Port of Napier

Baseline survey for non-indigenous marine species (Research Project ZBS2000/04)

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Prepared for BNZ Post-clearance Directorate
by Graeme Inglis, Nick Gust, Isla Fitridge, Oliver Floerl, Chris Woods, Barbara Hayden, Graham Fenwick

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MAF Information Bureau
P O Box 2526
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Executive Summary

This report describes the results of a January 2003 survey to provide a baseline inventory of native, non-indigenous and cryptogenic marine species within the Port of Napier.

- The survey is part of a nationwide investigation of native and non-native marine biodiversity in 13 international shipping ports and three marinas of first entry for yachts entering New Zealand from overseas.

- 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. Modifications were made to the CRIMP protocols for use in New Zealand port conditions.

- A wide range of sampling techniques was used to collect marine organisms from a range of habitats within the Port of Napier. Fouling assemblages were scraped from hard substrata by divers, benthic assemblages were sampled using a sled and benthic grabs, and a gravity corer was used to sample for dinoflagellate cysts. Mobile predators and scavengers were sampled using baited fish, crab, starfish and shrimp traps.

- The distribution of sampling effort in the Port of Napier was designed to maximise the chances of detecting non-indigenous species and concentrated on high-risk locations and habitats where non-indigenous species were most likely to be found.

- Organisms collected during the survey were sent to local and international taxonomic experts for identification.

- A total of 199 species or higher taxa was identified from the Port of Napier survey. They consisted of 134 native species, 10 non-indigenous species, 14 cryptogenic species (those whose geographic origins are uncertain) and 41 species indeterminata (taxa for which there is insufficient taxonomic or systematic information available to allow identification to species level).

- Seven species of marine organisms collected from the Port of Napier have not previously been described from New Zealand waters; two of these were newly discovered non-indigenous species (the polychaete, *Spirobranchus polytrema* and the hydroid *Eudendrium generale*), and five are considered cryptogenic.

- The ten non-indigenous organisms described from the Port of Napier included representatives of six phyla. The non-indigenous species detected (ordered alphabetically by phylum, class, order, family, genus and species) were: (Annelida) *Spirobranchus polytrema*, *Barantolla lepte,* (Bryozoa) *Bugula flabellata*, *Bugula neritina*, *Watersipora subtorquata,* (Cnidaria) *Eudendrium generale* (Mollusca) *Theora lubrica*, (Phycophyta) *Undaria pinnatifida,* (Urochordata) *Ciona intestinalis* and *Ascidiella aspersa*

- The only species from the Port of Napier on the New Zealand register of unwanted organisms is the Asian kelp, *Undaria pinnatifida*. This alga is known to now have a wide distribution in southern and eastern New Zealand.

- Most non-indigenous species located in the Port are likely to have been introduced to New Zealand accidentally by international shipping or through domestic translocation or spread from other locations in New Zealand.

- Approximately 60% (6 of 10 species) of NIS in the Port of Napier are likely to have been introduced in hull fouling assemblages, while 10% could have been introduced via ballast water and 30% may have been introduced by either ballast water or hull fouling vectors.

- The predominance of hull fouling species in the introduced biota of the Port of Napier (as opposed to ballast water introductions) is consistent with findings from similar port baseline studies overseas.

Introduction

Introduced (non-indigenous) plants and animals are now recognised as one of the most serious threats to the natural ecology of biological systems worldwide (Wilcove et al 1998, Mack et al 2000). Growing international trade and trans-continental travel mean that humans now intentionally and unintentionally transport a wide range of species outside their natural biogeographic ranges to regions where they did not previously occur. A proportion of these species are capable of causing serious harm to native biodiversity, industries and human health. Recent studies suggest that coastal marine environments may be among the most heavily invaded ecosystems, as a consequence of the long history of transport of marine species by international shipping (Carlton and Geller 1993, Grosholz 2002). Ocean-going vessels transport marine species in ballast water, in sea chests and other recesses in the hull structure, and as fouling communities attached to submerged parts of their hulls (Carlton 1985, 1999, AMOG Consulting 2002, Coutts et al 2003). These shipping transport mechanisms have enabled hundreds of marine species to spread worldwide and establish populations in shipping ports and coastal environments outside their natural range (Cohen and Carlton 1995, Hewitt et al 1999, Eldredge and Carlton 2002, Leppäkoski et al 2002).

Biosecurity[1] is important to all New Zealanders. New Zealand's geographic isolation makes it particularly vulnerable to marine introductions because more than 95% of its trade in commodities is transported by shipping, with several thousand international vessels arriving and departing from more than 13 ports and recreational boat marinas of first entry (Inglis 2001). The country's geographic remoteness also means that its marine biota and ecosystems have evolved in relative isolation from other coastal ecosystems. New Zealand's marine biota is as unique and distinctive as its terrestrial biota, with large numbers of native marine species occurring nowhere else in the world.

The numbers, identity, distribution and impacts of non-indigenous species in New Zealand's marine environments are poorly known. A recent review of existing records suggested that by 1998, at least 148 species had been deliberately or accidentally introduced to New Zealand's coastal waters, with around 90 % of these establishing permanent populations (Cranfield et al 1998). To manage the risk from these and other non-indigenous species, better information is needed on the current diversity and distribution of species present within New Zealand.

BIOLOGICAL BASELINE SURVEYS FOR NON-INDIGENOUS MARINE SPECIES

In 1997, the International Maritime Organisation (IMO) released guidelines for ballast water management (Resolution A868-20) encouraging countries to undertake biological surveys of port environments for potentially harmful non-indigenous aquatic species. As part of its comprehensive five-year Biodiversity Strategy package on conservation, environment, fisheries, and biosecurity released in 2000, the New Zealand Government funded a national series of baseline surveys. These surveys aimed to determine the identity, prevalence and distribution of native, cryptogenic and non-indigenous species in New Zealand's major shipping ports and other high risk points of entry. The government department responsible for biosecurity in the marine environment at the time, the New Zealand Ministry of Fisheries (MFish), commissioned NIWA to undertake biological baseline surveys in 13 ports and three marinas that are first ports of entry for vessels entering New Zealand from overseas (Fig. 1). Marine biosecurity functions are now vested in Biosecurity New Zealand.

[1] Biosecurity is the management of risks posed by introduced species to environmental, economic, social, and cultural values.

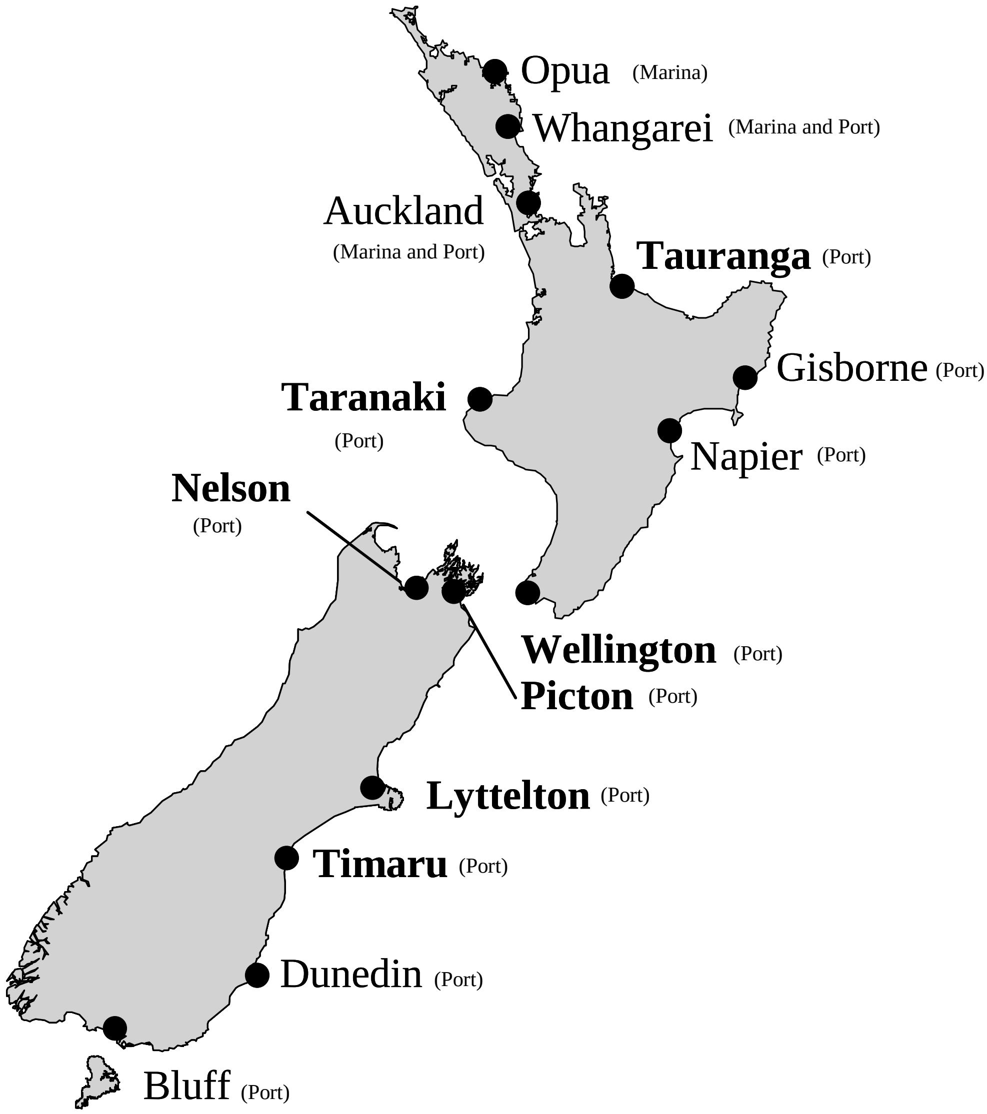

Figure 1: Commercial shipping ports in New Zealand where baseline non-indigenous species surveys have been conducted. Group 1 ports surveyed in the summer of 2001/2002 are indicated in bold and group 2 ports surveyed in the summer of 2002/2003 are indicated in plain font. Marinas were also surveyed for NIS in Auckland, Opua and Whangarei in 2002/2003.

The port surveys have two principal objectives:

i. To provide a baseline assessment of native, non-indigenous and cryptogenic[2] species, and
ii. To determine the distribution and relative abundance of a limited number of target species in shipping ports and other high risk points of entry for non-indigenous marine species.

The surveys will form a baseline for future monitoring of new incursions by non-indigenous marine species in port environments nationwide, and will assist international risk profiling of problem species through the sharing of information with other shipping nations.

[2] "Cryptogenic:" species are species whose geographic origins are uncertain (Carlton 1996).

This report summarises the results of the Port of Napier survey and provides an inventory of species detected in the Port. It identifies and categorises native, introduced ("non-indigenous") and cryptogenic species. Organisms that could not be identified to species level are also listed as species indeterminata.

