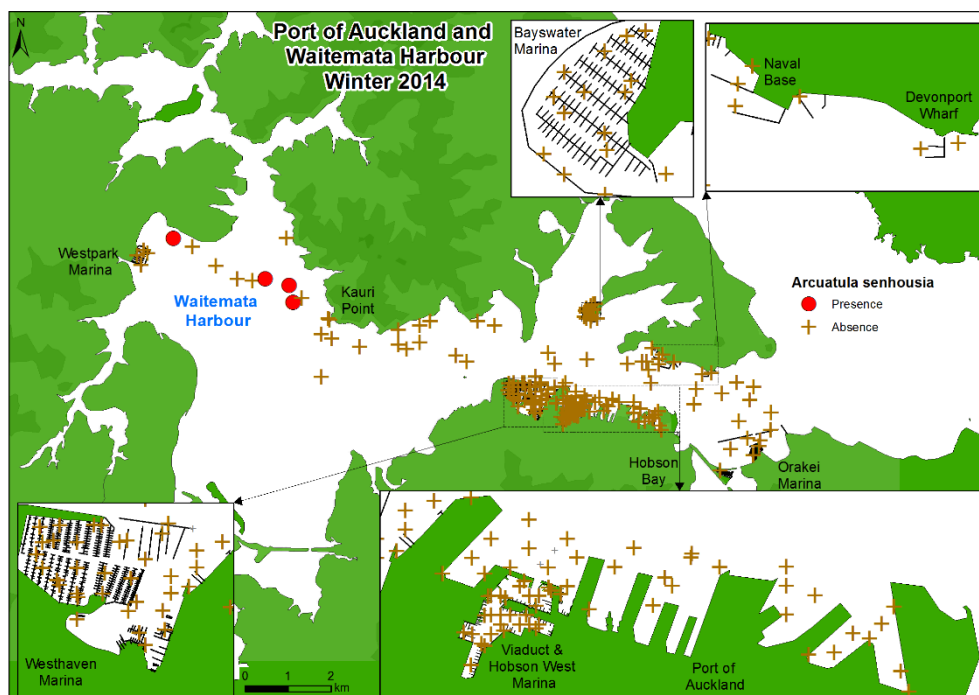
### *ACENTROGOBIUS PFLAUMII*

#### Auckland (Waitemata) Harbour Winter 2014

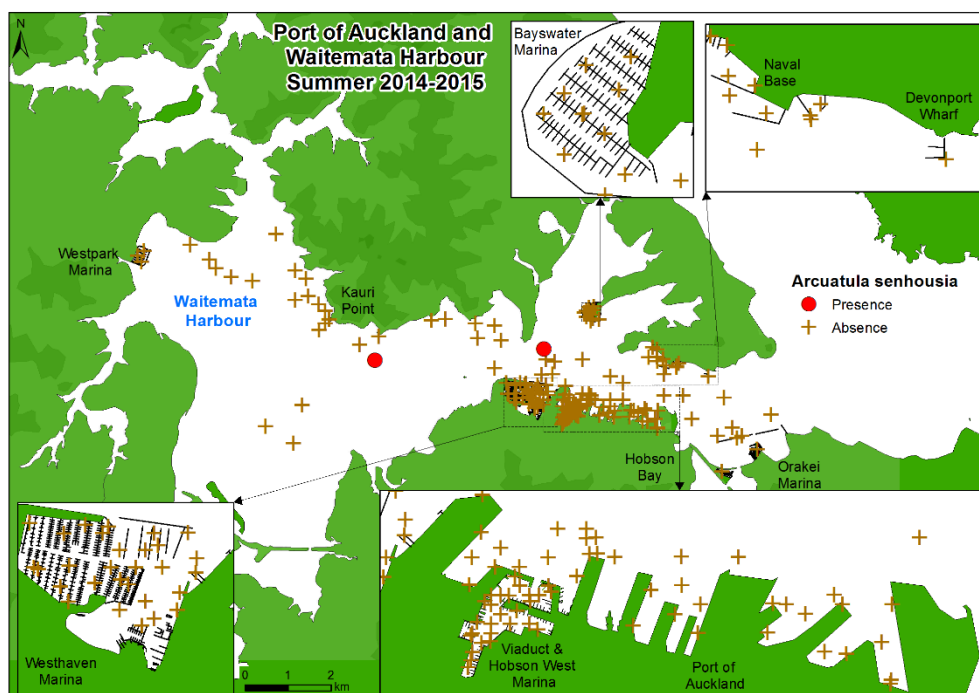


## ARCUATULA SENHOUSIA

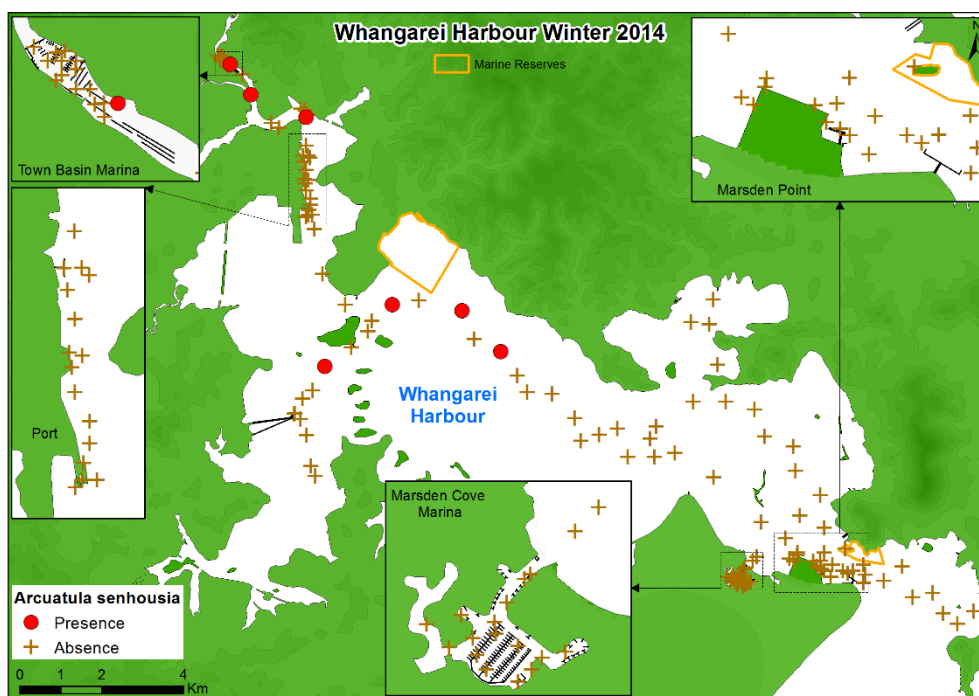
### Auckland (Waitemata) Harbour Winter 2014



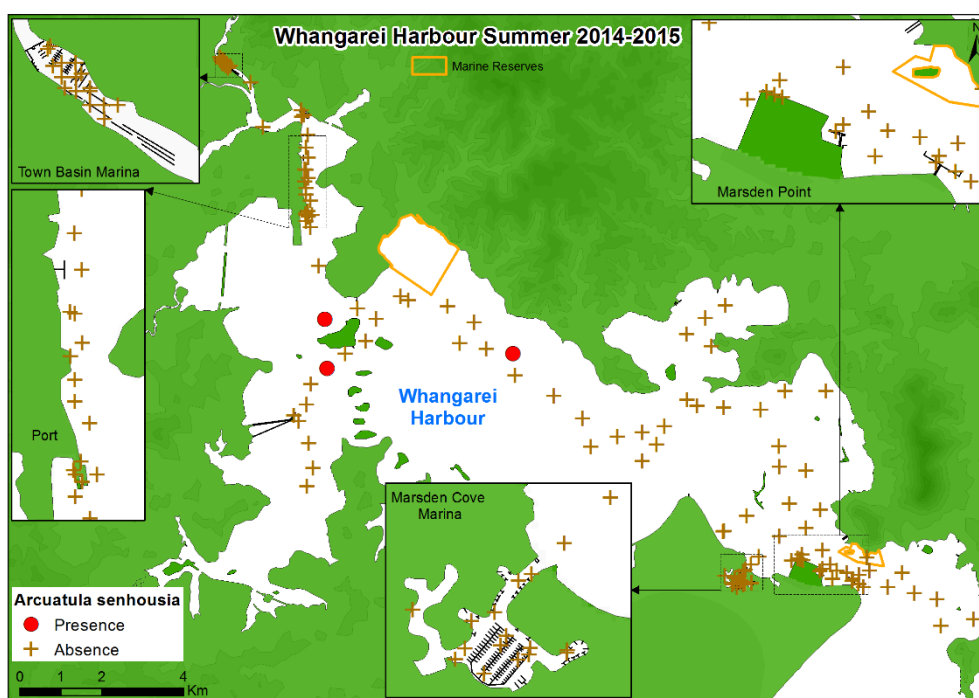
### Auckland (Waitemata) Harbour Summer 2014–15



## Whangarei Harbour Winter 2014

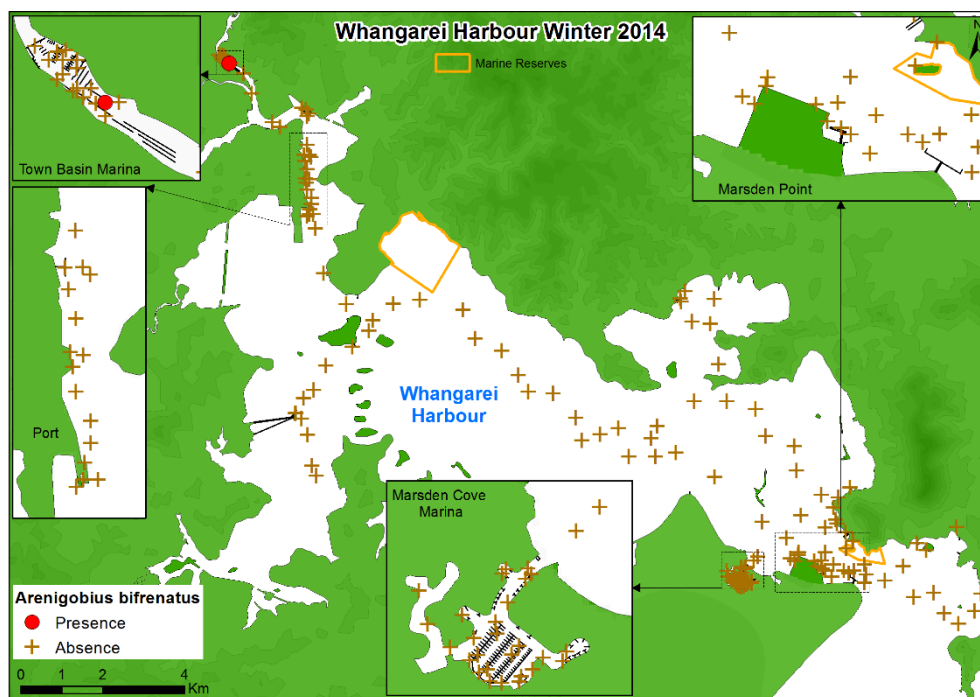


## Whangarei Harbour Summer 2014-15



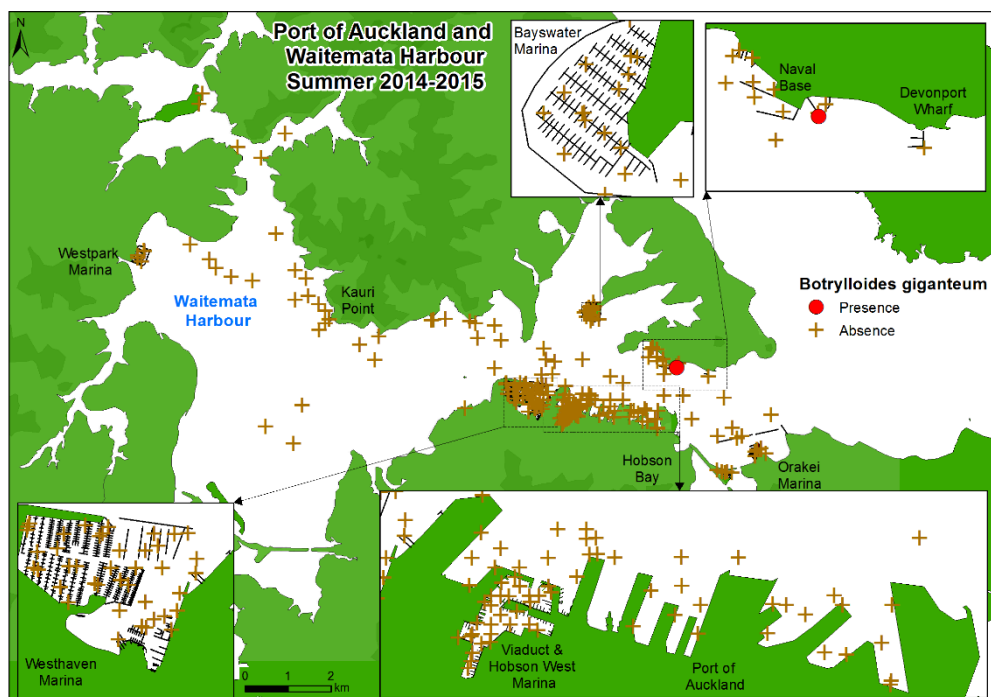
## *ARENIGOBIUS BIFRENATUS*

### Whangarei Harbour Winter 2014

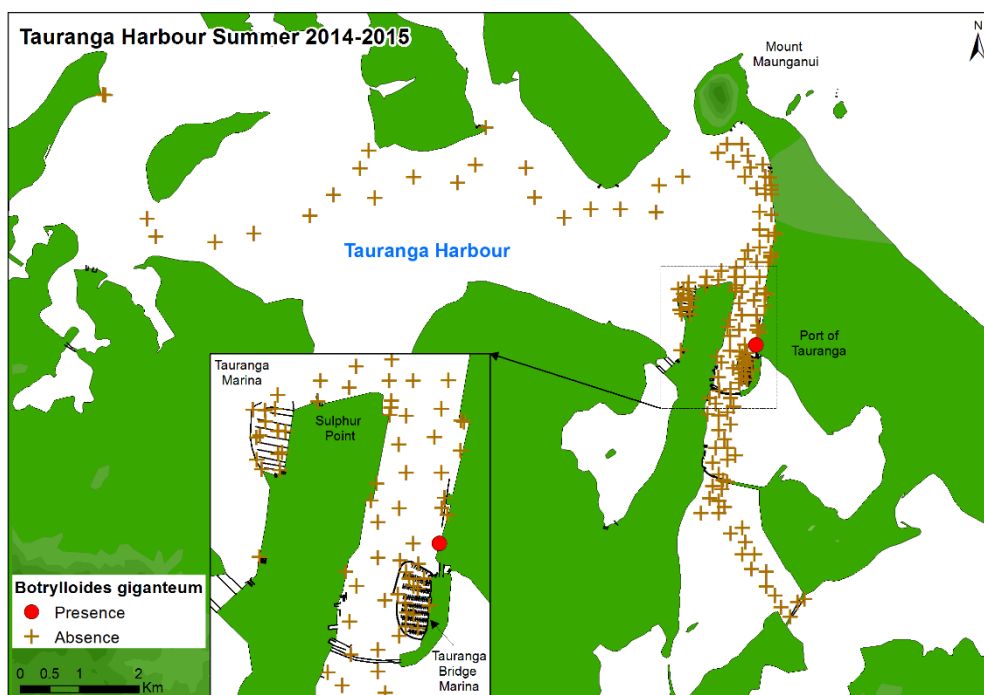


## *BOTRYLLOIDES GIGANTEUM*

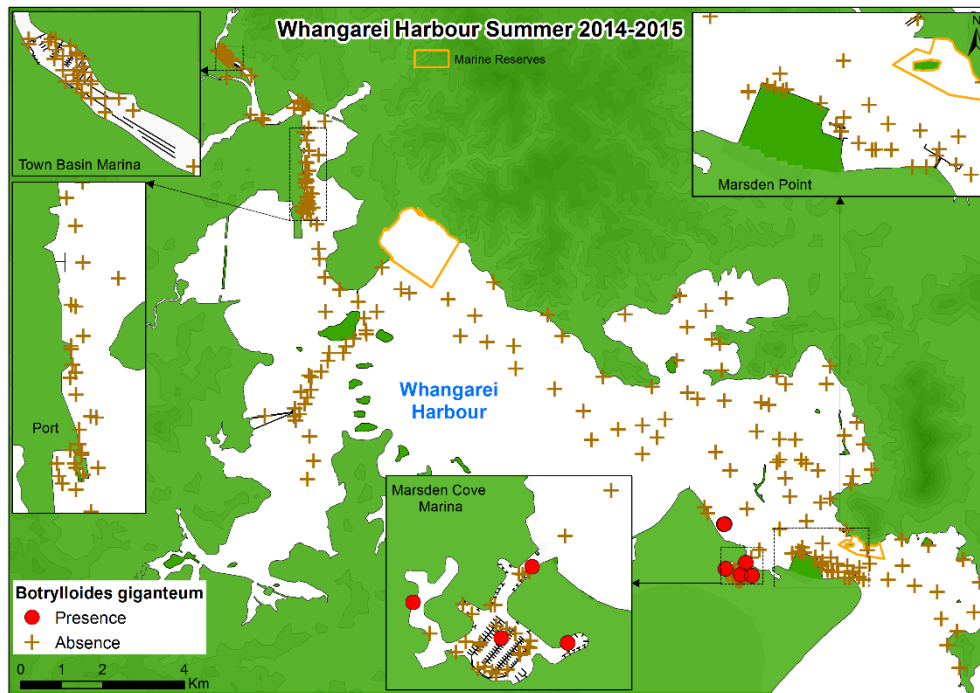
### Auckland (Waitemata) Harbour Summer 2014–15



### Tauranga Harbour Summer 2014–15

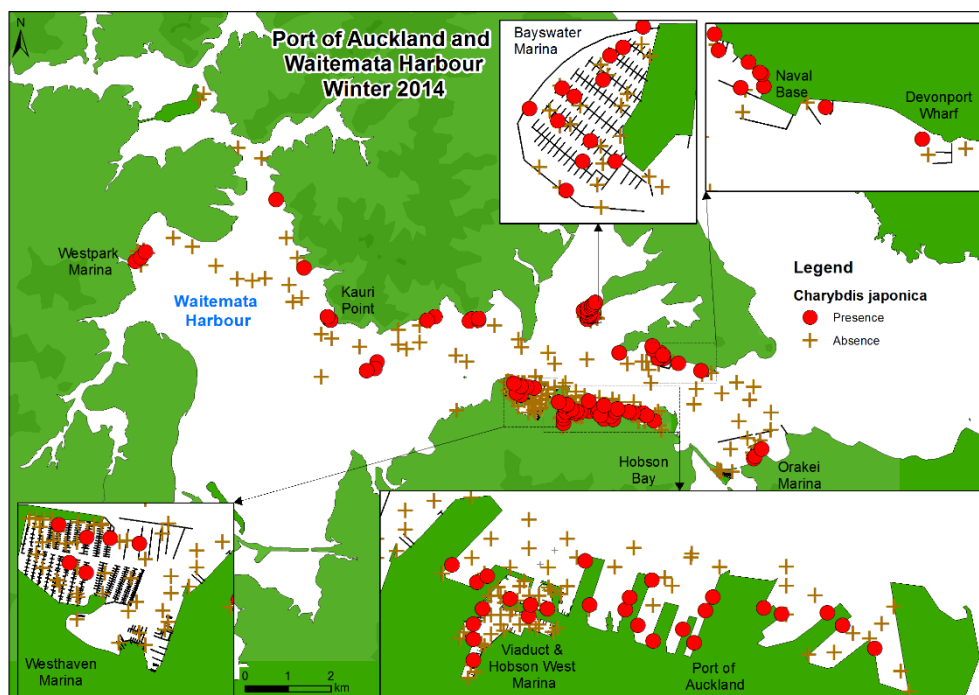


## Whangarei Harbour Summer 2014–15

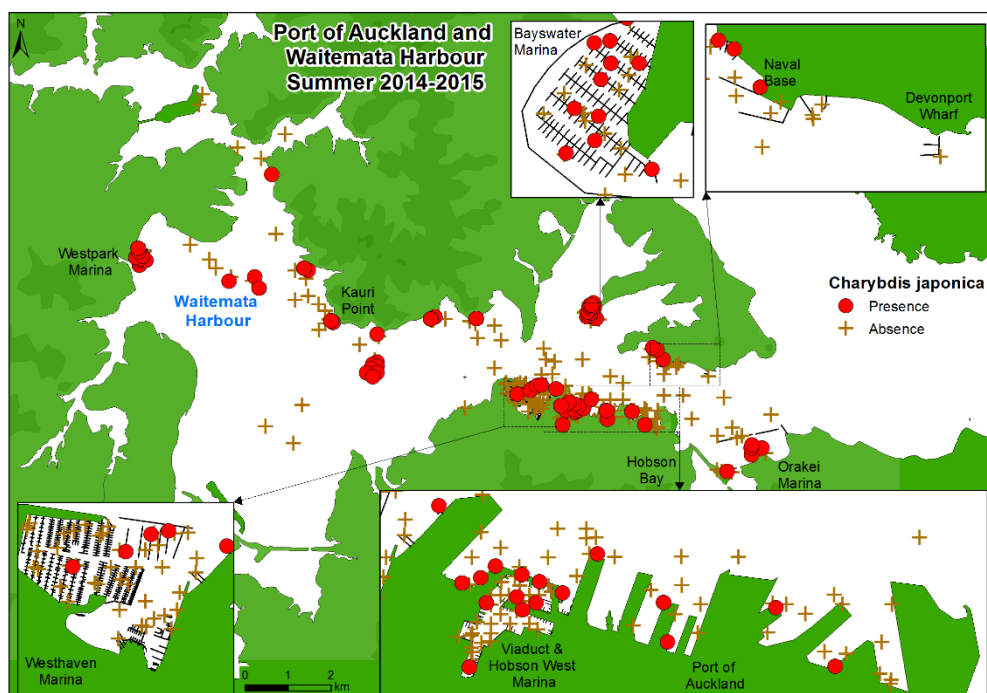


## CHARYBDIS JAPONICA

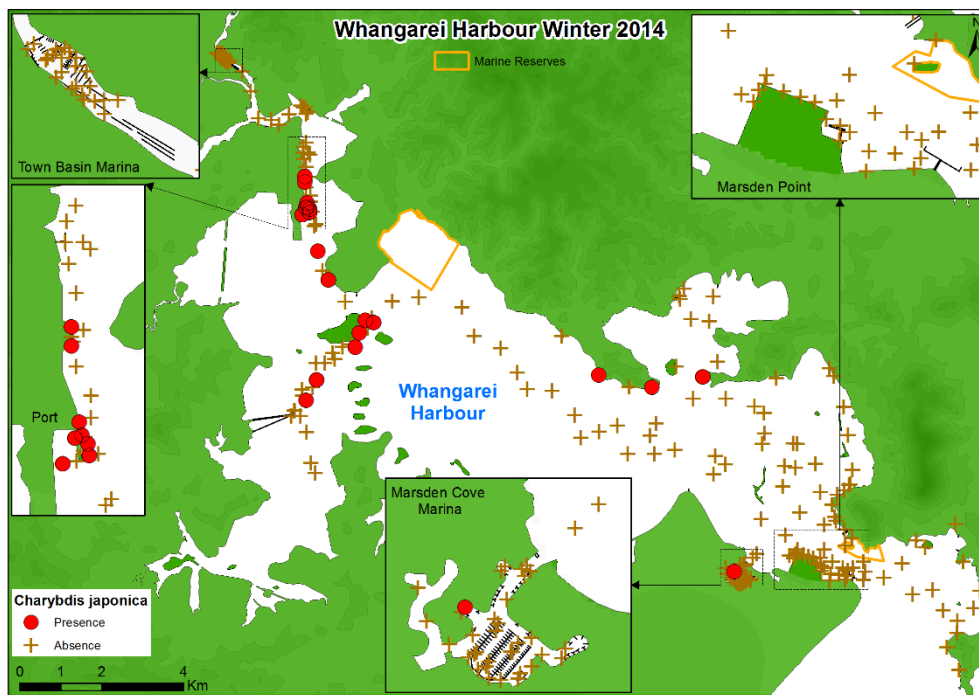
### Auckland (Waitemata) Harbour Winter 2014



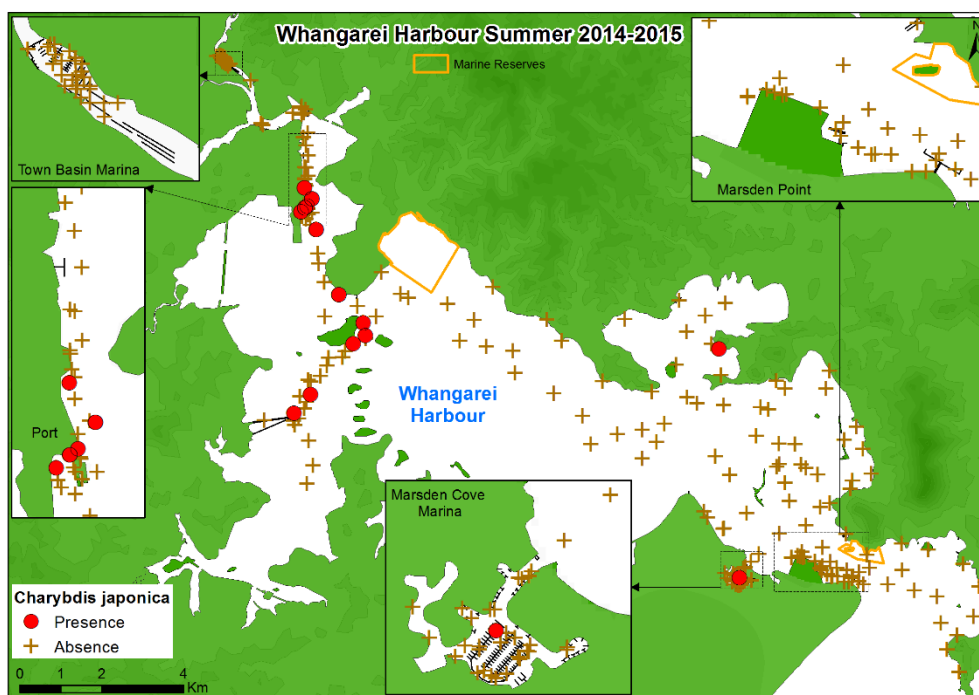
### Auckland (Waitemata) Harbour Summer 2014–15



