Kaipara Harbour Targeted Marine Pest Survey May 2019

Melanie Tupe, Chris Woods and Samantha Happy

April 2020

Technical Report 2020/008

Auckland Council
Te Kaunihera o Tāmaki Makaurau

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M. Tupe (nee Vaughan)
Environmental Services, Auckland Council

C. Woods
National Institute of Water and Atmospheric Research, NIWA

S. Happy
Environmental Services, Auckland Council

NIWA project: ARC19501

Auckland Council
Technical Report 2020/008

ISSN 2230-4525 (Print)
ISSN 2230-4533 (Online)

ISBN 978-1-99-002214-2 (Print)
ISBN 978-1-99-002215-9 (PDF)

This report has been peer reviewed by the Peer Review Panel.
Review completed on 30 April 2020 Reviewed by two reviewers
Name: Samantha Hill Position: Head of Natural Environment Design (Environmental Services)
Name: Imogen Bassett Position: Biosecurity Principal Advisor (Environmental Services)
Date: 30 April 2020

Recommended citation

Tupe, M., C Woods and S Happy (2020). Kaipara Harbour targeted marine pest survey May 2019. Auckland Council technical report, TR2020/008

Cover image: close-up image of the Australian droplet tunicate, *Eudistoma elongatum*. Photo credit: Chris Woods (NIWA)

Executive summary

The introduction of new species to an environment in which they did not evolve has been recognised as one of the top threats to ecosystem function and biodiversity. Once established, non-indigenous marine species (NIMS) have the ability to spread quickly compete with native species for food or habitat. These introductions can negatively impact ecological, socio-cultural and economic marine values. Within the marine environment, there are limited tools to manage NIMS incursions, so early detection is essential for improving management outcomes.

In September and October 2006, a baseline survey of marine biota, including NIMS, was commissioned by Biosecurity New Zealand (Biosecurity NZ) and carried out in the Kaipara Harbour by the National Institute of Water and Atmospheric Research Ltd (NIWA). The survey identified 389 taxa, 274 of which were considered native (indigenous), 10 NIMS, 27 cryptogenic (origin unknown), with the remaining 77 taxa being indeterminate (unable to be identified to genus or species level) and one zooplankton species (Inglis et al., 2010). No further surveys have been carried out in the harbour following this original baseline survey. As a result, Auckland Council (AC), Northland Regional Council (NRC) and Biosecurity NZ identified the need to update the current knowledge of NIMS in the Kaipara Harbour

NIWA was engaged to carry out a targeted marine pest survey in May 2019 to detect NIMS currently present in the harbour. The targeted marine pest survey methodology used aligns with the national Marine High-Risk Site Surveillance (MHRSS) programme which surveys 11 New Zealand ports and marinas bi-annually, using five sampling methodologies (crab condos, crab (box) traps, benthic sled tows, diver searches and shore searches). It should be noted that the aims, survey design, sampling effort, and sometimes sampling methodology are fundamentally different between baseline and targeted surveys used for different information purposes.

The survey focused on the detection of primary and secondary target species, as outlined by Biosecurity NZ. A total of 280 sites were surveyed during the 2019 survey, and 14 NIMS were detected (3 target and 11 non-target species), along with five cryptogenic species. No primary target species were detected. The three secondary target species detected were the Asian date mussel, *Arcuatula senhousia*, the Australian droplet tunicate, *Eudistoma elongatum* and the clubbed tunicate, *Styela clava*. *A. senhousia* and *S. clava* were found at several locations throughout the harbour, and *E. elongatum* was detected at three locations associated with aquaculture structures.

Twenty-four specimen sample lots were sent to the Marine Invasive Taxonomic Service (MITS) for formal identification, and seven non-target NIMS and five cryptogenic species were confirmed from these submitted samples. For five of these NIMS, their detection and confirmation of taxonomic identity represent range extensions (recorded for the first time in Kaipara Harbour, but found elsewhere in New Zealand). These NIMS were the colonial tunicates *Botrylloides giganteum*, *Diplosoma listerianum* and *Eudistoma elongatum*, the Australian dog whelk *Tritia burchardi* and the pink-mouthed hydroid *Ectopleura crocea*.

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1.0 Introduction

The spread of non-indigenous marine species (NIMS) outside their natural range can negatively impact ecological, socio-cultural and economic marine values. The threat from NIMS has been identified as one of the most important pressures on coastal marine habitats and ecosystems in the "*Our marine environment 2019*" report (prepared by the Ministry for the Environment and Stats NZ under the Environmental Reporting Act 2015, MfE, 2019). NIMS are often transported via vessels in ballast water, in sea chests, and as hull biofouling, enabling the spread of species outside their natural range. Other human mediated vectors for NIMS spread include aquaculture equipment and stock, other equipment (e.g. fishing and diving gear) and floating oceanic debris (often plastic). (Inglis et al., 2013).

Regional councils have a statutory responsibility to provide leadership in activities that prevent, reduce, or eliminate adverse effects from harmful organisms (pest management) that are present in New Zealand in the regions that they manage under the Biosecurity Act 1993, s12B. This requires an understanding of both the pathways, and the presence of species within a regional council's jurisdiction. And an understanding of potential impacts and the efficacy and costs of potential management interventions in order to inform management decisions. Data on the presence of NIMS in the Kaipara Harbour are limited, with a baseline survey conducted in 2006 (Inglis et al., 2010) the only previous sampling undertaken.

In 2019, Auckland Council (AC) and Northland Regional Council (NRC) commissioned the National Institute of Water and Atmospheric Research Ltd (NIWA) to carry out a targeted marine pest survey in the Kaipara Harbour, with an aim to provide an update on the current presence of NIMS. This report provides the results of the 2019 survey.

1.1 Description of the harbour

The Kaipara Harbour is situated on the west coast of Auckland, New Zealand's largest city (Figure 1). The harbour is the second largest in the southern hemisphere, with a total surface area of 947km^2, a total intertidal area of 409km^2 (Hailes and Carter, 2015) and a coastline estimated to be around 900km long (Haggitt et al., 2008). Formed from a system of drowned river valleys, the large inlet, bound by two, large sand spits (South Head and Pouto Point), provides an entrance for high wave action and strong current velocities, creating a very dynamic system (Hailes and Carter, 2015).

Both Māori and European settlers recognised the "bounty of the Kaipara ecosystem", and it has been referred to as the 'food basket' by Kaipara hapū (Integrated Kaipara Harbour Management Group, IKHMG, 2011). The harbour is an area of international importance for coastal birds, has a high diversity of marine organisms, and contains ecologically significant marine communities that provide a wide variety of functions and services (Haggitt et al., 2008). It boasts some of the rarest ecosystems in New Zealand, namely sand dunes, seagrass, freshwater and wetland ecosystems (Integrated Kaipara Harbour Management Group, IKHMG, 2011).

During the late 1800s into the early 1900s a port operated at the Kaipara Heads with ships transporting kauri logs and gum from Dargaville, Helensville, the northern Wairoa River and smaller settlements throughout the harbour (Inglis et al., 2010). Coal boats delivered coal to Dargaville until the 1940s, and a ferry used to operate on the Wairoa River (Inglis et al., 2010).

There are now no commercial port facilities operating within the harbour mostly due to the shallow, dangerous conditions, and treacherous bar at the mouth of the harbour (Inglis et al., 2020). The harbour remains an important area recreationally, providing opportunities for tourism, fishing, swimming, kayaking, boating and yacht racing, such as the "Pahi Regatta" which has been running since 1886.

Local ecological knowledge of the harbour suggests that there has been a long association with 'muddy' turbid conditions, and large-scale environmental changes (i.e., deforestation, kauri-gum extraction, conversion to pastoral agriculture) have collectively substantially increased catchment sediment loads. In many instances, there have been shifts from sand to mud dominated systems, which has had flow on effects to water clarity, benthic community structure, biodiversity and key biogenic-habitat forming species such as mangroves, seagrass and bed-forming bivalves (Morrison, et al., 2014).

Research has shown that the Kaipara Harbour supports the majority of snapper recruits to New Zealand's North Island west coast, underpinning the substantial SNA

8 fishery (Morrison et al., 2009). Mangroves, subtidal seagrass beds and upper harbour reaches provide valuable nursery habitats for both estuarine based species and those that move out to the open coast, including key commercial, recreational, and customary species such as snapper, kahawai, trevally, red gurnard, sand and yellow-belly flounders, rig, school and hammerhead sharks, yellow-eyed and grey mullet and shellfish (Morrison et al., 2014). Both rig and school sharks are found in large numbers, including pregnant females, supporting the suggestion of the importance of the harbour as a nursery (Francis et al., 2012 and Paul & Sanders, 2001). Great white sharks have also been reported as frequent visitors and residents of the harbour, with some locals suggesting that females come in during the winter to pup (Morrison, et al., 2014).

The harbour is also an important area for both commercial and recreational shellfish harvest from species such as scallops (although this fishery is currently closed under section 11 Fisheries Act 1996), cockles, oysters and pipi (Morrison et al., 2014). A 76 ha Kaipara oyster farms operates in the central harbour, capable of producing more than 24 million oysters annually (Kaipara Oysters, 2017).

In 1987, a land-based aquaculture prawn farm was developed close to South Head, by Kiwi China Prawn Company. While it kicked off to a successful start with prawns breeding and restaurants interested, a disagreement with Chinese staff over technology saw the stock poisoned and the venture and the investment crashed (Freer, 2004).

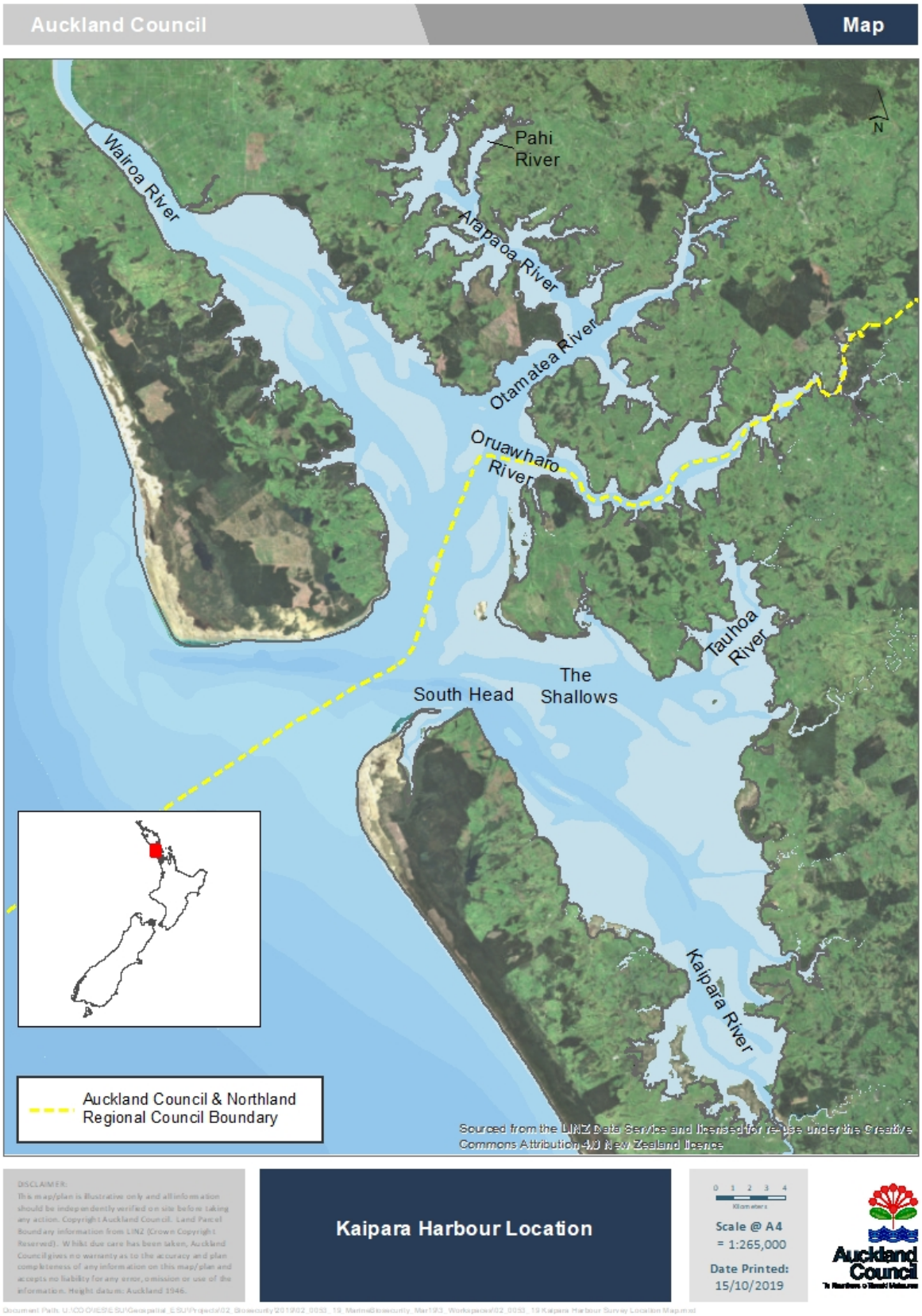

Figure 1. Kaipara Harbour location map

1.2 Background – previous survey results

The 2006 baseline survey of Kaipara Harbour was carried out by NIWA and commissioned by Biosecurity NZ. Prior to the baseline survey, a desktop survey was conducted to compile an inventory of NIMS of previous records from the Kaipara Harbour and surrounding areas, identifying seven NIMS. The baseline survey was designed to provide an inventory of native, non-indigenous and cryptogenic marine species. Baseline survey protocols are intended to sample a variety of habitats within ports and harbours, including epibenthic fouling communities on hard substrata, soft-sediment communities, mobile invertebrates and fishes, and dinoflagellates. Sampling methods used in these surveys were based on protocols developed by the Australian Centre for Research on Introduced Marine Pests (CRIMP) for baseline surveys of non-indigenous species in ports. The baseline sampling methods included small cores for dinoflagellate cysts, benthic sled tows, large cores and box dredge samples for benthic/infaunal invertebrates, 20-µm and 100-µm plankton nets, crab and shrimp traps, qualitative visual searches, quadrat scraping, photo stills and video, fish poison stations, beach seines and beach walks (shore searches) (Inglis et al., 2010).