DESCRIPTION OF THE PORT OF NAPIER

The Port of Napier (39°28'S, 176°58.9'E) is on the northern side of Ahuriri bluff in Hawke's Bay (Fig. 1). The harbour provides safe anchorage for up to eight vessels in all weathers, and is protected by two breakwaters with the entrance to the northwest (Thompson 1981). The Port of Napier is a major import/export hub port in the North Island of New Zealand, particularly for the export of forestry products (Inglis 2001).

PORT OPERATION AND SHIPPING MOVEMENTS

Shipping in Napier originally centred on West Quay on the lower reaches of the Ahuriri estuary in the late 1800's and early 1900's. Port Ahuriri acted as a principal port for the entry of supplies as well as the export of local produce such as wool and was a customs house point of entry. However, with its physical and tidal restrictions Port Ahuriri was limited in terms of expansion, and with its shallow bottom being further raised by the destructive 1931 Napier earthquake, the majority of port activities were relocated a short distance westwards to the current artificial harbour at Bluff Hill, whose construction was initiated in 1887 (www.ahuriri.co.nz/history.htm). In 1966, port exports were wool, frozen meat, dairy produce, and fruit with a tonnage handled in 1964 of approximately 700,000 tons (www.teara.govt.nz).

The Port of Napier is currently run by the Port of Napier Ltd (www.portofnapier.co.nz), which is largely owned by Hawke's Bay Regional Council. The port handles a wide variety of refrigerated cargo in container and bulk form, seafood, forestry products, oils and liquids, cement, fertiliser, and cars. For the 2003/04 financial year, trade volume through the port was 3.1 million tonnes and the port received a total of 748 ships visits (www.portofnapier.co.nz). The Port has a total of five main wharves that can accommodate ships of a wide variety of sizes (Fig. 2). Berth construction is predominantly concrete decking with a mixture of reinforced-concrete and wooden piles, with some wooden pile fendering at the face and some steel sheet piling and aggregate backfill at the rear of the berths. Details of the berthing facilities available in the Port are provided in Table 1.

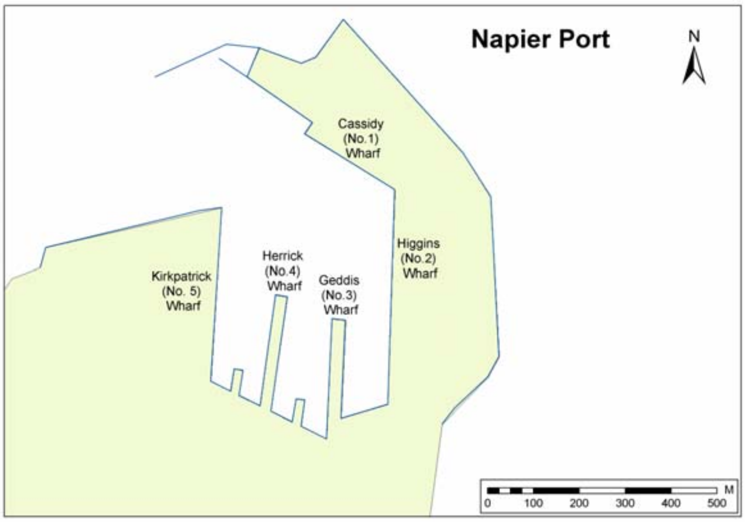

Figure 2: Port of Napier map

In 2000, there were 45 registered fishing vessels operating from the Port of Napier and Port Ahuriri (Sinner et al 2000). Recreational vessels utilise the nearby Napier inner harbour, Port Ahuriri (39°54'S, 176°54'E), which possesses approximately 122 berths of an average 10m length, and has customs-clearance facilities.

Recent analyses of shipping arrivals show that the Port of Napier received 96 international ship visits during 2002/2003 (87 merchant, 6 pleasure, 2 fishing, and 1 barge/tug vessels). During this period, most commercial vessels entering the port arrived from the NW Pacific (59.1 %), Australia (8 %), the Northeast Pacific (5.7 %), the South Pacific (4.5 %), and the Arabian seas (3.4 %) (Campbell 2004).

Vessels unable to be berthed immediately in the port may anchor outside the port at two charted anchorage points (nautical chart NZ571): No. 1 south of Pania Reef (approximately 4 km away from the port), No. 2 north of Pania Reef (Denys Carpenter, Port Napier Ltd, pers. comm.).

Vessels are expected to comply with the Voluntary Controls on the Discharge of Ballast Water in New Zealand (www.fish.govt.nz/sustainability/biosecurity/); vessels are requested to exchange ballast water in mid-ocean (away from coastal influences) en route to New Zealand and discharge only the exchanged water while in port. According to Inglis (2001), a total volume of 8,141 m^3 of ballast water was discharged in the Port of Napier in 1999, with the largest country-of-origin volumes of 3,985 m^3 from Japan, 1,243 m^3 from Australia, 790 m^3 from China, and 1,810 m^3 unspecified.

Within the port there is minimal on-going maintenance dredging as water depth is reasonably static. The approach channel is dredged approximately once every 5 years (Denys Carpenter, Port Napier Ltd, pers. comm.). Spoil disposal is distributed amongst two consented and monitored spoil disposal sites. One site is just offshore from Westshore Beach and is used for the deposit of clean sand as the Port's contribution to the renourishment of Westshore Beach. The mud and silt material dredged from the swinging basin and the inner part of the entrance channel is transported to an offshore site (approximately 39°45'S, 176°90'E) for disposal (www.portofnapier.co.nz).

Port Napier Ltd is reviewing options for future development. This includes a westwards expansion of the port facilities for new deepwater berths, for which consents have been granted. The current emphasis is also on optimising the existing footprint and improving operational efficiency (Denys Carpenter, Port Napier Ltd, pers. comm.).

PHYSICAL ENVIRONMENT OF NAPIER HARBOUR

The Port of Napier is an artificial port that opens to the northwest and is protected from all other directions by an extensive reclamation area, and a breakwall to the north. The Port entrance is approximately 200 m wide with a dredged depth of 12.5 m. Average depth within the Port at low water is 10.0 m, with a tidal range of 1.3 m. Alongside the berths, berthing pockets are dredged to maintain a depth slightly greater than the immediate surrounding. For example, chart depth at Cassidy Quay (No. 1 wharf) is 11.3 m, but the berthing pocket is 12.2 m depth. The main port area is approximately 600 m in length and 350 m in width. The seabed of the port is composed of consolidated basement rock (limestone, sandstone, and mudstone) and overlying unconsolidated muddy and sandy sediments. Tidal currents within the port are generally weak, ranging from 0-7 cm sec^{-1}.

EXISTING BIOLOGICAL INFORMATION

Over the last three decades there have been few biological surveys carried out in and around the Port of Napier and Napier Harbour, with little effort dedicated to collecting and identifying non-indigenous species. We briefly review these studies and their findings below.

Hume *et al.* (1988) conducted a preliminary investigation into the possible effects of dredge spoil disposal from the Port of Napier in a confidential report to the Port Company. They undertook studies to determine the impact of discarding spoil in dumping grounds near the port (e.g. 1-5 km from the port) to determine the suitability of existing and proposed dumping sites. They examined aspects such as sediment particle sizes, current direction and strength, and benthic biota.

Roper *et al.* (1992) carried out a survey of the benthic biota and sediments at the western end of the Port of Napier's breakwater for the Port Company. In a confidential client report they described and compared existing biota and sediments to nearby areas in light of a proposal by the Port Company to infill a potential reclamation site. A more comprehensive assessment of the effects of dredging and marine disposal, and stormwater runoff within the port was subsequently conducted by Roper et al (1993) for the Port Company. In this report they described sediments, tidal currents and the benthic biota within the port area, as well as chemical constituents of stormwater runoff.

The invasive kelp *Undaria pinnatifida* was identified in the Port of Napier in 1993, and this port is deemed in the optimal temperature zone for this macroalga (Forrest et al 2000; Sinner *et al.* 2000). Taylor and MacKenzie (2001) also tested the Port of Napier for the presence of the toxic blooming dinoflagellate *Gymnodinium catenatum*, and detected resting cysts from sediment samples and motile cells from phytoplankton samples at one sample site.

Survey methods

SURVEY METHOD DEVELOPMENT

The sampling methods used in this survey were based on the CSIRO Centre for Research on Introduced Marine Pests (CRIMP) protocols developed for baseline port surveys in Australia (Hewitt and Martin 1996, 2001). CRIMP protocols have been adopted as a standard by the International Maritime Organisation's Global Ballast Water Management Programme (GloBallast). Variations of these protocols are being applied to port surveys in many other nations. A group of New Zealand marine scientists reviewed the CRIMP protocols and conducted a workshop in September 2001 to assess their feasibility for surveys in this country (Gust et al. 2001). A number of recommendations for modifications to the protocols ensued from the workshop and were implemented in surveys throughout New Zealand. The modifications were intended to ensure cost effective and efficient collection of baseline species data for New Zealand ports and marinas. The modifications made to the CRIMP protocols and reasons for the changes are summarised in Table 2. Further details are provided in Gust et al. (2001).

Baseline survey protocols are intended to sample a variety of habitats within ports, including epibenthic fouling communities on hard substrata, soft-sediment communities, mobile invertebrates and fishes, and dinoflagellate cysts. Below, we describe the methods and sampling effort used for the Port of Napier survey. The survey was undertaken between January 26th and 31st, 2003. Most sampling was concentrated on four main berths: Cassidy Wharf, Higgins Wharf, Geddis Wharf and Herrick Wharf. A summary of sampling effort within the Port is provided in Tables 3a,b.

DIVER OBSERVATIONS AND COLLECTIONS ON WHARF PILES

Fouling assemblages were sampled on four pilings at each berth. Selected pilings were separated by 10 – 15 m and comprised two pilings on the outer face of the berth and, where possible, two inner pilings beneath the berth (Gust et al 2001). On each piling, four quadrats (40 cm x 25 cm) were fixed to the outer surface of the pile at water depths of approximately -0.5 m, -1.5 m, -3.0 m and -7 m. A diver descended slowly down the outer surface of each pile and filmed a vertical transect from approximately high water to the base of the pile, using a digital video camera in an underwater housing. On reaching the sea floor, the diver then ascended slowly and captured high-resolution still images of each quadrat using the photo capture mechanism on the video camera. Because of limited visibility, four overlapping still images, each covering approximately ¼ of the area of the quadrat were taken for each quadrat. A second diver then removed fouling organisms from the piling by scraping the organisms inside each quadrat into a 1-mm mesh collection bag, attached to the base of the quadrat (Fig. 3). Once scraping was completed, the sample bag was sealed and returned to the laboratory for processing. The second diver also made a visual search of each piling for potential invasive species and collected samples of large conspicuous organisms not represented in quadrats. Opportunistic visual searches were also made of breakwalls and rock facings within the commercial port area. Divers swam vertical profiles of the structures and collected specimens that could not be identified reliably in the field.