## Whangarei Harbour Winter 2014

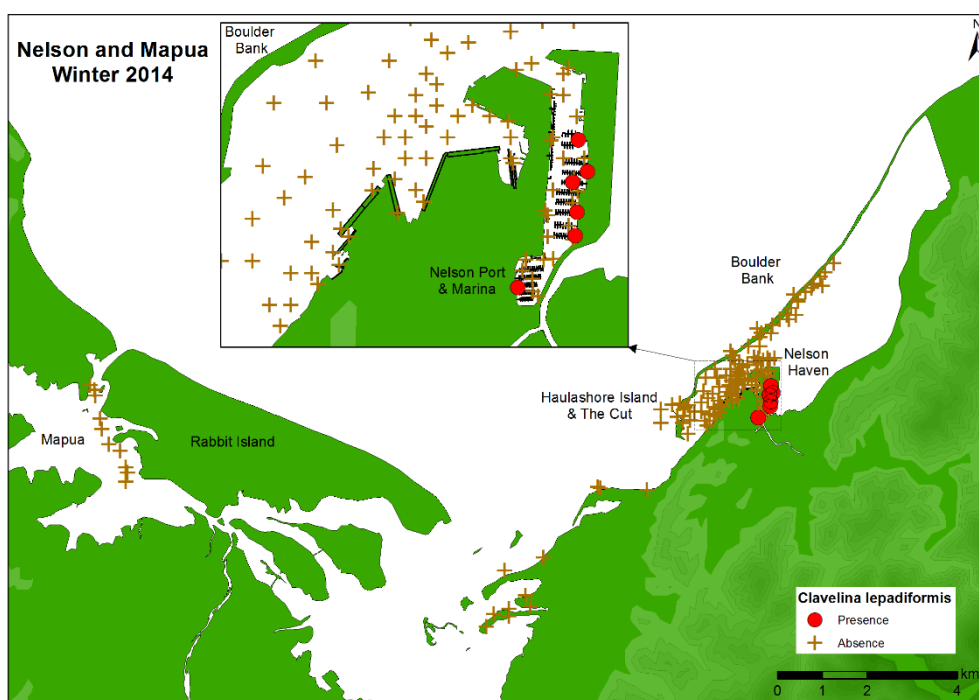


## Whangarei Harbour Summer 2014–15

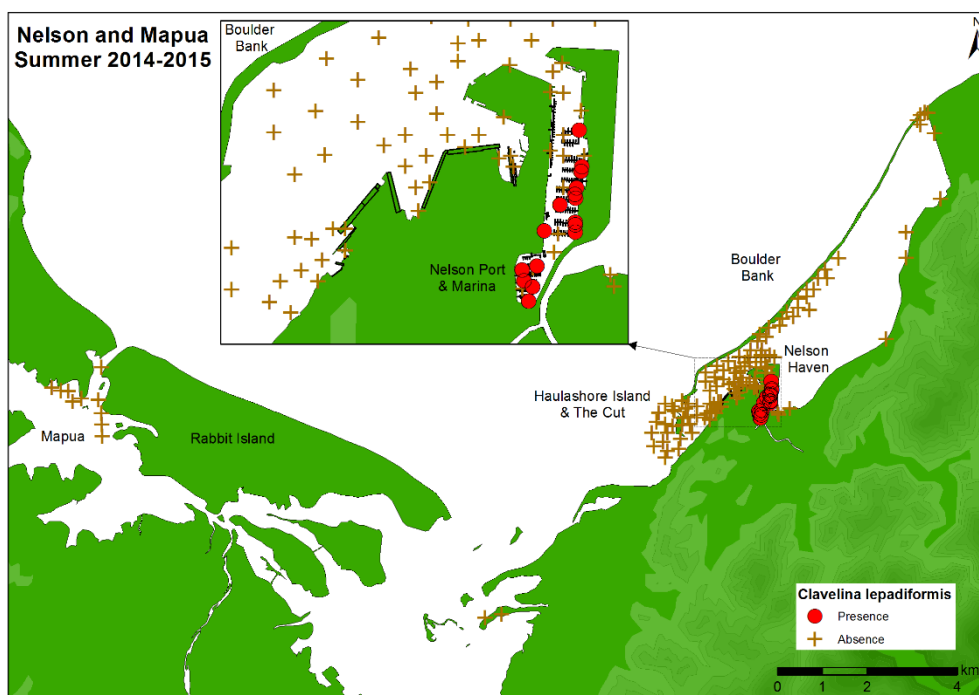


## *CLAVELINA LEPADIFORMIS*

### Nelson Harbour Winter 2014

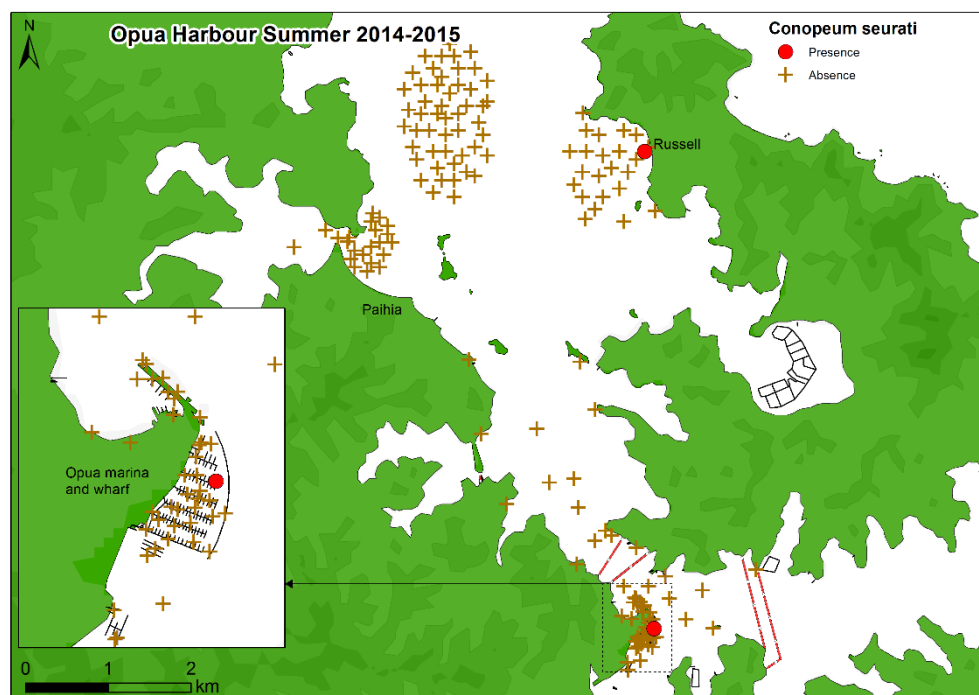


### Nelson Harbour Summer 2014–15



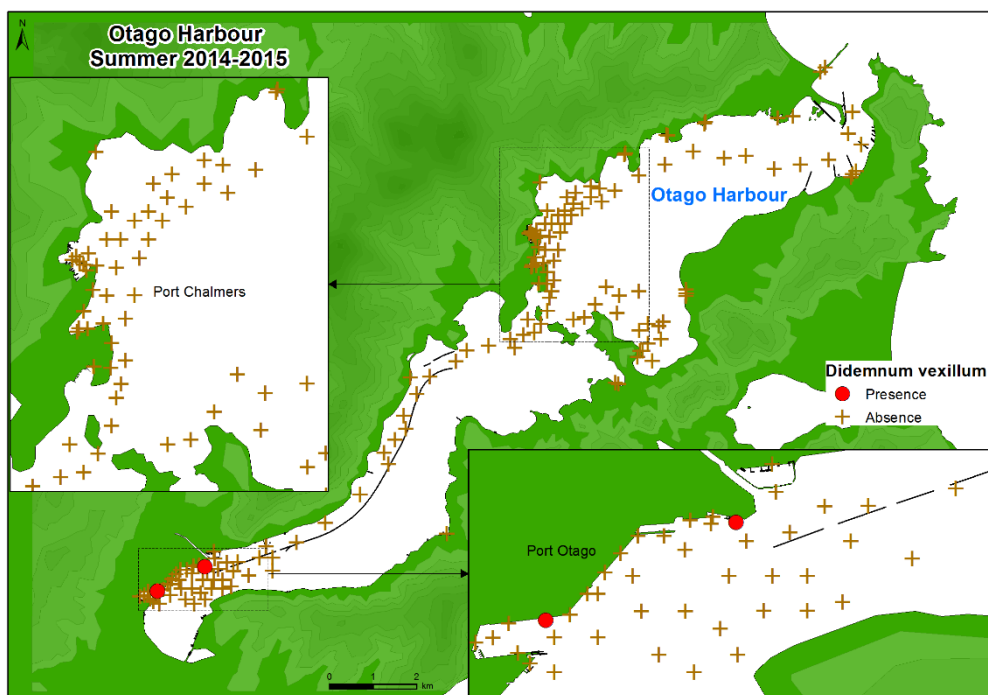
## *CONOPEUM SEURATI*

Opua Summer 2014–15

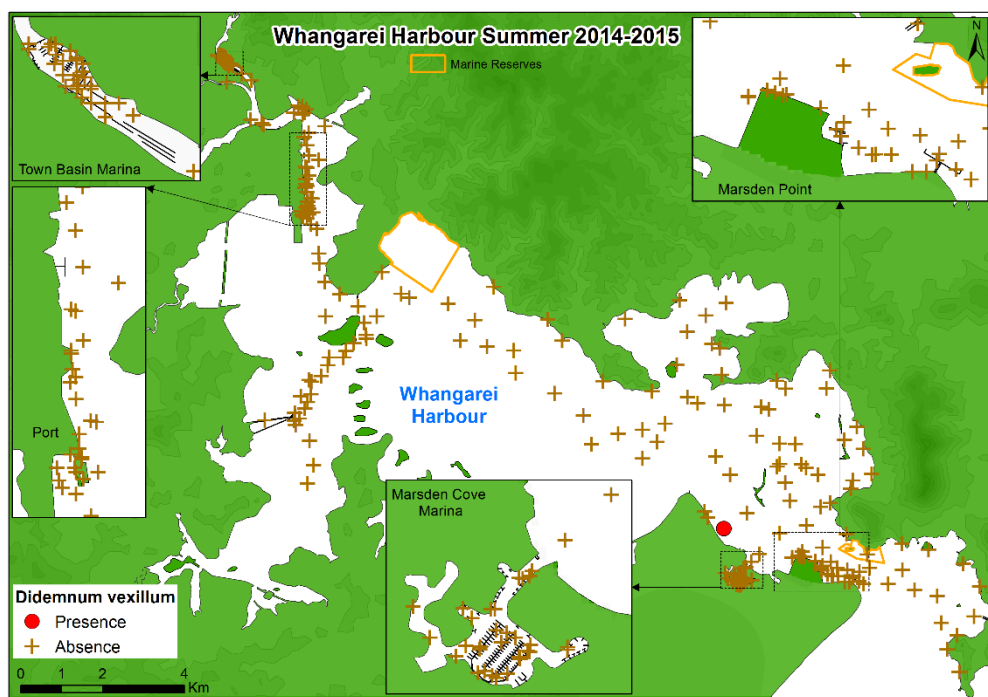


## *DIDEMNUM VEXILLUM*

### Otago Harbour Summer 2014–15

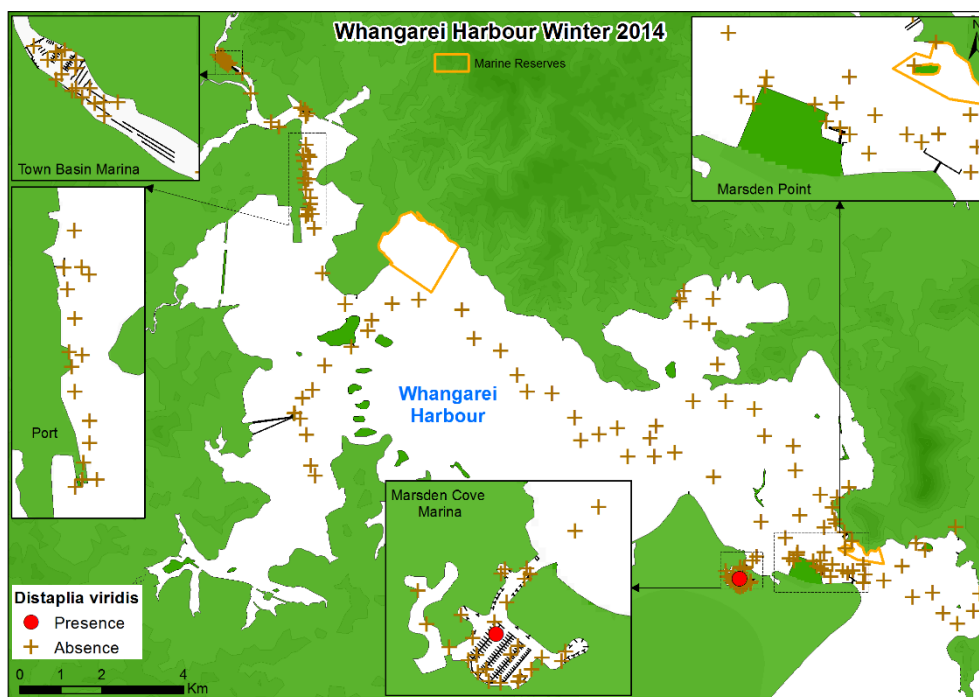


### Whangarei Harbour Summer 2014–15



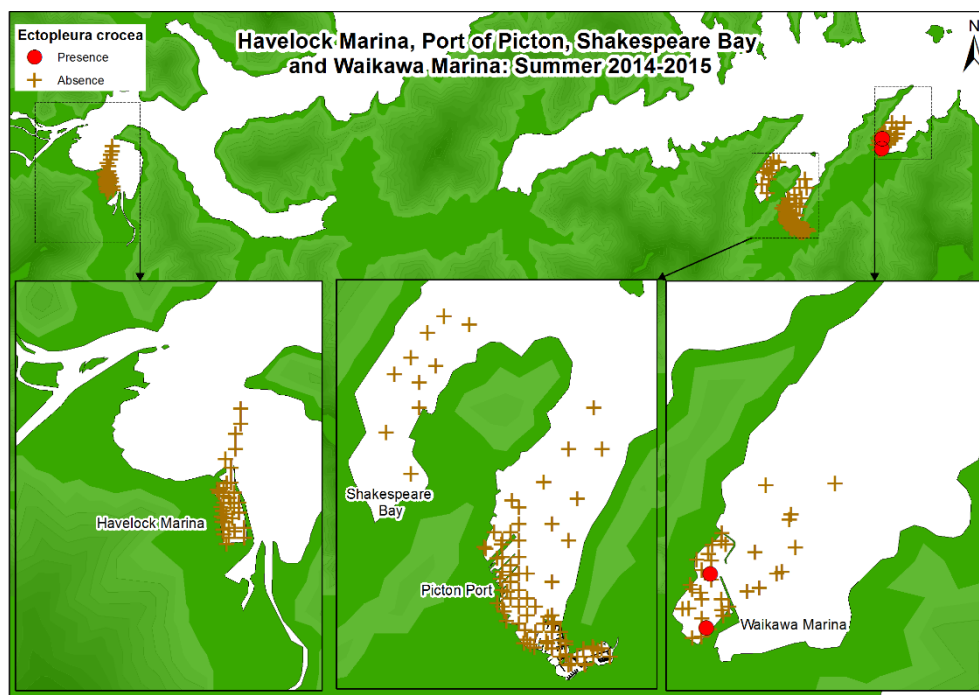
## *DISTAPLIA VIRIDIS*

### Whangarei Harbour Winter 2014



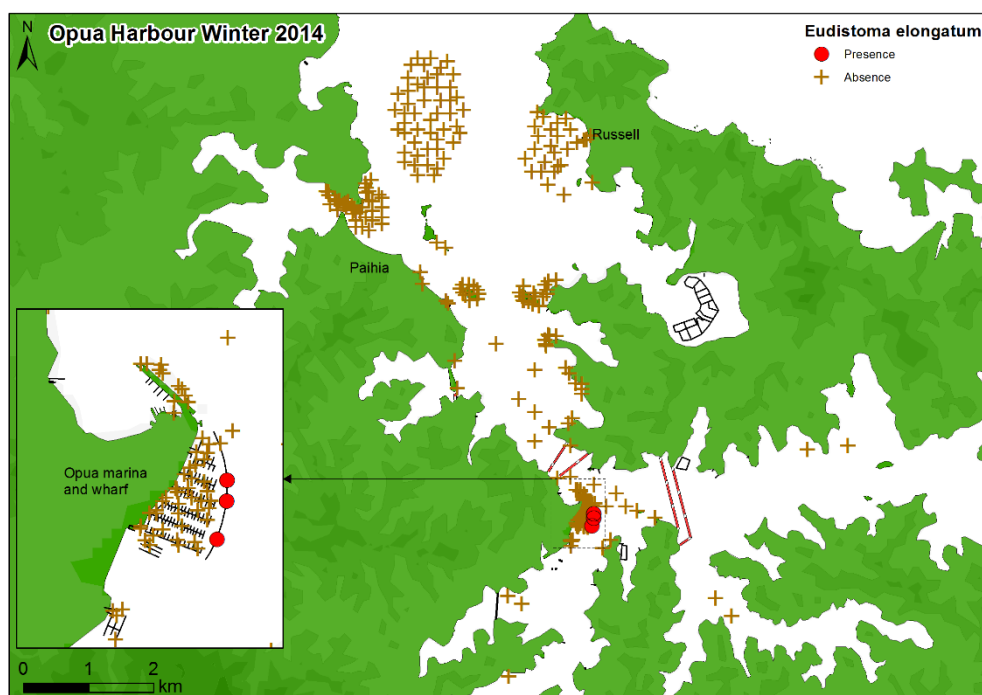
## *ECTOPLEURA CROCEA*

### Picton/Havelock Summer 2014–15

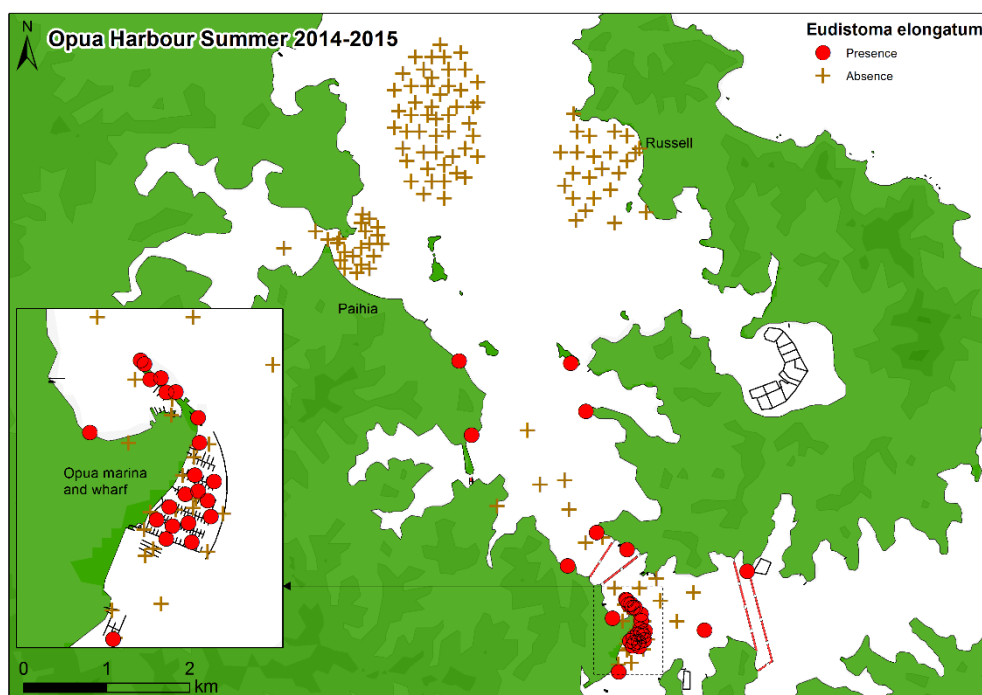


## *EUDISTOMA ELONGATUM*

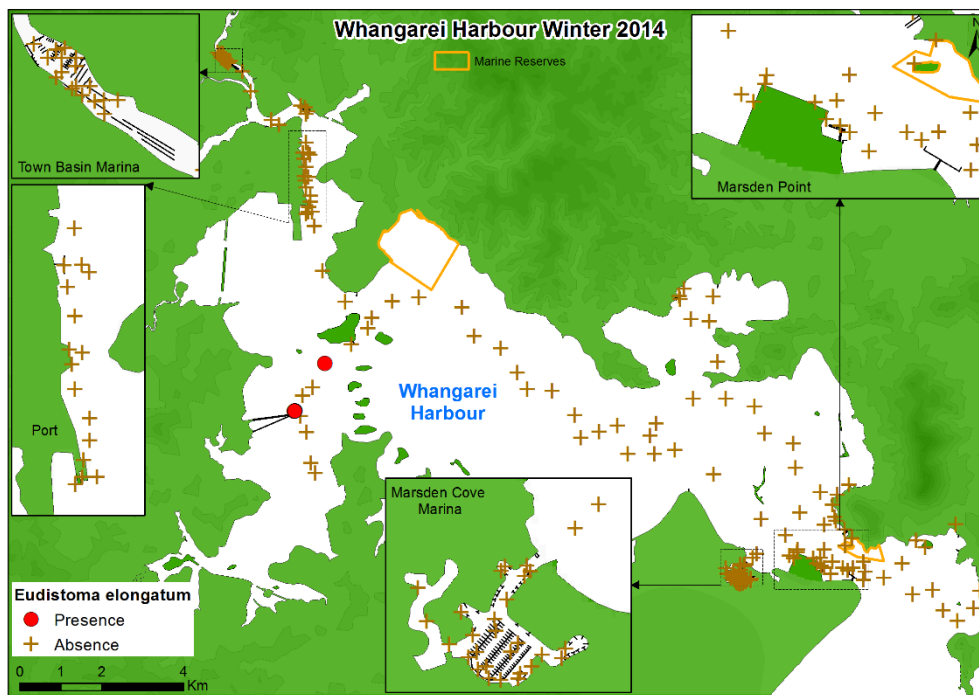
### Opua Winter 2014



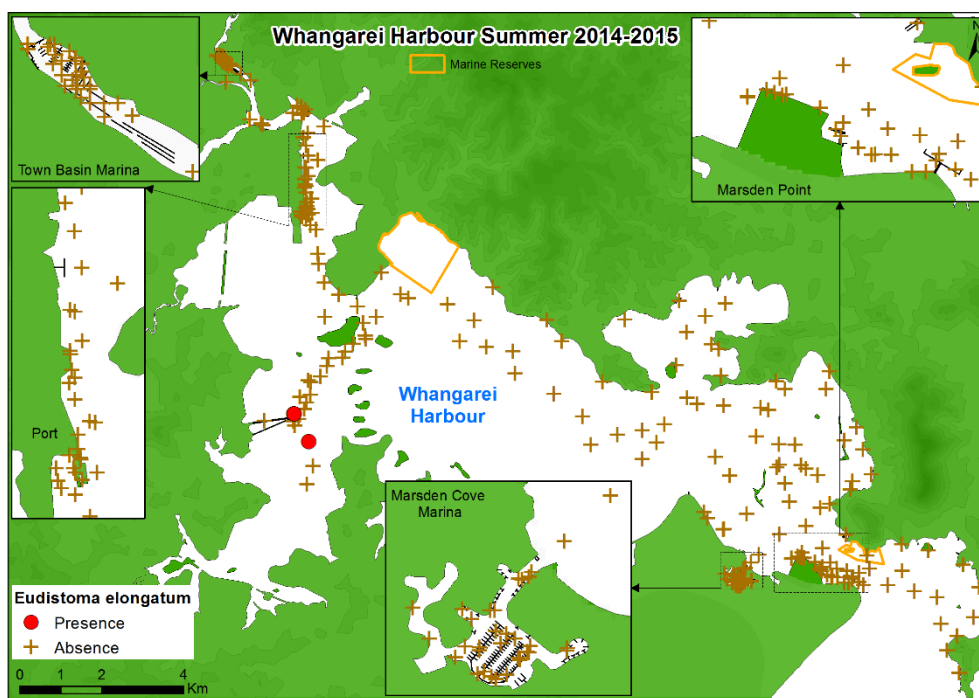
### Opua Summer 2014–15



## Whangarei Harbour Winter 2014

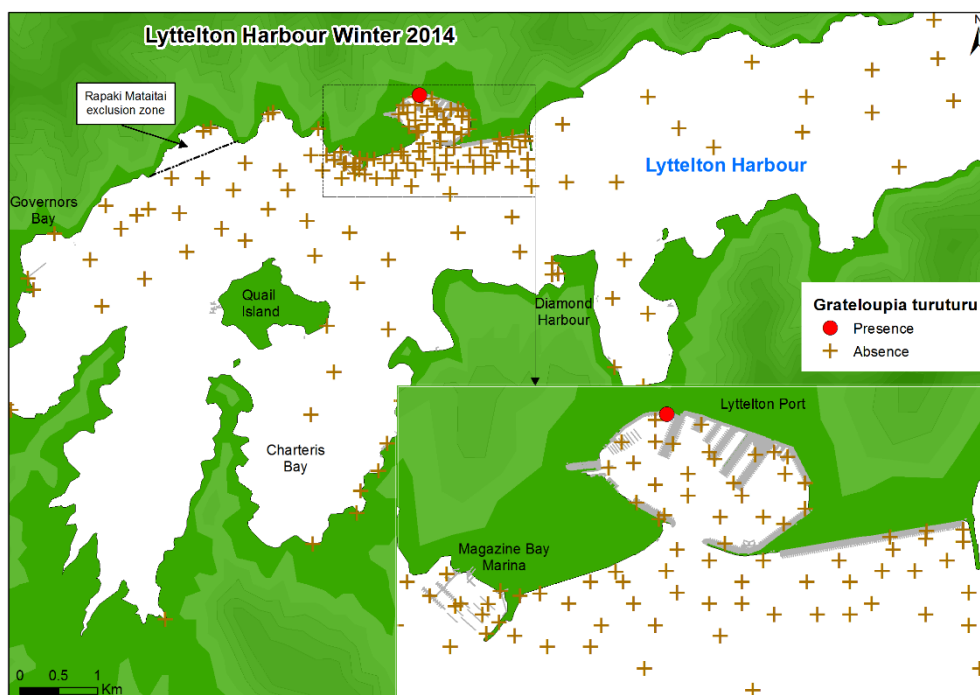