In total, 22 sites were sampled during the 2006 baseline survey, using both quantitative and qualitative methods to sample soft and hard substrates, and pelagic communities (Inglis, et al., 2010). The baseline survey detected 389 species or higher taxa, of which 274 were considered native (indigenous), 10 NIMS, 27 cryptogenic[1] (Table 1), with the remaining 77 taxa being indeterminate (unable to be identified to genus or species level) and one zooplankton species (Inglis et al., 2010).

Infrared aerial photography of the southern area of the harbour was carried out in 2012 and 2013 to understand the distribution of seagrass beds and recorded an unexpected habitat; the presence of low relief subtidal “beds” of the Asian date mussel, *Arcuatula senhousia*. The imagery showed both large and small shallow subtidal areas throughout the survey area and documented 7.2km^2 area of *A.senhousia* both with and without algal cover (Morrison et al., 2014).

[1] Cryptogenic species are those whose geographic origins are uncertain and, therefore whose identity as either indigenous or non-indigenous is ambiguous.

Table 1. Non-indigenous and cryptogenic species detected during the Kaipara Harbour and surrounding areas 2006 baseline survey

Type of organism	Species found	Status
Annelida	*Amphicteis Amphicteis*-A	Cryptogenic
Annelida	*Dipolydora armata*	Non-indigenous
Annelida	*Lanice Lanice*-01 [conchilega / aoteoroae]	Cryptogenic
Annelida	*Neanthes* aff. *succinea*	Cryptogenic
Annelida	*Perinereis Perinereis*-A	Cryptogenic
Annelida	*Pirakia Pirakia*-A	Cryptogenic
Annelida	*Spirobranchus S. polytrema* complex	Cryptogenic
Arthropod	*Jassa slatteryi*	Non-indigenous
Arthropod	*Lysmata vittata*	Cryptogenic
Arthropod	*Pyromaia tuberculata*	Non-indigenous
Bryozoa	*Anguinella palmata*	Non-indigenous
Byrozoa	*Bowerbankia gracillis*	Non-indigenous
Bryozoa	*Conopeum seurati*	Non-indigenous
Chordata	*Didemnum* sp.	Cryptogenic
Cnidaria	*Bougainvillia muscus*	Cryptogenic
Mollusca	*Crassostrea gigas*	Non-indigenous
Mollusca	*Musculista senhousia* (now known as *Arcuatula senhousia*)	Non-indigenous
Mollusca	*Theora lubrica*	Non-indigenous
Myzozoa	*Alexandrium affine*	Cryptogenic
Myzozoa	*Alexandrium catenella*	Cryptogenic
Myzozoa	*Gymnodinium catenatum*	Cryptogenic
Porifera	*Adocia* new sp. 10	Cryptogenic
Porifera	*Amphilectus fucorum*	Non-indigenous
Porifera	*Callyspongia ramosa*	Cryptogenic
Porifera	*Ciocalypta* cf. *pencillus*	Cryptogenic
Porifera	*Clathria* new sp. 1	Cryptogenic
Porifera	*Clathria* new sp. 3	Cryptogenic
Porifera	*Eurypon* new sp. 1	Cryptogenic
Porifera	*Halichondria* new sp. 1	Cryptogenic
Porifera	*Haliclona* new sp. 3	Cryptogenic

Type of organism	Species found	Status
Porifera	*Haliclona* new sp. 5	Cryptogenic
Porifera	*Haliclona* new sp. 6	Cryptogenic
Porifera	*Haliclona* new sp. 9	Cryptogenic
Porifera	*Haliclona* new sp. 21	Cryptogenic
Porifera	*Ophlitospongia* new sp. 1	Cryptogenic
Porifera	*Suberites* cf. *perfectus*	Cryptogenic
Porifera	*Tedania* new sp. 5	Cryptogenic

2.0 Methods

2.1 Survey aim

The Kaipara survey aims to update the existing knowledge of marine pests found within the harbour using similar methodology to the MHRSS programme to detect new species to the harbour and record the distribution expansion of known pests within the harbour.

The survey methodology aligns with the primary objective of the MHRSS programme to detect incursions of new-to-New Zealand NIMS on the Unwanted Organisms Register at High Risk Sites throughout New Zealand. This programme is carried out to facilitate the early detection of NIMS as part of Biosecurity NZ's wider marine biosecurity programme. Currently, 11 high-risk ports and marinas around New Zealand are surveyed in winter and summer each year to capture biological changes of species throughout the year (Woods et al., 2018).

The secondary objective is to detect new-to-New Zealand non-indigenous or cryptogenic organisms not listed throughout New Zealand, and to detect range extensions[2] of known established non-indigenous or cryptogenic organisms (Woods et al., 2018). Refer to www.marinebiosecurity.org.nz for further detail about the national surveys. Since the purpose of the MHRSS programme is detection (with limited enumeration), techniques in which the presence or absence of target species could be determined rapidly within a sample were selected, thereby allowing a comparatively large number of locations to be sampled on each survey compared with baseline surveys.

2.2 Target species

The NIMS of most concern to the Kaipara Harbour survey are those listed by Biosecurity NZ, as **primary target species** from the MHRSS. These are species which are not present in New Zealand, and are as follows:

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.**

[2] The term 'range extension' is frequently applied when a NIMS is detected at a geographic location where it has not been documented as previously occurring. They represent expansions to the known geographic distribution of a NIMS, but do not implicitly equate to actual geographic spread of a NIMS

In addition to the primary target species, there are four **secondary target species** known to be established in localised areas within New Zealand's coastal waters and their detection will help monitor their distribution, and are as follows:

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

*Notifiable organism under Biosecurity (Notifiable Organisms) Order 2016

The primary and secondary target species were the focus of the Kaipara Harbour 2019 survey. All other non-target NIMS species detected were recorded and reported, along with cryptogenic and indigenous species.

It should be noted that the range of sampling methodology used in the 2006 baseline survey was far more extensive than that used for this 2019 survey and the MHRSS programme. The number of sampling sites is reduced in comparison, in an attempt to capture and enumerate as many species present as possible, whether they be native, NIMS, cryptogenic or otherwise. As baseline surveys seek to taxonomically identify all biota sampled, this type of survey involves a significantly greater time period between survey date and dissemination of survey results due to the requirement for the (often) substantial number of specimens collected to be identified by pertinent taxonomic experts. This contrasts with targeted surveys which focus on target and suspect or unknown organisms, enabling more rapid knowledge of NIMS detected and survey results.

2.3 Survey area and sites

Spread over a two week period to cover the huge expanse of the Kaipara Harbour, sampling sites were allocated pre-survey through discussion with AC, NRC, NIWA and affiliated iwi. These discussions aimed to achieve thorough survey coverage of all 'likely' locations where NIMS could occur based upon habitat, substratum and proximity to areas of anthropogenic activity (i.e., potential human-mediated transfer of NIMS). This includes artificial structures including jetties, wharfs, marine farms, and navigational buoys or markers. A representation of the sampling sites from the 2006 baseline survey and areas of previous unconfirmed NIMS reports were also included. All pre-allocated site locations were mapped using a Geographic Information System. In some instances, the conditions or location of the preferred sampling site prevented access, and the site was relocated to another nearby location and the new coordinates recorded and mapped (Appendix A).

2.4 Survey methods

Between Monday 13th and Friday 24th May 2019, a variety of methodologies were used to sample a range of soft and hard habitat types such as mud and gravel bottoms, intertidal rocky shores, and artificial structures including pilings, moorings, jetties and commercial vessel berths. The sampling methodologies included benthic sled tows, crab (box) traps, crab condos, diver searches, shore searches and remotely operated vehicle searches where possible. For further detail around the sampling methodology, refer to Inglis et al., 2006a and Woods et al., 2018 and Appendix A which indicates the locations of each sampling method.

The following survey sampling effort was planned:

- 100 benthic sled tows (Figure 14)
- 80 crab (box) trap lines (Figure 11)
- 8 crab condo lines (Figure 12)
- 30 diver searches (Figure 13)
- 25 shore searches (Figure 15)
- Submersible Remotely Operated Vehicle (Boxfish ROV) searches if possible.

2.4.1 Specimen samples

All survey samples were sorted on site and individuals of target (primary and secondary) species recorded and enumerated on sample datasheets against the sample location where they were found. Specimens retained included all primary target species, representative samples of secondary target species at locations where they are not currently known to occur (i.e., range extensions), and any suspect organisms whose identities were uncertain.

Each specimen collected was allocated a waterproof label with a unique identifying number (the “sample lot code” including the identity of the survey location). The sample lot code is recorded on the sample data sheet against the site in which it was found, linking the specimen to its exact location and date of collection. The sample lot code, date of collection, method of sampling, sample number, number of specimens retained and a description of the specimens (minimally the relevant taxon) are also recorded on a field sample register sheet, providing a list of all specimens retained during the survey.

At the end of each day, all specimens retained are returned to the field laboratory and their labels and sample lot codes checked against the sample register. Specimens are preserved in the chemical appropriate to that taxon, and where appropriate,

photographic images of specimens were taken to aid in their identification. All specimens collected were sent to MITS for formal taxonomic identification.

All significant marine pest observations that could be confirmed in the field were immediately reported to AC and Biosecurity NZ via the Ministry of Primary Industries (MPI) pest and disease hotline (0800 80 99 66). Where formal taxonomic identification was required for a suspect organism, observations were reported to AC and Biosecurity NZ via MITS upon taxonomic confirmation.

3.0 Survey results

3.1 Sampling effort

Sampling effort saw 280 sites searched through a variety of methods using benthic sled tows, crab condo lines, crab (box) trap lines, diver searches, shore searches and submersible remote operative vehicle (Boxfish ROV) searches. Table 2 displays the number of survey sites.

Table 2. Sampling collection summary

Sampling method	Target number	Number collected	Percent of target
Benthic sled tows	100	100	100
Crab (box) trap lines	80	80	100
Crab condo lines	8	20	250
Diver searches	30	36	120
Shore searches	25	38	152
Submersible ROV* searches	0	6	600
Total	**243**	**280**	**115**

*Boxfish ROV

3.2 Specimens submitted to Marine Invasive Taxonomic Service

Twenty-four sample lots of specimens were collected for submission to MITS. These included known (where positive identification is required for confirming range extensions) and suspected NIMS, as well as unknown specimens (which can include native organisms). Refer to Appendix B for the sample register confirmed by MITS taxonomic experts.

Expert formal taxonomic identification confirmed a range extension for five NIMS: the colonial tunicates *Botrylloides giganteum*, *Diplosoma listerianum* and the Australian droplet tunicate, *Eudistoma elongatum*, the Australian dog whelk *Tritia burchardi* and the pink-mouthed hydroid *Ectopleura crocea* (Table 3 and Table 4).

3.3 Non-indigenous marine species detected

Fourteen NIMS were detected in the surveys and are explained in sections 3.3.1 and 3.3.2. Of these, four species were detected during the 2006 baseline survey, the Asian date mussel *Arcuatula senhousia* (then *Musculista senhousia*), the Asian semele *Theora lubrica* and the tuberculate pear crab *Pyromaia tuberculata*. Appendix C contains the results of all species identified during the 2019 survey and their recorded number or abundance.

3.3.1 Primary and secondary target species

No primary target NIMS were detected during the survey. However, three secondary target NIMS were detected; the Asian date mussel *Arcuatula senhousia*, Australian droplet tunicate *Eudistoma elongatum* and clubbed tunicate *Styela clava*.

A. senhousia was detected at numerous locations throughout the harbour (12 of 100 benthic sled locations, 10 of 80 crab trap locations, 1 of 36 diver search locations and 1 of 38 shore search locations). *A. senhousia* was found at numerous locations throughout the harbour (Table 3). The findings comprised instances of beds (mats) of live specimens as well as loose/empty dead shells. Previous reported detections include those from the AC Soft Sediment Ecology monitoring programme, which has observed *A. senhousia* south of Tapora Bank in 2009, with frequently migrating beds, noting that in 2013 they were no longer present (Hailes and Carter, 2015). At Kakarai Flats, shell hash was present, but no live organisms were reported between 2012 and 2014 monitoring. Low densities are found at Haratahi Creek site, with raised beds to the west of the monitored area (Hailes and Carter, 2015), and from aerial photography mapping of the Southern Kaipara (Morrison et al., 2014).

Figure 2. Example of *Arcuatula senhousia* mat (upper left) and individual mussels (upper right) detected in Kaipara Harbour. The extensive bed exposed at low tide in bottom image is at Kapua Point (images: C. Woods/NIWA).

Eudistoma elongatum was detected at three locations (identity confirmed by MITS) in both northern and southern areas of the harbour associated with aquaculture farm structures (3 of 36 diver search locations) (Table 3). This represents a range extension for this NIMS.