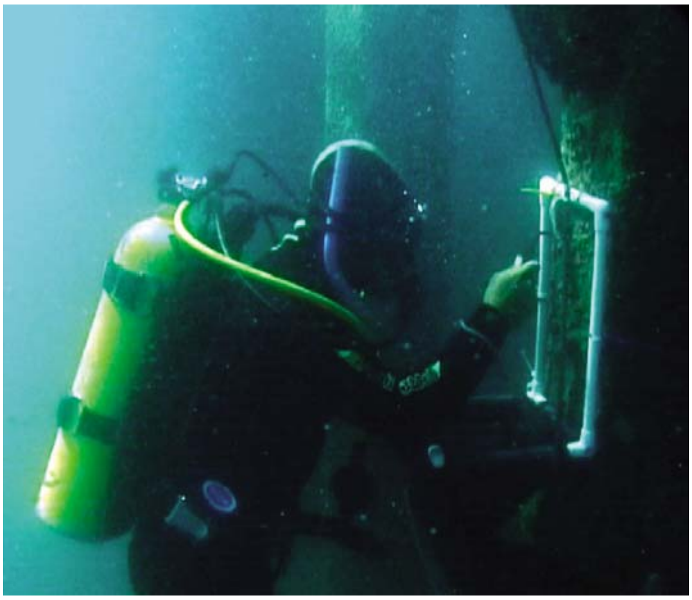

Figure 3: Diver sampling organisms on pier piles.

BENTHIC INFAUNA

Benthic infauna was sampled using a Shipek grab sampler deployed from a research vessel moored adjacent to the berth (Fig. 4), with samples collected from within 5 m of the edge of the berth. The Shipek grab removes a sediment sample of ~3 *l* and covers an area of approximately 0.04 m^2 on the seafloor to a depth of about 10 cm. It is designed to sample unconsolidated sediments ranging from fine muds and sands to hard-packed clays and small cobbles. Because of the strong torsion springs and single, rotating scoop action, the Shipek grab is generally more efficient at retaining samples intact than conventional VanVeen or Smith McIntyre grabs with double jaws (Fenwick *pers obs*). Three grab samples were taken at haphazard locations along each sampled berth. Sediment samples were washed through a 1-mm mesh sieve and animals retained on the sieve were returned to the field laboratory for sorting and preservation.

Figure 4: Shipek grab sampler: releasing benthic sample into bucket

EPIBENTHOS

Larger benthic organisms were sampled using an Ocklemann sled (hereafter referred to as a "sled"). The sled is approximately one meter long with an entrance width of ~0.7 m x 0.2 m. A short yoke of heavy chain connects the sled to a tow line (Fig. 5). The mouth of the sled partially digs into the sediment and collects organisms in the surface layers to a depth of a few centimetres. Runners on each side of the sled prevent it from sinking completely into the sediment so that shallow burrowing organisms and small, epibenthic fauna pass into the exposed mouth. Sediment and other material that enters the sled is passed through a mesh basket that retains organisms larger than about two mm. Sleds were towed for a standard time of two minutes at approximately two knots. During this time, the sled typically traversed between 80 – 100 m of seafloor before being retrieved. Two to three sled tows were completed adjacent to each sampled berth within the port, and the entire contents were sorted.

SEDIMENT SAMPLING FOR CYST-FORMING SPECIES

A TFO gravity corer (hereafter referred to as a "javelin corer") was used to take small sediment cores for dinoflagellate cysts (Fig. 6). The corer consists of a 1.0-m long x 1.5-cm diameter hollow stainless steel shaft with a detachable 0.5-m long head (total length = 1.5 m). Directional fins on the shaft ensure that the javelin travels vertically through the water so that the point of the sampler makes first contact with the seafloor. The detachable tip of the javelin is weighted and tapered to ensure rapid penetration of unconsolidated sediments to a depth of 20 to 30 cm. A thin (1.2-cm diameter) sediment core is retained in a perspex tube within the hollow spearhead. In muddy sediments, the corer preserves the vertical structure of the sediments and fine flocculant material on the sediment surface more effectively than hand-held coring devices (Matsuoka and Fukuyo 2000). The javelin corer is deployed and retrieved from a small research vessel. Cyst sample sites were not constrained to the berths sampled by pile scraping and trapping techniques. Sampling focused on high sedimentation areas within the Port and avoided areas subject to strong tidal flow. On retrieval, the perspex tube was removed from the spearhead and the top 5 cm of sediment retained for analysis. Sediment samples were kept on ice and refrigerated prior to culturing. Culture procedures generally followed those described by Hewitt and Martin (2001).

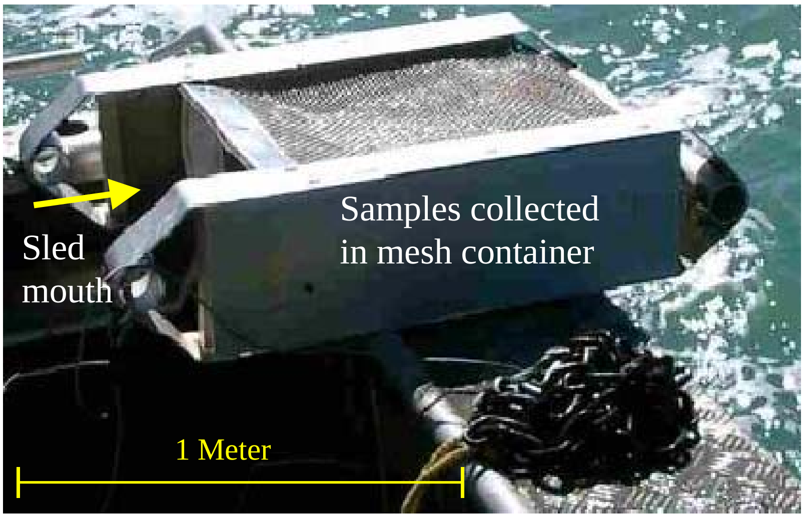

Figure 5: Benthic sled

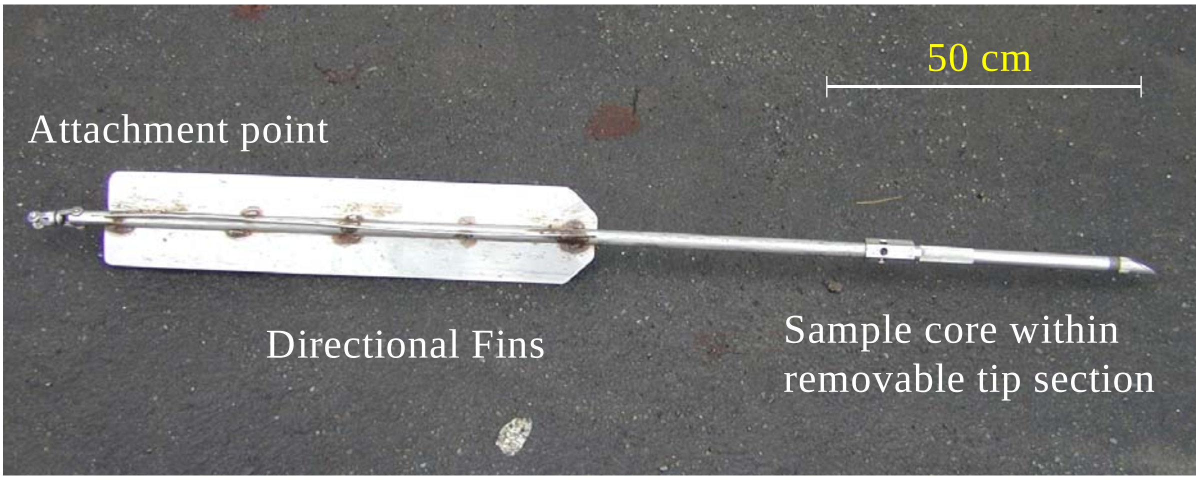

Figure 6: Javelin corer

MOBILE EPIBENTHOS

Benthic scavengers and fishes were sampled using a variety of baited trap designs described below.

Opera house fish traps

Opera house fish traps (1.2 m long x 0.8 m wide x 0.6 m high) were used to sample fishes and other bentho-pelagic scavengers (Fig. 7). These traps were covered in 1-cm^2 mesh netting and had entrances on each end consisting of 0.25 m long tunnels that tapered in diameter from 40 to 14 cm. The trap was baited with two dead pilchards (*Sardinops neopilchardus*) held in plastic mesh suspended in the centre of the trap. Two trap lines, each containing two opera house traps were set for a period of 1 hour at each site before retrieval. Previous studies have shown opera house traps to be more effective than other types of fish trap and that consistent catches are achieved with soak times of 20 to 50 minutes (Ferrell et al 1994; Thrush et al 2002).

Box traps

Box traps (63 cm x 42 cm x 20 cm) with 1.3-cm mesh netting were used to sample mobile crabs and other small epibenthic scavengers (Fig. 7). A central mesh bait holder containing two dead pilchards was secured inside the trap. Organisms attracted to the bait enter the traps through slits in inward sloping panels at each end. Two trap lines, each containing two box traps, were set on the sea floor at each site and left to soak overnight before retrieval.

Starfish traps

Starfish traps designed by Whayman-Holdsworth were used to catch asteroids and other large benthic scavengers (Fig. 7). These are circular hoop traps with a base diameter of 100 cm and an opening on the top of 50 cm diameter. The sides and bottom of the trap are covered with 26-mm mesh and a plastic, screw-top bait holder is secured in the centre of the trap entrance (Andrews et al 1996). Each trap was baited with two dead pilchards. Two trap lines, each with two starfish traps were set on the sea floor at each site and left to soak overnight before retrieval.

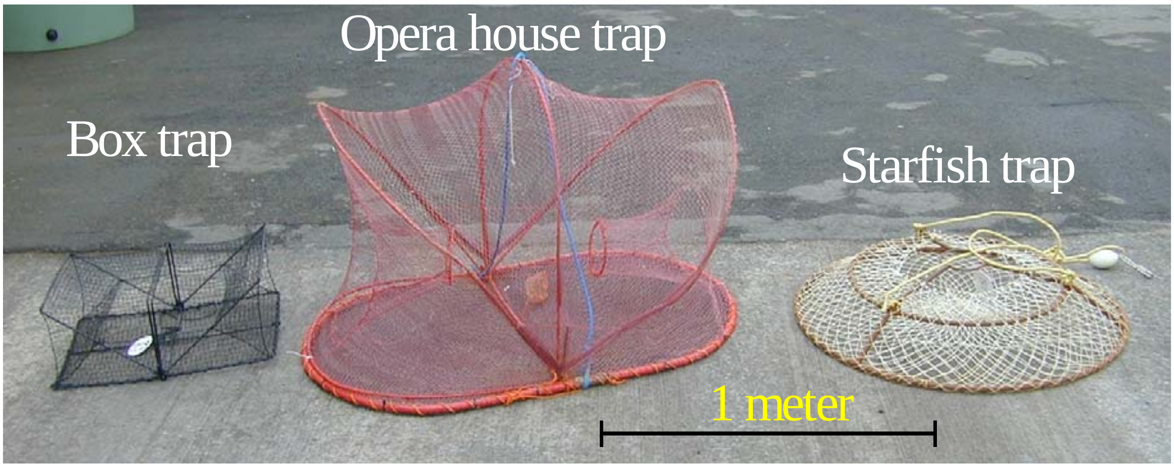

Figure 7: Trap types deployed in the port.