## Whangarei Harbour Summer 2014-15

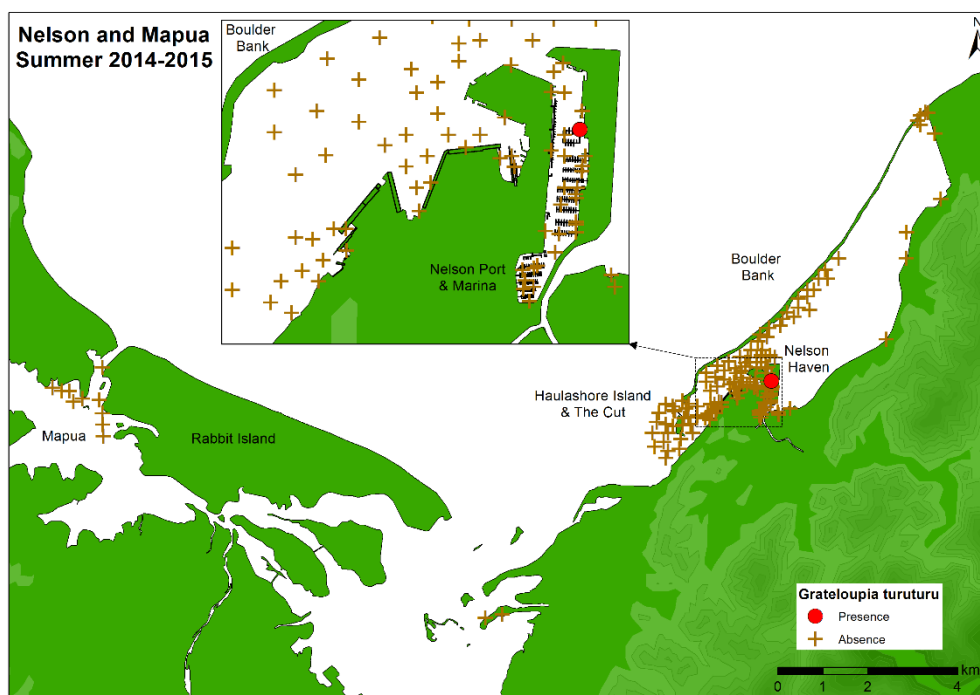


# GRATELOUPIA TURUTURU

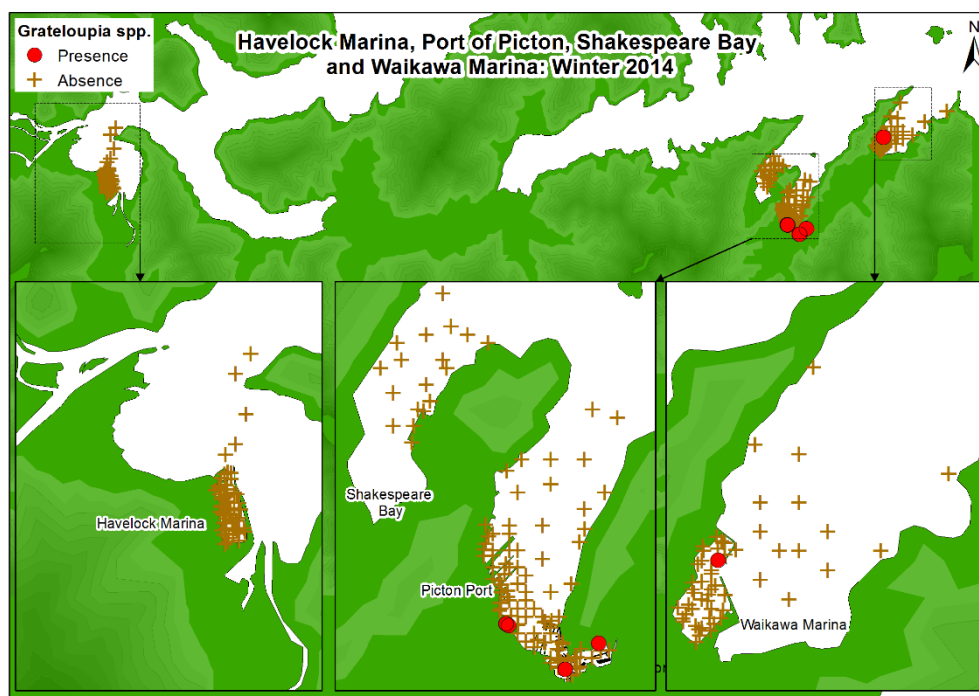
## Lyttelton Harbour Winter 2014



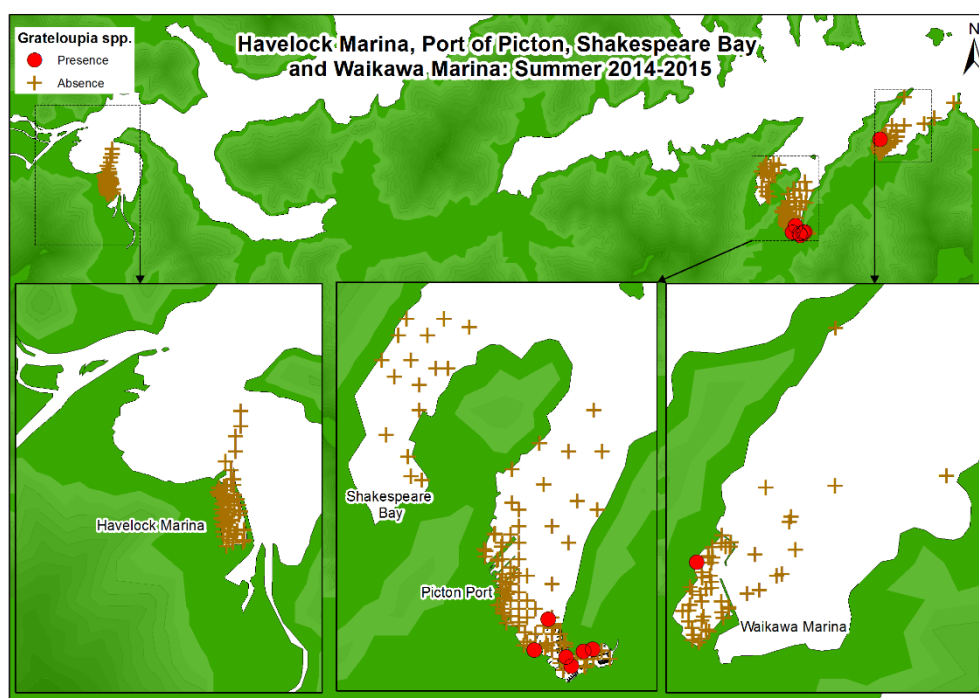
## Nelson Harbour Summer 2014–15



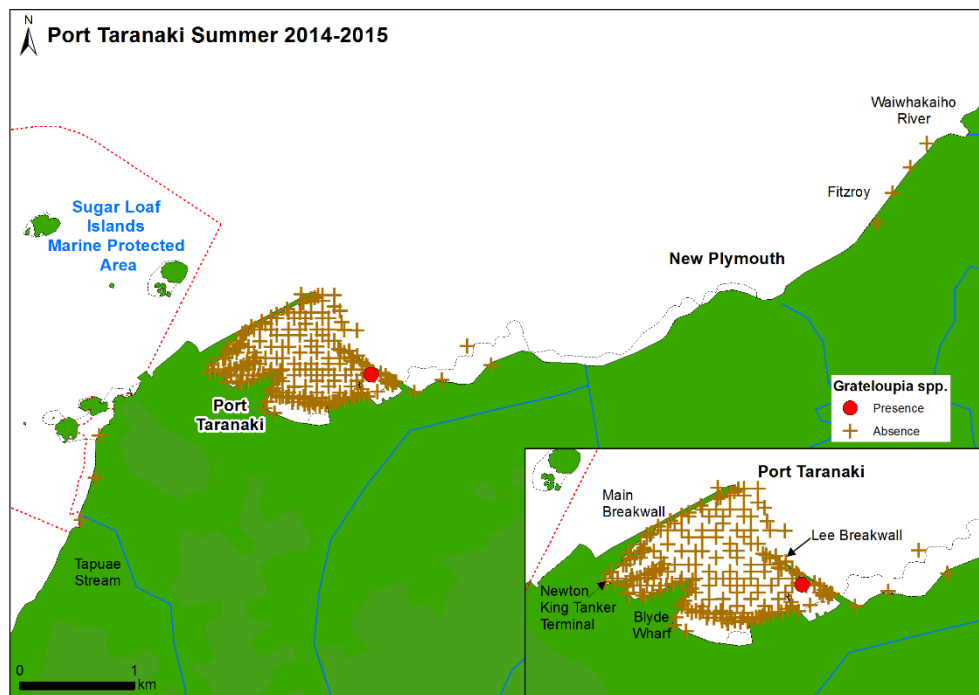
## Picton/Havelock Winter 2014



## Picton/Havelock Summer 2014–15

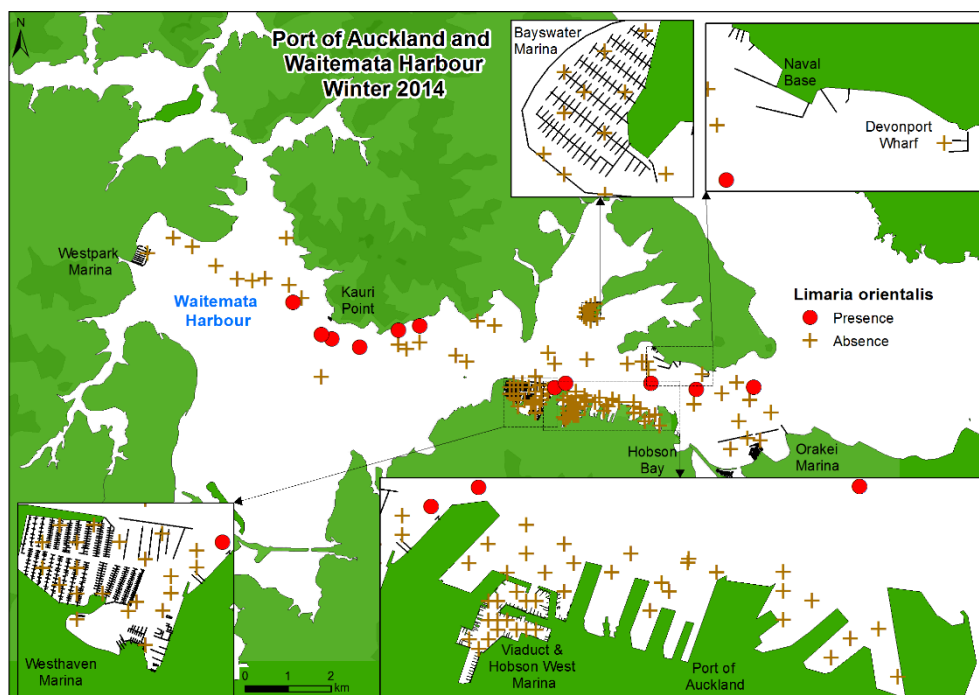


## Port Taranaki Summer 2014–15

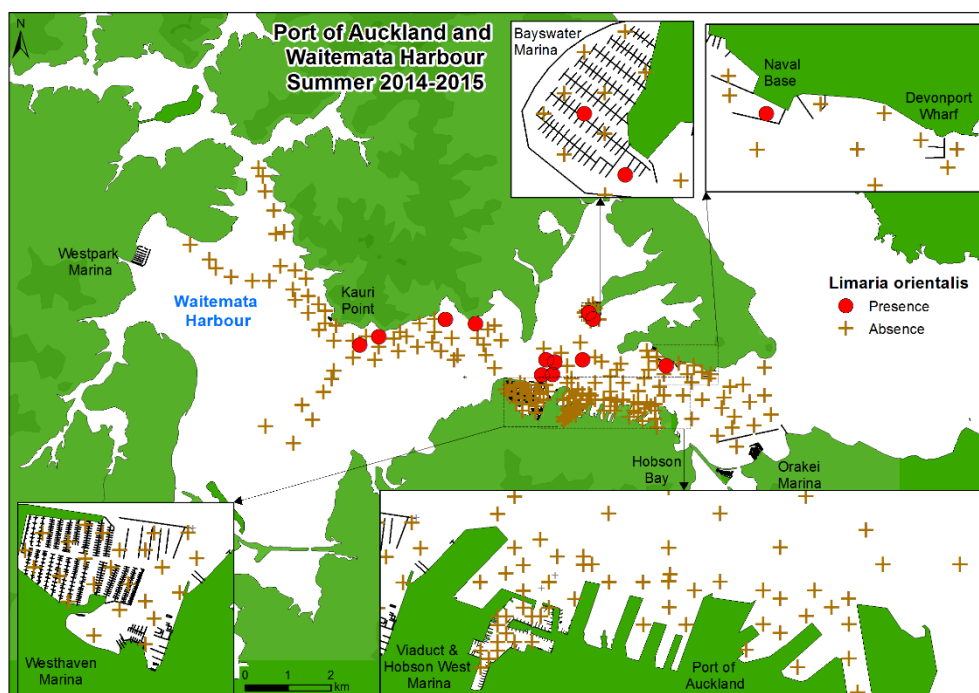


## LIMARIA ORIENTALIS

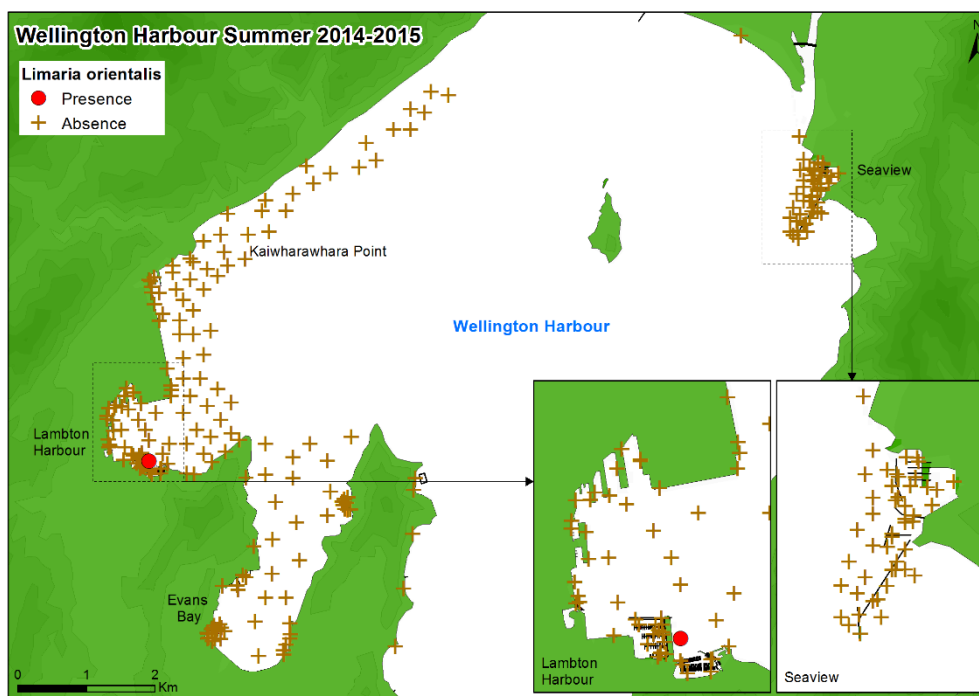
### Auckland (Waitemata) Harbour Winter 2014



### Auckland (Waitemata) Harbour Summer 2014–15

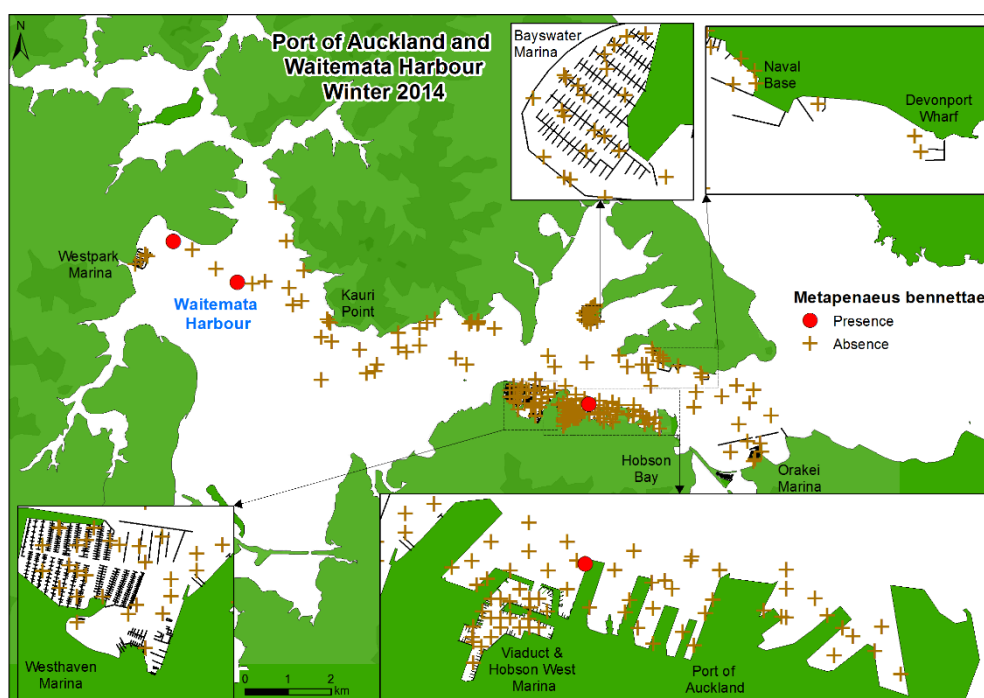


## Wellington Harbour Summer 2014–15

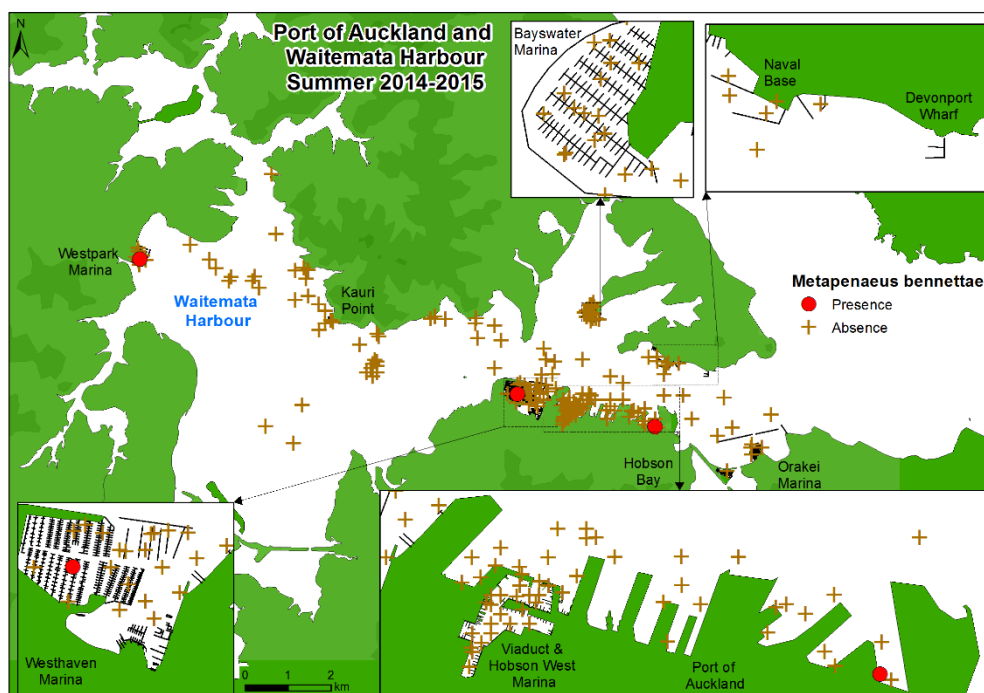


## *METAPENAEUS BENNETTAE*

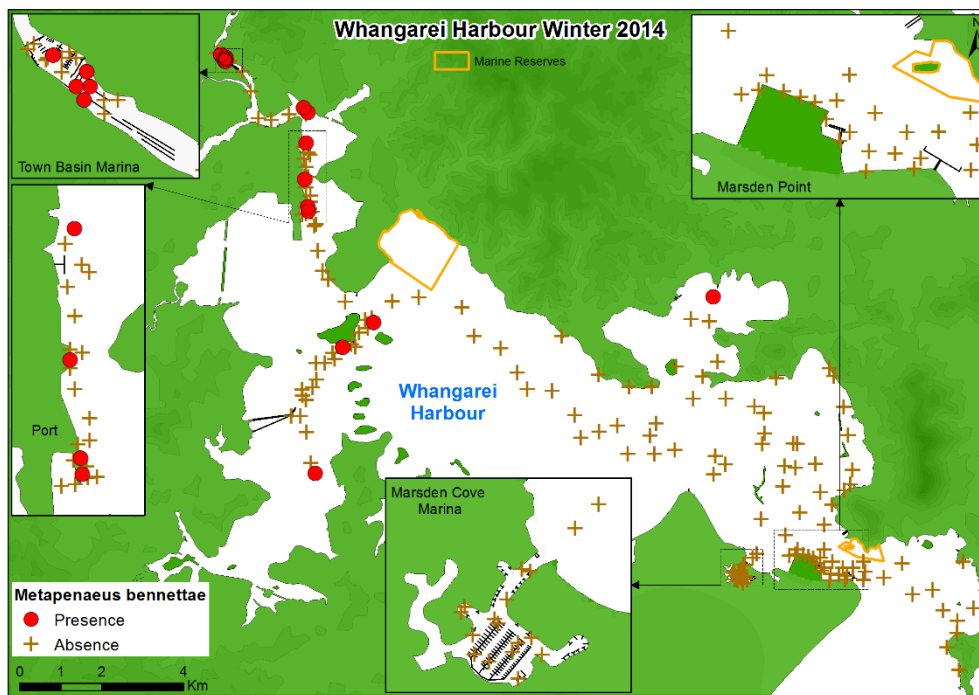
### Auckland (Waitemata) Harbour Winter 2014



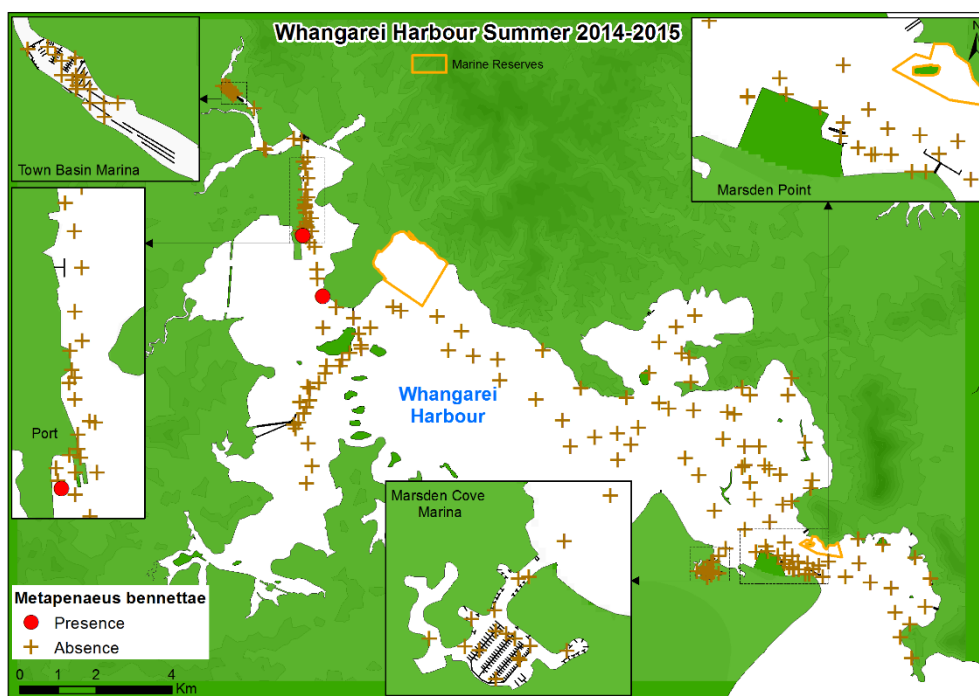
### Auckland (Waitemata) Harbour Summer 2014–15