Figure 3. Example of *Eudistoma elongatum* detected in Kaipara Harbour associated with an oyster farm (left) with close-up detail (right) (images: C. Woods/NIWA).

Styela clava was detected at several locations throughout the harbour (Table 3), mainly associated with anthropogenic structures and hard substratum (e.g., reef) (12 of 36 diver search locations, 2 of 38 shore search locations and 1 of 6 ROV search locations). *S. clava* was not detected during the 2006 baseline survey, but a record from Shelly Beach in 2017 is noted on the Marine Biosecurity Porthole (Marine Biosecurity Porthole, 2020a). *S. clava* was also recorded in small numbers at two northern Kaipara sites during a 2017 scallop survey (Williams et al., 2018).

Figure 4. Example of *Styela clava* detected in Kaipara Harbour (left: Kaipara River Channel beacon (FLWR.10s6m4/2M Bn R), right: South Head mudstone) (images: C. Woods/NIWA).

Table 3. Secondary target non-indigenous marine species (NIMS) detected

Species	Location detected
Arcuatula senhousia (Asian date mussel)	Wairoa River Channel, Arapaoa River Channel, Pahi River Channel, Otamatea Channel, Oruawharo River Channel, Kaipara River Channel
Eudistoma elongatum (Australian droplet tunicate)	Arapaoa River Channel, The Shallows (southern Kaipara Harbour)
Styela clava (clubbed sea squirt)	Wairoa River Channel, Tinopai, Arapaoa River Channel, Oruawharo River Channel, South Head, Tauhoa River Channel, Kaipara River Channel

3.3.2 Selected non-target species

Eleven non-target NIMS were detected at various locations throughout the harbour and are outlined in Table 4. Range extensions have been confirmed for four of these, the colonial tunicates *Botrylloides giganteum* and *Diplosoma listerianum*, the Australian dog whelk *Tritia burchardi* and the pink-mouthed hydroid *Ectopleura crocea*.

Five cryptogenic species were also detected at various locations throughout the harbour. These species were the colonial ascidian *Didemnum* sp., solitary ascidian *Styela plicata*, bryozoan *Alcyonidium* sp., caprellid amphipod *Caprella equilibra* and hydroid *Bougainvillia muscus*.

Table 4. Non-target non-indigenous marine species (NIMS) detected

Non-target species detected	Location detected
Amathia verticillata (spaghetti bryozoan)	Oruawharo River Channel, Kaipara River Channel
*Botrylloides giganteum***	The Shallows (southern Kaipara Harbour)
Chaetopterus sp. (parchment worm)	The Shallows (southern Kaipara Harbour), Tauhoa River Channel
Charybdis (Charybdis) japonica (Asian paddle crab)	Wairoa River Channel, Arapaoa River Channel, Pahi River Channel, Otamatea Channel, Oruawharo River Channel, Tauhoa River Channel, Kaipara River Channel
Codium fragile (dead man's fingers)	South Head, Te Whau Bay, Tinopai Coates Bay, Ngaupiko Point
*Diplosoma listerianum***	The Shallows (southern Kaipara Harbour), Kaipara River Channel
*Ectopleura crocea*** (pink-mouthed hydroid)	Wairoa River Channel, Pahi River Channel, Arapaoa River Channel, Oruawharo River Channel, The Shallows (southern Kaipara Harbour)
Oratosquilla oratoria (Japanese mantis shrimp)	Wairoa River Channel, Pahi River Channel, Oruawharo River Channel, Kaipara River Channel
Pyromaia tuberculate (tuberculate pear crab)	Wairoa River Channel, Arapaoa River Channel, Oruawharo River Channel, Tauhoa River Channel, Kaipara River Channel
Theora lubrica (Asian semele)	Wairoa River Channel, Arapaoa River Channel, Otamatea River Channel, Oruawharo River Channel, Kaipara River Channel
*Tritia burchardi*** (Australian dog whelk)	Wairoa River Channel, Arapaoa River Channel, Oruawharo River Channel

Note: ** indicates species with a confirmed range extension.

The non-indigenous spaghetti bryozoan *Amathia verticillata* was detected at several locations in the southern region of the harbour (3 of 80 crab trap locations and 1 of 36 shore search locations (all as drift specimens).

The non-indigenous colonial tunicate *Botrylloides giganteum* was detected at an oyster farm at "The Shallows" (southern Kaipara) (1 of 36 diver search locations). A sample was taken for submission to MITS to confirm taxonomic identity, with confirmation representing a range extension for this NIMS.

Figure 5. Example of *Botrylloides giganteum* detected in Kaipara Harbour associated with an oyster farm (left) and close-up detail (right) (images: C. Woods/NIWA).

The non-indigenous parchment tubeworm *Chaetopterus* sp. was detected at "The Shallows" and in the Tauhoa River Channel (southern Kaipara) (1 of 100 benthic sled locations and 1 of 36 diver search locations).

The non-indigenous Asian paddle crab *Charybdis (Charybdis) japonica* was detected at several locations throughout the harbour (11 of 100 benthic sled locations, 27 of 80 crab trap locations, 4 of 20 crab condo locations, 6 of 36 diver search locations and 9 of 38 shore search locations). Both very small juveniles and mature male and female (no ovigerous females) crabs were detected, ranging in carapace width from 10 to 85mm. All specimens detected were euthanised. What was unusual about the behaviour of *C. japonica* in the Kaipara Harbour was the large number of crabs detected in the intertidal zone, hiding underneath rocks and partially buried in the wetted sediment. While this behaviour is observed in its native range (for example in Japan) it has not been commonly observed to date at other invaded sites within New Zealand.

Figure 6. Example of *Charybdis (Charybdis) japonica* detected in Kaipara Harbour (left: juvenile caught in a benthic sled, right: crab hiding underneath a rock in the intertidal zone) (images: C. Woods/NIWA).

The non-indigenous green macroalga *Codium fragile* was detected at several locations in the northern Kaipara Harbour in the intertidal zone (5 of 38 shore search locations). *Codium* sp. were detected in the baseline survey but taxonomic resolution to species level was not possible.

The non-indigenous colonial tunicate *Diplosoma listerianum* (Figure 7) was detected at two locations in the southern region of the harbour (MITS confirmed identity) associated with anthropogenic structures (2 of 36 diver search locations), representing a range extension for this NIMS.

Figure 7. Examples of *Diplosoma listerianum* detected in southern Kaipara Harbour (left) with close-up detail (right) (images: C Woods/NIWA).

The non-indigenous pink-mouthed hydroid *Ectopleura crocea* was detected at several locations throughout the harbour associated with anthropogenic structures (9 of 36 diver search locations). A sample was taken for submission to MITS to confirm taxonomic identity, with confirmation representing a range extension for this NIMS.

Figure 8. Example of *Ectopleura crocea* detected in Kaipara Harbour (image: C. Woods/NIWA).

The non-indigenous Japanese mantis shrimp *Oratosquilla oratoria* was detected at several locations throughout the harbour (4 of 80 crab trap locations). A sample was taken for submission to MITS which confirmed this taxonomic identity. There have been many reports of *O. oratoria* from both recreational and commercial fishermen

throughout the harbour, with first confirmed Marine Biosecurity Porthole records from 2010 (Marine Biosecurity Porthole, 2020b).

The non-indigenous tuberculate pear crab *Pyromaia tuberculata* was detected at numerous locations throughout the main channels of the harbour (22 of 100 benthic sled locations, 20 of 80 crab trap locations, 2 of 20 crab condo locations and 1 of 36 diver search locations). This species is considered established and was recorded in the 2006 baseline survey.

Figure 9. Example of *Pyromaia tuberculata* detected in Kaipara Harbour (image: C. Woods/NIWA).

The non-indigenous Asian semele *Theora lubrica* was detected at numerous locations throughout the main channels of the harbour, mainly in upper channel reaches (22 of 100 benthic sled locations). This species was recorded in the 2006 baseline survey.

The non-indigenous Australian dog whelk *Tritia burchardi* was detected at several locations throughout the main channels of the northern harbour, mainly in upper reaches (9 of 100 benthic sled locations). A sample was taken for submission to MITS to confirm taxonomic identity, with confirmation representing a range extension for this NIMS. This detection confirms recent findings by AC during soft sediment ecological monitoring of southern Kaipara Harbour. In January 2019 (three specimens) and April 2019 (one specimen), of *T. burchardi* was detected at the sampling site Ngapuke Creek for the first time in the harbour.

Figure 10. Example of *Tritia burchardi* detected in Kaipara Harbour (left) with close-up detail (right) (images: C. Woods/NIWA).

4.0 Discussion

Fourteen NIMS species were detected in the Kaipara Harbour (3 target and 11 non-target), along with five cryptogenic species. No primary target species were detected. The three secondary target species detected were the Asian date mussel *A. senhousia*, the Australian droplet tunicate *E. elongatum* and the clubbed tunicate *S. clava*. *A. senhousia* and *S. clava* were found at several locations throughout the harbour and *E. elongatum* was detected at three locations associated with aquaculture farm structures.

The number of species detected differed from the baseline survey (NIMS species, baseline 10 this survey 14; cryptogenic species, baseline 27 this survey 5). However, it should be noted that the aims, survey design, sampling effort, and sometimes sampling methodology are fundamentally different between baseline and targeted surveys – they are different survey tools used for different information purposes. The survey methodology used for this survey is consistent with the MHRSS programme where detection sensitivity (efficiency of the survey method), cost-effectiveness, impacts on native species and environments, feasibility and consistency with safe field-working practice have been evaluated in selecting sampling methods suitable to the rapid detection of a certain suite of target NIMS along with other non-target or incidental NIMS (Inglis et al., 2006a).

Detections and taxonomic identification of five NIMS species confirmed range extensions in the Kaipara Harbour for the colonial tunicates *B. giganteum*, *D. listerianum* and *E. elongatum*, the Australian dog whelk *T. burchardi* and pink-mouthed hydroid *E. crocea*. However, due to infrequent marine biosecurity monitoring within the harbour, it is difficult to ascertain exactly how long these species may have been present. The large expanse and dynamic nature of the Kaipara Harbour means that detection probabilities may be comparatively low for species with low prevalence, even when species-specific survey methods are used (Inglis et al., 2006b). More regular harbour surveys may help to eliminate the low detection levels of low prevalence species, along with the support from the public and reporting to the MPI hotline.

Overall, the target survey methodology and sampling effort is considered appropriate to service the aim of the targeted survey. However, improvements to survey design and methodology are always worthy of consideration. As undertaken in the MHRSS programme, future survey sampling plans may benefit from a combination of niche models for the target species and particle dispersion models (to simulate dispersal of propagules from the point of release). The niche models used in the MHRSS programme were based on Habitat Suitability Indices, derived from expert opinion and their performance was compared with niche models derived statistically from

independent data on the distribution of representative NIMS (Inglis et al., 2006b). Stochastic Scenario Tree (SST) modelling can also be used to evaluate and optimise confidence of target species detection, and identify the resources needed to achieve the required detection outcomes (e.g., Morrisey et al., 2012a, b). Detection of certain NIMS may also be better facilitated through utilising different sampling methodologies. For example, the predatory Japanese mantis shrimp *O. oratoria*, was detected at several locations using baited crab (box) traps, but nocturnal ROV surveys, scampi traps (e.g., Nessia, 2019) or even bottom-trawl and trammel nets may be more effective sampling methods as used in their commercial fishery in which it is endemic. *O. oratoria* was officially first detected in the Kaipara Harbour during research beam trawling (Ahyong, 2010). The Boxfish ROV that we trialled at six locations was found to be an effective survey tool better suited to visual surveys at deeper depths compared to divers due to longer possible bottom time, and along with the increasing technological advances available for ROV use, this survey tool is worthy of further exploration for biosecurity surveys (e.g., NIWA is currently trialling SONAR, GPS and 3D-photogrammetry applications to their Boxfish ROV for biosecurity surveys).

Encouragingly, no primary target species were detected, and notably, this included no observations of *S. spallanzanii* (Mediterranean fanworm). *S. spallanzanii* became established in the Waitematā Harbour in 2009, rapidly becoming widespread and abundant, and has slowly been spreading within the inner Hauraki Gulf. This species is a dominant filter-feeding organism that can have significant reproductive effects on other invertebrates in its introduced range, such as reducing recruitment potential from their physical structure and larval abundance from water samples was lower beneath the fanworm canopies (Holloway and Keough, 2002). A more recent study carried out shows that *S. spallanzanii* has the potential to change soft-sediment benthic habitats due to its physical presence and associated biological activities especially suspension feeding and bio-deposition. Using experimental plots, the study found that these activities caused alterations to nutrient cycling, bioturbation and benthic-pelagic coupling, ultimately altering the structure of native communities (Atalah et al., 2019). The spread of this species on to aquaculture structures has potentially serious impacts for the New Zealand aquaculture industry (Soliman and Inglis, 2018). This highlights the biosecurity risk and importance of preventative measures to reduce the risk of NIMS introduction from where they are established on the east coast of the North Island, to the relatively isolated west coast.

The detection of *C. japonica* at multiple locations throughout the harbour is of particular concern. This species is an aggressive opportunistic omnivore (tending towards carnivory) with rapid growth to maturity, high fecundity, high competitive ability and

broad environmental tolerances, that may result in significant ecological impacts in New Zealand (Fowler et al., 2013; Townsend, et al., 2015 and Weaver, 2017).

E. elongatum (first detected in New Zealand on oyster farms in Houhora Harbour) is also of concern, as it can form dense seasonal colonies, smothering beaches, rocks and tide-pools. It displaces native species and grows on boats, aquaculture equipment (potentially interfering with crop production) and other marine structures (Morrisey et al., 2009).