Shrimp traps

Shrimp traps were used to sample small, mobile crustaceans. They consisted of a 15 cm plastic cylinder with a 5-cm diameter screw top lid in which a funnel had been fitted. The funnel had a 20 cm entrance that tapered in diameter to 1 cm. The entrance was covered with 1-cm plastic mesh to prevent larger animals from entering and becoming trapped in the funnel entrance. Each trap was baited with a single dead pilchard. Two trap lines, each containing two scavenger traps, were set on the sea floor at each site and left to soak overnight before retrieval.

SAMPLING EFFORT

A summary of sampling effort within the Port of Napier is provided in Tables 3a,b. We particularly focused sampling effort on hard substrata within ports (such as pier piles and wharves) where invasive species are likely to be found (Hewitt and Martin 2001), and increased the level of quadrat scraping replication on each pile from the CRIMP protocols, as well as sampling both shaded and unshaded piles. The distribution of effort within ports aimed to maximise spatial coverage and represent the diversity of active berthing sites within the area. Total sampling effort was constrained by the costs of processing and identifying specimens obtained during the survey. The spatial distribution of sampling effort in the Port of Napier is indicated in the following figures; diver pile scrapings and javelin cyst coring (Fig. 8), benthic sledding and shipek benthic grab sampling (Fig. 9), box, starfish, shrimp and opera house fish trapping (Fig. 10). Sampling effort was varied between ports on the basis of risk assessments (Inglis 2001) to maximise the search efficiency for NIS nationwide. Sampling effort in each of the thirteen Ports and three marinas surveyed over two summers is summarised in Table 3c.

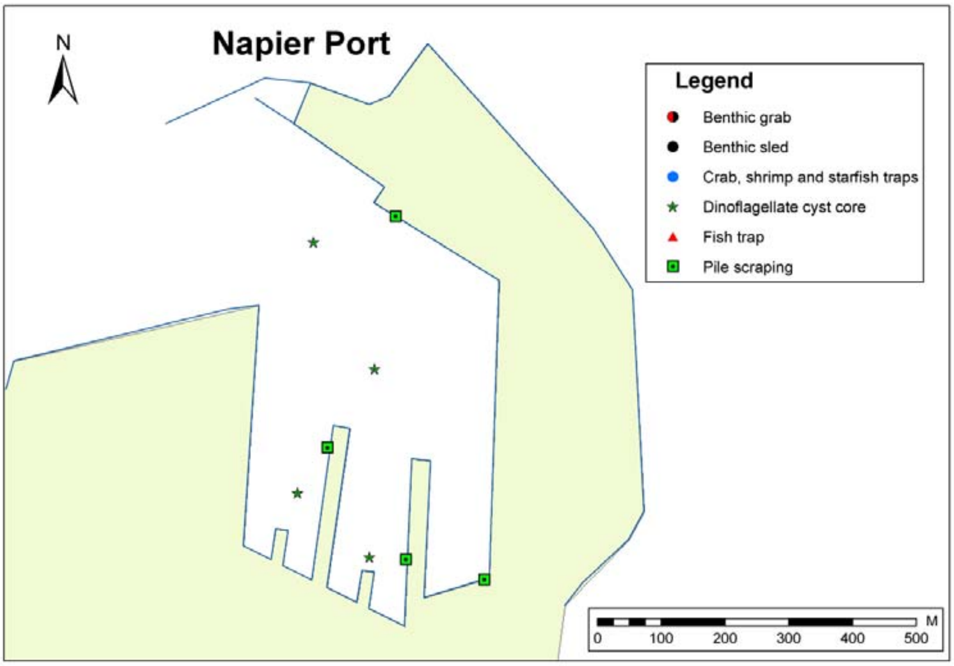

Figure 8: Diver pile scrape sites and dinoflagellate cyst sample sites

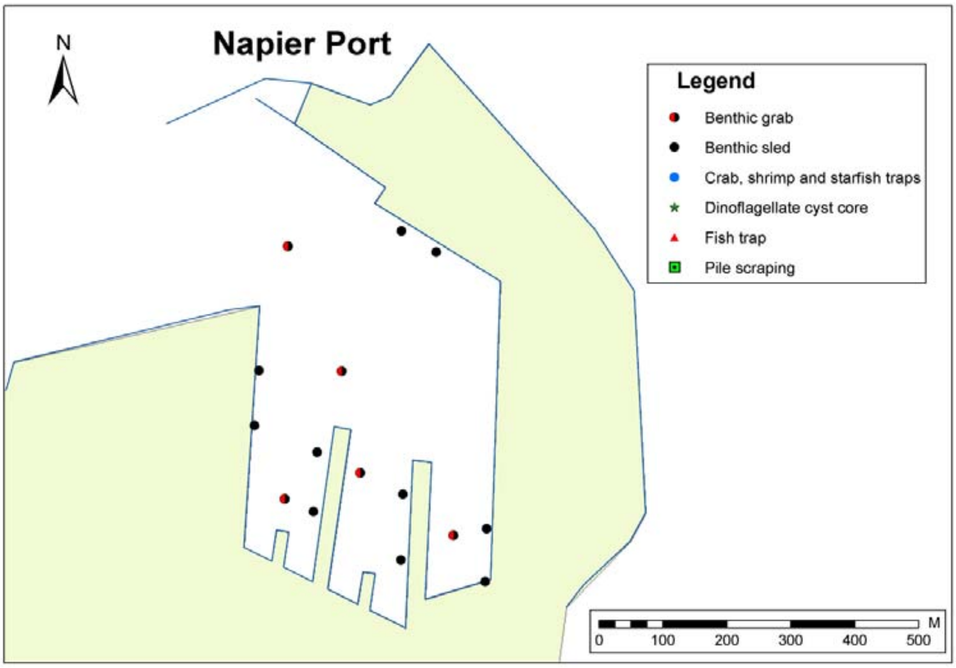

Figure 9: Benthic sled and benthic grab sites.

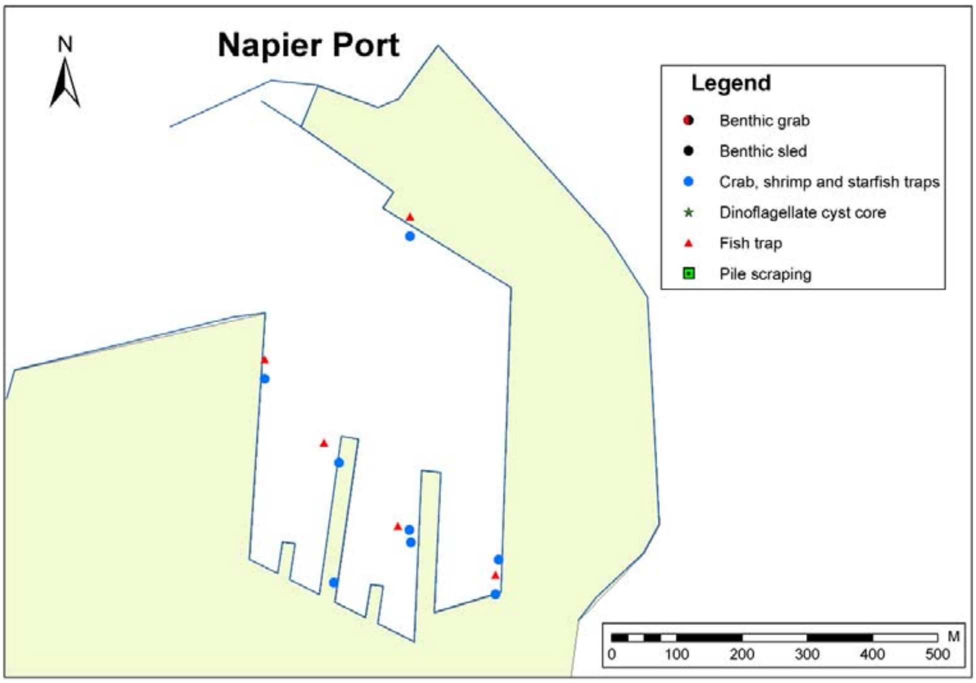

Figure 10: Sites trapped using box (crab), shrimp, starfish and opera house fish traps

SORTING AND IDENTIFICATION OF SPECIMENS

Each sample collected in the diver pile scrapings, benthic sleds, box, starfish and shrimp traps, opera house fish traps, shipek grabs and javelin cores was allocated a unique code on waterproof labels and transported to a nearby field laboratory where it was sorted by a team into broad taxonomic groups (e.g. ascidians, barnacles, sponges etc.). These groups were then preserved and individually labelled. Details of the preservation techniques varied for many of the major taxonomic groups collected, and the protocols adopted and preservative solutions used are indicated in Table 4. Specimens were subsequently sent to over 25 taxonomic experts (Appendix 1) for identification to species or lowest taxonomic unit (LTU). We also sought information from each taxonomist on the known biogeography of each species within New Zealand and overseas. Species lists compiled for each port were compared with the marine species listed on the New Zealand register of unwanted organisms under the Biosecurity Act 1993 (Table 5a) and the marine pest list produced by the Australian Ballast Water Management Advisory Council (Table 5b).

DEFINITIONS OF SPECIES CATEGORIES

Each species recovered during the survey was classified into one of four categories that reflected its known or suspected geographic origin. To do this we used the experience of taxonomic experts and reviewed published literature and unpublished reports to collate information on the species' biogeography.

Patterns of species distribution and diversity in the oceans are complex and still poorly understood (Warwick 1996). Worldwide, many species still remain undescribed or undiscovered and their biogeography is incomplete. These gaps in global marine taxonomy and biogeography make it difficult to reliably determine the true range and origin of many species. The four categories we used reflect this uncertainty. Species that were not demonstrably native or non-indigenous were classified as "cryptogenic" (sensu Carlton 1996). Cryptogenesis can arise because the species was spread globally by humans before scientific descriptions of marine flora and fauna began in earnest (i.e. historical introductions).

Alternatively the species may have been discovered relatively recently and there is insufficient biogeographic information to determine its native range. We have used two categories of cryptogenesis to distinguish these different sources of uncertainty. In addition, a fifth category ("species indeterminata") was used for specimens that could not be identified to species-level. Formal definitions for each category are given below.

Native species

Native species are known to be endemic to the New Zealand biogeographical region and have not been introduced to coastal waters by human mediated transport.

Non-indigenous species (NIS)

Non-indigenous species (NIS) are known or suspected to have been introduced to New Zealand as a result of human activities. They were determined using a series of questions posed by Chapman and Carlton (1991, 1994), as exemplified by Cranfield et al (1998).

1. Has the species suddenly appeared locally where it has not been found before?
2. Has the species spread subsequently?
3. Is the species' distribution associated with human mechanisms of dispersal?
4. Is the species associated with, or dependent on, other non-indigenous species?
5. Is the species prevalent in, or restricted to, new or artificial environments?
6. Is the species' distribution restricted compared to natives?