## Whangarei Harbour Winter 2014

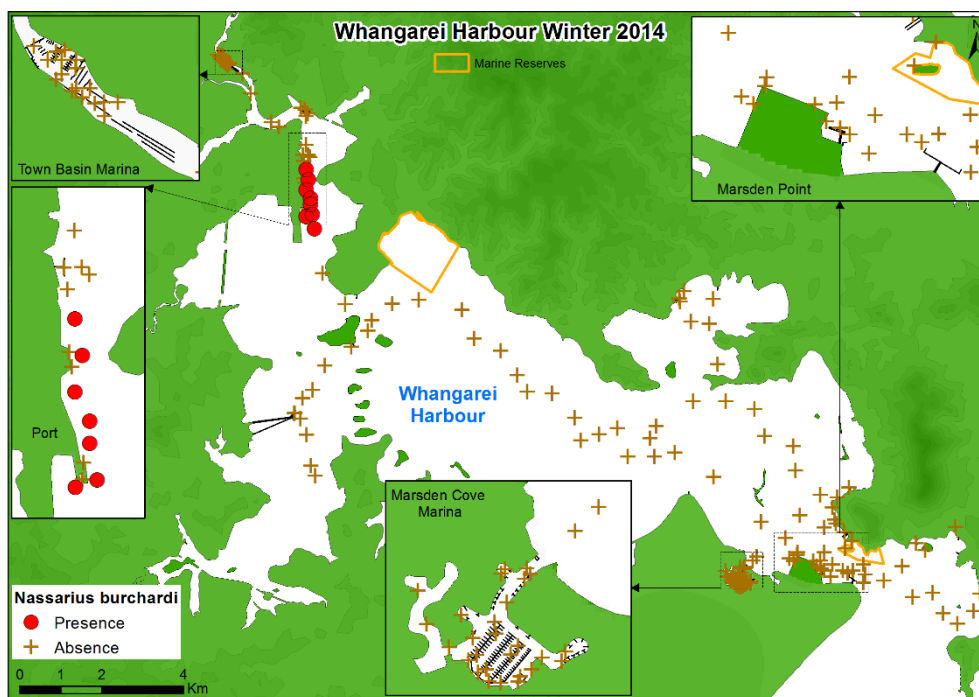


## Whangarei Harbour Summer 2014-15

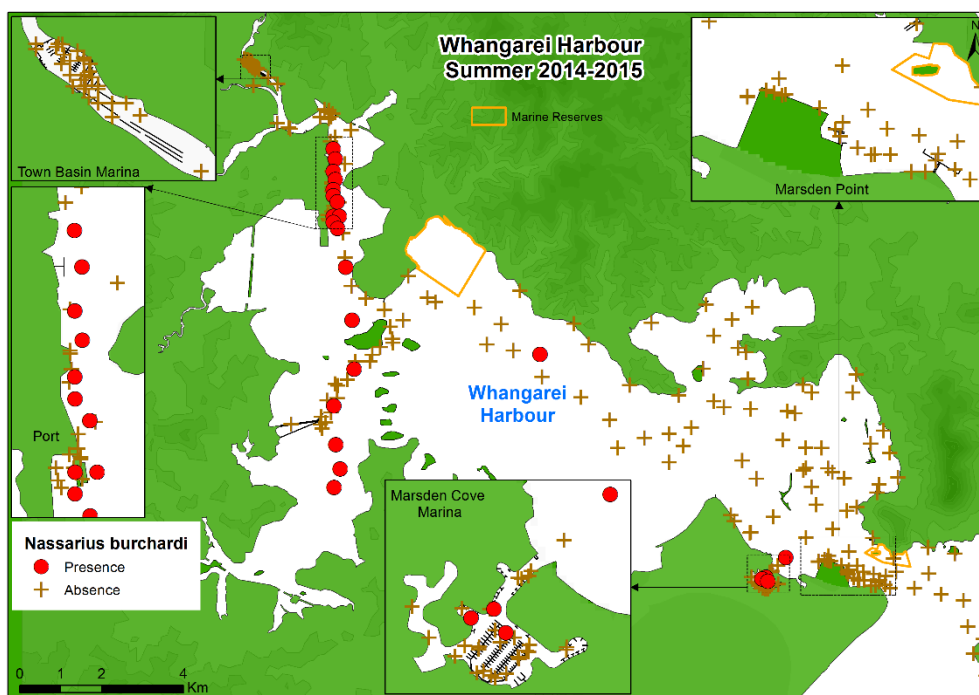


## *NASSARIUS BURCHARDI*

### Whangarei Harbour Winter 2014

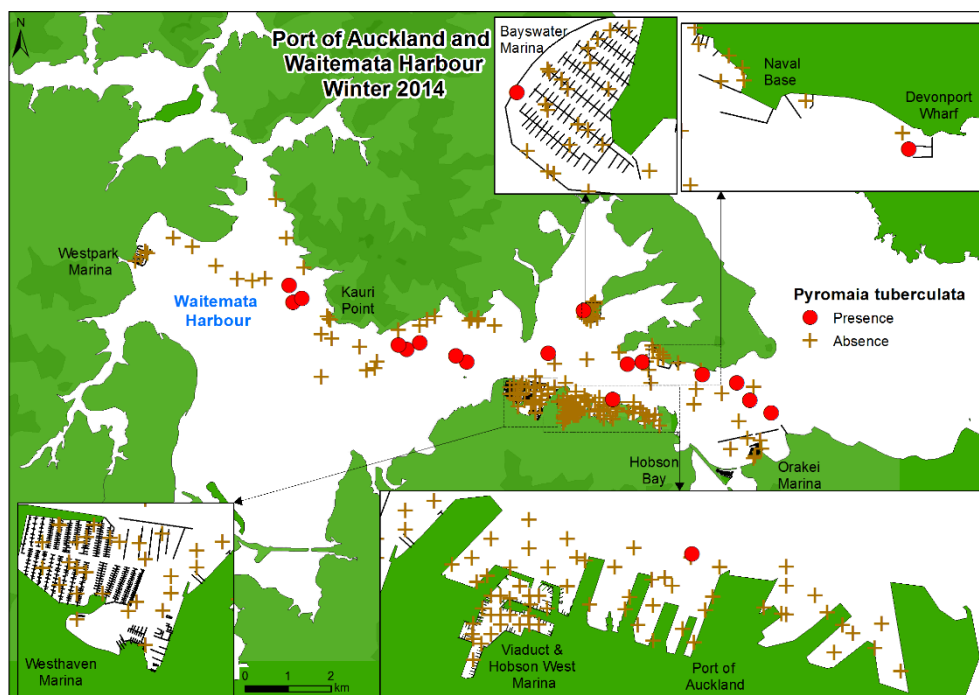


### Whangarei Harbour Summer 2014-15

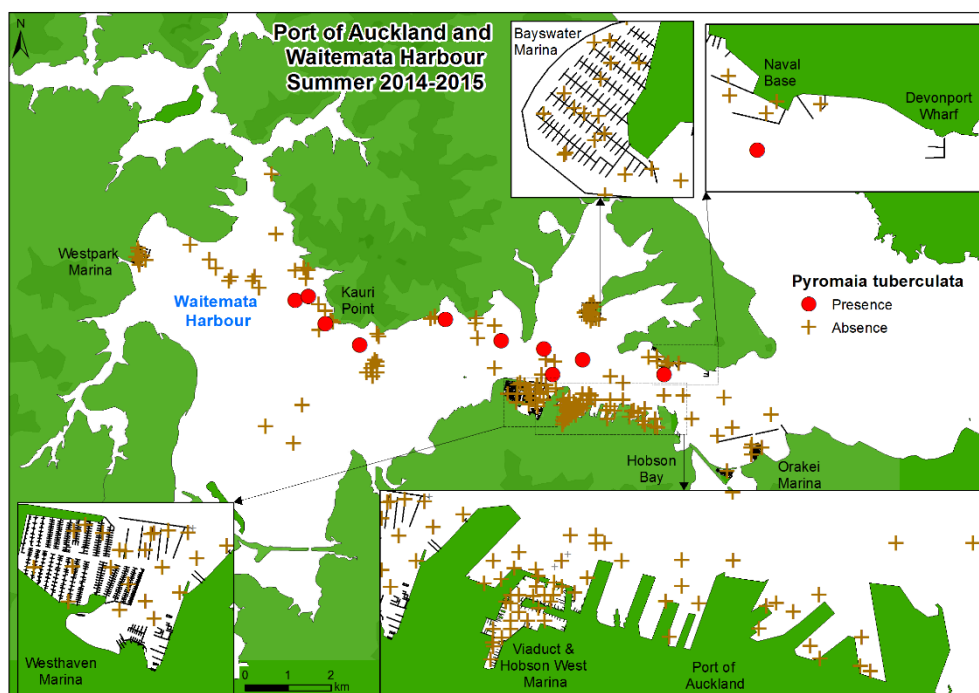


## PYROMAIA TUBERCULATA

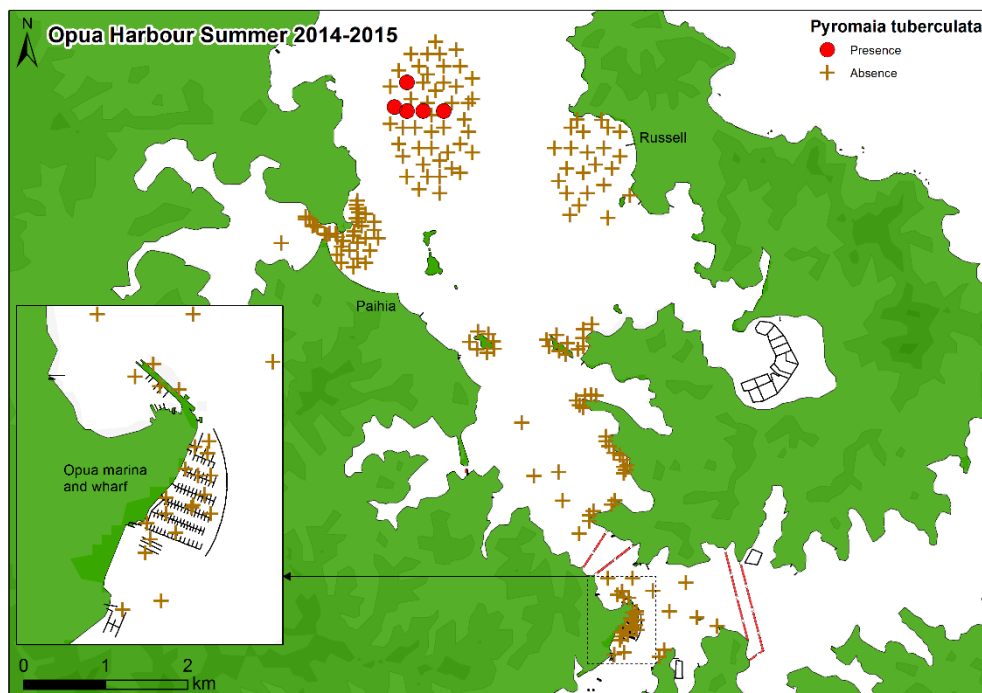
### Auckland (Waitemata) Harbour Winter 2014



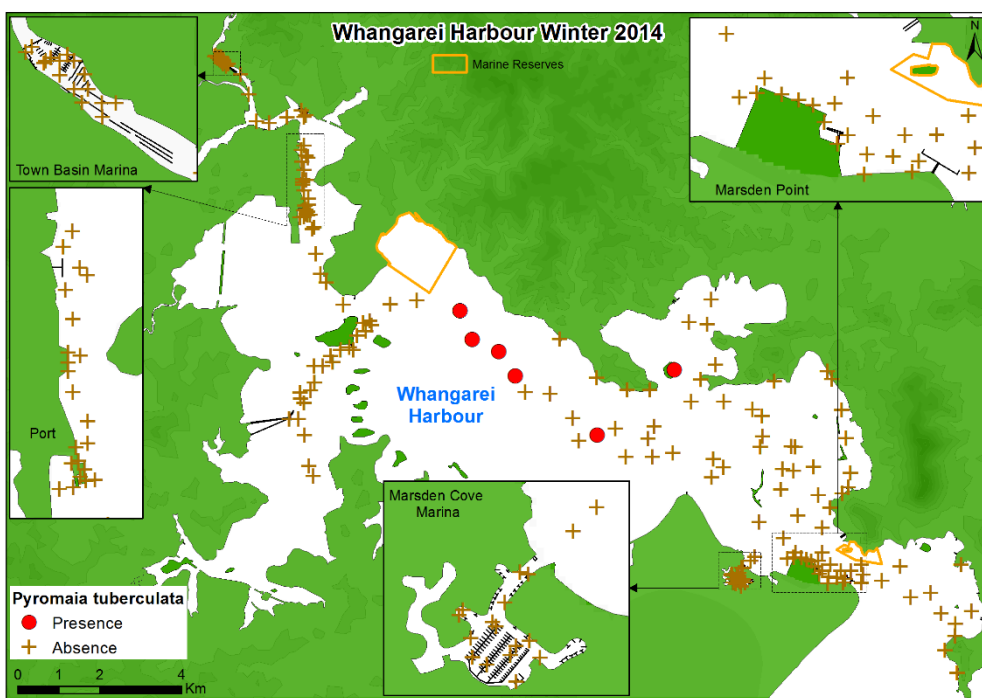
### Auckland (Waitemata) Harbour Summer 2014–15



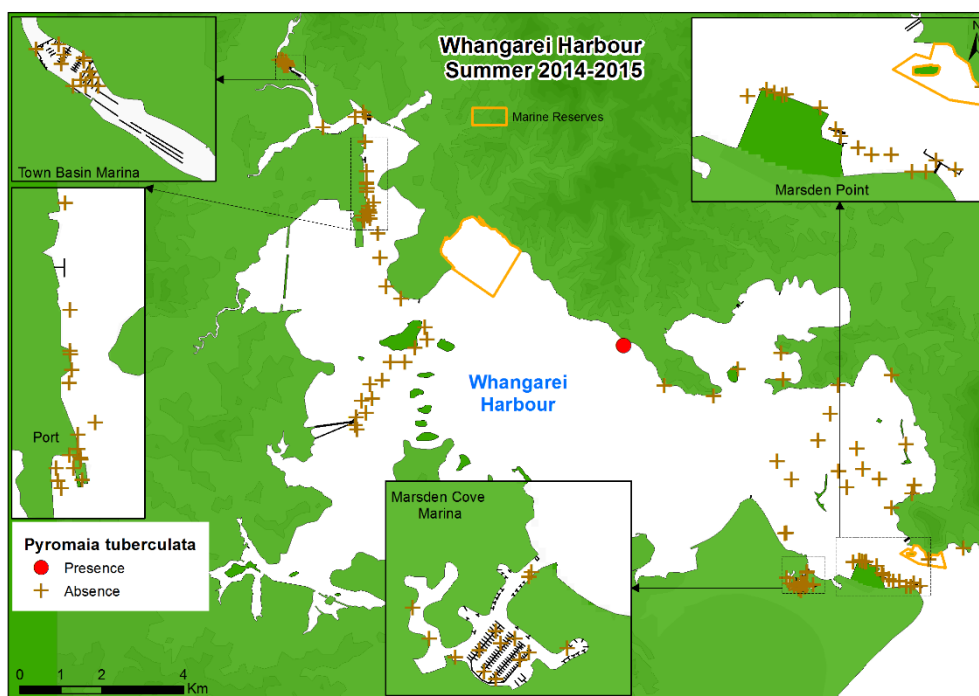
## Opua Harbour Summer 2014–15



## Whangarei Harbour Winter 2014

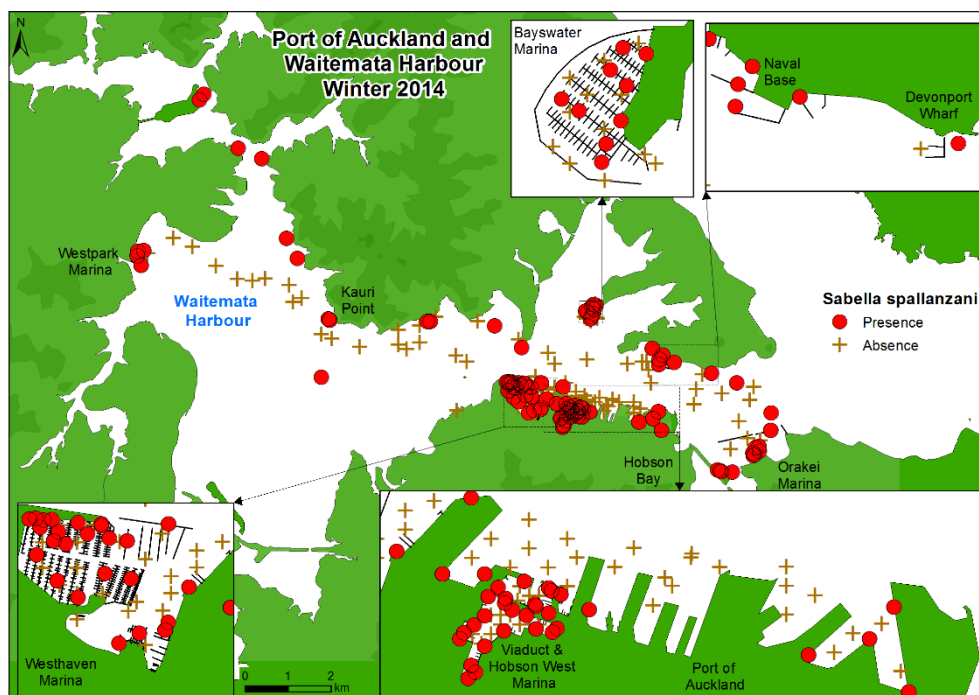


## Whangarei Harbour Summer 2014–15

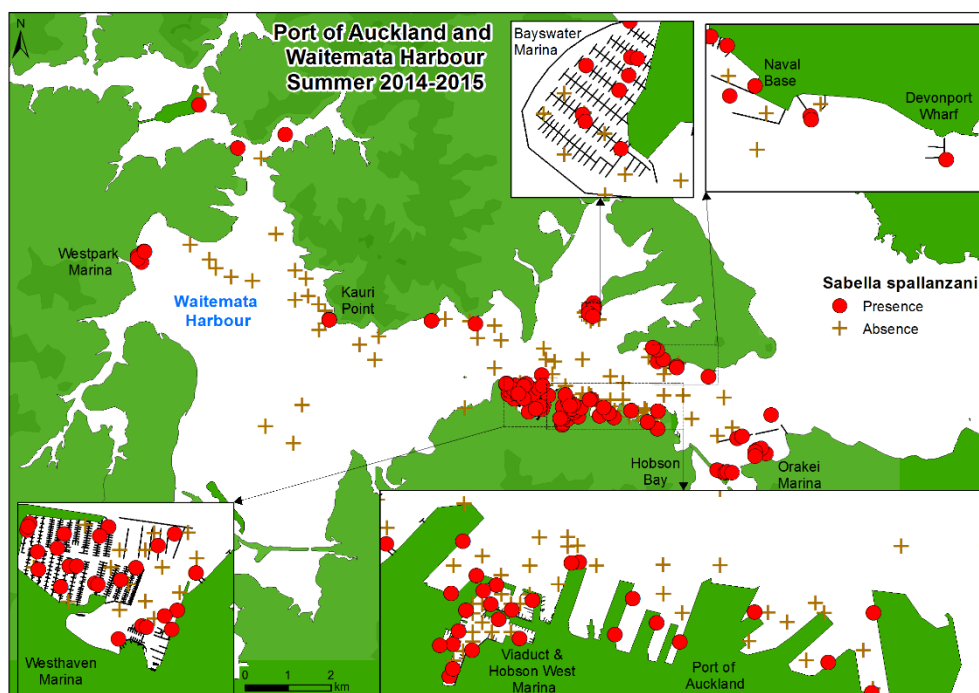


## *SABELLA SPALLANZANII*

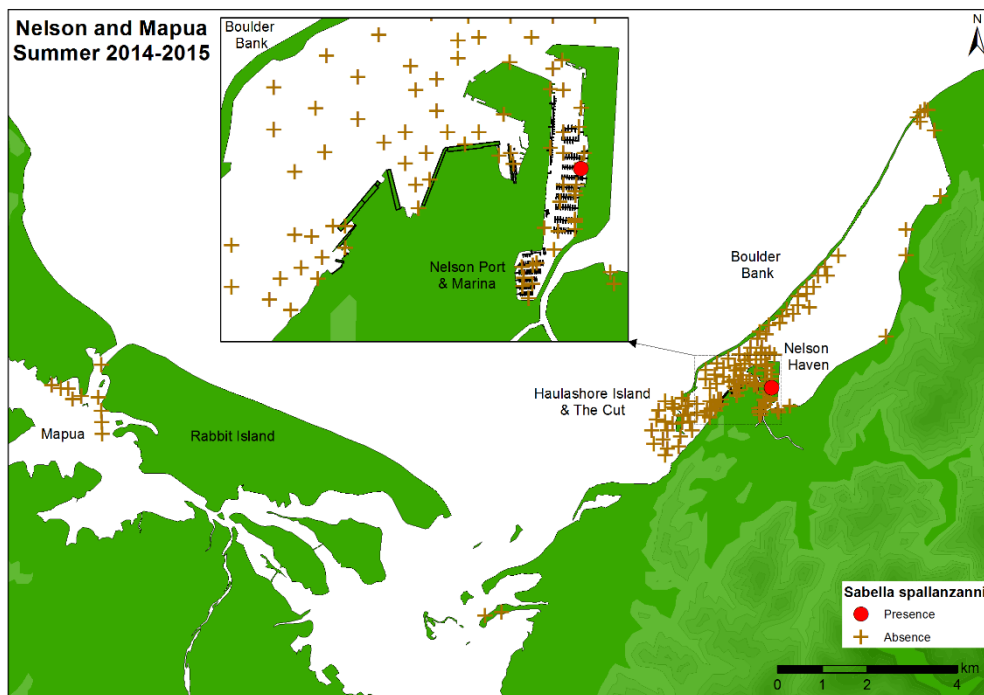
### Auckland (Waitemata) Harbour Winter 2014



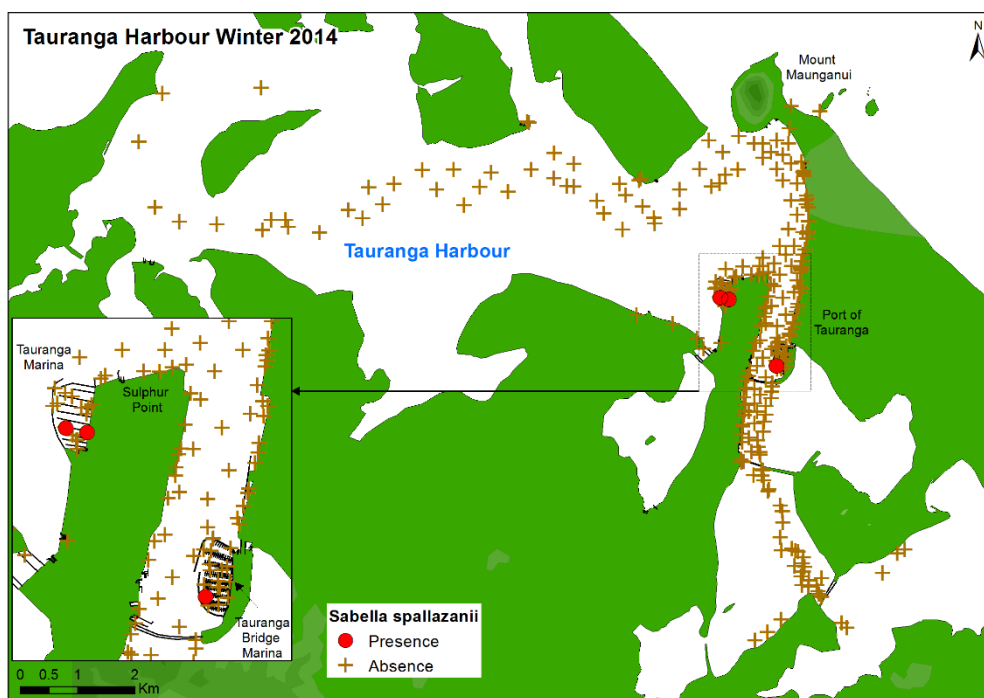
### Auckland (Waitemata) Harbour Summer 2014–15