The presence of NIMS in the Kaipara Harbour may have originated from hull biofouling or ballast water discharge from visiting vessels involved in the timber and iron sand industries (Morrison, et al., 2014). Aquaculture activities, commercial and recreational boating or fishing (e.g., trailered boats being moved between different maritime locations) are also likely pathways (Inglis et al., 2013) for the introduction of NIMS into Kaipara Harbour. For example, the detection of the non-indigenous tunicates *B. giganteum*, *D. listerianum* and *E. elongatum* (the last a secondary target species) only at aquaculture farms, suggests aquaculture activities as the likely introduction pathway for these NIMS into the harbour, with associated boats, stock and/or equipment as the likely vectors of these species from the east coast (where they occur at several locations) to west coast. Auckland Council along with Northland, Waikato and Bay of Plenty Regional Councils, are working together to develop integrated pathway management, that would implement consistent rules across the regions to reduce the spread of marine pest species on vectors such as boat hulls, helping protect our marine environment from invaders.

The Kaipara Harbour would benefit from an increase in biosecurity monitoring, affording early detection of NIMS should they occur. This would enhance the opportunity to undertake successful management actions prior to a species becoming established.

5.0 Acknowledgements

The Kaipara Harbour Targeted Marine Pest Survey was funded by the Auckland Council Natural Environment Targeted Rate and Northland Regional Council with the support from Biosecurity NZ.

We would like to thank Matt Smith (field team leader) and the NIWA staff who planned and executed the survey (Dane Buckthought, Oliver Evans, Richard Hughes, Christian Hyde, Graeme McKay, Ann Parkinson, Lily Pryor Rodgers, Kimberley Seaward and Leigh Tait), Hayley Nessia and Kyle Hilliam who volunteered their time during the fieldwork and the Marine Invasive Taxonomic Services (MITS) team for their taxonomic identification.

We also appreciate the support of mana whenua and stakeholders who contributed input to the pre-selected sites.

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Appendix A Survey sampling maps