The worldwide distribution of the species was tested by a further three criteria:

7. Does the species have a disjunctive worldwide distribution?
8. Are dispersal mechanisms of the species inadequate to reach New Zealand, and is passive dispersal in ocean currents unlikely to bridge ocean gaps to reach New Zealand?
9. Is the species isolated from the genetically and morphologically most similar species elsewhere in the world?

In this report we distinguish two categories of NIS. "NIS" refers to non-indigenous species previously recorded from New Zealand waters, and "NIS (new)" refers to non-indigenous species first discovered in New Zealand waters during this project.

Cryptogenic species Category 1

Species previously recorded from New Zealand whose identity as either native or non-indigenous is ambiguous. In many cases this status may have resulted from their spread around the world in the era of sailing vessels prior to scientific survey (Chapman and Carlton 1991, Carlton 1992), such that it is no longer possible to determine their original native distribution. Also included in this category are newly described species that exhibited invasive behaviour in New Zealand (Criteria 1 and 2 above), but for which there are no known records outside the New Zealand region.

Cryptogenic species Category 2:

Species that have recently been discovered but for which there is insufficient systematic or biogeographic information to determine whether New Zealand lies within their native range. This category includes previously undescribed species that are new to New Zealand and/or science.

Species indeterminata

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.

Survey results

All organisms collected in the Port of Napier survey were classified as native (Table 6), cryptogenic (Table 7), non-indigenous (Table 8) or species indeterminata (Table 9). A total of 199 species or higher taxa were identified from the Napier survey. This collection consisted of 134 native, 14 cryptogenic, 10 non-indigenous species and 41 species indeterminata (Fig. 11). Seven species from the Port of Napier had not previously been described from New Zealand waters. These included two NIS and five species of unknown geographic origin (Cryptogenic category 2; Table 7). Eleven phyla were represented in the survey samples, with annelids, crustaceans and molluscs being the three most diverse groups collected (Fig. 12). For general descriptions of the main groups of organisms encountered during this study refer to Appendix 2.

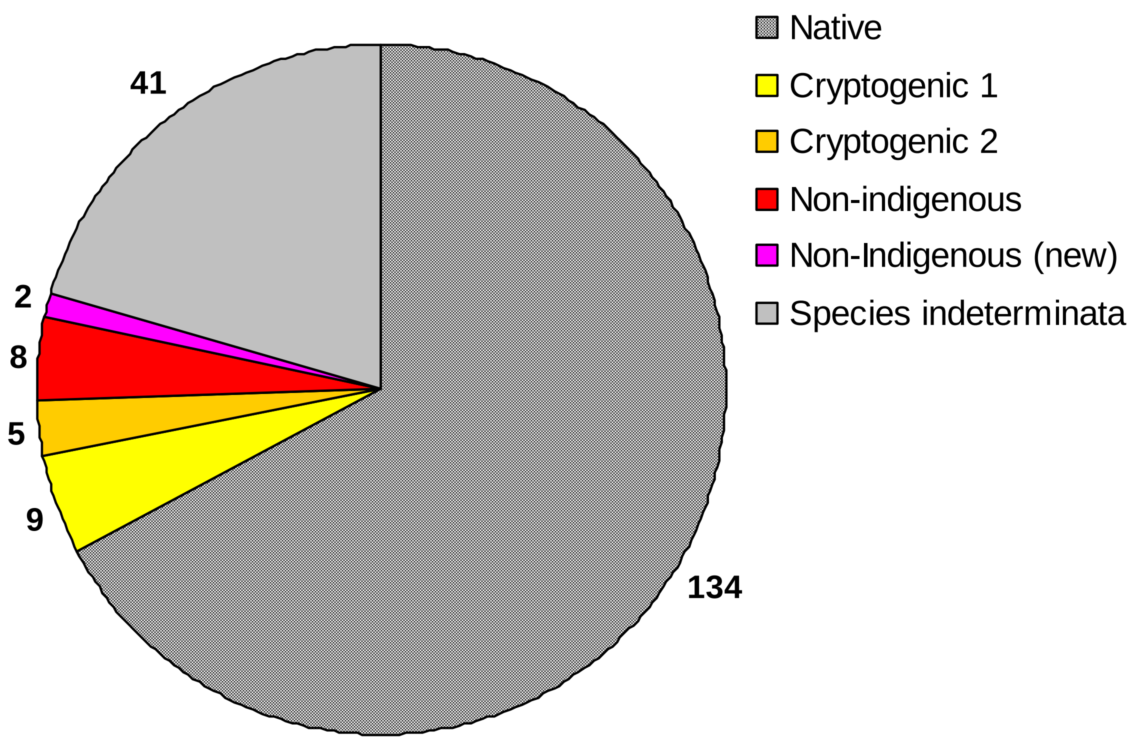

Figure 11: Diversity of marine species sampled in the Port of Napier. Values indicate the number of species in native, cryptogenic, non-indigenous and species indeterminata categories.

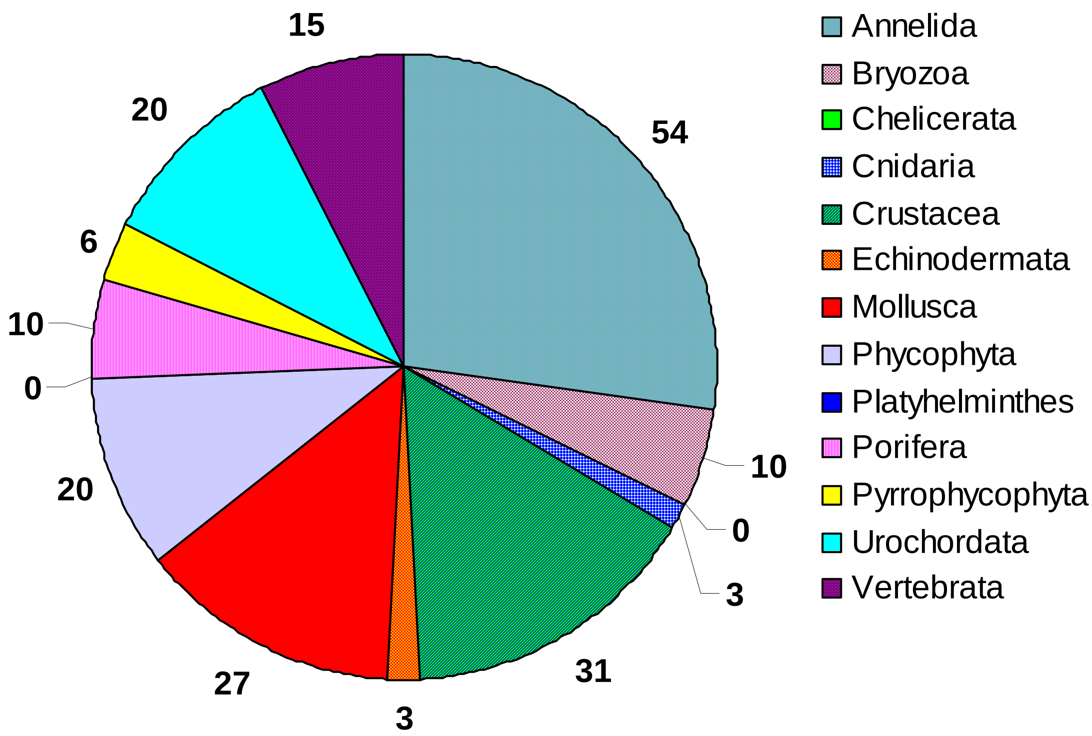

Figure 12: Marine Phyla sampled in the Port of Napier. Values indicate the number of species in each of the major taxonomic groups.

NATIVE SPECIES

A total of 134 native species was identified from the Port of Napier. Native species represented 67.3% of all species identified in the survey (Table 6), and included highly diverse assemblages of annelids (37 species), crustaceans (26 species) and molluscs (23 species). A number of other less diverse phyla including bryozoans, echinoderms, phycophya, porifera, pyrrophycophyta and vertebrates were also present in the Port (Table 6).

CRYPTOGENIC SPECIES

Fourteen cryptogenic species were discovered in the Port of Napier (7.0% of all identified species). These organisms included one bryozoan, one crustacean, six sponges, one dinoflagellate and five ascidian species (Table 7). The cryptogenic organisms identified included nine Category 1 and five Category 2 species as defined in Section 2.9 above. Many of the Category 1 cryptogenic species (e.g. *Halichondria panacea*, *Aplidium phortax*, *Corella eumyota*, *Botrylliodes leachii* and *Asterocarpa cerea*) have probably been present in New Zealand for more than 100 years but have distributions outside New Zealand that suggest non-native origins (Cranfield et al. 1998).

NON-INDIGENOUS SPECIES

Ten non-indigenous species (NIS) were recorded from the Port of Napier (Table 8). NIS represented 5.0% of all identified species from this location. Two of these species - the polychaete *Spirobranchus polytrema* and the hydroid *Eudendrium generale* - were not previously known from New Zealand. The other NIS included a polychaete, three bryozoans, one mollusc, a macroalga and two ascidians.

A list of Chapman and Carlton's (1994) criteria (see Section 2.9.2) that were met by these non-indigenous species is given in Appendix 3. Below we summarise available information on the biology of each of these species, providing images where available, and indicate what is known about their distribution, habitat preferences and impacts. This information was sourced from published literature, the taxonomists listed in Appendix 1 and from regional databases on non-indigenous marine species in Australia (National Introduced Marine Pest Information System; http://www.crimp.marine.csiro.au/nimpis) and the USA (National Exotic Marine and Estuarine Species Information System; http://invasions.si.edu/nemesis).

Distribution maps for each NIS in the Port of Napier are composites of multiple replicate samples. Where overlayed presence and absence symbols occur on the map, this indicates the NIS was found in at least one, but not all replicates at that GPS location. NIS are presented below by phyla in the same order as Table 8.

Spirobranchus polytrema **(Philippi, 1844)**

No image available

Spirobranchus polytrema is a widely distributed serpulid tubeworm, with a recorded distribution from Australia, Lord Howe Island, Solomon Islands, Sri Lanka, Japan, the Indo-west Pacific and the Mediterranean. The type specimen for this species was recorded from the Mediterranean, but there is continued uncertainty over the synonomy of Mediterranean and Indo-Pacific forms of this species complex.

S. polytrema is most commonly found along the continental shelf, intertidal, rock bottom, and sublittoral habitats, and on the underside of stones around the low water mark (www.deh.gov.au/cgi-bin/abrs/fauna/). Its impacts are unknown. During the port baseline surveys, *S. polytrema* was recorded from the ports of Wellington, Napier and Dunedin (Table 10). In the Port of Napier it occurred in pile scrape samples taken from Higgins Wharf (Fig. 13).