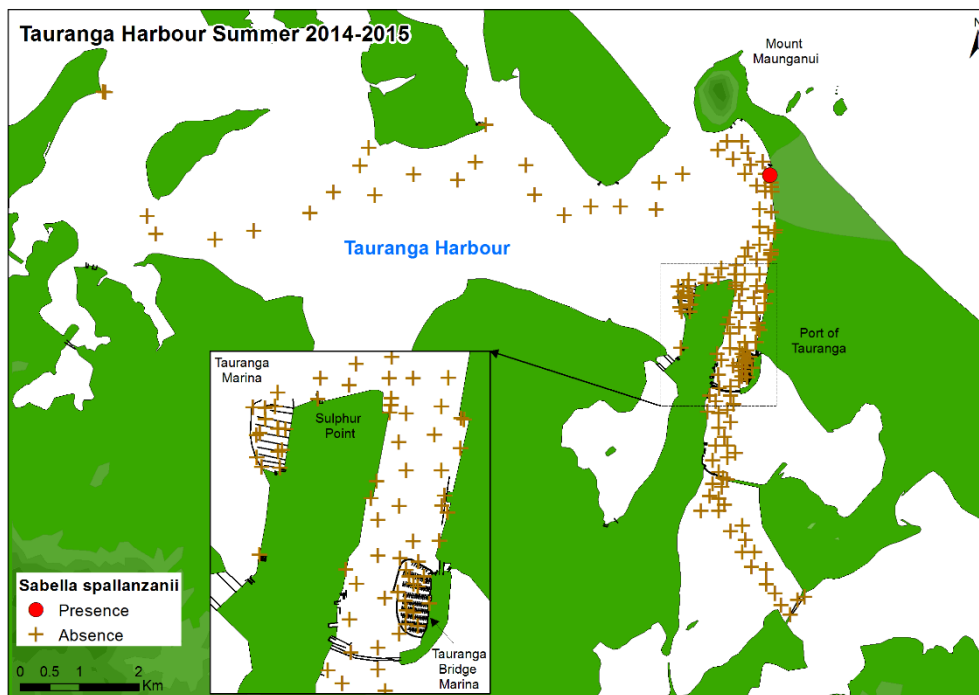
## Nelson Harbour Summer 2014–15



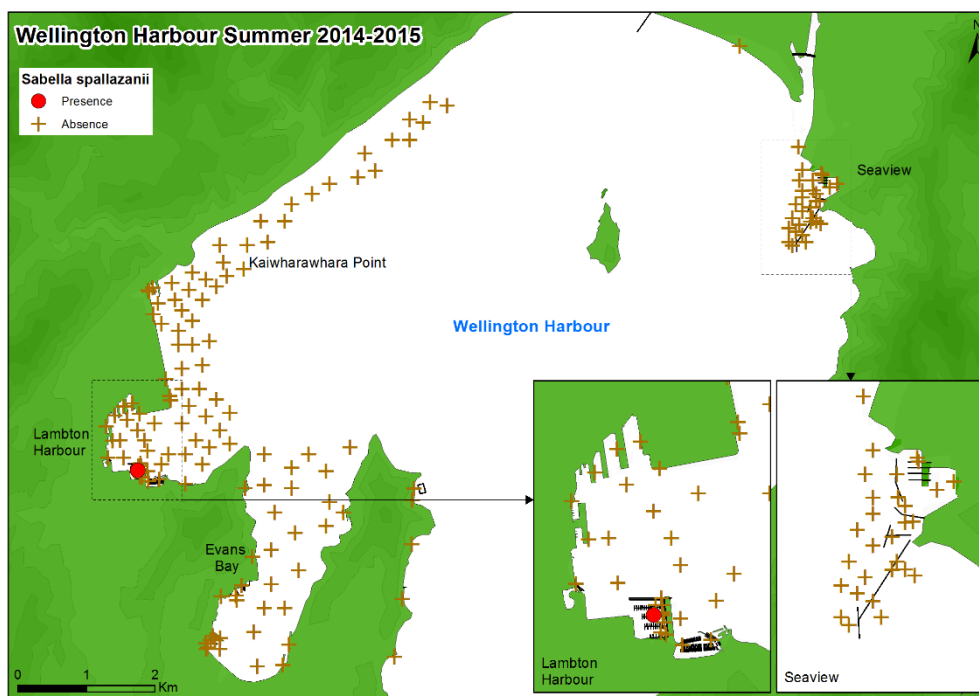
## Tauranga Harbour Winter 2014



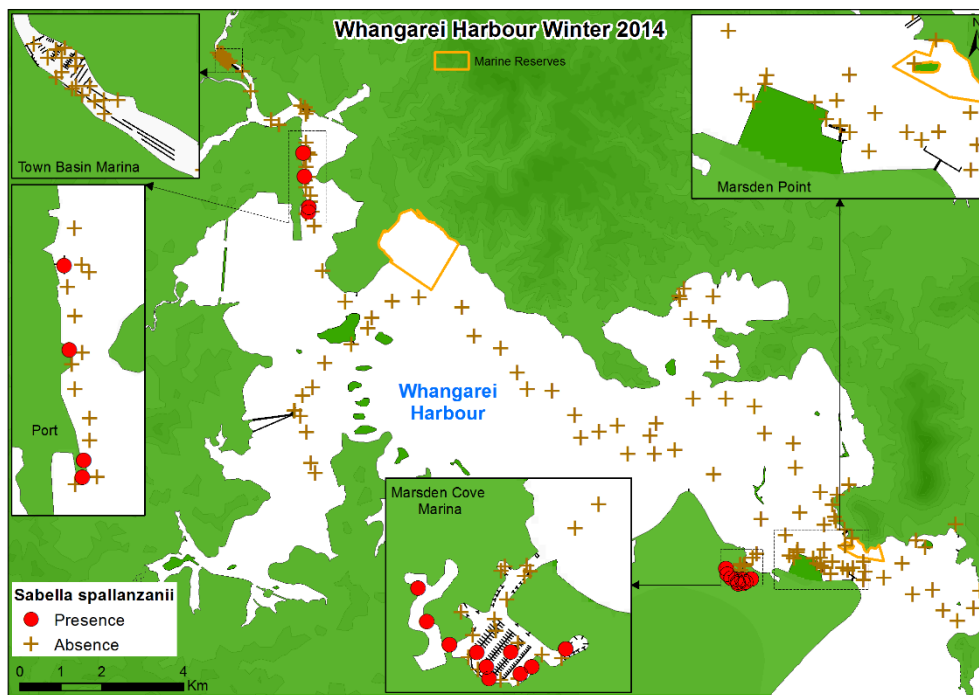
## Tauranga Harbour Summer 2014–15



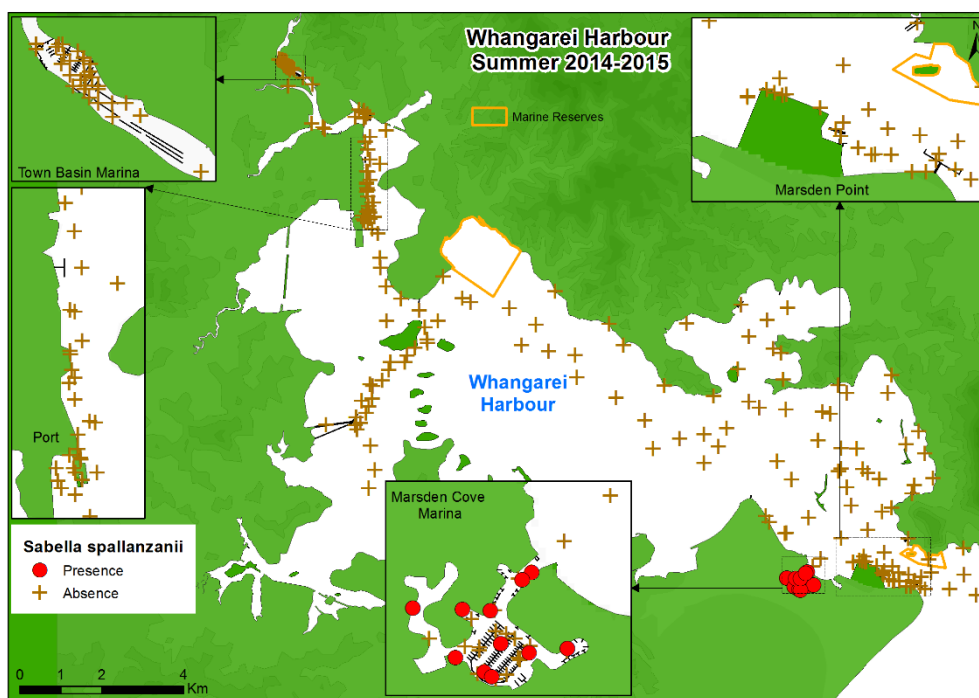
## Wellington Harbour Summer 2014–15



## Whangarei Harbour Winter 2014

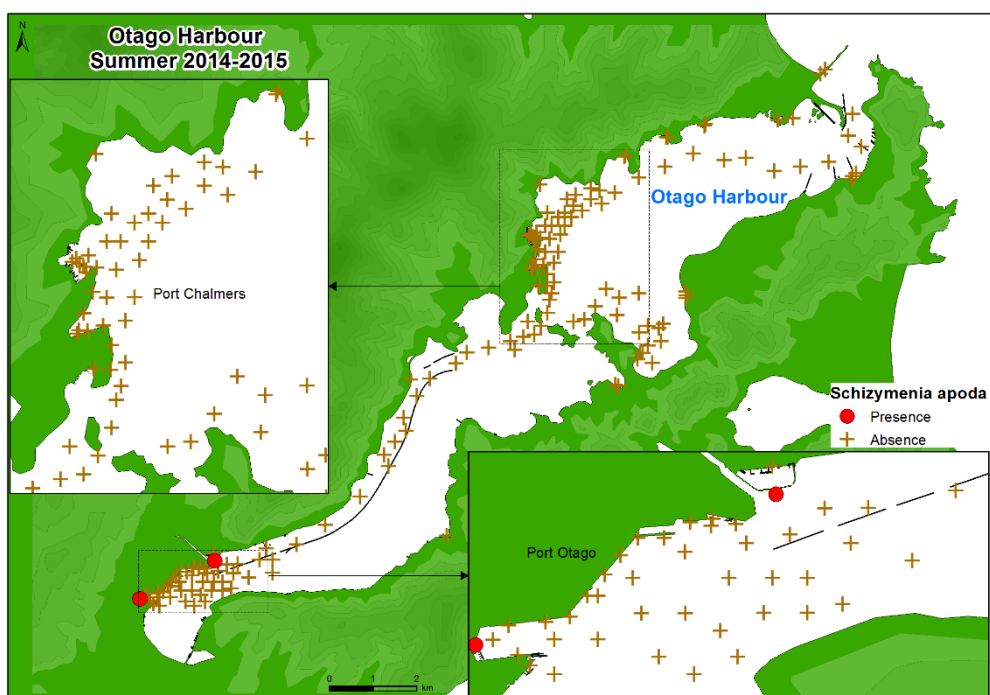


## Whangarei Harbour Summer 2014-15

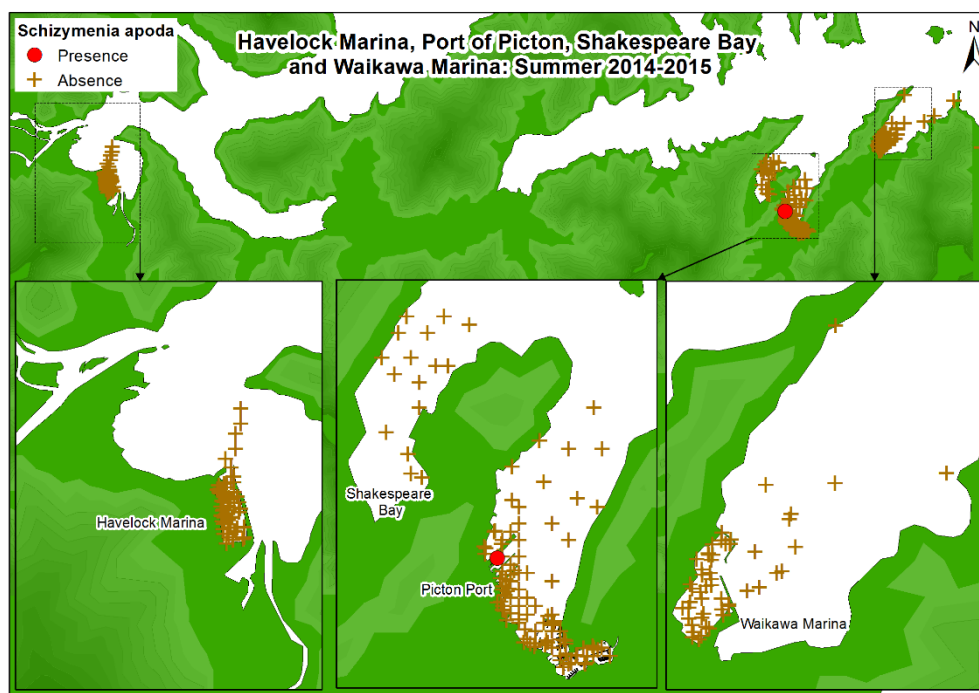


## SCHIZYMENIA APODA

### Otago Harbour Summer 2014–15

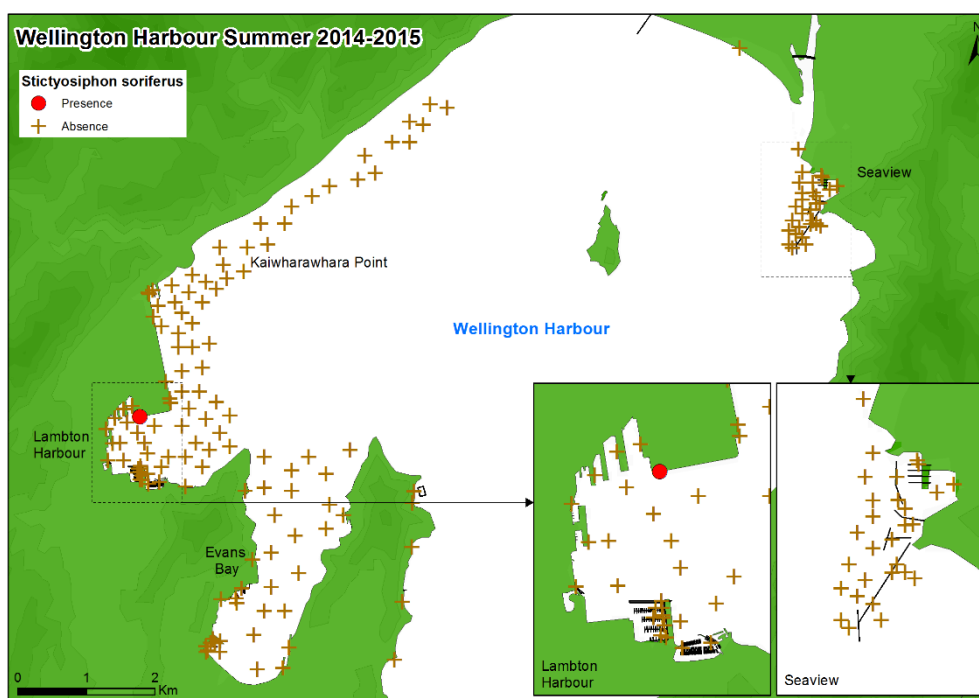


### Picton/Havelock Summer 2014–15



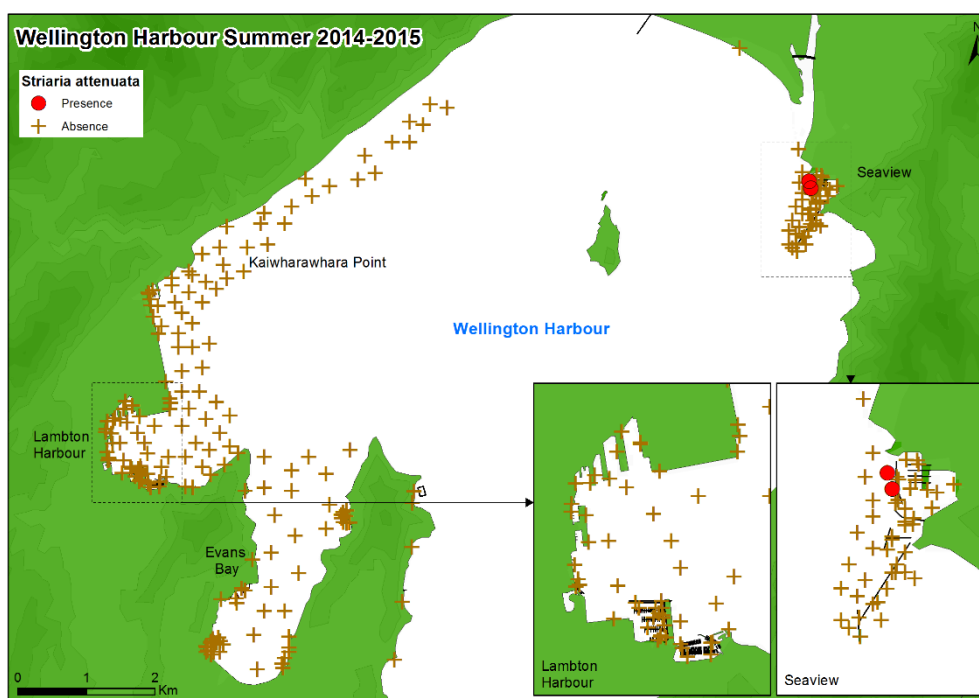
## *STICTYOSIPHON SORIFERUS*

### Wellington Harbour Summer 2014–15



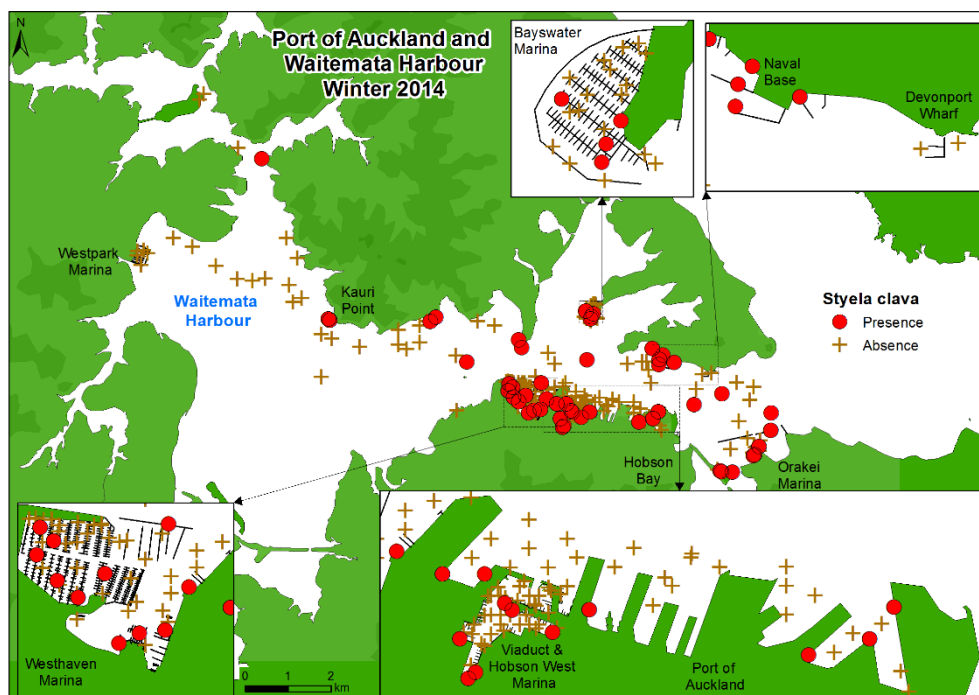
## *STRIARIA ATTENUATA*

### Wellington Harbour Summer 2014–15

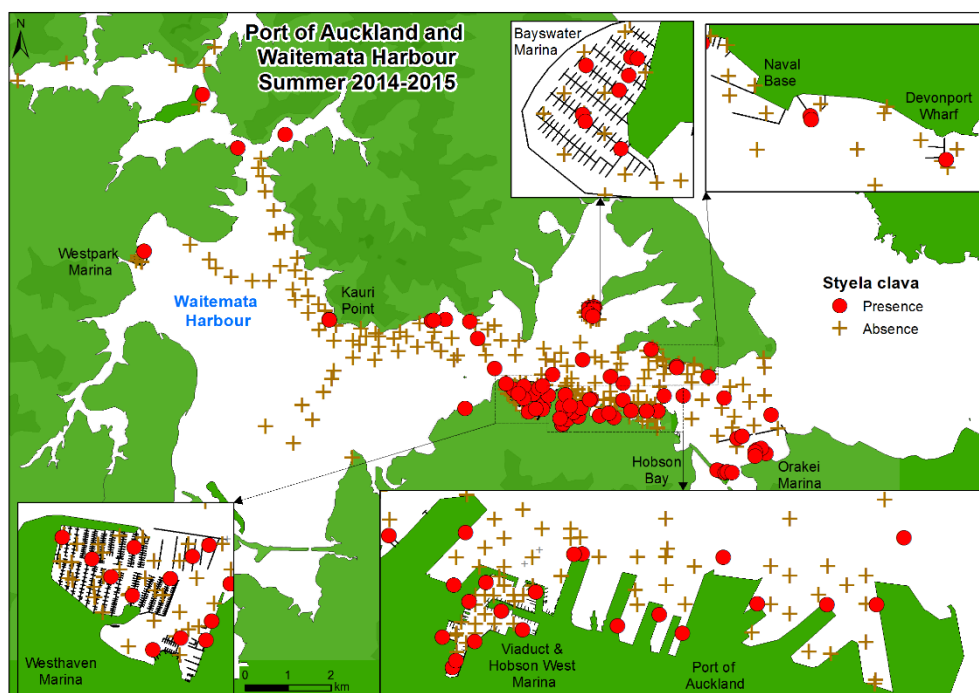


## STYELA CLAVA

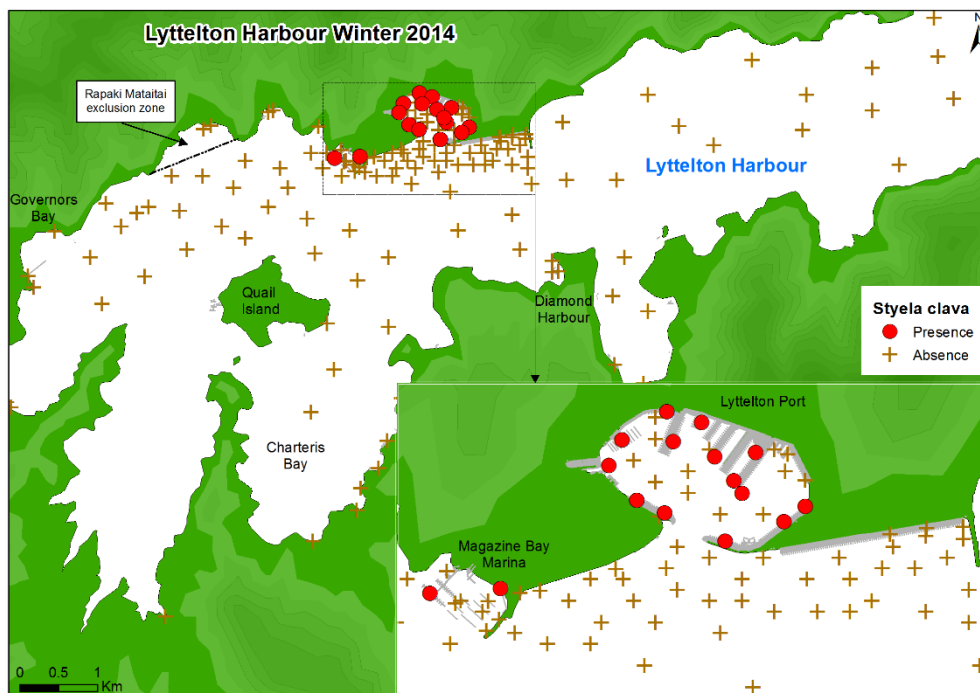
### Auckland (Waitemata) Harbour Winter 2014



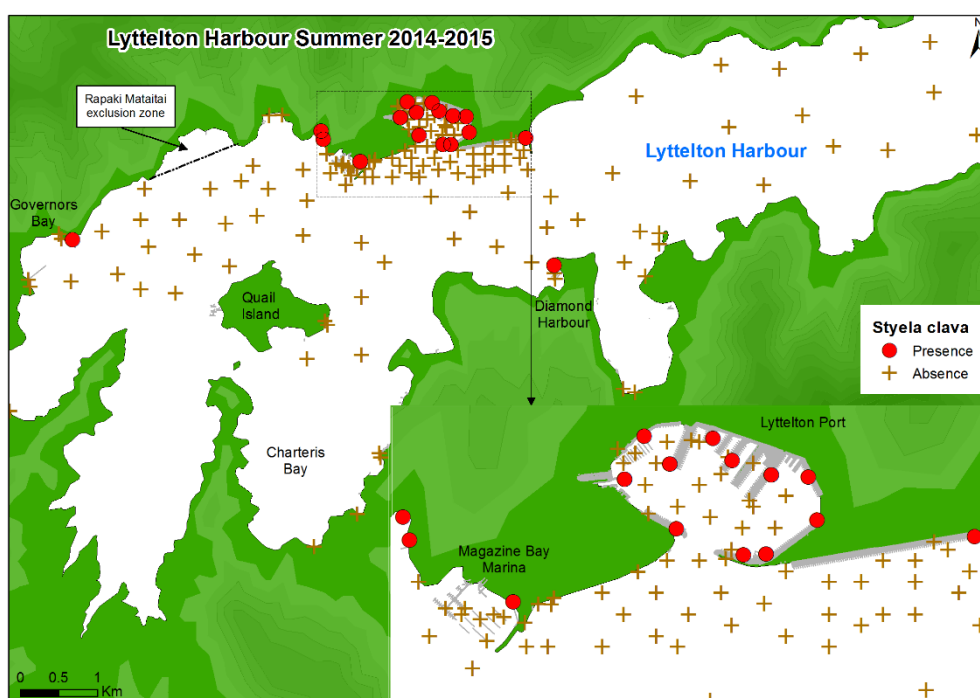
### Auckland (Waitemata) Harbour Summer 2014–15