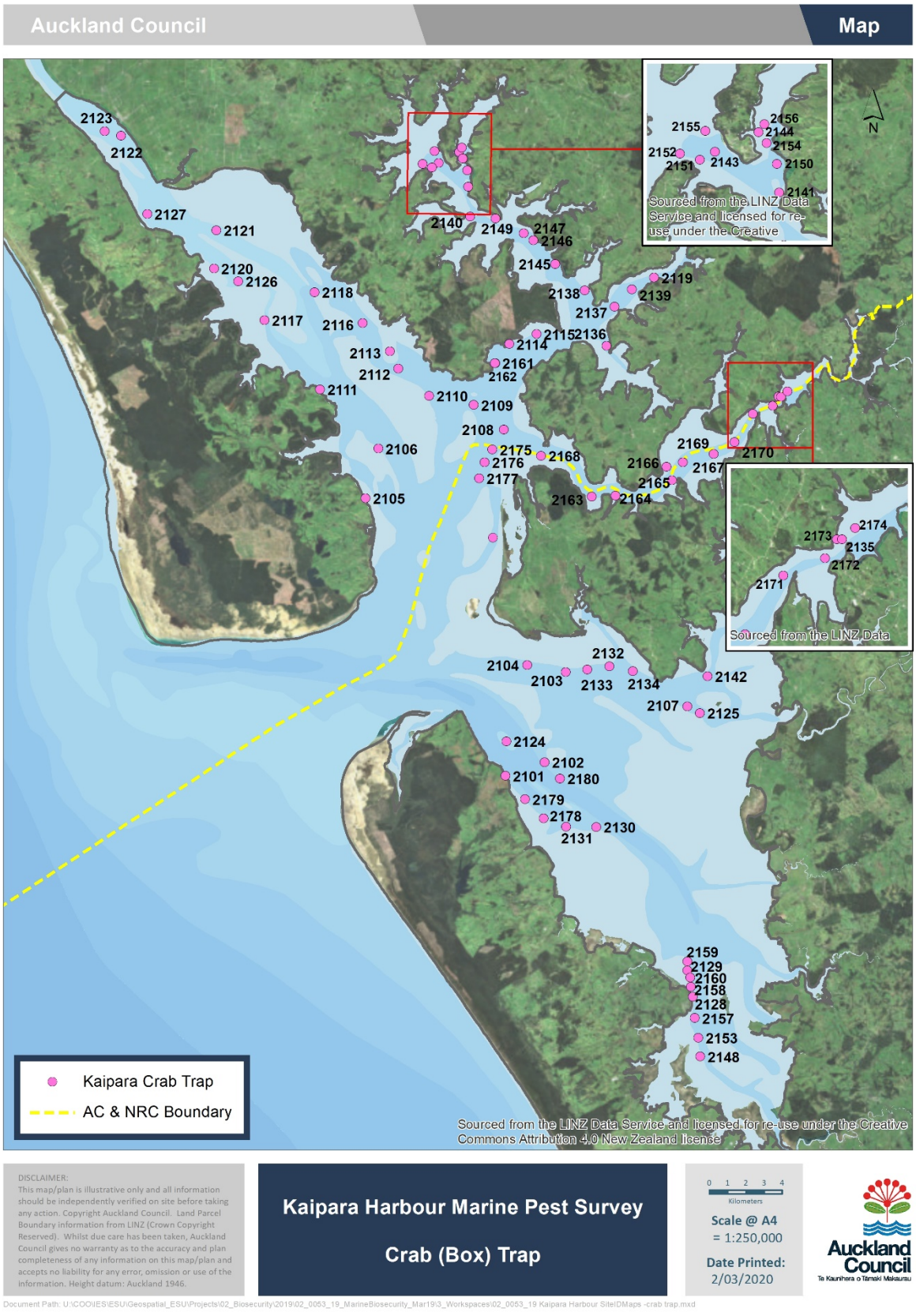

Figure 11. Crab (box) trap site locations

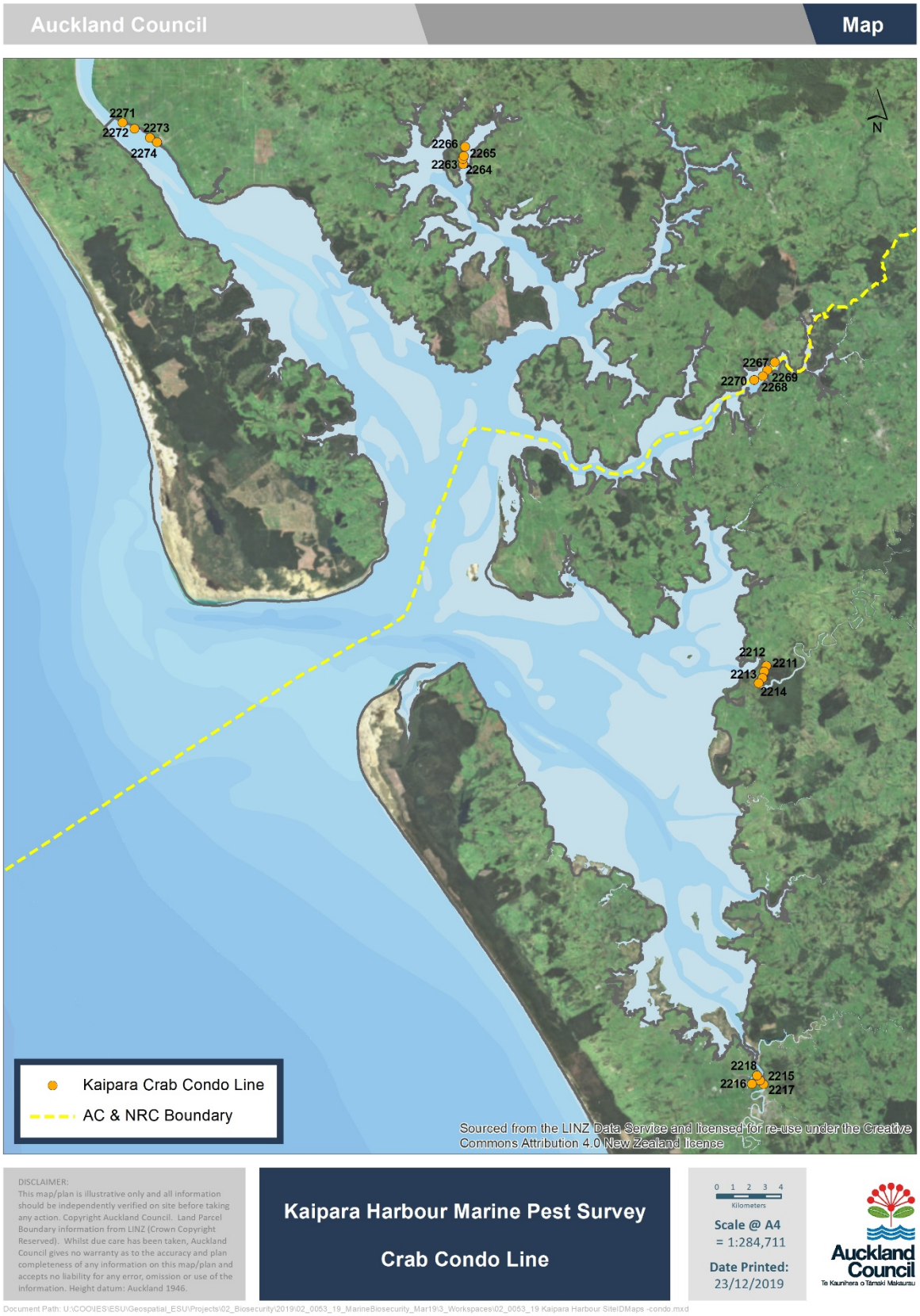

Figure 12. Crab condo trap site locations

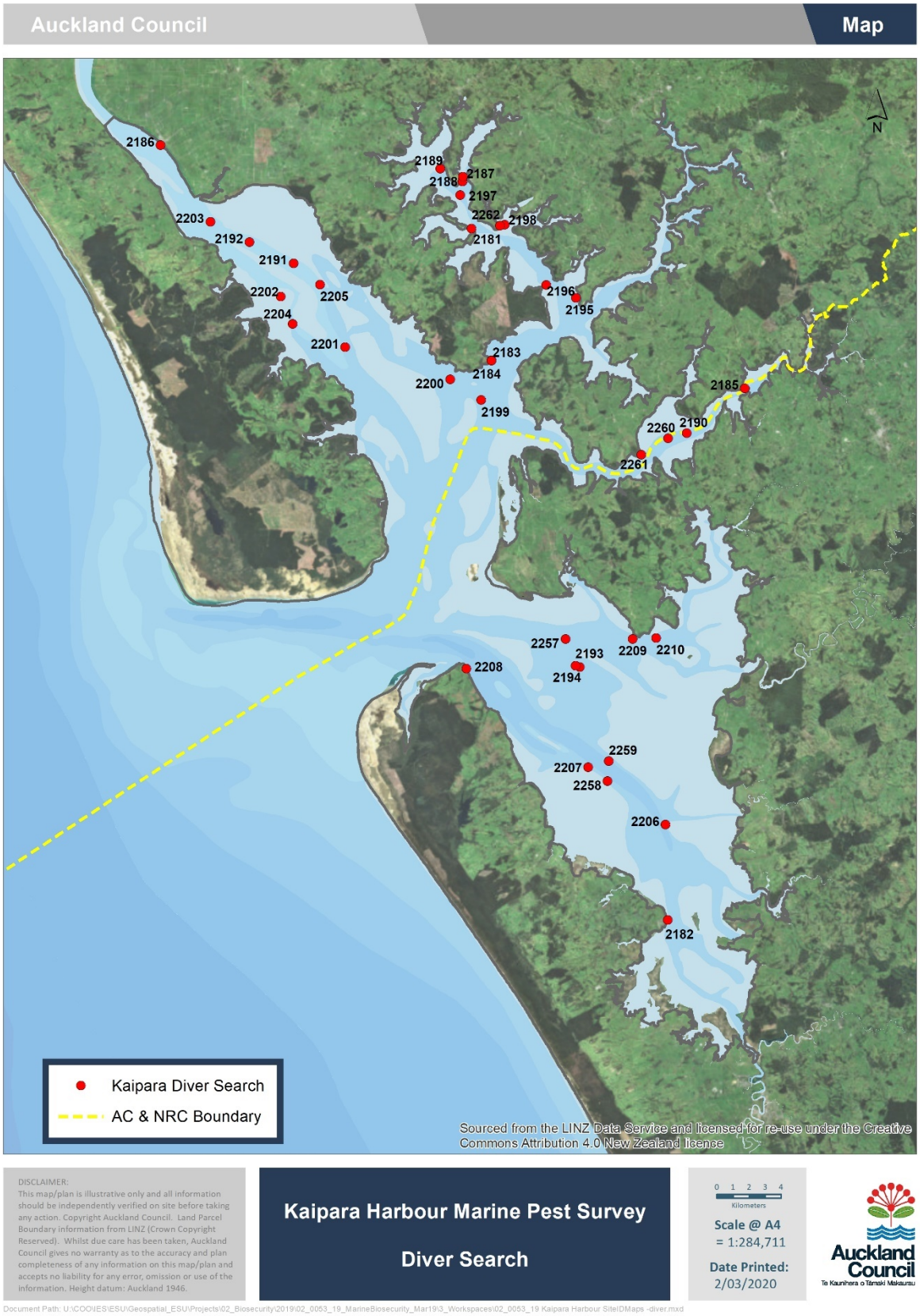

Figure 13. Visual dive search locations

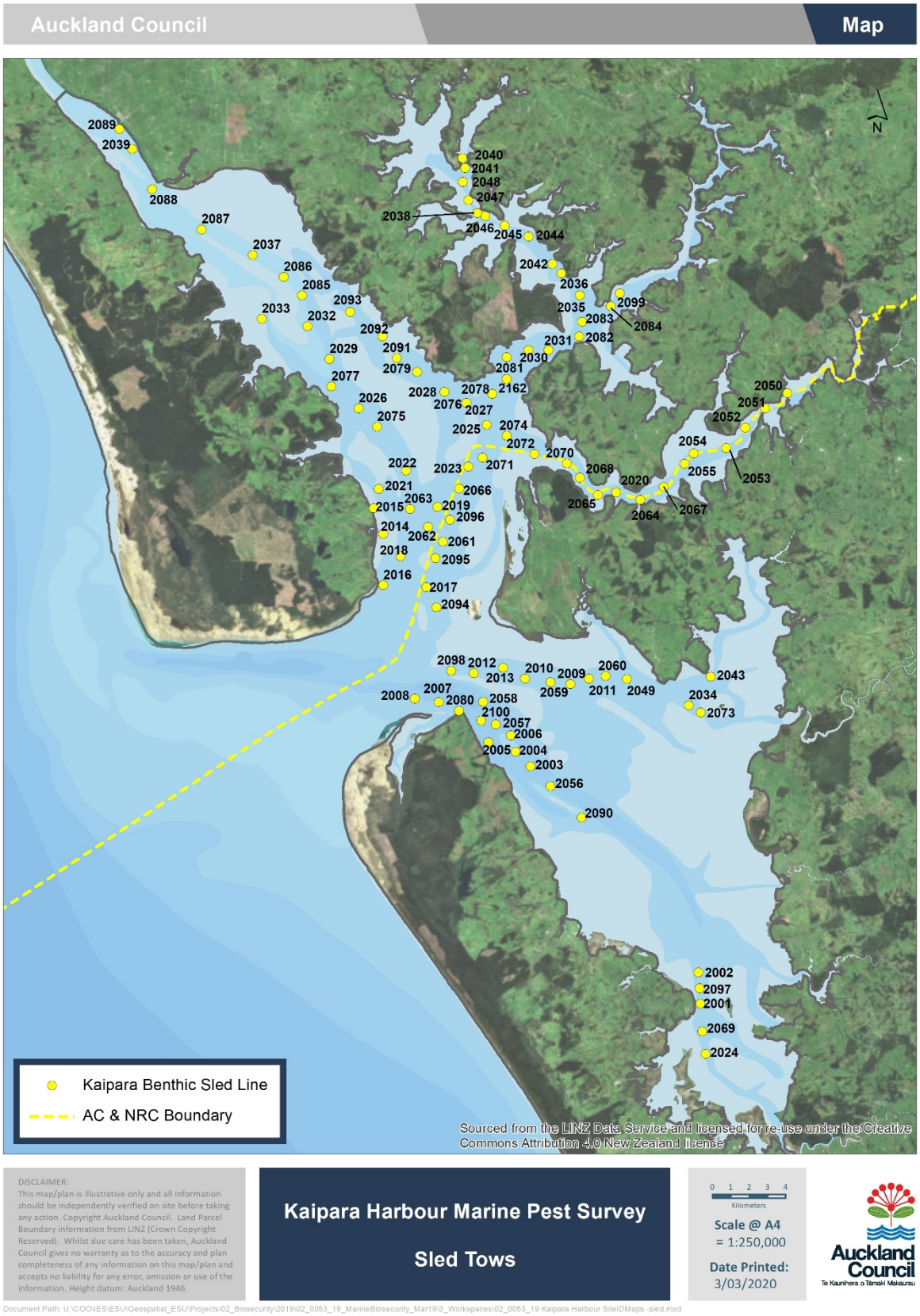

Figure 14. Benthic sled tow locations

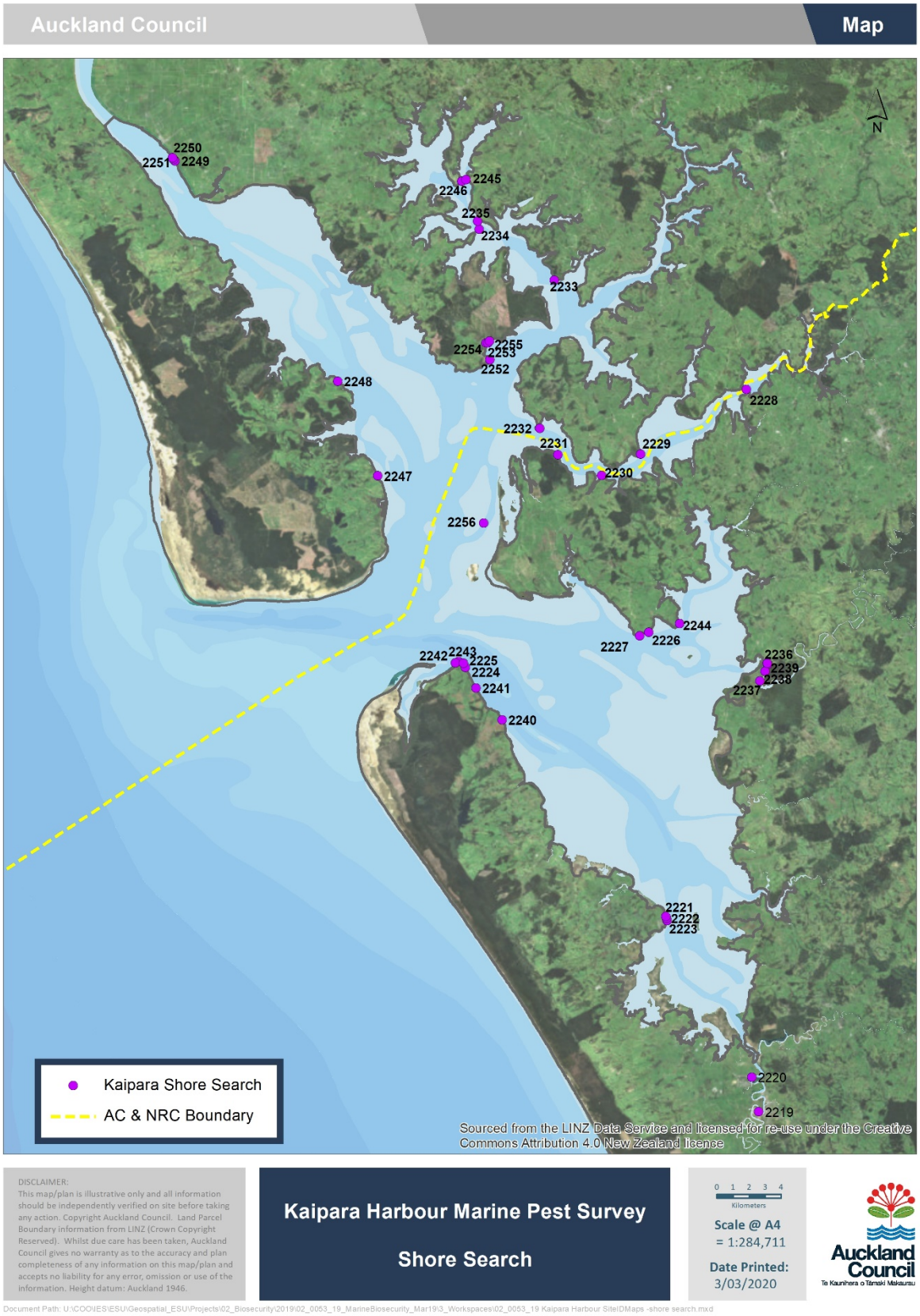

Figure 15. Shore search site locations

Appendix B Marine Invasive Taxonomic Service, MITS specimen samples

Table 5. Information of organisms collected during the survey and sent to the Marine Invasive Taxonomic Service (MITS) for identification.

Associated environmental data are also shown (nr=not recorded). Species in bold are non-indigenous. Range extensions are highlighted in blue. Indeterminate = specimens that could not be reliably identified to genus or species level. This group includes: (1) organisms that were damaged, propagule or juvenile stage, 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 genus/species level. Presence in the 2006 baseline survey is noted in the final column.

Site ID (KPR[3])	Latitude	Longitude	Date	Method	Type of organism and number of individuals retained	MITS ID	Biosecurity status	Water temperature (°C)	Salinity	Secchi depth (m)	Habitat	Estimated prevalence of incursion	Present in 2006
KPR2090	-36.47778	174.30709	14/05/19	Benthic sled	1 x fish	*Favonigobius exquisitus*	Indigenous	17.5	35	0.9	Muddy sand	1-10 per 100-m sled	No
KPR2056	-36.46232	174.28779	14/05/19	Benthic sled	1 x shrimp	*Periclimenes yaldwyni*	Indigenous	17.2	35	2.3	Shelly gravel, sand	1-10 per 100-m sled	Yes
KPR2034	-36.42314	174.37162	14/05/19	Benthic sled	1 x worm	*Owenia petersenae*	Indigenous	17.1	35	1.4	Sandy mud	1-10 per 100-m sled	Yes
KPR2080	-36.42660	174.23253	14/05/19	Benthic sled	1 x crab	*Guinusia chabrus*	Indigenous	17.6	35	1.6	Sand foul	1 per 100-m sled	Yes (as *Plagusia chabrus*)
KPR2080	-36.42660	174.23253	14/05/19	Benthic sled	1 x crab	*Petrolisthes novaezelandiae*	Indigenous	17.6	35	1.6	Sand foul	1 per 100-m sled	Yes
KPR2016	-36.36391	174.18517	22/05/19	Benthic sled	1 x pycnogonid	*Achelia assimilis*	Indigenous	17	35	4.4	Sandy mud	1-10 per 100-m sled	Yes

[3] KPR (Kaipara) was the original location code for the Kaipara Harbour Baseline survey in 2006.

Site ID (KPR[3])	Latitude	Longitude	Date	Method	Type of organism and number of individuals retained	MITS ID	Biosecurity status	Water temperature (°C)	Salinity	Secchi depth (m)	Habitat	Estimated prevalence of incursion	Present in 2006
KPR2031	-36.24929	174.28201	20/05/19	Benthic sled	2 x bryozoan	*Gregarinidra* n. sp.[4]	Indigenous	16.8	35	1.5	Shelly gravel	1-10 per 100-m sled	Yes
KPR2088	**-36.0418**	**174.1709**	**20/05/19**	**Benthic sled**	**3 x gastropod**	***Tritia burchardi***	**Non-indigenous**	**16.5**	**34**	**0.9**	**Shelly gravel**	**1-10 per 100-m sled**	No
KPR2051	**-36.27520**	**174.416145**	**15/05/19**	**Benthic sled**	**5 x gastropod**	***Tritia burchardi***	**Non-indigenous**	**17**	**34**	**0.3**	**Mud**	**1-10 per 100-m sled**	No
KPR2193	-36.42915	174.31651	14/5/19	Diver search	1 x colonial ascidian	*Didemnum* sp.	Cryptogenic	17.2	35	1.5	Oyster farm	30% cover	Yes
KPR2193	**-36.42915**	**174.31651**	**14/5/19**	**Diver search**	**1 x colonial ascidian**	***Eudistoma elongatum***	**Non-indigenous**	**17.2**	**35**	**1.5**	**Oyster farm**	**1% cover**	No
KPR2193	-36.42915	174.31651	14/5/19	Diver search	1 x hydoid	*Bougainvillia muscus*	Indigenous	17.2	35	1.5	Oyster farm	10% cover	Yes
KPR2193	**-36.42915**	**174.31651**	**14/5/19**	**Diver search**	**1 x colonial ascidian**	***Diplosoma listerianum***	**Non-indigenous**	**17.2**	**35**	**1.5**	**Oyster farm**	**<1% cover**	No
KPR2193	**-36.42915**	**174.31651**	**14/5/19**	**Diver search**	**1 x colonial ascidian**	***Botrylloides giganteum***	**Non-indigenous**	**17.2**	**35**	**1.5**	**Oyster farm**	**<1% cover**	No
KPR2195	-36.22164	174.31048	21/05/19	Diver search	1 x solitary ascidian	*Styela plicata*	Cryptogenic	16.6	35	1.9	Oyster rock	1 specimen	No
KPR2192	-36.19245	174.08354	21/05/19	Diver search	1 x bryozoan	*Alcyonidium* sp.	Cryptogenic	16.2	35	1.8	Marker buoy and mooring	10% cover	Yes
KPR2191	-36.20411	174.11426	21/05/19	Diver search	1 x caprellid amphipod	*Caprella equilibra*	Cryptogenic	16.4	35	1.8	Marker buoy and mooring	>1000 from search	No
KPR2181	-36.18334	174.23745	21/05/19	Diver search	1 x bryozoan	*Alcyonidium* sp.	Cryptogenic	16.7	35	0.8	Oyster farm line	<1% cover	Yes

[4] n. sp. = new species (previously undescribed).