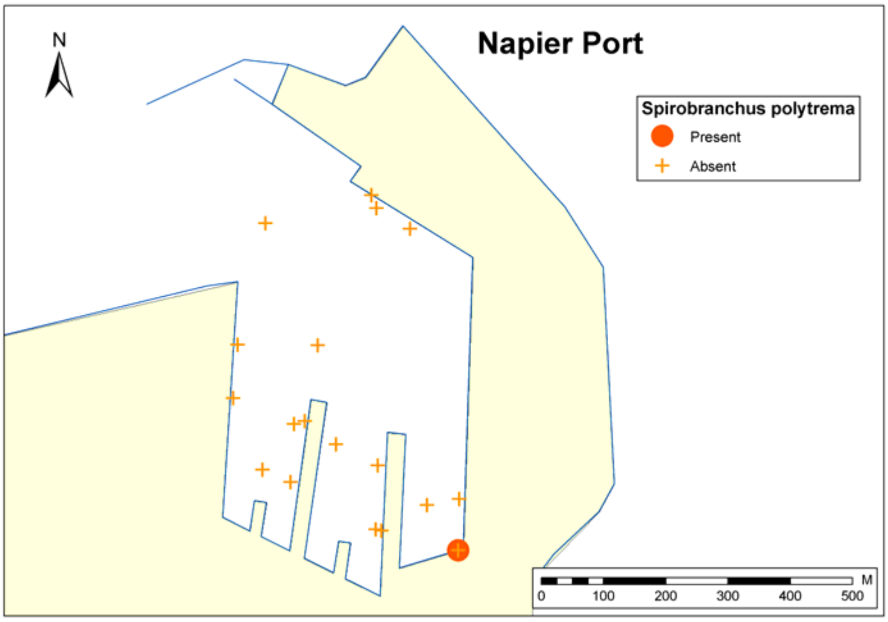

Figure 13: ***Spirobranchus polytrema*** **distribution in the Port of Napier**

Barantolla lepte **(Hutchings, 1974)**

No image available.

Barantolla lepte is a small polychaete worm in the family Capitellidae. It is found predominantly in estuarine sublittoral muds and weed beds. The type specimen for this species was described from New South Wales, Australia (Hutchings 1974). It is also known to occur in Victoria and Tasmania (Australian Faunal Directory 2005). The first New Zealand record of *B. lepte* was from the port of Timaru in 1998 (G. read, pers. comm.). During the baseline port surveys, it was recorded from the ports of Timaru, Napier and Taranaki. In the Port of Napier *B. lepte* occurred in benthic grab samples taken near Herrick and Higgins Wharves (Fig. 14).

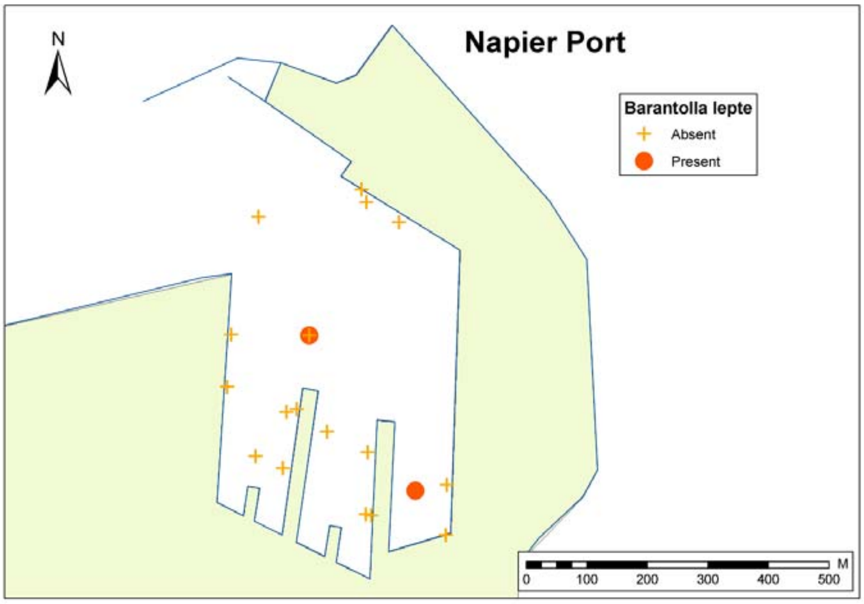

Figure 14: ***Barantolla lepte*** **distribution in the Port of Napier**

Bugula flabellata **(Thompson in Gray, 1847)**

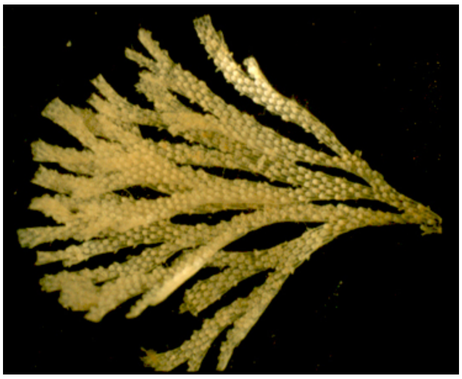

Image and information: NIMPIS (2002a)

Bugula flabellata is an erect bryozoan with broad, flat branches. It is a colonial organism and consists of numerous 'zooids' connected to one another. It is pale pink and can grow to about 4 cm high and attaches to hard surfaces such as rocks, pilings and pontoons or the shells of other marine organisms. It is often found growing with other erect bryozoan species such as *B. neritina* (see below) or growing on encrusting bryozoans. Vertical, shaded, sub-littoral rock surfaces also form substrata for this species. It has been recorded down to 35 m. *Bugula flabellata* is native to the British Isles and North Sea and has been introduced to Chile, Florida and the Caribbean and the northern east and west coasts of the USA, as well as Australia and New Zealand. It is cryptogenic on the Atlantic coasts of Spain, Portugal and France. *Bugula flabellata* is a major fouling bryozoan in ports and harbours, particularly on vessel hulls, pilings and pontoons and has also been reported from offshore oil platforms. *Bugula flabellata* has been present in New Zealand since at least 1949 and is present in most New Zealand ports. There have been no recorded impacts from *B. flabellata*. During the current baseline surveys it was recorded from Opua marina, Whangarei, Auckland, Tauranga, Napier, Taranaki, Wellington, Picton, Nelson, Lyttelton, Timaru, Dunedin and Bluff. In the Port of Napier *B. flabellata* occurred in pile scrape samples taken from the Cassidy, Geddis, Herrick and Higgins Wharves and in benthic sled samples taken near Herrick Wharf (Fig. 15).

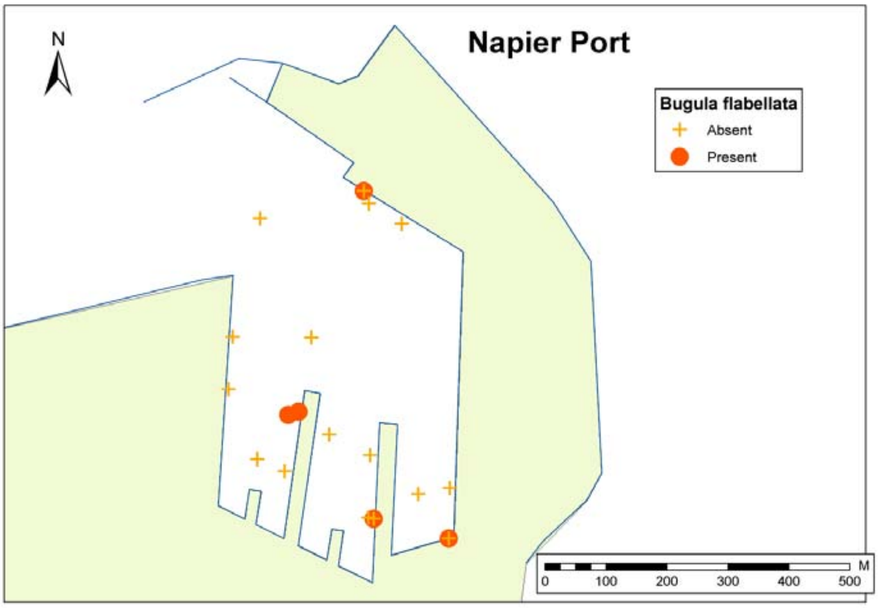

Figure 15: ***Bugula flabellata*** **distribution in the Port of Napier**

Bugula neritina **(Linnaeus, 1758)**

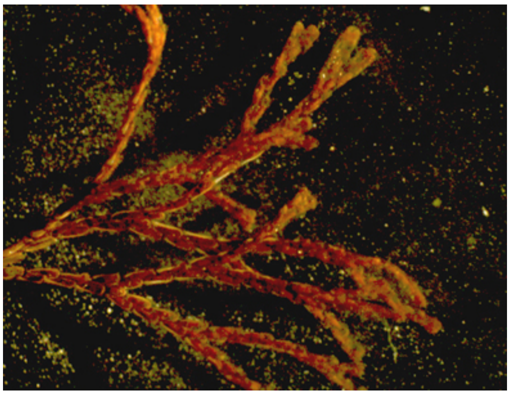

Image and information: NIMPIS (2002b)

Bugula neritina is an erect, bushy, red-purple-brown bryozoan. Branching is dichotomous (in series of two) and zooids alternate in two rows on the branches. Unlike all other species of *Bugula*, *B. neritina* has no avicularia (defensive structures) or spines, but there is a single pointed tip on the outer corner of zooids. Ovicells (reproductive structures) are large, globular and white. They often appear in such high numbers that they resemble small snails or beads. *Bugula neritina* is native to the Mediterranean Sea. It has been introduced to most of North America, Hawaii, India, the Japanese and China Seas, Australia and New Zealand. It is cryptogenic in the British Isles. *Bugula neritina* is one of the most abundant bryozoans in ports and harbours and an important member of the fouling community. The species colonises any available substratum and can form extensive monospecific growths. It grows well on pier piles, vessel hulls, buoys and similar submerged surfaces. It even grows heavily in ships' intake pipes and condenser chambers. In North America, *B. neritina* occurs on rocky reefs and seagrass leaves. In Australia, it occurs primarily on artificial substrata. *B. neritina* occurs in all New Zealand ports (Gordon & Matawari 1992). In the Port of Napier it occurred in pile scrape samples taken from Cassidy, Geddis, Herrick and Higgins Wharves and in benthic sled samples from near Geddis and Herrick Wharves (Fig. 16).