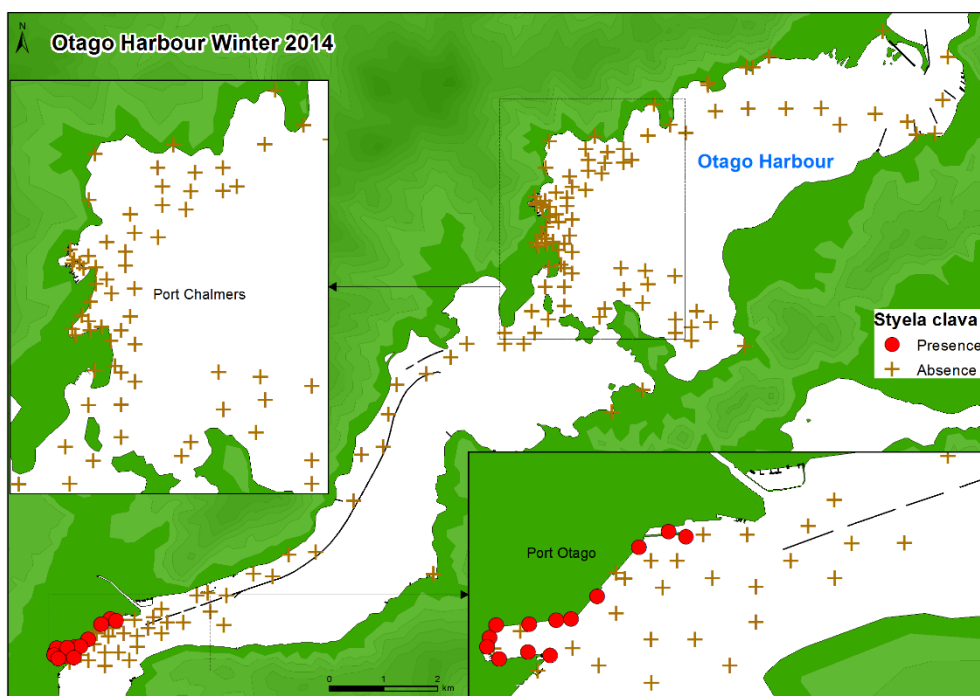
## Lyttelton Harbour Winter 2014



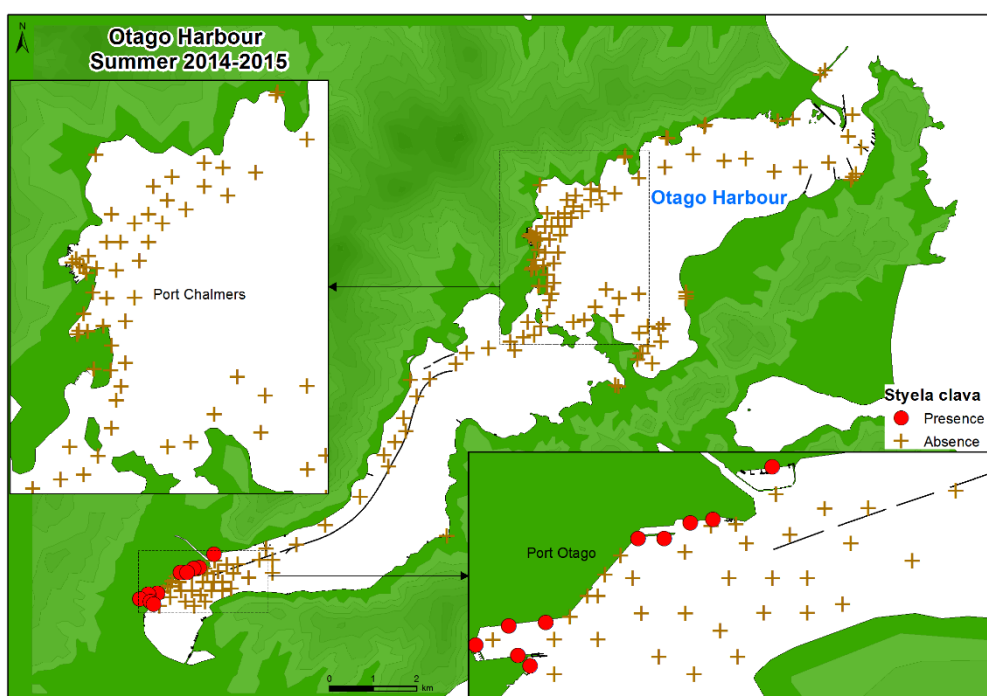
## Lyttelton Harbour Summer 2014–15



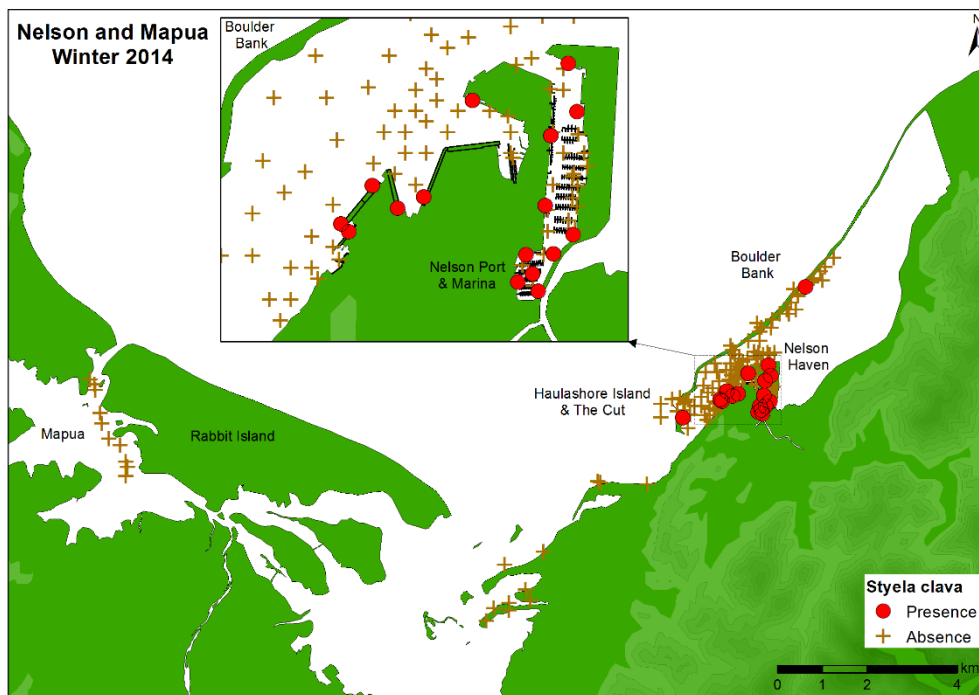
## Otago Harbour Winter 2014



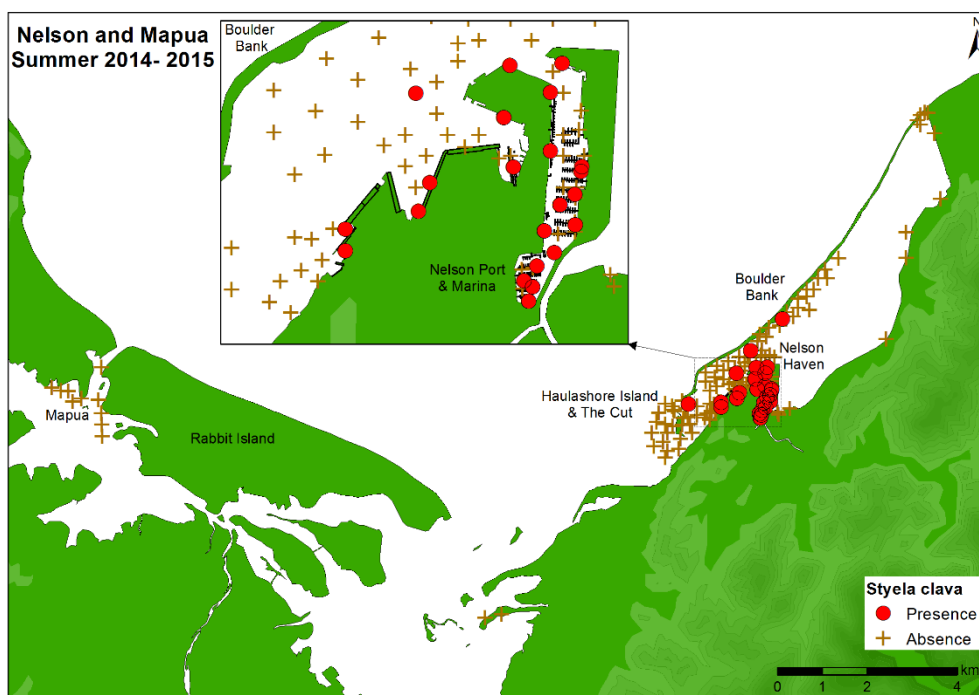
## Otago Harbour Summer 2014-15



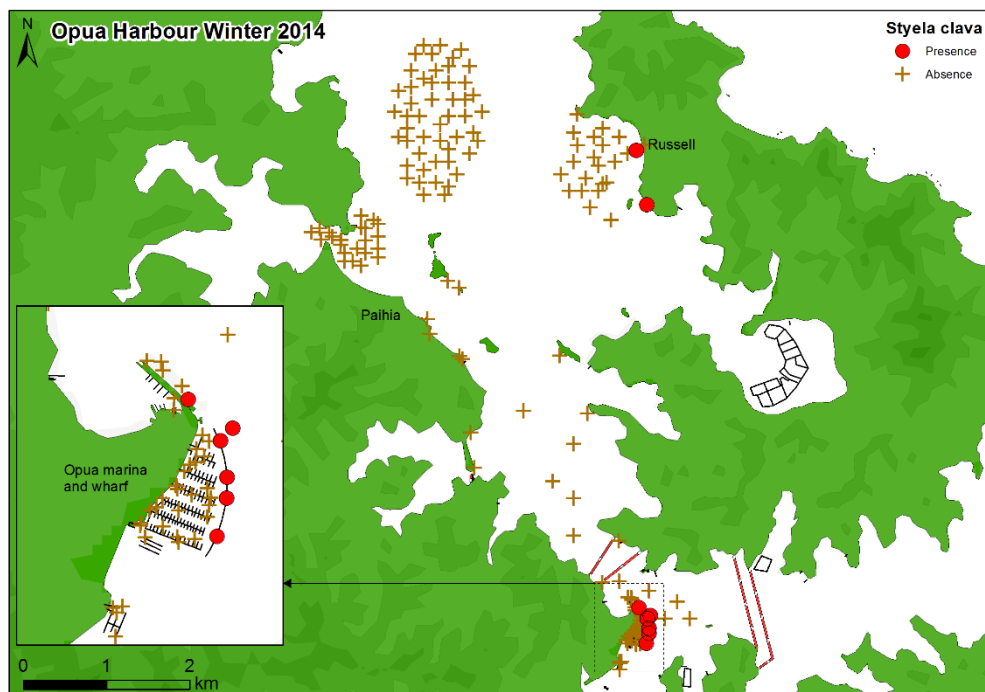
## Nelson Harbour Winter 2014



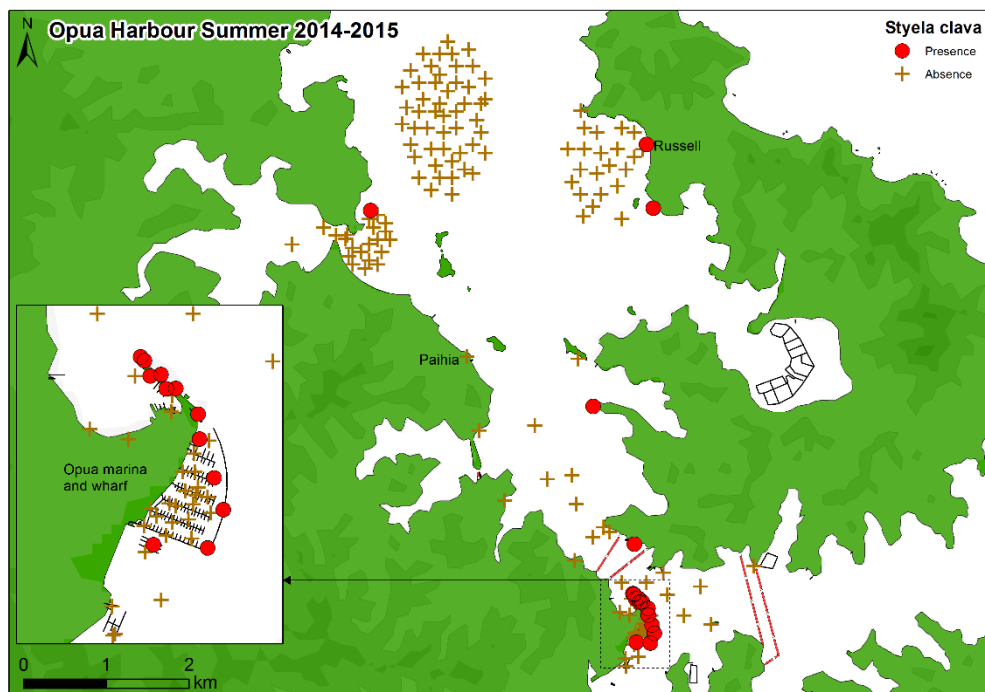
## Nelson Harbour Summer 2014–15



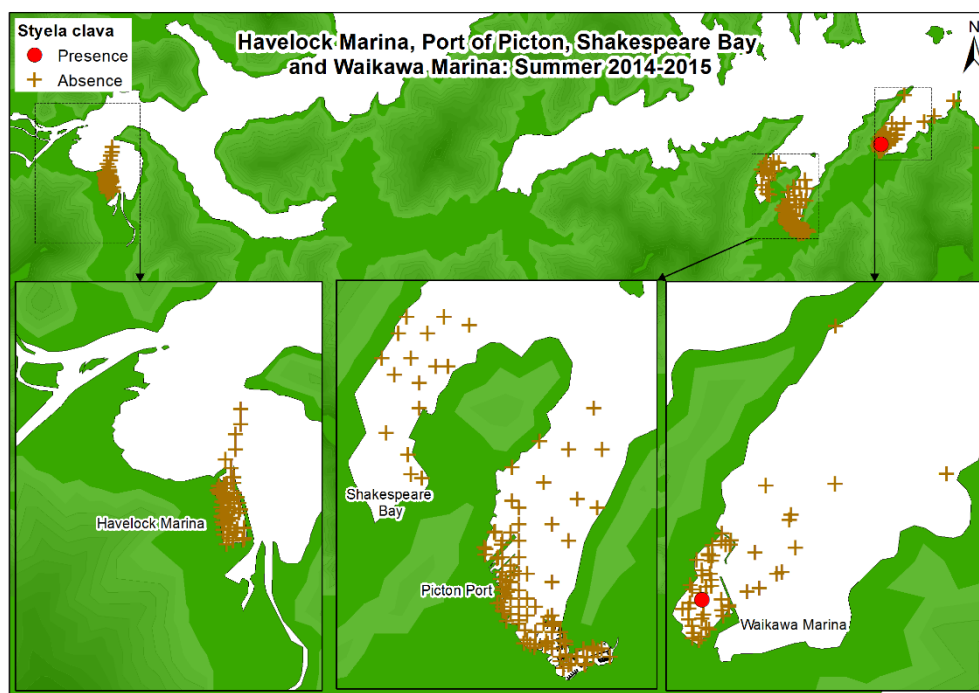
## Opua Winter 2014



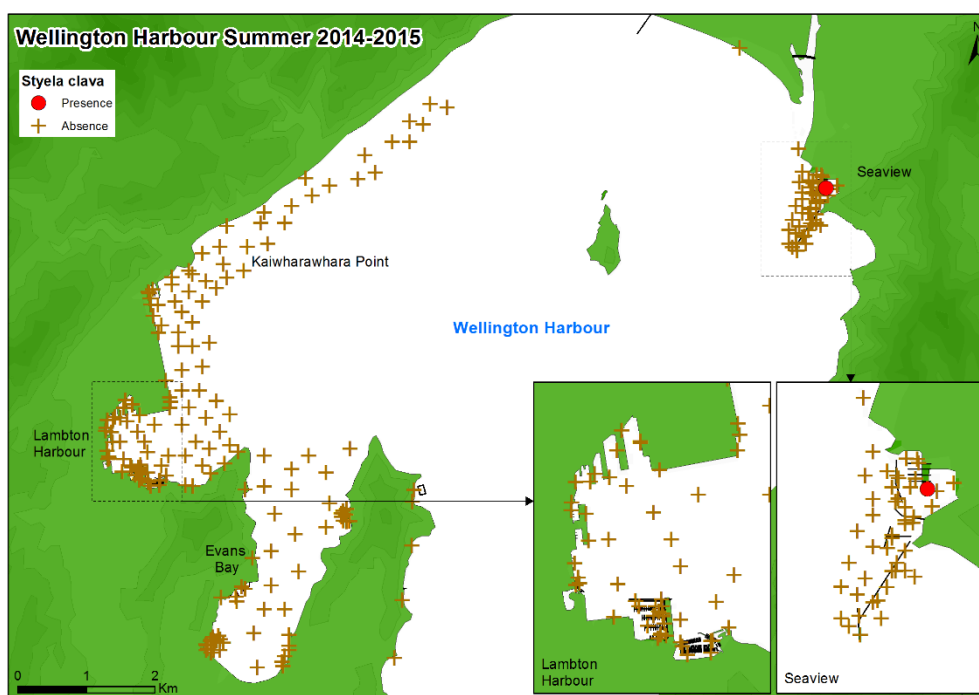
## Opua Summer 2014–15



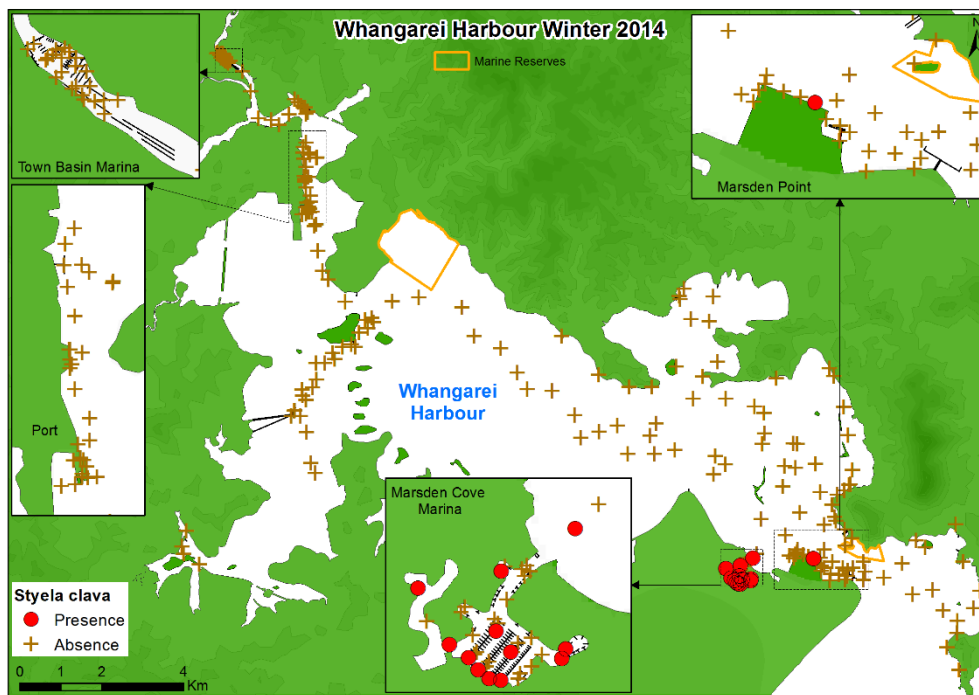
## Picton/Havelock Summer 2014–15



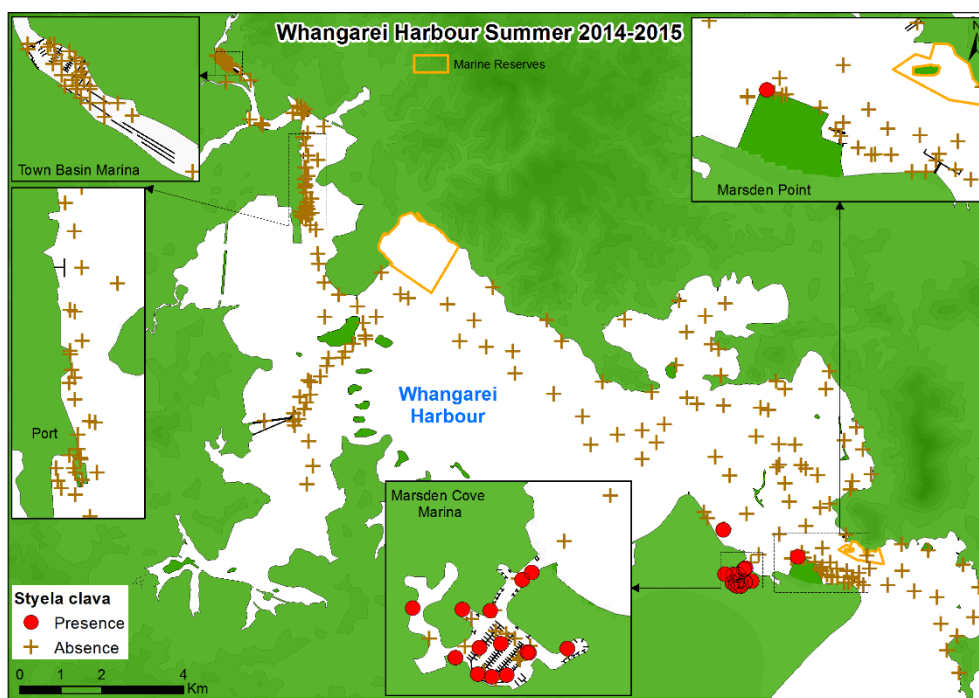
## Wellington Harbour Summer 2014–15



## Whangarei Harbour Winter 2014

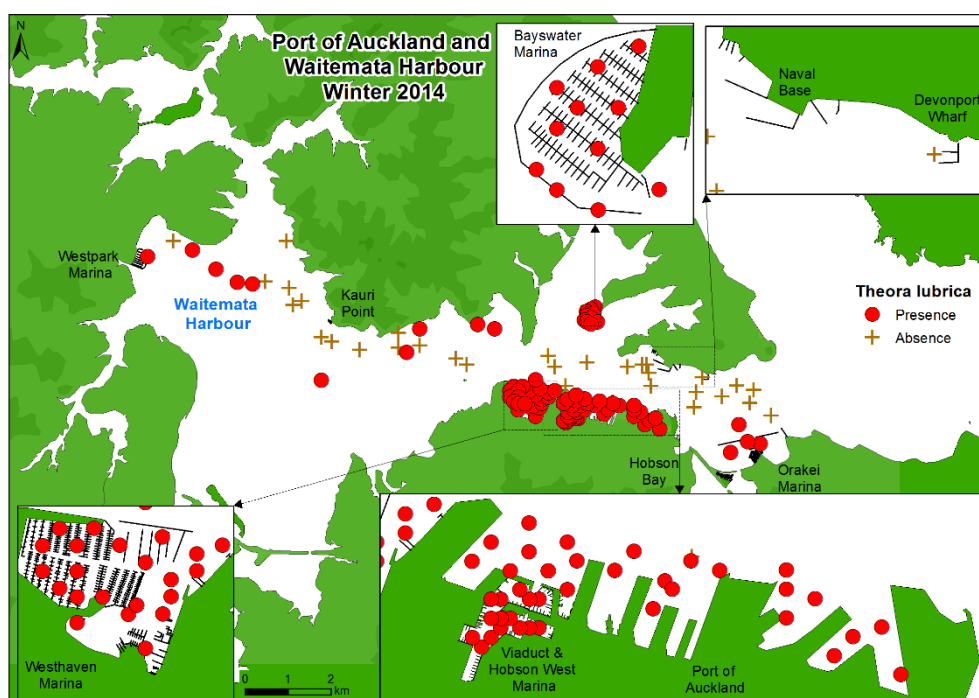


## Whangarei Harbour Summer 2014-15

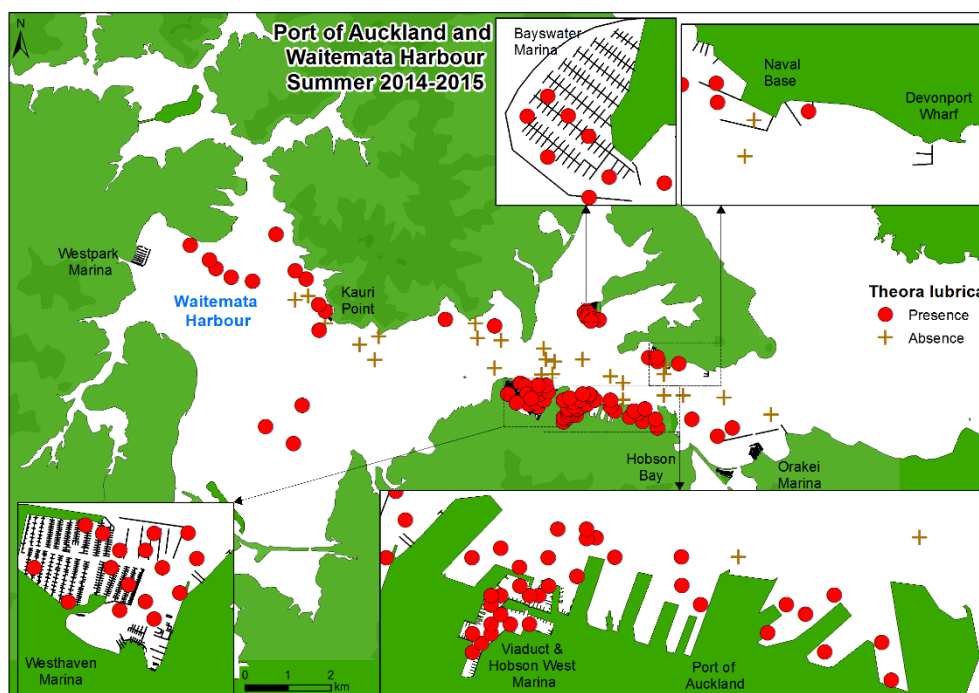


## THEORA LUBRICA

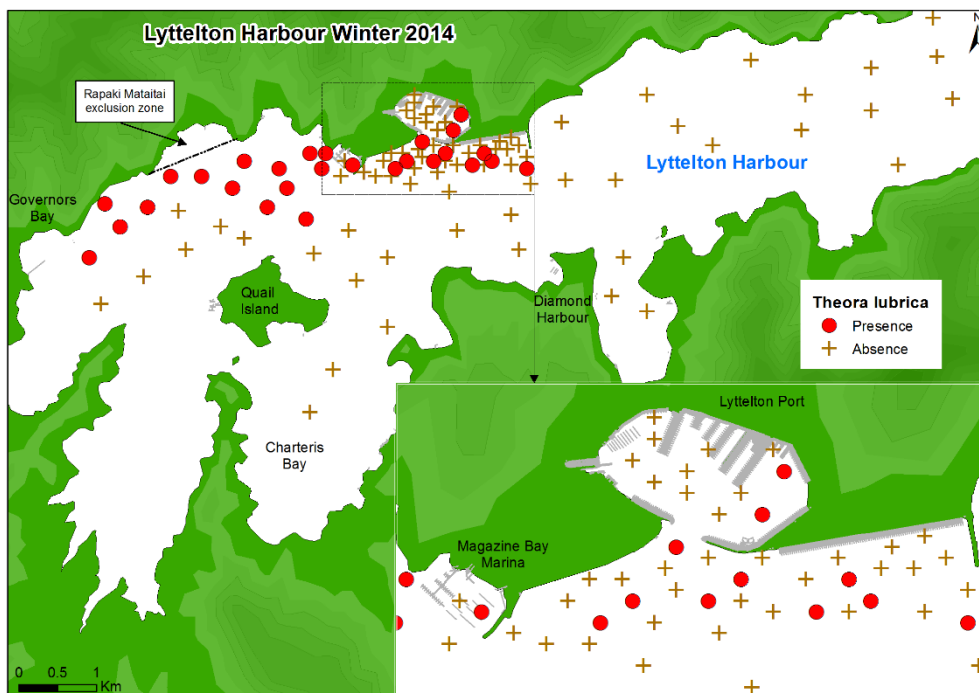
### Auckland (Waitemata) Harbour Winter 2014



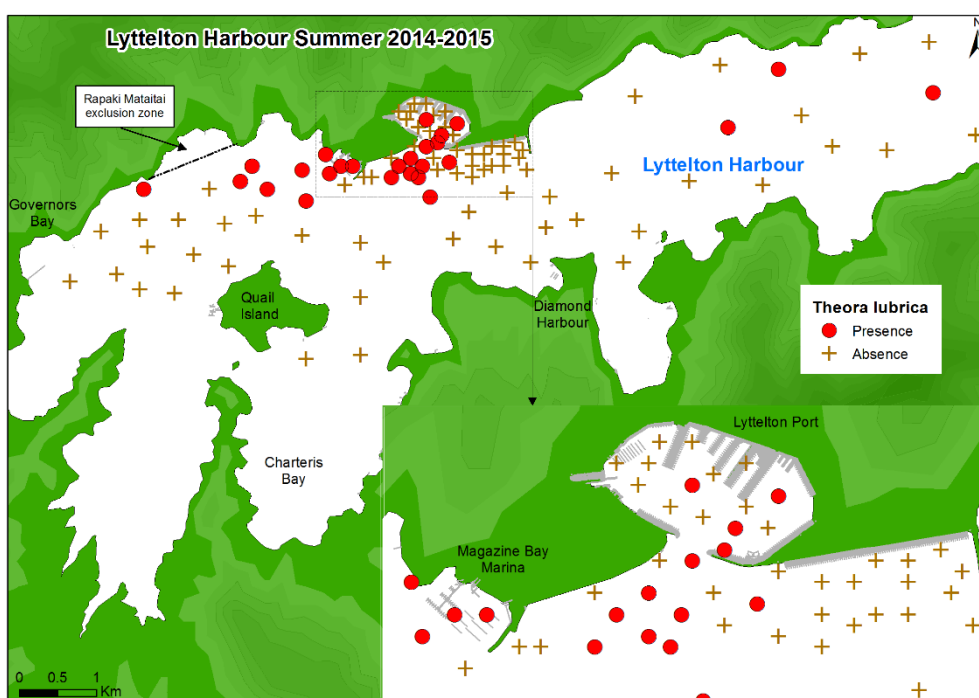
### Auckland (Waitemata) Harbour Summer 2014–15