Site ID (KPR[3])	Latitude	Longitude	Date	Method	Type of organism and number of individuals retained	MITS ID	Biosecurity status	Water temperature (°C)	Salinity	Secchi depth (m)	Habitat	Estimated prevalence of incursion	Present in 2006
KPR 4 DIVE	**-36.29991**	**174.37562**	**15/05/19**	**Diver search**	**1 x hydroid**	***Ectopleura crocea***	**Non-indigenous**	**16.6**	**35**	**0.3**	**Mooring chain**	**20% cover**	No
KPR2226	-36.40878	174.36446	14/05/19	Shore search	1 x colonial ascidian	*Didemnum* sp.	Cryptogenic	nr	nr	nr	Mud stone shore	1 from 50-m search	Yes
KPR2239	-36.42546	174.44698	14/05/19	Shore search	1 x colonial ascidian	*Didemnum* sp.	Cryptogenic	16.7	nr	0.5	Ramp and pontoons	1 from 50-m search	Yes
KPR2148	**-36.5974**	**174.3847**	**14/05/19**	**Crab trap**	**1 x crab**	***Pyromaia tuberculata***	**Non-indigenous**	**17.8**	**35**	**0.3**	**nr**	**1 per trap line**	Yes
KPR2128	**-36.56782**	**174.37971**	**14/05/19**	**Crab trap**	**1 x mantis shrimp**	***Oratosquilla oratoria***	**Non-indigenous**	**17.7**	**35**	**0.3**	**nr**	**1 per trap line**	No
KPR2124	-36.44249	174.26303	14/05/19	Crab trap	1 x crab megalopa[5]	Brachyura	Indeterminate	17.9	35	2.8	nr	1 per trap line	Unknown

[5]Megalopa - final larval stage found in decapod crustaceans.

Appendix C Kaipara Harbour 2019 survey results – species detected by site.

Table 6. Kaipara Harbour species results – species detected by site.

For Site ID, replicate numbers are denoted by lowercase letters (i.e., traps 1-3 on a crab trap or crab condo trapline are a, b and c, divers 1-2 in a buddy pair are a and b).

For number or abundance metric, these are qualified as either: number of piles searched (#p) followed by the number of piles on which the organism was detected; abundance per-m²(m2); actual number (ActNum); abundance category (AbundCat (1-10 =1, 11-100=2, >101 =3)); or percent cover (%cover))