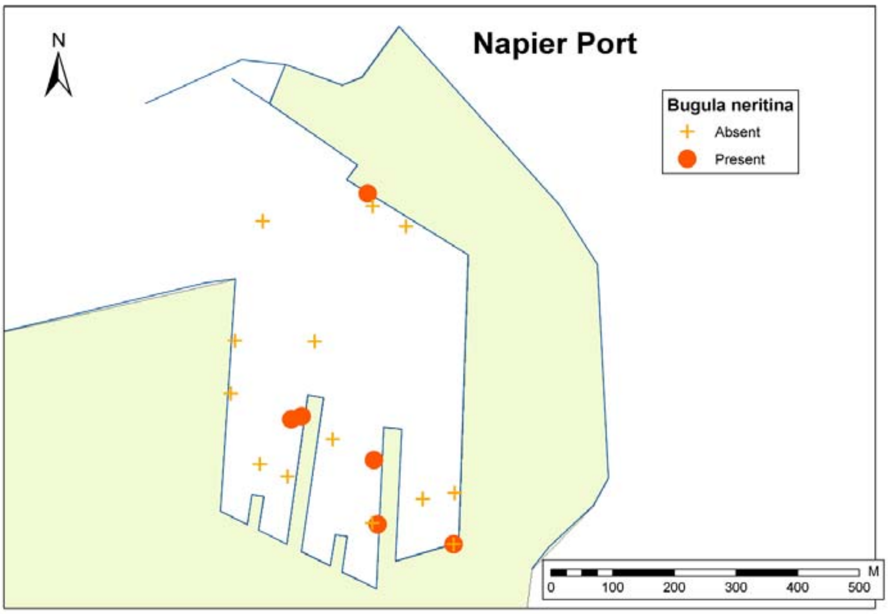

Figure 16: ***Bugula neritina*** **distribution in the Port of Napier**

Watersipora subtorquata **(d'Orbigny, 1842)**

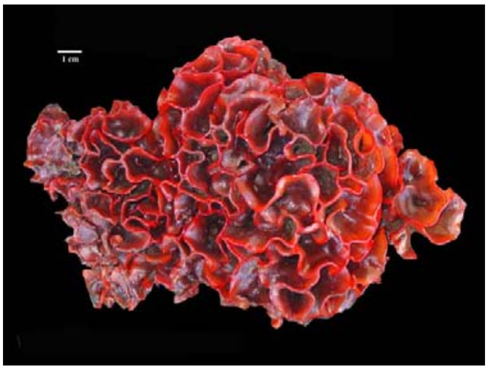

Image: California Academy of Sciences.
Information: Gordon and Matawari (1992)

Watersipora subtorquata is a loosely encrusting bryozoan capable of forming single or multiple layer colonies. The colonies are usually dark red-brown, with a black centre and a thin, bright red margin. The operculum is dark, with a darker mushroom shaped area centrally. *Watersipora subtorquata* has no spines, avicularia or ovicells. The native range of the species is unknown, but is thought to include the Wider Caribbean and South Atlantic. The type specimen was described from Rio de Janeiro, Brazil (Gordon and Matawari 1992). It also occurs in the north-west Pacific, Torres Strait and north-eastern and southern Australia.

W. subtorquata is an important marine fouling species in ports and harbours. It occurs on vessel hulls, pilings and pontoons. This species can also be found attached to rocks and seaweeds. They form substantial colonies on these surfaces, typically around the low water mark. *Watersipora subtorquata* is also an abundant fouling organism and is resistant to a range of antifouling toxins. It can therefore spread rapidly on vessel hulls and provide an area for other species to settle onto which can adversely impact on vessel maintenance and speed, as fouling assemblages can build up on the hull.

W. subtorquata has been present in New Zealand since at least 1982 and is now present in most ports from Opua to Bluff (Gordon and Matawari 1992). In the Port of Napier it occurred in pile scrape samples taken from Cassidy Wharf, Geddis Wharf, Herrick Wharf, and Higgins Wharf and a grab sample near Herrick Wharf (Fig. 17).

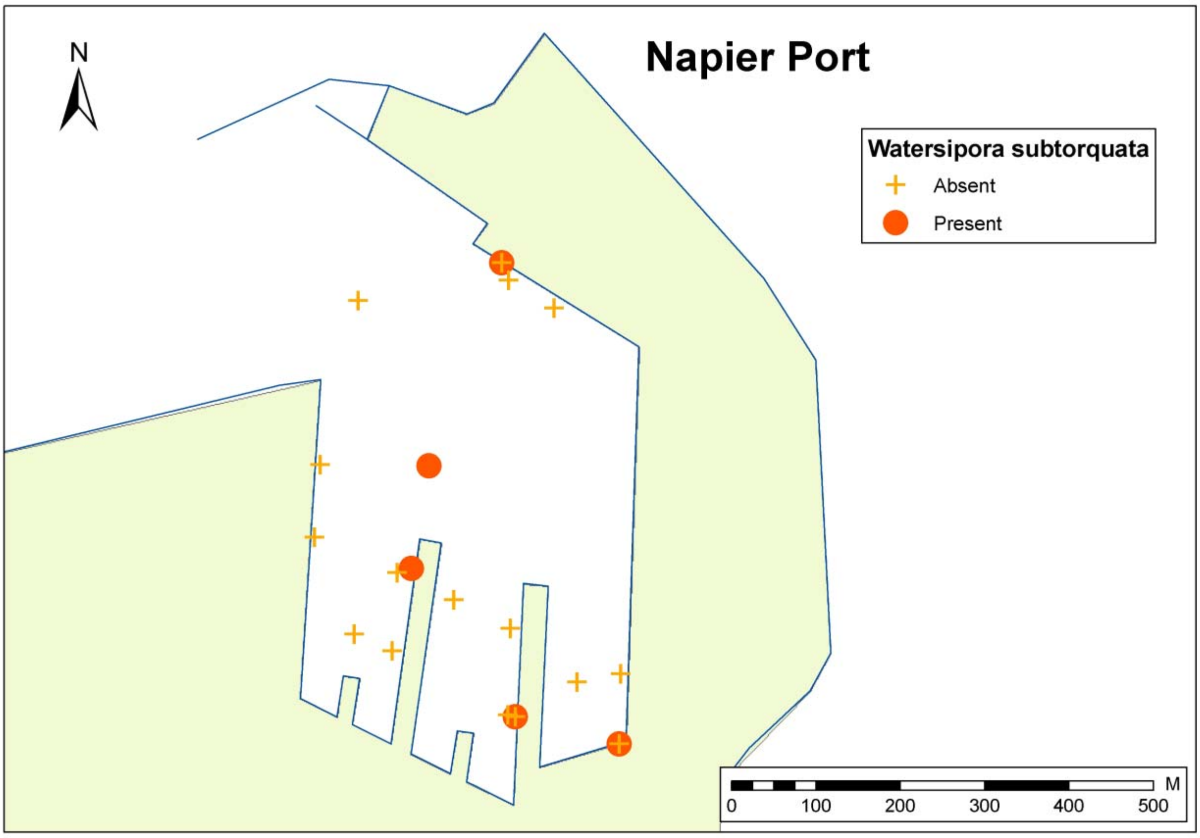

Figure 17: *Watersipora subtorquata* distribution in the Port of Napier

***Eudendrium generale* (Von Lendenfeld, 1885)**

No image available

Eudendrium generale is a small hydroid from the family Eudendriidae. It forms bushy, erect colonies, 2-30 cm high. *Eudendrium generale* typically occurs in the deep ocean or sheltered waters, often attached to calcareous bryozoa or rocks (Southcott and Thomas 1982). The type specimen was described from southern Australia, but it has also recently been reported from the Antarctic (Puce *et al.* 2004). The specimens obtained from the Port of Napier represent the first known records of this species in New Zealand. It occurred in pile scrape samples taken from Cassidy Wharf (Fig. 18).

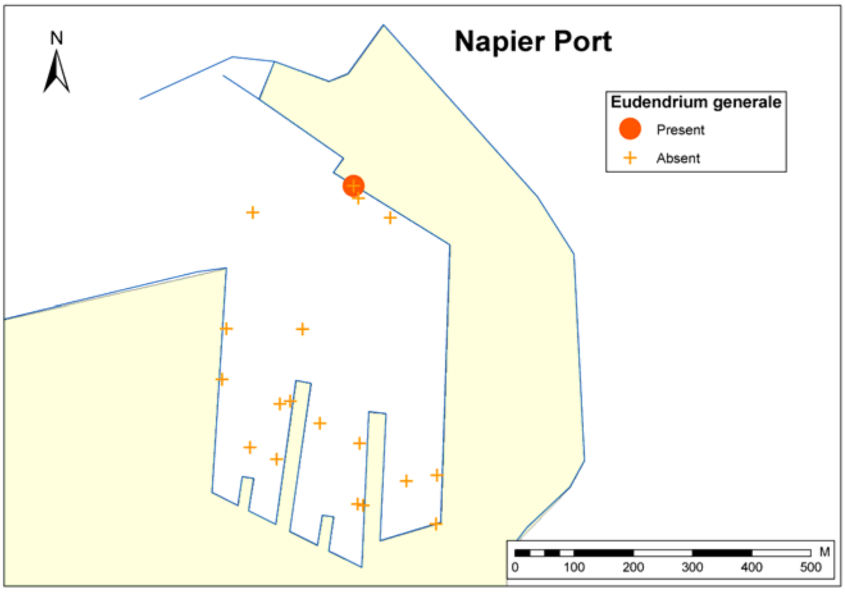

Figure 18: ***Eudendrium generale* distribution in the Port of Napier**

***Theora lubrica* (Gould, 1861)**

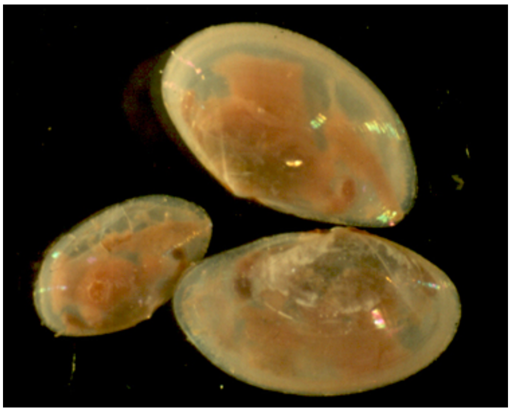

Image and information: NIMPIS (2002c)

Theora lubrica is a small bivalve with an almost transparent shell. The shell is very thin, elongated and has fine concentric ridges. *Theora lubrica* grows to about 15 mm in size, and is characterised by a fine elongate rib extending obliquely across the internal surface of the shell. *Theora lubrica* is native to the Japanese and China Seas. It has been introduced to the west coast of the USA, Australia and New Zealand. *Theora lubrica* typically lives in muddy sediments from the low tide mark to 50 m, however it has been found at 100 m. In many localities, *T. lubrica* is an indicator species for eutrophic and anoxic areas. *Theora lubrica* has been present in New Zealand since at least 1971. It occurs in estuaries of the north-east coast of the North Island, including the Bay of Islands, Whangarei Harbour, Waitemata Harbour, Wellington and Pelorus Sound. During the port baseline surveys, it was recovered from Opua, Whangarei port and marina, Gulf Harbour marina, Auckland, Gisborne, Napier, Taranaki, Wellington, Nelson, and Lyttelton. *Theora lubrica* occurred throughout benthic environments in the Port of Napier. It was present in benthic sled samples taken near Geddis, Herrick, Higgins, and Kirkpatrick Wharves and from benthic grab samples taken adjacent to Geddis, Herrick, Herrick end, Higgins, and Kirkpatrick Wharves (Fig. 19).