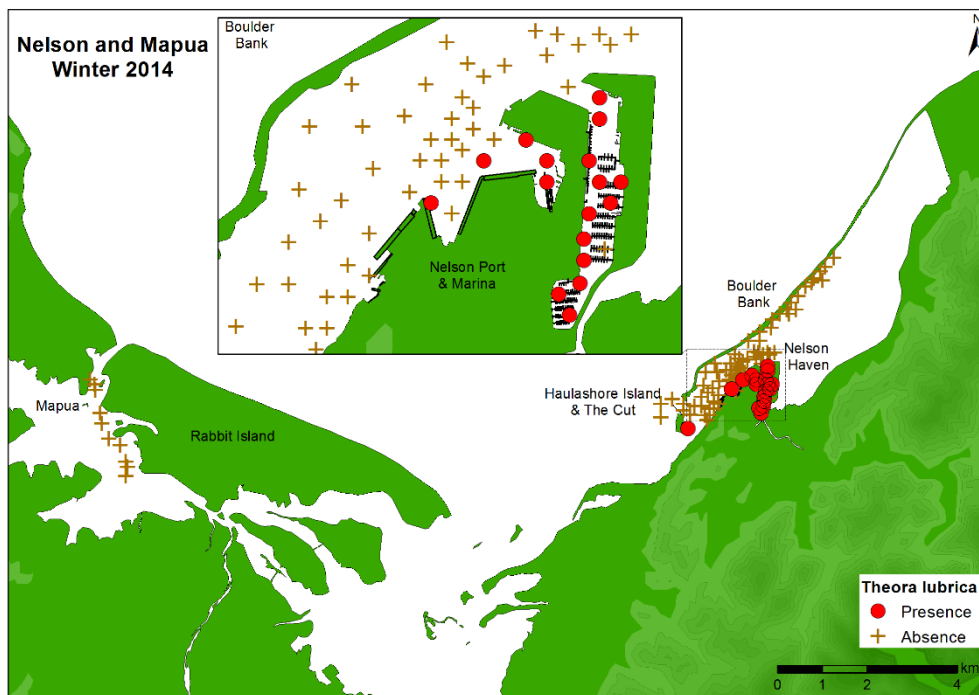
## Lyttelton Harbour Winter 2014



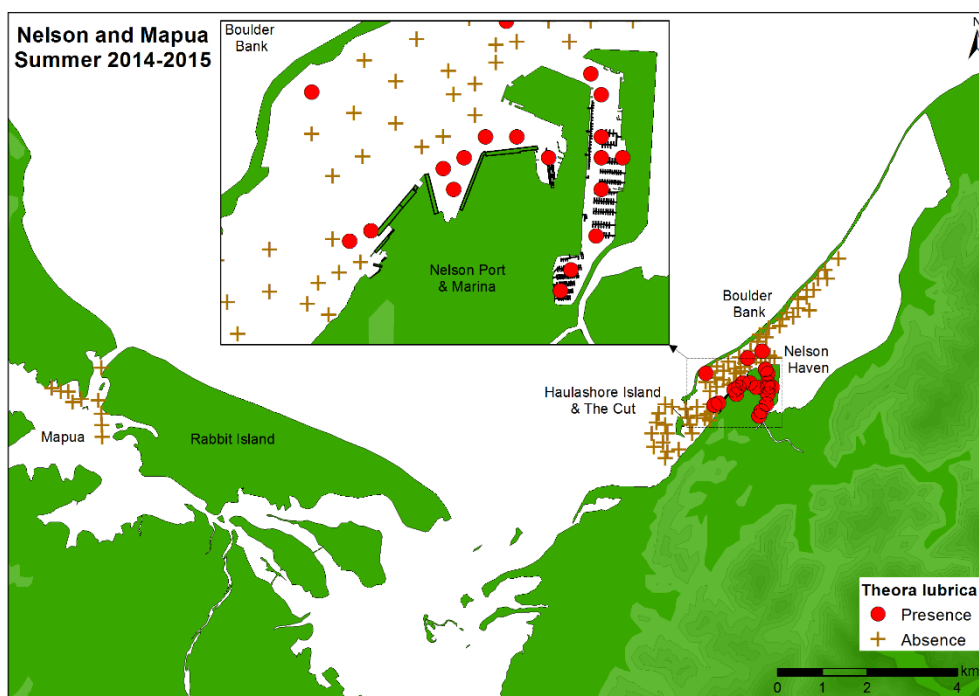
## Lyttelton Harbour Summer 2014–15



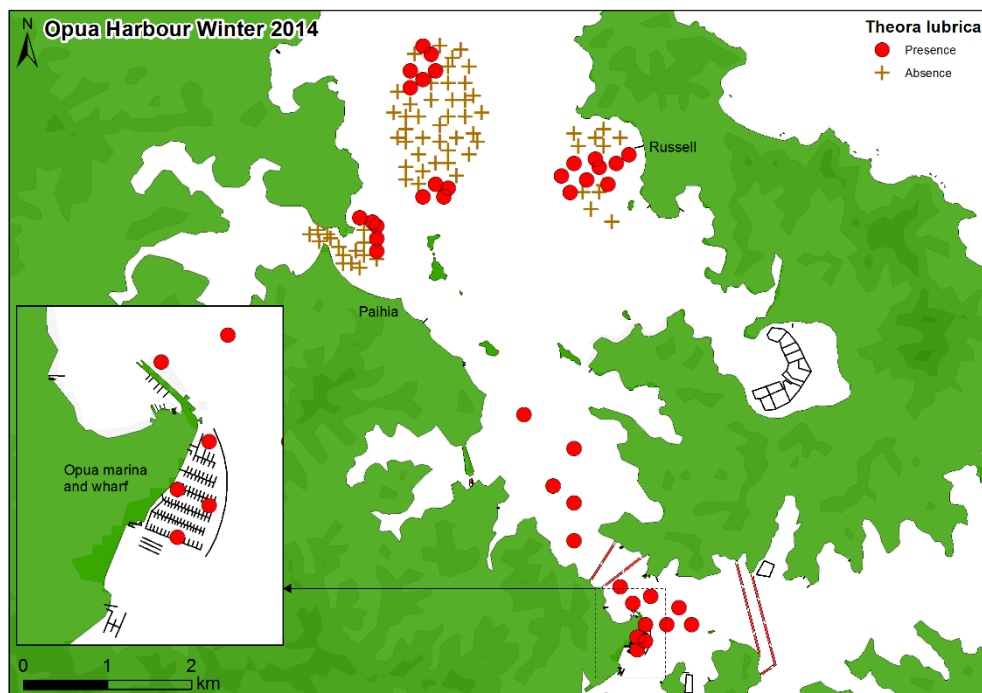
## Nelson Harbour Winter 2014



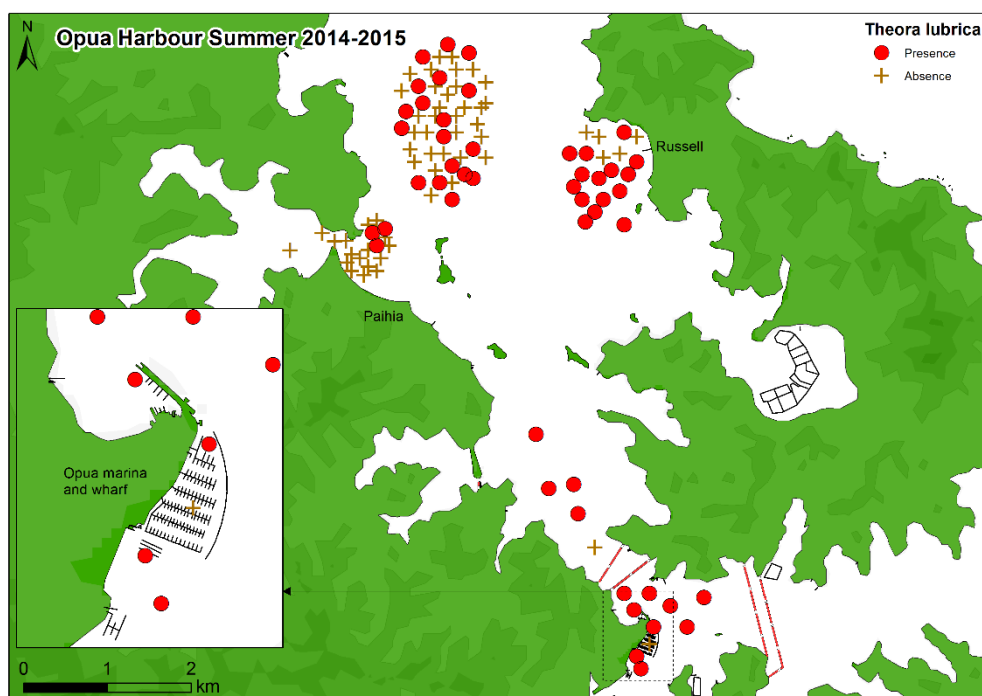
## Nelson Harbour Summer 2014–15



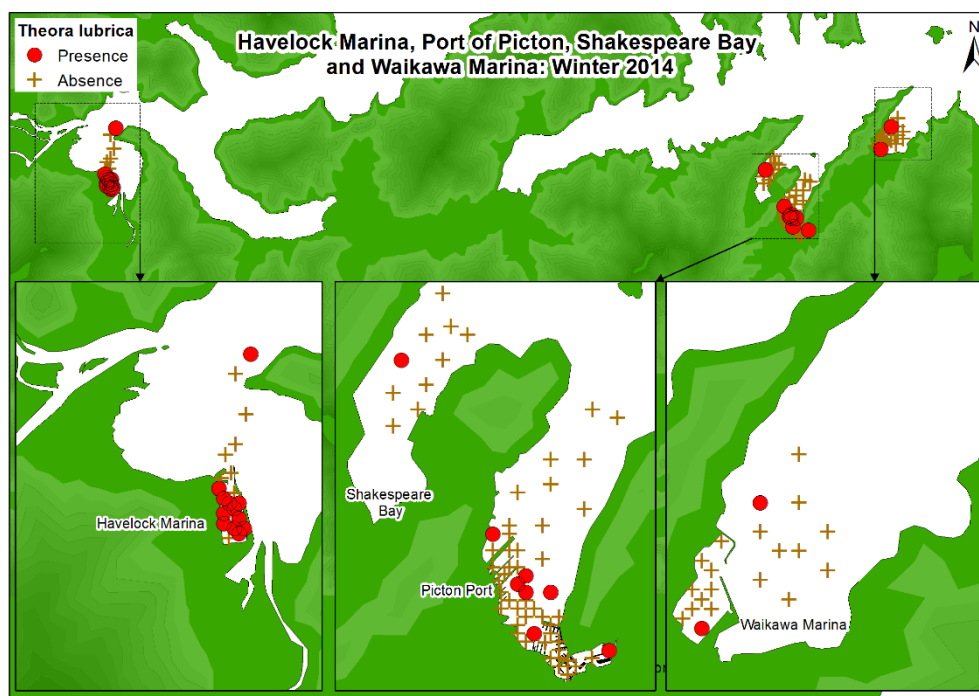
## Opua Harbour Winter 2014



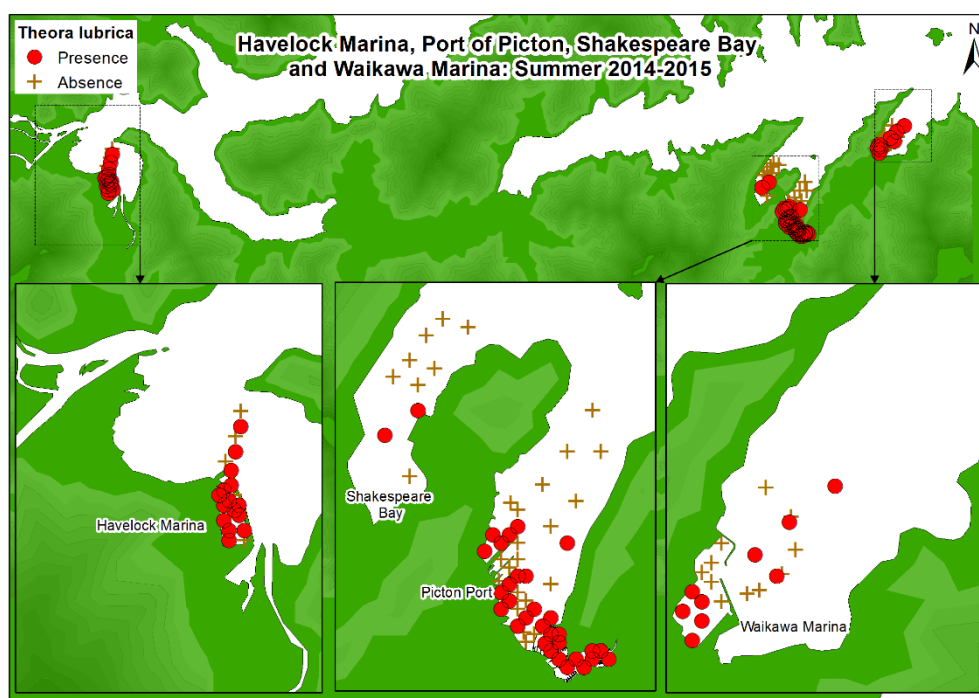
## Opua Harbour Summer 2014–15



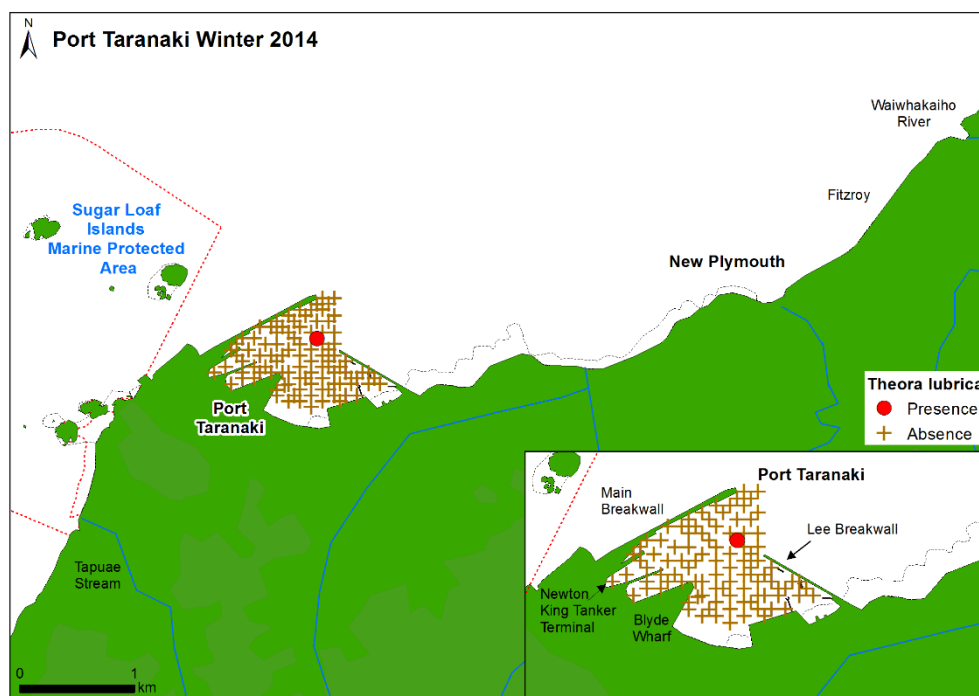
## Picton/Havelock Winter 2014



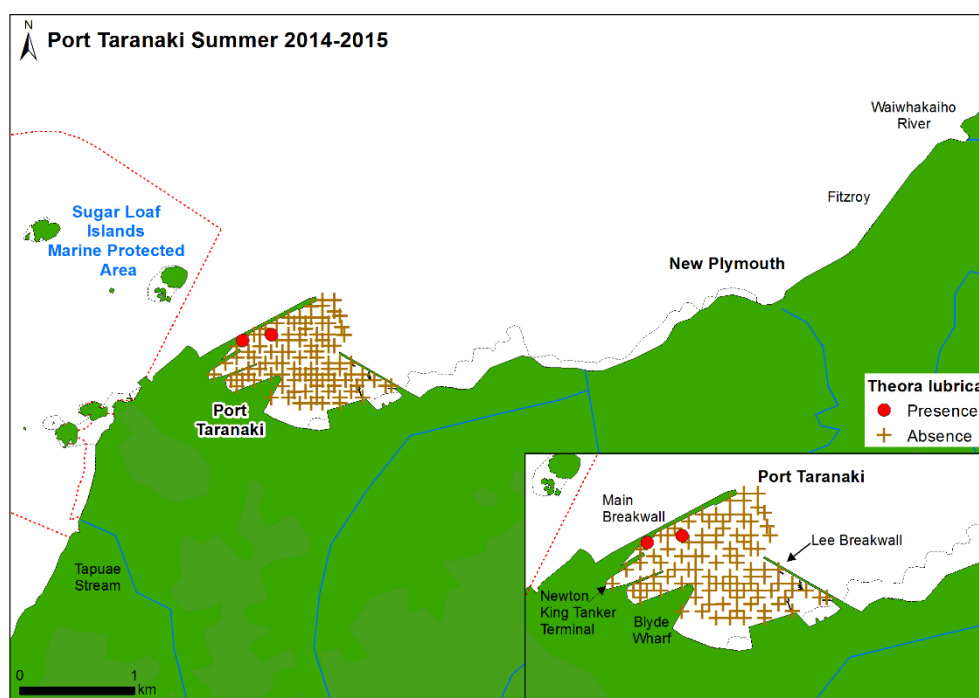
## Picton/Havelock Summer 2014–15



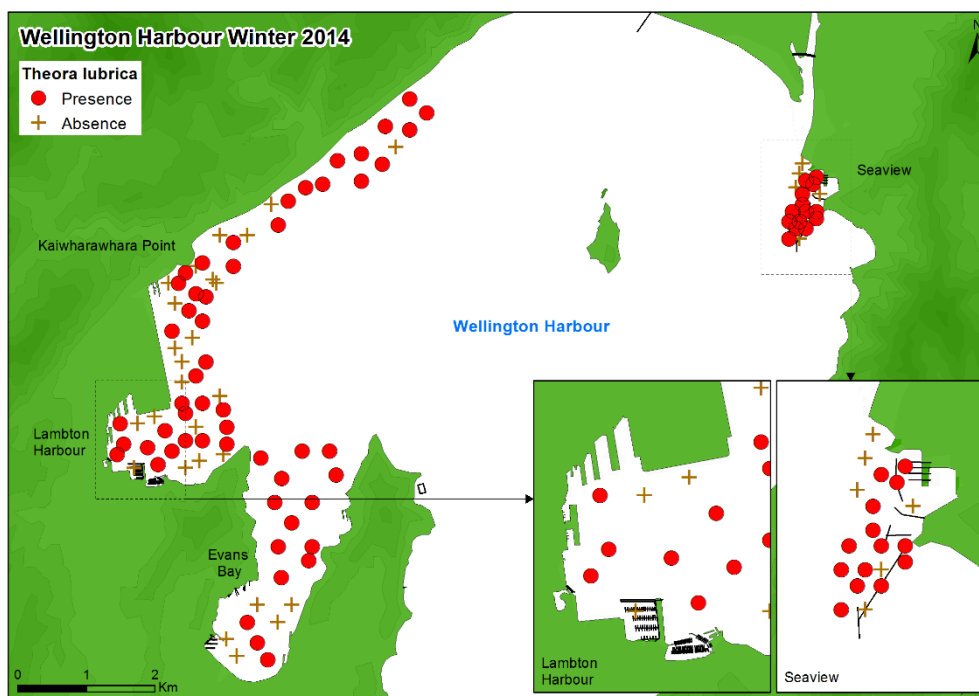
## Port Taranaki Winter 2014



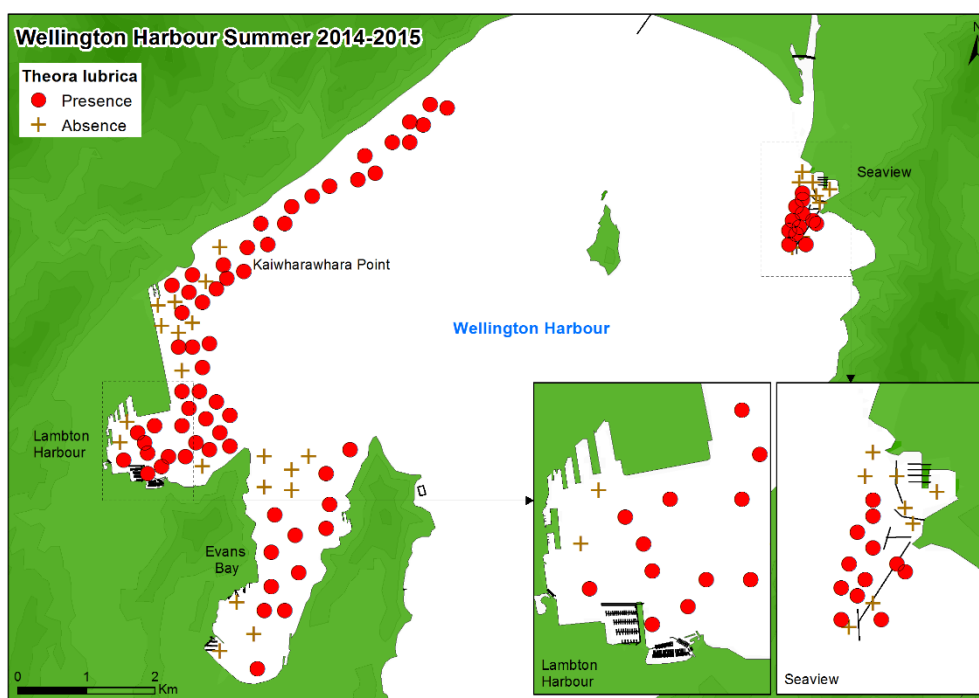
## Port Taranaki Summer 2014–15



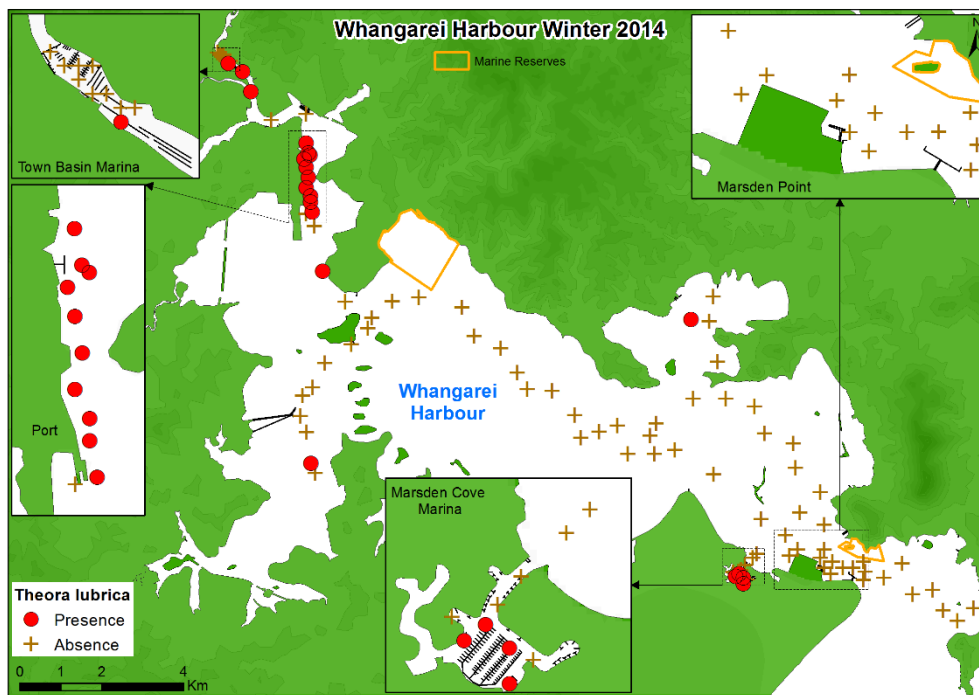
## Wellington Harbour Winter 2014



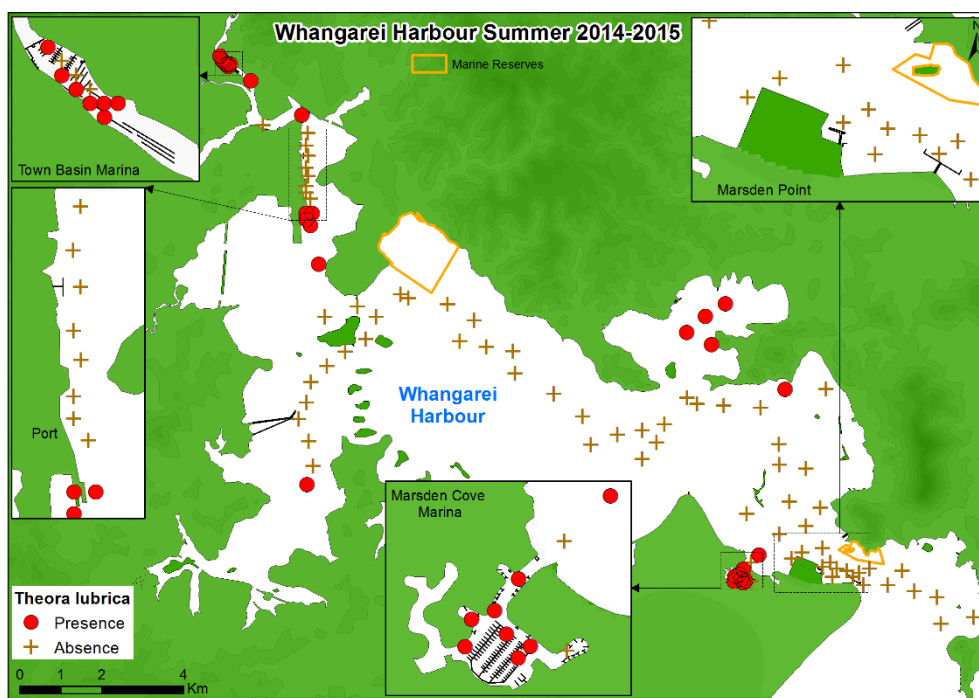
## Wellington Harbour Summer 2014–15



## Whangarei Harbour Winter 2014

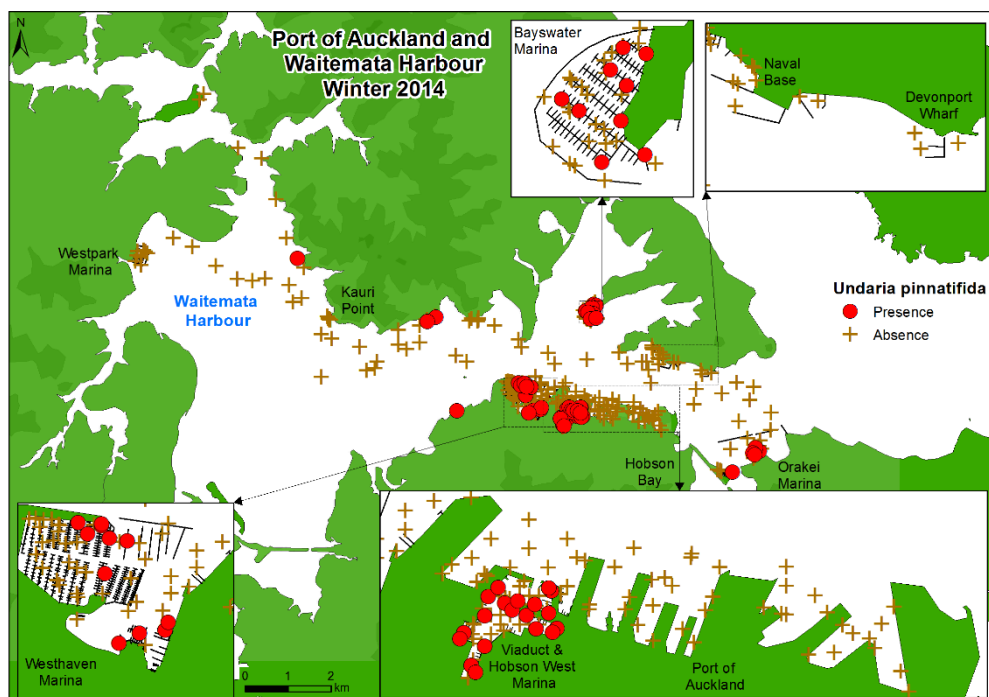


## Whangarei Harbour Summer 2014-15

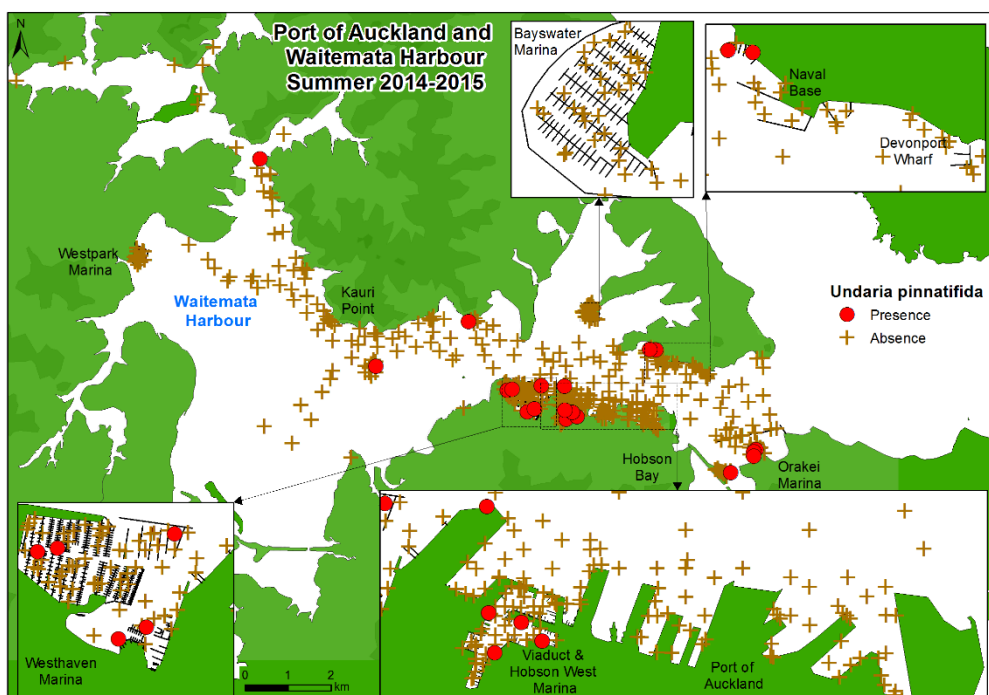


## *UNDARIA PINNATIFIDA*

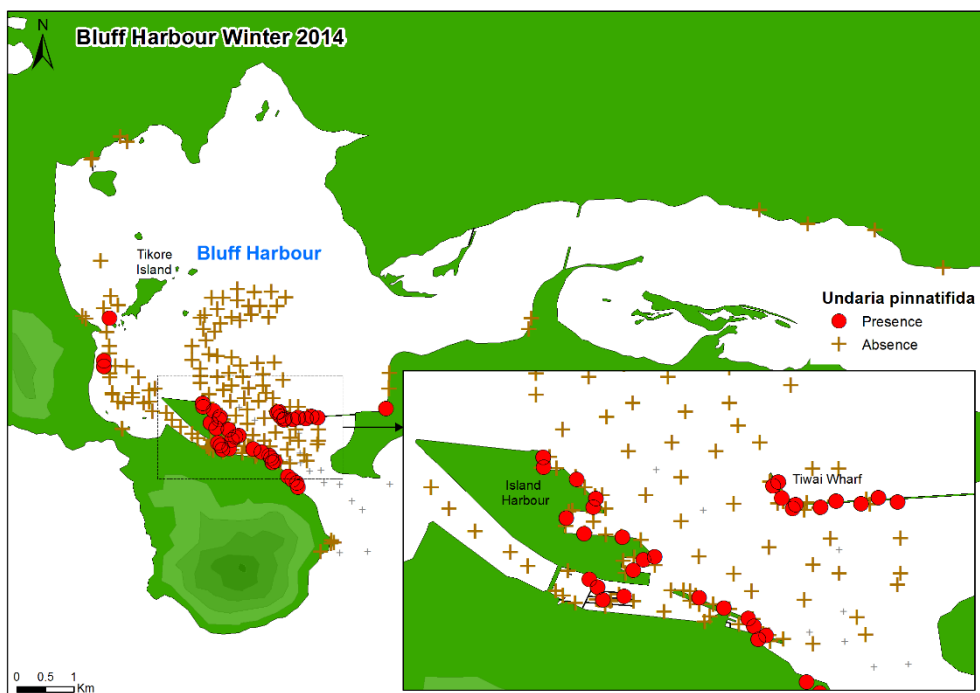
### Auckland (Waitemata) Harbour Winter 2014