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2001	2001	Benthic sled	*Theora lubrica*	AbundCat	3	No
SVKPR2002	2002	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2002	2002	Benthic sled	*Arcuatula senhousia*	AbundCat	1	No
SVKPR2003	2003	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2003	2003	Benthic sled	*Fellaster zelandiae*	AbundCat	2	No
SVKPR2004	2004	Benthic sled	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2004	2004	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2004	2004	Benthic sled	*Fellaster zelandiae*	AbundCat	2	No
SVKPR2005	2005	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2006	2006	Benthic sled	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2006	2006	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2006	2006	Benthic sled	*Fellaster zelandiae*	AbundCat	2	No
SVKPR2007	2007	Benthic sled	*Charybdis (Charybdis) japonica*	AbundCat	1	No
SVKPR2008	2008	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2008	2008	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2009	2009	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2009	2009	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2011	2011	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2011	2011	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2012	2012	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2012	2012	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2013	2013	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2013	2013	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2013	2013	Benthic sled	*Favonigobius exquisitus*	AbundCat	1	No
SVKPR2014	2014	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2014	2014	Benthic sled	*Pagurus* sp.	AbundCat	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2014	2014	Benthic sled	Pycnogonid	AbundCat	1	No
SVKPR2015	2015	Benthic sled	*Arcuatula senhousia*	AbundCat	1	No
SVKPR2016	2016	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2016	2016	Benthic sled	Pycnogonid	AbundCat	2	No
SVKPR2018	2018	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2018	2018	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2020	2020	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2020	2020	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2024	2024	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2024	2024	Benthic sled	*Arcuatula senhousia*	AbundCat	2	No
SVKPR2026	2026	Benthic sled	*Ovalipes catharus*	AbundCat	1	No
SVKPR2028	2028	Benthic sled	*Patiriella regularis*	AbundCat	1	No
SVKPR2029	2029	Benthic sled	*Arcuatula senhousia*	AbundCat	1	No
SVKPR2031	2031	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2031	2031	Benthic sled	*Petrolisthes elongatus*	AbundCat	3	No
SVKPR2031	2031	Benthic sled	*Gregarinidra* n. sp.	AbundCat	1	Yes
SVKPR2032	2032	Benthic sled	*Arcuatula senhousia*	AbundCat	1	No
SVKPR2032	2032	Benthic sled	*Ovalipes catharus*	AbundCat	1	No
SVKPR2032	2032	Benthic sled	*Tritia burchardi*	AbundCat	1	No
SVKPR2033	2033	Benthic sled	*Tritia burchardi*	AbundCat	1	No
SVKPR2034	2034	Benthic sled	*Arcuatula senhousia*	AbundCat	3	No
SVKPR2034	2034	Benthic sled	*Patiriella regularis*	AbundCat	1	No
SVKPR2034	2034	Benthic sled	*Chaetoperus* sp.	AbundCat	1	No
SVKPR2034	2034	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2034	2034	Benthic sled	*Owenia petersenae*	AbundCat	1	Yes
SVKPR2034	2034	Benthic sled	*Coscinasterias muricata*	AbundCat	1	No
SVKPR2036	2036	Benthic sled	*Patiriella regularis*	AbundCat	1	No
SVKPR2036	2036	Benthic sled	*Pyromaia tuberculata*	AbundCat	2	No
SVKPR2037	2037	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2037	2037	Benthic sled	*Ovalipes catharus*	AbundCat	1	No
SVKPR2037	2037	Benthic sled	*Tritia burchardi*	AbundCat	1	No
SVKPR2038	2038	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2040	2040	Benthic sled	*Arcuatula senhousia*	AbundCat	3	No
SVKPR2041	2041	Benthic sled	*Tritia burchardi*	AbundCat	1	No
SVKPR2042	2042	Benthic sled	*Patiriella regularis*	AbundCat	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2042	2042	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2042	2042	Benthic sled	*Charybdis (Charybdis) japonica*	AbundCat	1	No
SVKPR2042	2042	Benthic sled	*Hemiplax hirtipes*	AbundCat	1	No
SVKPR2042	2042	Benthic sled	*Pilumnopeus serratifrons*	AbundCat	3	No
SVKPR2043	2043	Benthic sled	*Charybdis (Charybdis) japonica*	AbundCat	1	No
SVKPR2044	2044	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2045	2045	Benthic sled	*Theora lubrica*	AbundCat	2	No
SVKPR2046	2046	Benthic sled	*Patiriella regularis*	AbundCat	1	No
SVKPR2047	2047	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2048	2048	Benthic sled	*Ovalipes catharus*	AbundCat	1	No
SVKPR2048	2048	Benthic sled	*Tritia burchardi*	AbundCat	1	No
SVKPR2049	2049	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2050	2050	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2050	2050	Benthic sled	*Tritia burchardi*	AbundCat	1	No
SVKPR2051	2051	Benthic sled	*Tritia burchardi*	AbundCat	1	No
SVKPR2053	2053	Benthic sled	*Theora lubrica*	AbundCat	2	No
SVKPR2053	2053	Benthic sled	*Pilumnopeus serratifrons*	AbundCat	1	No
SVKPR2054	2054	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2054	2054	Benthic sled	*Hemiplax hirtipes*	AbundCat	1	No
SVKPR2055	2055	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2055	2055	Benthic sled	*Charybdis (Charybdis) japonica*	AbundCat	1	No
SVKPR2055	2055	Benthic sled	*Hemiplax hirtipes*	AbundCat	1	No
SVKPR2055	2055	Benthic sled	*Ennucula hartvigiana*	AbundCat	1	No
SVKPR2056	2056	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2056	2056	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2056	2056	Benthic sled	*Periclimenes yaldwyni*	AbundCat	1	Yes
SVKPR2057	2057	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2058	2058	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2058	2058	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2059	2059	Benthic sled	*Notomithrax* sp.	AbundCat	1	No
SVKPR2060	2060	Benthic sled	*Patiriella regularis*	AbundCat	1	No
SVKPR2060	2060	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2064	2064	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2064	2064	Benthic sled	*Ennucula hartvigiana*	AbundCat	1	No
SVKPR2064	2064	Benthic sled	*Theora lubrica*	AbundCat	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2065	2065	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2067	2067	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2068	2068	Benthic sled	*Arcuatula senhousia*	AbundCat	3	No
SVKPR2068	2068	Benthic sled	*Patiriella regularis*	AbundCat	1	No
SVKPR2068	2068	Benthic sled	*Pyromaia tuberculata*	AbundCat	2	No
SVKPR2069	2069	Benthic sled	*Theora lubrica*	AbundCat	2	No
SVKPR2069	2069	Benthic sled	*Arcuatula senhousia*	AbundCat	2	No
SVKPR2072	2072	Benthic sled	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2072	2072	Benthic sled	*Ennucula hartvigiana*	AbundCat	1	No
SVKPR2072	2072	Benthic sled	*Arcuatula senhousia*	AbundCat	1	No
SVKPR2073	2073	Benthic sled	*Arcuatula senhousia*	AbundCat	1	No
SVKPR2073	2073	Benthic sled	*Patiriella regularis*	AbundCat	1	No
SVKPR2073	2073	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2074a	2074	Benthic sled	*Charybdis (Charybdis) japonica*	ActNum	7	No
SVKPR2074b	2074	Benthic sled	*Charybdis (Charybdis) japonica*	ActNum	11	No
SVKPR2074c	2074	Benthic sled	*Charybdis (Charybdis) japonica*	ActNum	4	No
SVKPR2075	2075	Benthic sled	*Ovalipes catharus*	AbundCat	1	No
SVKPR2076	2076	Benthic sled	*Coscinasterias muricata*	AbundCat	1	No
SVKPR2076	2076	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2076	2076	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2076	2076	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2076	2076	Benthic sled	*Ennucula hartvigiana*	AbundCat	1	No
SVKPR2080	2080	Benthic sled	*Patiriella regularis*	AbundCat	1	No
SVKPR2080	2080	Benthic sled	*Charybdis (Charybdis) japonica*	ActNum	3	No
SVKPR2080	2080	Benthic sled	*Pyromaia tuberculata*	AbundCat	2	No
SVKPR2080	2080	Benthic sled	*Notomithrax* sp.	AbundCat	1	No
SVKPR2080	2080	Benthic sled	*Guinusia chabrus*	ActNum	2	Yes
SVKPR2080	2080	Benthic sled	*Coscinasterias muricata*	AbundCat	1	No
SVKPR2081	2081	Benthic sled	*Patiriella regularis*	AbundCat	1	No
SVKPR2081	2081	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2081	2081	Benthic sled	*Ennucula hartvigiana*	AbundCat	2	No
SVKPR2082	2082	Benthic sled	*Arcuatula senhousia*	AbundCat	1	No
SVKPR2082	2082	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2083	2083	Benthic sled	*Arcuatula senhousia*	AbundCat	1	No
SVKPR2083	2083	Benthic sled	*Theora lubrica*	AbundCat	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2084	2084	Benthic sled	*Patiriella regularis*	AbundCat	1	No
SVKPR2084	2084	Benthic sled	*Theora lubrica*	AbundCat	2	No
SVKPR2084	2084	Benthic sled	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2084	2084	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2084	2084	Benthic sled	*Pilumnopeus serratifrons*	AbundCat	1	No
SVKPR2087	2087	Benthic sled	*Tritia burchardi*	AbundCat	1	No
SVKPR2088	2088	Benthic sled	*Arcuatula senhousia*	AbundCat	2	No
SVKPR2088	2088	Benthic sled	*Tritia burchardi*	AbundCat	1	Yes
SVKPR2090	2090	Benthic sled	*Arcuatula senhousia*	ActNum	1	No
SVKPR2090	2090	Benthic sled	*Patiriella regularis*	AbundCat	1	No
SVKPR2090	2090	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2090	2090	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2090	2090	Benthic sled	*Favonigobius exquisitus*	ActNum	1	Yes
SVKPR2090	2090	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2091	2091	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2091	2091	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2091	2091	Benthic sled	*Ennucula hartvigiana*	AbundCat	1	No
SVKPR2092	2092	Benthic sled	*Arcuatula senhousia*	AbundCat	2	No
SVKPR2092	2092	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2092	2092	Benthic sled	*Pyromaia tuberculata*	AbundCat	2	No
SVKPR2092	2092	Benthic sled	*Ennucula hartvigiana*	AbundCat	1	No
SVKPR2093	2093	Benthic sled	*Arcuatula senhousia*	AbundCat	1	No
SVKPR2093	2093	Benthic sled	*Charybdis (Charybdis) japonica*	AbundCat	1	No
SVKPR2093	2093	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2097	2097	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2097	2097	Benthic sled	*Charybdis (Charybdis) japonica*	AbundCat	1	No
SVKPR2097	2097	Benthic sled	*Pyromaia tuberculata*	AbundCat	1	No
SVKPR2098	2098	Benthic sled	*Pagurus* sp.	AbundCat	1	No
SVKPR2098	2098	Benthic sled	*Fellaster zelandiae*	AbundCat	2	No
SVKPR2099	2099	Benthic sled	*Theora lubrica*	AbundCat	1	No
SVKPR2100	2100	Benthic sled	*Fellaster zelandiae*	AbundCat	1	No
SVKPR2101a	2101	Crab trap	*Ovalipes catharus*	ActNum	1	No
SVKPR2102a	2102	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2102b	2102	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2103a	2103	Crab trap	*Cominella* sp.	ActNum	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2103b	2103	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2103b	2103	Crab trap	*Sparus auratus*	ActNum	2	No
SVKPR2103c	2103	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2104a	2104	Crab trap	*Cominella* sp.	ActNum	5	No
SVKPR2104b	2104	Crab trap	*Patiriella regularis*	ActNum	16	No
SVKPR2104c	2104	Crab trap	*Sparus auratus*	ActNum	7	No
SVKPR2105a	2105	Crab trap	*Arripis trutta*	ActNum	1	No
SVKPR2105a	2105	Crab trap	*Cominella* sp.	ActNum	3	No
SVKPR2105a	2105	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2105a	2105	Crab trap	*Cominella* sp.	ActNum	10	No
SVKPR2105b	2105	Crab trap	*Cominella* sp.	ActNum	2	No
SVKPR2105c	2105	Crab trap	*Cominella* sp.	ActNum	29	No
SVKPR2106a	2106	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2106a	2106	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2107a	2107	Crab trap	*Pyromaia tuberculata*	ActNum	3	No
SVKPR2107b	2107	Crab trap	*Cominella* sp.	ActNum	2	No
SVKPR2107b	2107	Crab trap	*Pyromaia tuberculata*	ActNum	3	No
SVKPR2107c	2107	Crab trap	*Patiriella regularis*	ActNum	2	No
SVKPR2107c	2107	Crab trap	*Pyromaia tuberculata*	ActNum	3	No
SVKPR2108c	2108	Crab trap	*Sparus auratus*	ActNum	3	No
SVKPR2109a	2109	Crab trap	*Cominella* sp.	ActNum	4	No
SVKPR2109b	2109	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2110a	2110	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2110a	2110	Crab trap	*Cominella* sp.	ActNum	24	No
SVKPR2110b	2110	Crab trap	*Cominella* sp.	ActNum	5	No
SVKPR2111a	2111	Crab trap	*Cominella* sp.	ActNum	29	No
SVKPR2111c	2111	Crab trap	*Amathia verticillata*	ActNum	1	No
SVKPR2111c	2111	Crab trap	*Cominella* sp.	ActNum	3	No
SVKPR2111c	2111	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2112a	2112	Crab trap	*Cominella* sp.	ActNum	2	No
SVKPR2112b	2112	Crab trap	*Cominella* sp.	ActNum	3	No
SVKPR2112c	2112	Crab trap	*Cominella* sp.	ActNum	2	No
SVKPR2113a	2113	Crab trap	*Cominella* sp.	ActNum	5	No
SVKPR2113b	2113	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2114a	2114	Crab trap	*Cominella* sp.	ActNum	6	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2114b	2114	Crab trap	*Cominella* sp.	ActNum	52	No
SVKPR2114c	2114	Crab trap	*Cominella* sp.	ActNum	79	No
SVKPR2114c	2114	Crab trap	*Pyromaia tuberculata*	ActNum	2	No
SVKPR2114c	2114	Crab trap	*Patiriella regularis*	ActNum	3	No
SVKPR2115c	2115	Crab trap	Bryozoa	ActNum	1	No
SVKPR2116a	2116	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2116a	2116	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2116b	2116	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2116c	2116	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2116c	2116	Crab trap	*Cominella* sp.	ActNum	5	No
SVKPR2117b	2117	Crab trap	*Cominella* sp.	ActNum	2	No
SVKPR2117b	2117	Crab trap	*Ovalipes catharus*	ActNum	1	No
SVKPR2118a	2118	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2118a	2118	Crab trap	*Cominella* sp.	ActNum	3	No
SVKPR2118b	2118	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2119a	2119	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2119b	2119	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2119c	2119	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2120a	2120	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2121a	2121	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2121b	2121	Crab trap	*Cominella* sp.	ActNum	3	No
SVKPR2121b	2121	Crab trap	*Pyromaia tuberculata*	ActNum	2	No
SVKPR2121c	2121	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2122a	2122	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2123c	2123	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2124a	2124	Crab trap	*Ovalipes catharus*	ActNum	1	No
SVKPR2124a	2124	Crab trap	Crustacea megalopa	ActNum	1	Yes
SVKPR2125a	2125	Crab trap	*Patiriella regularis*	ActNum	4	No
SVKPR2125a	2125	Crab trap	*Coscinasterias muricata*	ActNum	1	No
SVKPR2125a	2125	Crab trap	*Pyromaia tuberculata*	ActNum	5	No
SVKPR2125b	2125	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2125b	2125	Crab trap	*Coscinasterias muricata*	ActNum	1	No
SVKPR2125b	2125	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2125c	2125	Crab trap	*Pyromaia tuberculata*	ActNum	2	No
SVKPR2126a	2126	Crab trap	*Arripis trutta*	ActNum	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2127a	2127	Crab trap	*Arripis trutta*	ActNum	1	No
SVKPR2127a	2127	Crab trap	*Oratosquilla oratoria*	ActNum	1	No
SVKPR2127a	2127	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2128a	2128	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2128c	2128	Crab trap	*Oratosquilla oratoria*	ActNum	1	Yes
SVKPR2129a	2129	Crab trap	*Pyromaia tuberculata*	ActNum	10	No
SVKPR2129a	2129	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2129b	2129	Crab trap	*Pyromaia tuberculata*	ActNum	10	No
SVKPR2129c	2129	Crab trap	*Pyromaia tuberculata*	ActNum	10	No
SVKPR2130b	2130	Crab trap	*Cominella* sp.	ActNum	2	No
SVKPR2130b	2130	Crab trap	*Ovalipes catharus*	ActNum	1	No
SVKPR2130b	2130	Crab trap	*Coscinasterias muricata*	ActNum	1	No
SVKPR2130c	2130	Crab trap	*Cominella* sp.	ActNum	2	No
SVKPR2130c	2130	Crab trap	*Amathia verticillata*	ActNum	1	No
SVKPR2131a	2131	Crab trap	*Cominella* sp.	ActNum	2	No
SVKPR2131b	2131	Crab trap	*Cominella* sp.	ActNum	4	No
SVKPR2131c	2131	Crab trap	*Cominella* sp.	ActNum	3	No
SVKPR2131c	2131	Crab trap	*Ovalipes catharus*	ActNum	1	No
SVKPR2131c	2131	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2132a	2132	Crab trap	*Patiriella regularis*	ActNum	7	No
SVKPR2132a	2132	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2132a	2132	Crab trap	*Cominella* sp.	ActNum	20	No
SVKPR2132b	2132	Crab trap	*Cominella* sp.	ActNum	3	No
SVKPR2132b	2132	Crab trap	*Patiriella regularis*	ActNum	2	No
SVKPR2132c	2132	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2132c	2132	Crab trap	*Cominella* sp.	ActNum	4	No
SVKPR2133a	2133	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2133a	2133	Crab trap	*Cominella* sp.	ActNum	3	No
SVKPR2133b	2133	Crab trap	*Patiriella regularis*	ActNum	6	No
SVKPR2133b	2133	Crab trap	*Cominella* sp.	ActNum	8	No
SVKPR2133c	2133	Crab trap	*Patiriella regularis*	ActNum	6	No
SVKPR2133c	2133	Crab trap	*Cominella* sp.	ActNum	12	No
SVKPR2133c	2133	Crab trap	Crustacea megalopa	ActNum	1	Yes
SVKPR2135a	2135	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2135b	2135	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2135c	2135	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	4	No
SVKPR2136a	2136	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2136a	2136	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2137a	2137	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2137c	2137	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2138a	2138	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2138a	2138	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2138c	2138	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2139b	2139	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2139c	2139	Crab trap	*Bathytoshia* sp.	ActNum	1	No
SVKPR2139c	2139	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2142a	2142	Crab trap	*Pyromaia tuberculata*	ActNum	24	No
SVKPR2142b	2142	Crab trap	*Pyromaia tuberculata*	ActNum	2	No
SVKPR2143b	2143	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2143b	2143	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2143b	2143	Crab trap	*Cominella* sp.	ActNum	3	No
SVKPR2144a	2144	Crab trap	*Conger verrauxi*	ActNum	1	No
SVKPR2144a	2144	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	5	No
SVKPR2146b	2146	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2148a	2148	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2148a	2148	Crab trap	*Pyromaia tuberculata*	ActNum	1	Yes
SVKPR2148c	2148	Crab trap	*Chelidonichthys kumu*	ActNum	1	No
SVKPR2148c	2148	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2149a	2149	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2149b	2149	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2151a	2151	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2152b	2152	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2153a	2153	Crab trap	*Pyromaia tuberculata*	ActNum	5	No
SVKPR2153b	2153	Crab trap	*Pyromaia tuberculata*	ActNum	9	No
SVKPR2153c	2153	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2154a	2154	Crab trap	*Conger verrauxi*	ActNum	1	No
SVKPR2154a	2154	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2154c	2154	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2154c	2154	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2156a	2156	Crab trap	*Oratosquilla oratoria*	ActNum	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2156a	2156	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	3	No
SVKPR2157a	2157	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2157a	2157	Crab trap	*Pyromaia tuberculata*	ActNum	10	No
SVKPR2157b	2157	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2157b	2157	Crab trap	*Pyromaia tuberculata*	ActNum	10	No
SVKPR2157c	2157	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2157c	2157	Crab trap	*Pyromaia tuberculata*	ActNum	10	No
SVKPR2158a	2158	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2158c	2158	Crab trap	*Pseudophycis bacchus*	ActNum	1	No
SVKPR2159a	2159	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2159b	2159	Crab trap	*Pyromaia tuberculata*	ActNum	10	No
SVKPR2159b	2159	Crab trap	*Pyromaia tuberculata*	ActNum	10	No
SVKPR2160b	2160	Crab trap	*Pyromaia tuberculata*	ActNum	2	No
SVKPR2160c	2160	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2160c	2160	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2161a	2161	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2161b	2161	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2161c	2161	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2162a	2162	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2162a	2162	Crab trap	*Arcuatula senhousia*	ActNum	1	No
SVKPR2162a	2162	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2162b	2162	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2162b	2162	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2162c	2162	Crab trap	*Patiriella regularis*	ActNum	2	No
SVKPR2164a	2164	Crab trap	*Oratosquilla oratoria*	ActNum	1	No
SVKPR2164b	2164	Crab trap	*Amathia verticillata*	ActNum	1	No
SVKPR2164c	2164	Crab trap	*Mustelus lenticulatus*	ActNum	1	No
SVKPR2165a	2165	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2165a	2165	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2165c	2165	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2167b	2167	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2167c	2167	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2168a	2168	Crab trap	*Cominella* sp.	ActNum	16	No
SVKPR2168a	2168	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2168b	2168	Crab trap	*Cominella* sp.	ActNum	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2168c	2168	Crab trap	*Cominella* sp.	ActNum	11	No
SVKPR2169a	2169	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2169b	2169	Crab trap	*Mustelus lenticulatus*	ActNum	1	No
SVKPR2170a	2170	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2170a	2170	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2170c	2170	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	3	No
SVKPR2171a	2171	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2171b	2171	Crab trap	*Mustelus lenticulatus*	ActNum	1	No
SVKPR2171c	2171	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2172a	2172	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2172c	2172	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2173a	2173	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	3	No
SVKPR2173b	2173	Crab trap	*Charybdis (Charybdis) japonica*	ActNum	7	No
SVKPR2176a	2176	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2176b	2176	Crab trap	*Cominella* sp.	ActNum	8	No
SVKPR2177a	2177	Crab trap	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2177a	2177	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2177a	2177	Crab trap	*Cominella* sp.	ActNum	12	No
SVKPR2177b	2177	Crab trap	*Cominella* sp.	ActNum	50	No
SVKPR2177b	2177	Crab trap	*Patiriella regularis*	ActNum	6	No
SVKPR2177b	2177	Crab trap	*Pyromaia tuberculata*	ActNum	6	No
SVKPR2177c	2177	Crab trap	*Cominella* sp.	ActNum	15	No
SVKPR2178a	2178	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2178b	2178	Crab trap	*Cominella* sp.	ActNum	2	No
SVKPR2178c	2178	Crab trap	*Patiriella regularis*	ActNum	1	No
SVKPR2178c	2178	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2179a	2179	Crab trap	*Sparus auratus*	ActNum	1	No
SVKPR2179a	2179	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2179c	2179	Crab trap	*Cominella* sp.	ActNum	1	No
SVKPR2180a	2180	Crab trap	*Ovalipes catharus*	ActNum	1	No
SVKPR2181b	2181	Diver search	*Eudistoma elongatum*	m^2	80	No
SVKPR2181b	2181	Diver search	*Styela clava*	m^2	1	No
SVKPR2181b	2181	Diver search	*Ectopleura crocea*	m^2	100	No
SVKPR2181b	2181	Diver search	*Alcyonidium* sp.	m^2	1	Yes
SVKPR2182a	2182	Diver search	*Styela clava*	5p	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2183a	2183	Diver search	*Styela clava*	5p	1	No
SVKPR2183a	2183	Diver search	*Charybdis (Charybdis) japonica*	5p	1	No
SVKPR2183b	2183	Diver search	*Charybdis (Charybdis) japonica*	5p	1	No
SVKPR2184a	2184	Diver search	*Styela clava*	5p	5	No
SVKPR2184a	2184	Diver search	*Charybdis (Charybdis) japonica*	5p	3	No
SVKPR2184b	2184	Diver search	*Styela clava*	5p	5	No
SVKPR2185a	2185	Diver search	*Charybdis (Charybdis) japonica*	5p	1	No
SVKPR2187b	2187	Diver search	*Eudistoma elongatum*	5p	2	No
SVKPR2188a	2188	Diver search	*Ectopleura* sp.	m^2	100	No
SVKPR2188b	2188	Diver search	*Ectopleura* sp.	m^2	1	No
SVKPR2190b	2190	Diver search	*Styela clava*	5p	1	No
SVKPR2191a	2191	Diver search	*Ectopleura* sp.	%cover	5	No
SVKPR2191b	2191	Diver search	*Ectopleura* sp.	%cover	5	No
SVKPR2191b	2191	Diver search	*Caprella equilibra*	ActNum	1000	Yes
SVKPR2192a	2192	Diver search	*Alcyonidium* sp.	%cover	10	Yes
SVKPR2193a	2193	Diver search	*Eudistoma elongatum*	%cover	1	Yes
SVKPR2193a	2193	Diver search	*Styela clava*	%cover	1	No
SVKPR2193a	2193	Diver search	*Didemnum* sp.	%cover	30	Yes
SVKPR2193a	2193	Diver search	*Botrylloides giganteum*	%cover	1	Yes
SVKPR2193a	2193	Diver search	*Diplosoma listerianum*	%cover	1	Yes
SVKPR2193b	2193	Diver search	*Eudistoma elongatum*	%cover	1	No
SVKPR2193b	2193	Diver search	*Styela clava*	%cover	1	No
SVKPR2193b	2193	Diver search	*Didemnum* sp.	%cover	30	No
SVKPR2193b	2193	Diver search	*Ectopleura* sp.	%cover	10	No
SVKPR2193b	2193	Diver search	*Botrylloides giganteum*	%cover	1	No
SVKPR2193b	2193	Diver search	*Diplosoma listerianum*	%cover	1	No
SVKPR2194a	2194	Diver search	*Chaetopterus* sp.	ActNum	1	No
SVKPR2194a	2194	Diver search	*Arcuatula senhousia*	ActNum	1	No
SVKPR2195a	2195	Diver search	*Eudistoma elongatum*	m^2	100	No
SVKPR2195a	2195	Diver search	*Styela clava*	m^2	1	No
SVKPR2195b	2195	Diver search	*Eudistoma elongatum*	m^2	100	No
SVKPR2195b	2195	Diver search	*Styela clava*	m^2	1	No
SVKPR2195b	2195	Diver search	*Styela plicata*	m^2	1	Yes
SVKPR2196a	2196	Diver search	*Charybdis (Charybdis) japonica*	m^2	1	No
SVKPR2196b	2196	Diver search	*Charybdis (Charybdis) japonica*	m^2	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2199a	2199	Diver search	*Ectopleura* sp.	%cover	10	No
SVKPR2199a	2199	Diver search	*Caprella* sp.	m^2	1000	No
SVKPR2200a	2200	Diver search	*Styela clava*	m^2	100	No
SVKPR2201a	2201	Diver search	*Ectopleura sp.*	m^2	20	No
SVKPR2201a	2201	Diver search	*Caprella* sp.	m^2	1000	No
SVKPR2202a	2202	Diver search	*Styela clava*	1p	1	No
SVKPR2202a	2202	Diver search	*Pyromaia tuberculata*	1p	1	No
SVKPR2202a	2202	Diver search	*Ectopleura* sp.	1p	1	No
SVKPR2204a	2204	Diver search	*Styela clava*	m^2	20	No
SVKPR2204a	2204	Diver search	*Ectopleura* sp.	m^2	20	No
SVKPR2205a	2205	Diver search	*Arcuatula senhousia*	m^2	10	No
SVKPR2206a	2206	Diver search	*Styela clava*	4p	2	No
SVKPR2206a	2206	Diver search	*Pyromaia tuberculata*	4p	1	No
SVKPR2206b	2206	Diver search	*Diplosoma listerianum*	4p	1	No
SVKPR2207a	2207	Diver search	*Styela clava*	1p	1	No
SVKPR2207a	2207	Diver search	*Charybdis (Charybdis) japonica*	1p	1	No
SVKPR2207b	2207	Diver search	*Styela clava*	1p	1	No
SVKPR2208a	2208	Diver search	*Styela clava*	%cover	1	No
SVKPR2210a	2210	Diver search	*Patiriella regularis*	AbundCat	1	No
SVKPR2211a	2211	Crab condo	*Potamopyrgus* sp.	AbundCat	3	No
SVKPR2211b	2211	Crab condo	*Potamopyrgus* sp.	AbundCat	3	No
SVKPR2211c	2211	Crab condo	*Potamopyrgus* sp.	ActNum	1	No
SVKPR2212a	2212	Crab condo	*Hemigrapsus sexdentatus*	ActNum	1	No
SVKPR2213c	2213	Crab condo	*Alphaeus novazealandia*	ActNum	1	No
SVKPR2215a	2215	Crab condo	*Potamopyrgus* sp.	ActNum	2	No
SVKPR2216a	2216	Crab condo	*Hemiplax hirtipes*	ActNum	1	No
SVKPR2216b	2216	Crab condo	*Hemiplax hirtipes*	ActNum	1	No
SVKPR2217a	2217	Crab condo	*Potamopyrgus* sp.	ActNum	2	No
SVKPR2217b	2217	Crab condo	*Hemiplax hirtipes*	ActNum	1	No
SVKPR2218a	2218	Crab condo	*Hemiplax hirtipes*	ActNum	3	No
SVKPR2218a	2218	Crab condo	*Halicarcinus* sp.	ActNum	2	No
SVKPR2218b	2218	Crab condo	*Hemiplax hirtipes*	ActNum	1	No
SVKPR2218c	2218	Crab condo	*Hemigrapsus crenulatus*	ActNum	1	No
SVKPR2219	2219	Shore search	*Austrohelice crassa*	AbundCat	3	No
SVKPR2220	2220	Shore search	*Austrohelice crassa*	AbundCat	3	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2221	2221	Shore search	*Austrohelice crassa*	AbundCat	2	No
SVKPR2221	2221	Shore search	*Alphaeus novazealandia*	AbundCat	1	No
SVKPR2221	2221	Shore search	*Amathia verticillata*	AbundCat	1	No
SVKPR2222	2222	Shore search	*Hemigrapsus crenulatus*	AbundCat	2	No
SVKPR2222	2222	Shore search	*Petrolisthes elongatus*	AbundCat	2	No
SVKPR2222	2222	Shore search	*Alphaeus novazealandia*	AbundCat	1	No
SVKPR2222	2222	Shore search	*Leptograpsus variegatus*	AbundCat	2	No
SVKPR2222	2222	Shore search	Gastropoda	AbundCat	1	No
SVKPR2223	2223	Shore search	*Hemigrapsus crenulatus*	AbundCat	2	No
SVKPR2223	2223	Shore search	*Petrolisthes elongatus*	AbundCat	3	No
SVKPR2223	2223	Shore search	*Cyclograpsus lavauxi*	AbundCat	2	No
SVKPR2224	2224	Shore search	*Leptograpsus variegatus*	AbundCat	3	No
SVKPR2225	2225	Shore search	*Codium fragile*	AbundCat	1	No
SVKPR2225	2225	Shore search	*Petrolisthes elongatus*	AbundCat	2	No
SVKPR2225	2225	Shore search	*Styela clava*	AbundCat	2	No
SVKPR2226	2226	Shore search	*Charybdis (Charybdis) japonica*	AbundCat	2	No
SVKPR2226	2226	Shore search	*Styela clava*	m^2	1	No
SVKPR2226	2226	Shore search	*Didemnum* sp.	%cover	1	Yes
SVKPR2226	2226	Shore search	*Leptograpsus variegatus*	AbundCat	3	No
SVKPR2226	2226	Shore search	*Ozius deplanatus*	AbundCat	1	No
SVKPR2227	2227	Shore search	*Charybdis (Charybdis) japonica*	AbundCat	2	No
SVKPR2227	2227	Shore search	*Leptograpsus variegatus*	AbundCat	3	No
SVKPR2227	2227	Shore search	*Ozius deplanatus*	AbundCat	1	No
SVKPR2228	2228	Shore search	*Austrohelice crassa*	AbundCat	3	No
SVKPR2229	2229	Shore search	*Hemigrapsus crenulatus*	AbundCat	1	No
SVKPR2229	2229	Shore search	*Petrolisthes elongatus*	AbundCat	3	No
SVKPR2229	2229	Shore search	*Pilumnopeus serratifrons*	AbundCat	2	No
SVKPR2229	2229	Shore search	*Cyclograpsus lavauxi*	AbundCat	3	No
SVKPR2230	2230	Shore search	*Charybdis (Charybdis) japonica*	AbundCat	1	No
SVKPR2230	2230	Shore search	*Petrolisthes elongatus*	AbundCat	3	No
SVKPR2230	2230	Shore search	*Pilumnopeus serratifrons*	AbundCat	1	No
SVKPR2231	2231	Shore search	*Hemigrapsus crenulatus*	AbundCat	1	No
SVKPR2231	2231	Shore search	*Pilumnopeus serratifrons*	AbundCat	1	No
SVKPR2231	2231	Shore search	*Cyclograpsus lavauxi*	AbundCat	3	No
SVKPR2232	2232	Shore search	*Charybdis (Charybdis) japonica*	AbundCat	1	No

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2232	2232	Shore search	*Petrolisthes elongatus*	AbundCat	3	No
SVKPR2232	2232	Shore search	*Pilumnopeus serratifrons*	AbundCat	1	No
SVKPR2232	2232	Shore search	*Ozius deplanatus*	AbundCat	2	No
SVKPR2233	2233	Shore search	*Charybdis (Charybdis) japonica*	AbundCat	1	No
SVKPR2233	2233	Shore search	*Cyclograpsus lavauxi*	AbundCat	2	No
SVKPR2233	2233	Shore search	*Leptograpsus variegatus*	AbundCat	2	No
SVKPR2234	2234	Shore search	*Arcuatula senhousia*	AbundCat	3	No
SVKPR2234	2234	Shore search	*Charybdis (Charybdis) japonica*	AbundCat	1	No
SVKPR2235	2235	Shore search	*Charybdis (Charybdis) japonica*	AbundCat	2	No
SVKPR2235	2235	Shore search	*Petrolisthes elongatus*	AbundCat	3	No
SVKPR2235	2235	Shore search	*Pilumnopeus serratifrons*	AbundCat	3	No
SVKPR2239	2239	Shore search	*Didemnum* sp.	AbundCat	1	Yes
SVKPR2241	2241	Shore search	*Coscinasterias muricata*	AbundCat	1	No
SVKPR2242	2242	Shore search	*Coscinasterias muricata*	AbundCat	1	No
SVKPR2243	2243	Shore search	*Austrohelice crassa*	AbundCat	2	No
SVKPR2243	2243	Shore search	*Coscinasterias muricata*	AbundCat	1	No
SVKPR2244	2244	Shore search	*Charybdis (Charybdis) japonica*	AbundCat	1	No
SVKPR2244	2244	Shore search	*Austrohelice crassa*	AbundCat	3	No
SVKPR2245	2245	Shore search	*Hemigrapsus crenulatus*	AbundCat	1	No
SVKPR2246	2246	Shore search	*Petrolisthes elongatus*	AbundCat	3	No
SVKPR2247	2247	Shore search	*Charybdis (Charybdis) japonica*	AbundCat	1	No
SVKPR2247	2247	Shore search	*Ovalipes catharus*	AbundCat	1	No
SVKPR2248	2248	Shore search	*Leptograpsus variegatus*	AbundCat	1	No
SVKPR2252	2252	Shore search	*Codium fragile*	AbundCat	1	No
SVKPR2252	2252	Shore search	*Pilumnopeus serratifrons*	AbundCat	1	No
SVKPR2253	2253	Shore search	*Codium fragile*	AbundCat	1	No
SVKPR2253	2253	Shore search	*Pilumnopeus serratifrons*	AbundCat	1	No
SVKPR2255	2255	Shore search	*Codium fragile*	AbundCat	1	No
SVKPR2255	2255	Shore search	*Leptograpsus variegatus*	AbundCat	1	No
SVKPR2256	2256	Shore search	*Codium fragile*	AbundCat	1	No
SVKPR2256	2256	Shore search	*Hemigrapsus crenulatus*	AbundCat	1	No
SVKPR2256	2256	Shore search	*Petrolisthes elongatus*	AbundCat	1	No
SVKPR2257a	2257	Diver search	*Charybdis (Charybdis) japonica*	ActNum	2	No
SVKPR2259a	2259	Diver search	*Pecten novaezelandiae*	ActNum	1	No
SVKPR2260a	2260	Diver search	*Ectopleura* crocea	%cover	20	Yes

Site ID	Sample number	Survey method	Taxon name	Number or abundance metric	Number or abundance	Sample kept?
SVKPR2260a	2260	Diver search	*Pyromaia tuberculata*	m^2	1	Yes
SVKPR2260b	2260	Diver search	*Ectopleura* crocea	%cover	20	Yes
SVKPR2261a	2261	Diver search	*Arcuatula senhousia*	m^2	100	No
SVKPR2263a	2263	Crab condo	*Notomithrax* sp.	ActNum	1	No
SVKPR2264a	2264	Crab condo	*Arcuatula senhousia*	ActNum	1	No
SVKPR2268a	2268	Crab condo	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2268b	2268	Crab condo	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2268b	2268	Crab condo	*Hemigrapsus crenulatus*	ActNum	1	No
SVKPR2269a	2269	Crab condo	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2270a	2270	Crab condo	*Pyromaia tuberculata*	ActNum	1	No
SVKPR2271c	2271	Crab condo	Gastropoda	ActNum	1	No
SVKPR2272a	2272	Crab condo	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2273a	2273	Crab condo	*Charybdis (Charybdis) japonica*	ActNum	1	No
SVKPR2274a	2274	Crab condo	*Charybdis (Charybdis) japonica*	ActNum	1	No

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