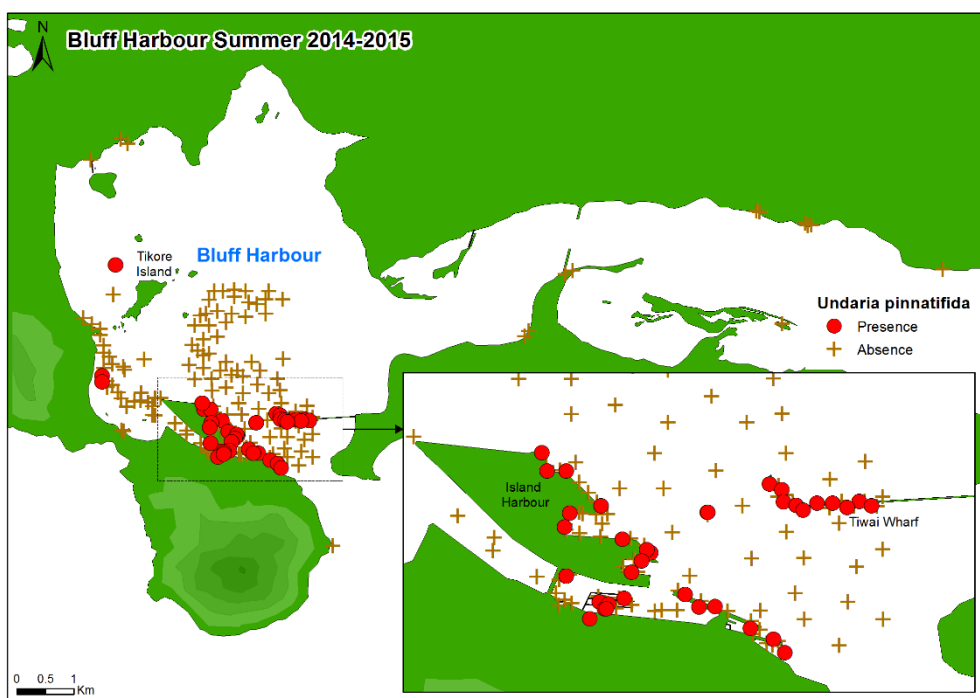
### Auckland (Waitemata) Harbour Summer 2014–15



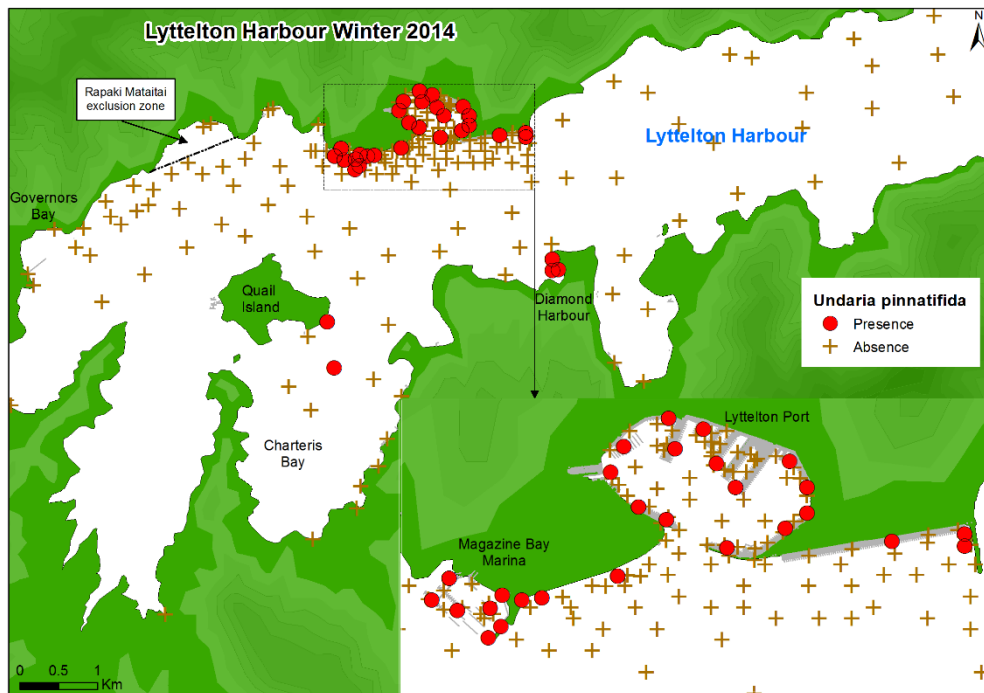
## Bluff Harbour Winter 2014



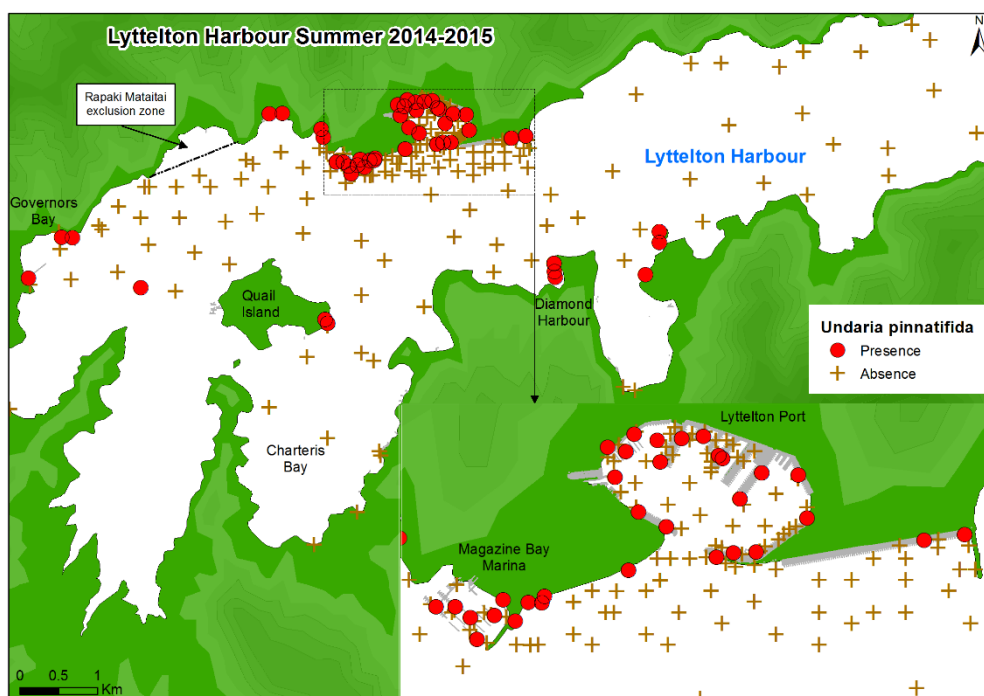
## Bluff Harbour Summer 2014–15



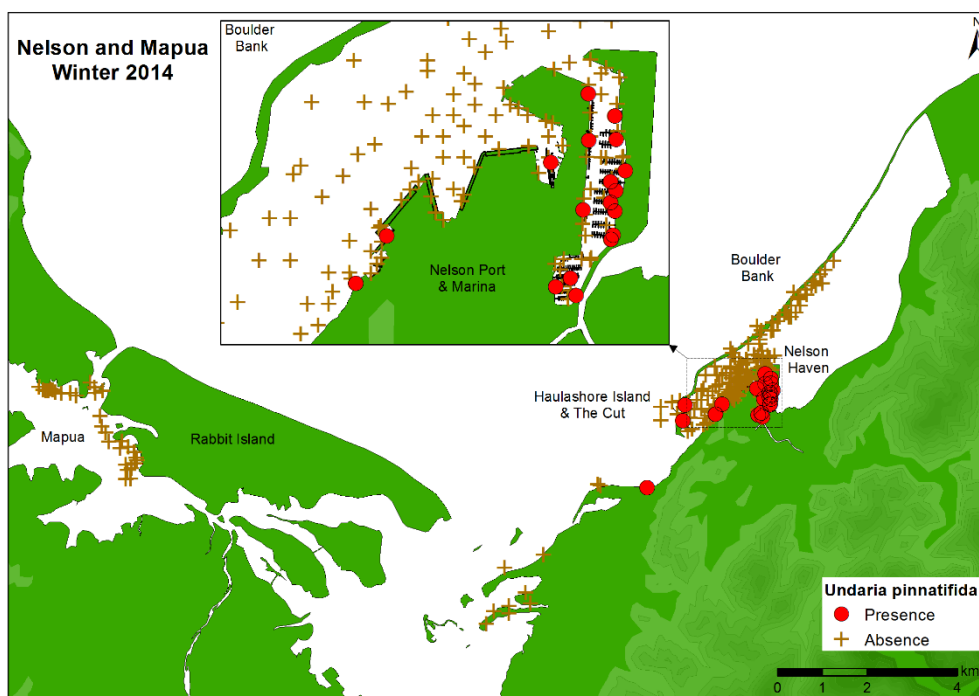
## Lyttelton Harbour Winter 2014



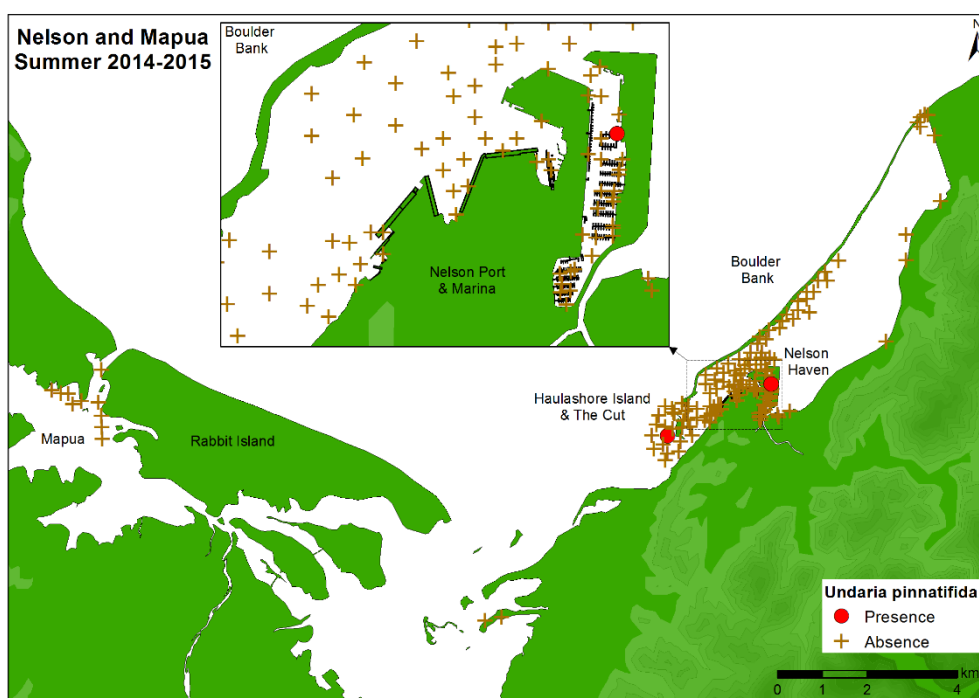
## Lyttelton Harbour Summer 2014–15



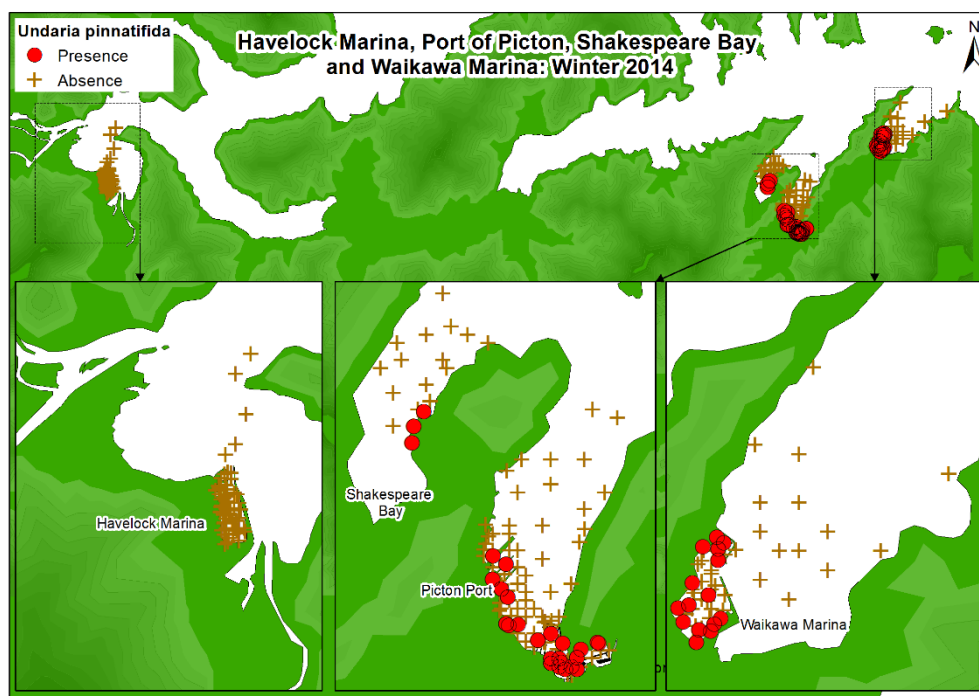
## Nelson Harbour Winter 2014



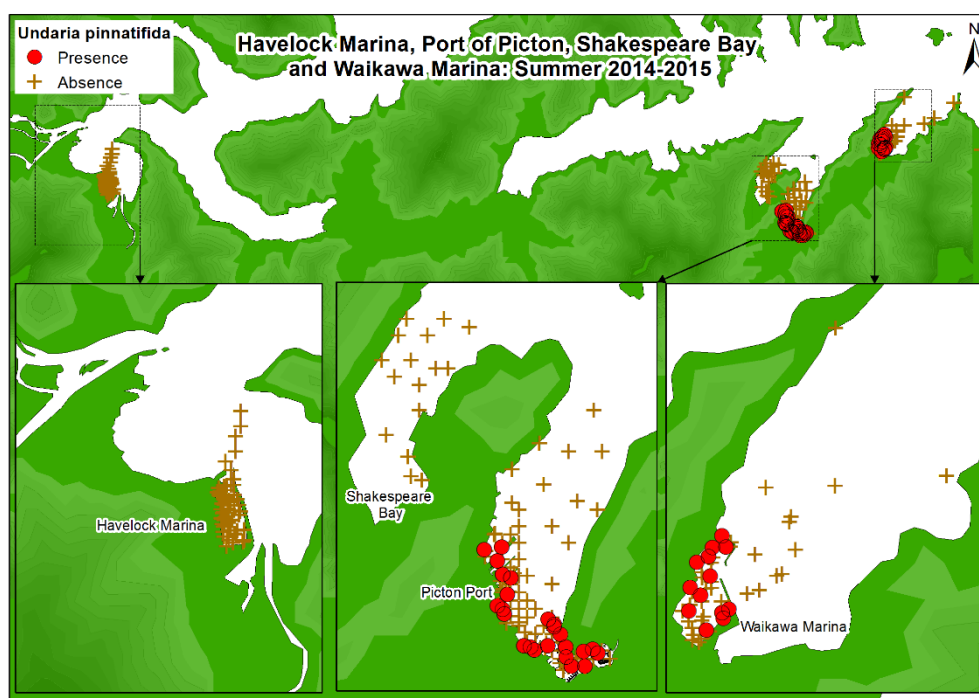
## Nelson Harbour Summer 2014–15



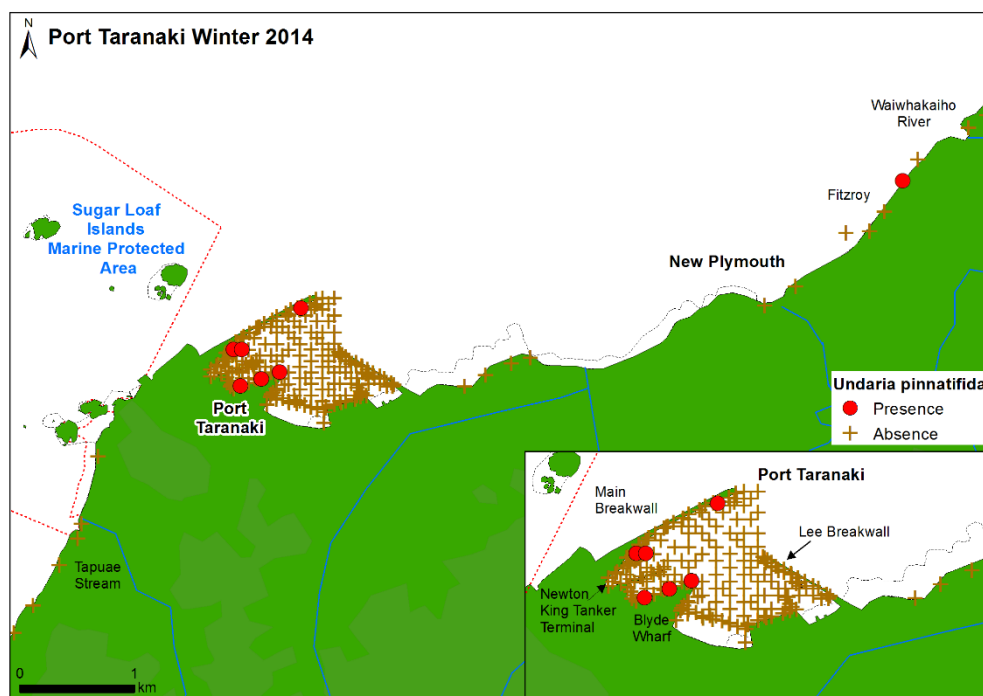
## Picton/Havelock Winter 2014



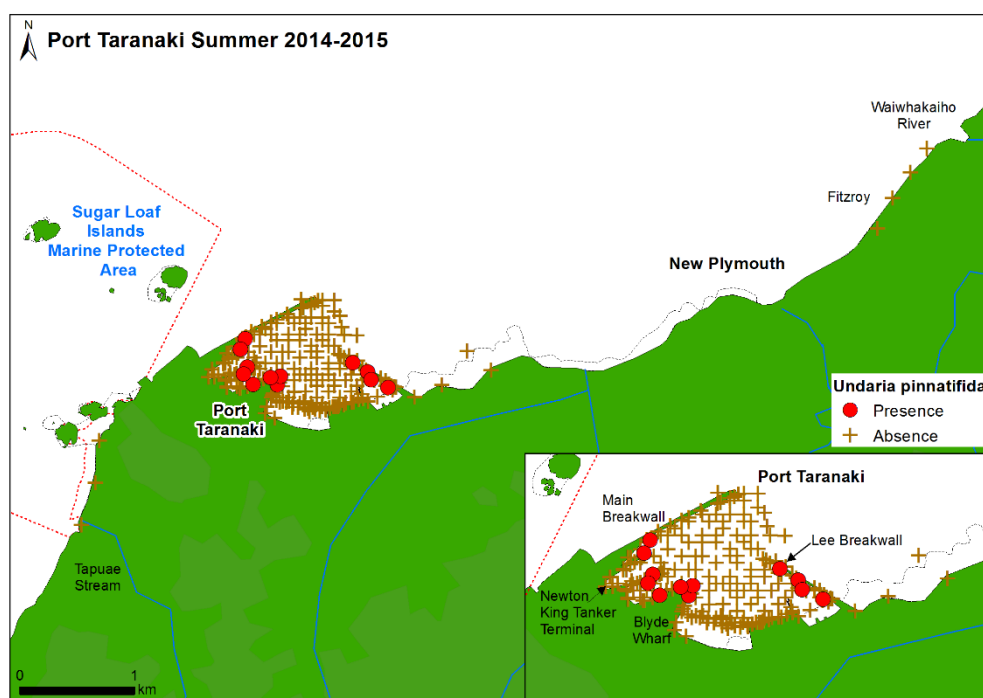
## Picton/Havelock Summer 2014–15



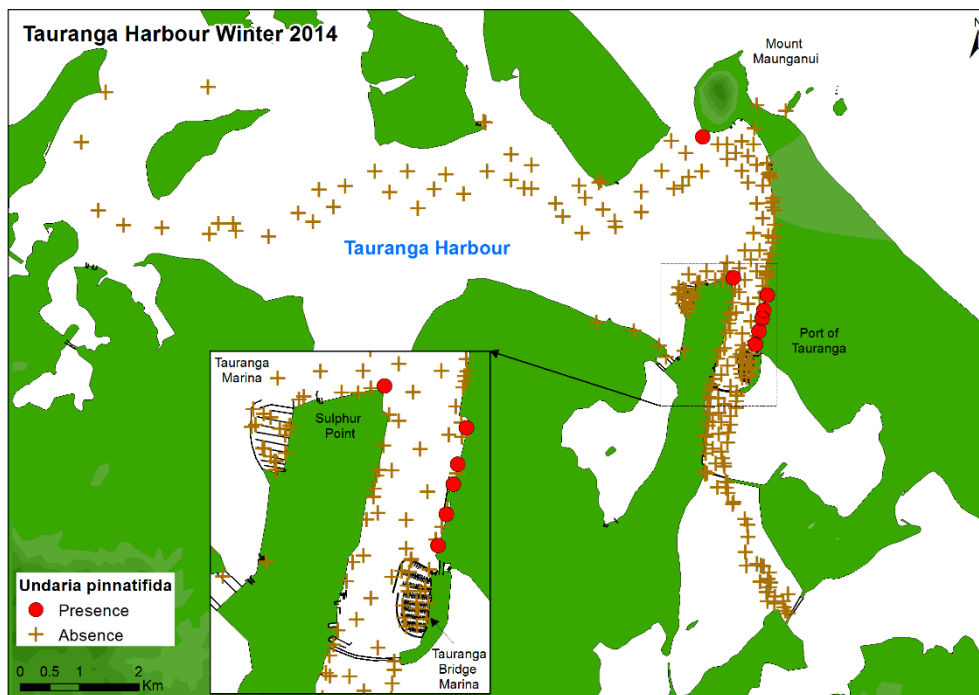
## Port Taranaki Winter 2014



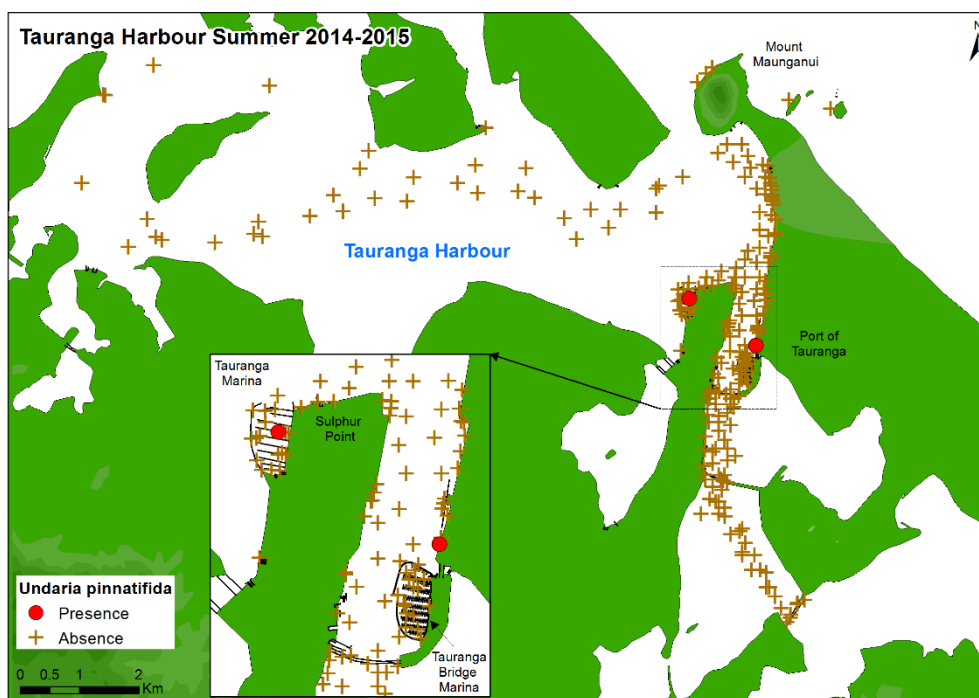
## Port Taranaki Summer 2014–15



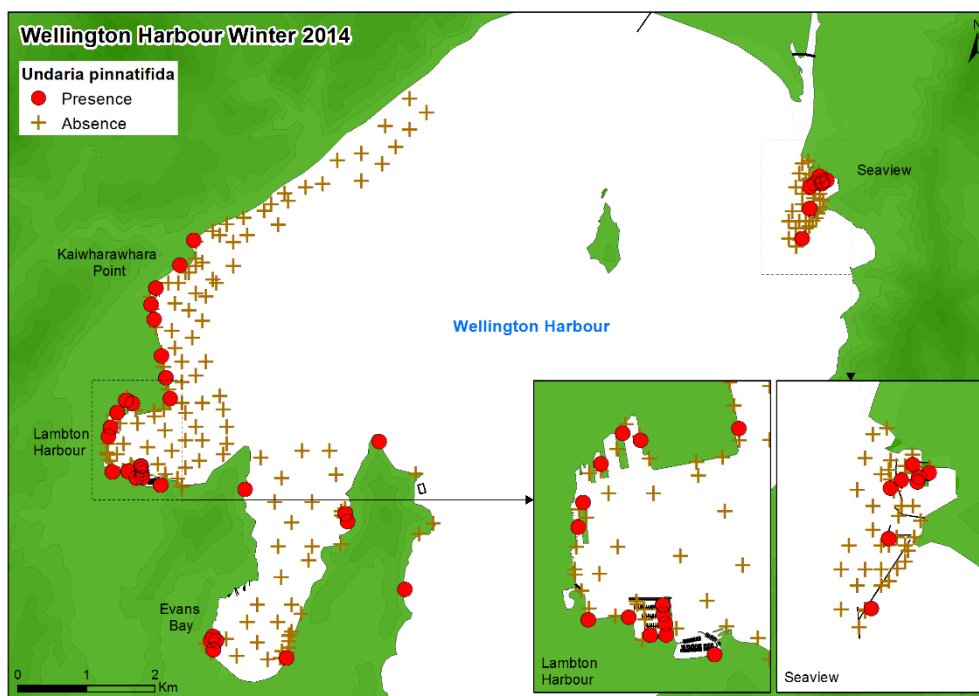
## Tauranga Harbour Winter 2014



## Tauranga Harbour Summer 2014-15



## Wellington Harbour Winter 2014



## Wellington Harbour Summer 2014–15