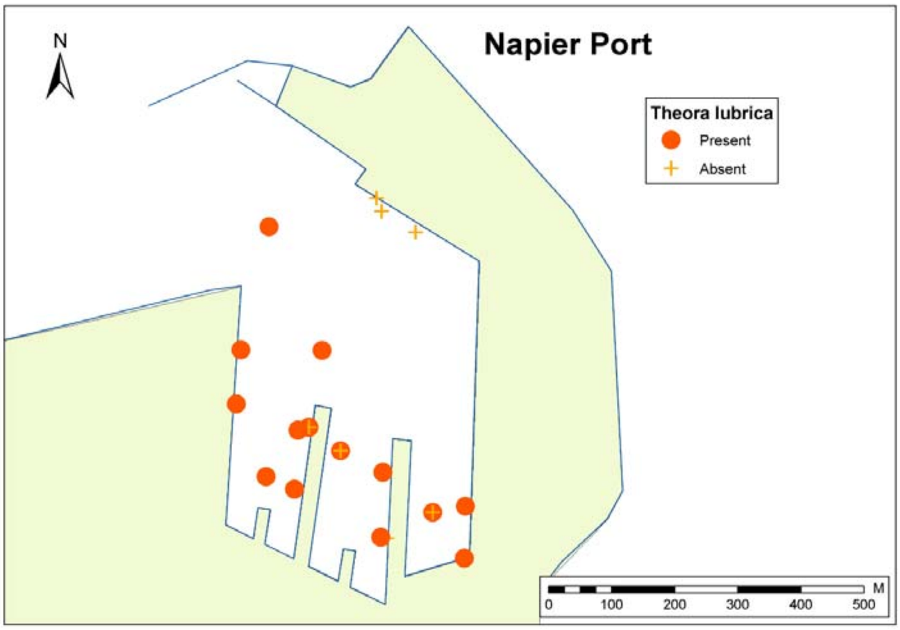

Figure 19: ***Theora lubrica*** **distribution in the Port of Napier**

Undaria pinnatifida **(Harvey Suringer, 1873)**

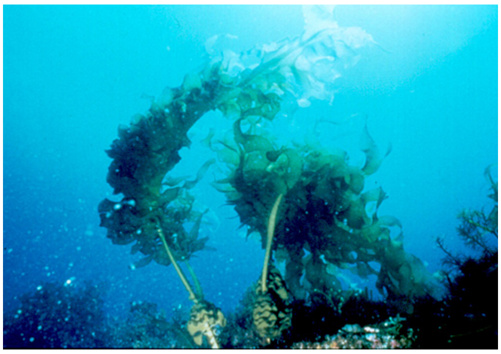

Image and information: NIMPIS (2002d); Fletcher and Farrell (1999)

Undaria pinnatifida is a brown seaweed that can reach an overall length of 1-3 metres. It is an annual species with two separate life stages; it has a large, "macroscopic" stage, usually present through the late winter to early summer months, and small, "microscopic" stage, present during the colder months. The macroscopic stage is golden-brown in colour, with a lighter coloured stipe with leaf-like extensions at the beginning of the blade and develops a distinctive convoluted structure called the "sporophyll" at the base during the reproductive season. It is this sporophyll that makes *Undaria* easily distinguishable from native New Zealand kelp species such as *Ecklonia radiata.* It is native to the Japan Sea and the northwest Pacific coasts of Japan and Korea and has been introduced to the Mediterranean and Atlantic coasts of France, Spain and Italy, the south coast of England, and parts of the coastline of Tasmania and Victoria (Australia), southern California and Argentina. It is cryptogenic on the coast of China.

Undaria pinnatifida is an opportunistic alga that has the ability to rapidly colonise disturbed or new surfaces. It grows from the intertidal zone down to the subtidal zone to a depth of 15-20 metres, particularly in sheltered reef areas subject to oceanic influence. It does not tend to become established successfully in areas with high wave action, exposure and abundant local vegetation. *Undaria pinnatifida* is highly invasive, grows rapidly and has the potential to overgrow and exclude native algal species. The effects on the marine communities it invades are not yet well understood, although its presence may alter the food resources of herbivores that would normally consume native species. In areas of Tasmania (Australia) it has become very common, growing in large numbers in areas where sea urchins have depleted stocks of native algae. It can also become a problem for marine farms by increasing labour costs due to fouling problems. *Undaria pinnatifida* is known to occur in a range of ports and marinas throughout eastern New Zealand, from Gisborne to Stewart Island (Sinner et al 2000). In the Port of Napier, *U. pinnatifida* was recorded in diver observations and pile scrape samples taken from Geddis and Herrick Wharves (Fig. 20).

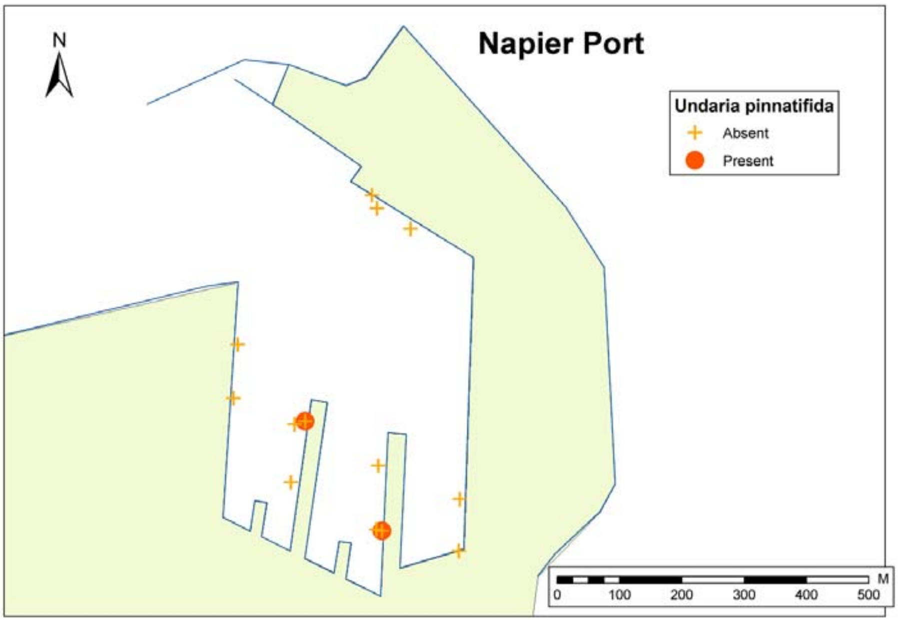

Figure 20: *Undaria pinnatifida* distribution in the Port of Napier

***Ciona intestinalis* (Linnaeus, 1767)**

Image and information: NIMPIS (2002e)

Ciona intestinalis is a solitary ascidian, commonly found in dense aggregations on rocks, algal holdfasts, seagrass, shells and artificial structures such as pylons, buoys and ships hulls. It usually hangs vertically upside-down in the water column, attached to hard surfaces. It is cylindrical, and 100-150 mm in length with distinctive inhalant and exhalant apertures (siphons) having yellow margins and orange/red spots. The body wall is generally soft and translucent with the internal organs visible. They can also be hard and leathery due to heavy fouling. Short projections (villi) at its base anchor the animal to the substratum.

The type specimen of *C. intestinalis* was described from Europe by Linnaeus 1767. It is thought to have been introduced to Chile and Peru, the northern west coast of the USA, equatorial West Africa and South Africa, Australia and New Zealand. *Ciona intestinalis* is considered cryptogenic to Alaska, the east coast of the USA and Canada, Greenland, Iceland, Japan, China and south east Asia. It is often found in enclosed and semi-protected marine embayments and estuaries and although it occurs in the low intertidal and shallow subtidal zones, *C. intestinalis* clearly decreases in abundance with depth. Australian populations appear to be in decline, disappearing from port areas where the species had previously dominated in the 1950s-1960s and the same phenomenon has been observed in New England, USA. Its high filtration rates and large numbers can reduce water turbidity and food availability in shallow waters and it can out-compete native species for food and space. Since it appeared in southern California in 1917, native species of ascidians previously found in the harbours have disappeared or have become much rarer. It is known to be a nuisance fouling species in aquaculture facilities such as mussel rope culture, oyster farms and suspended scallop ropes in Nova Scotia and other parts of North America, the Mediterranean, South Africa, Korea and Chile, and recently in the Marlborough Sounds, New Zealand. During the port baseline surveys it was recorded from the ports of Napier, Nelson, Lyttelton, and Timaru. In the Port of Napier *C. intestinalis* occurred in benthic sled samples taken near Higgins Wharf (Fig. 21).

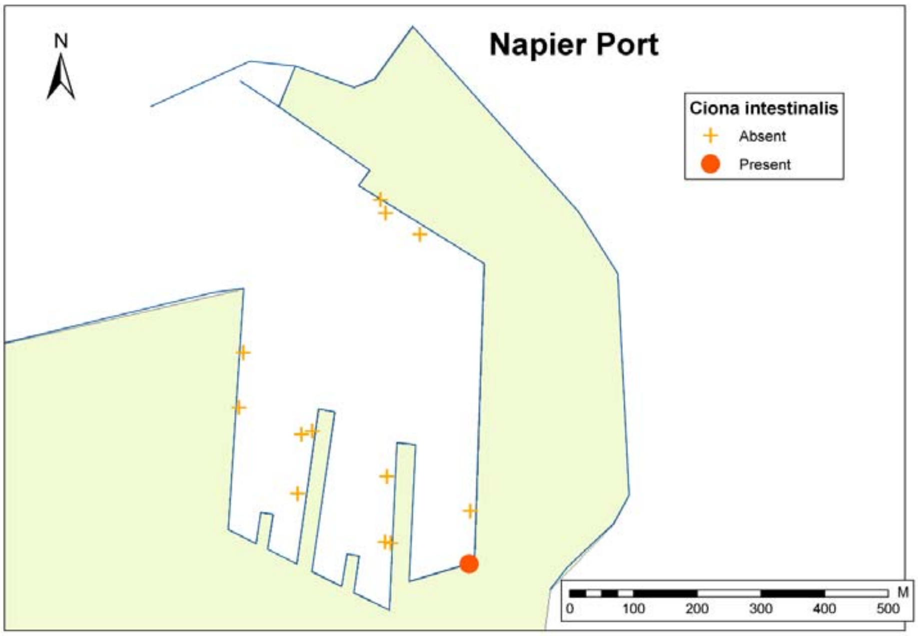

Figure 21: ***Ciona intestinalis*** **distribution in the Port of Napier**

Ascidiella aspersa **(Mueler, 1776)**

Image and information: NIMPIS (2002f).

Ascidiella aspersa is a solitary ascidian that is native to north-western Europe, the British Isles, the Mediterranean Sea and the north-west African coasts. It has been introduced to India, Australia and New Zealand, and is cryptogenic to the east coast of the USA. Ascidiella aspersa attaches to the substratum by its entire left side and grows up to 130 mm in length. The inhalant (branchial) siphon is positioned at the top of the body and is conical in shape. The exhalent (atrial) siphon is positioned around one third of the way down the body and both siphons are ridged. The body wall (test) is firm and is transparent with numerous papillae scattered over the surface. Small amounts of pink or orange may be visible inside the siphons. *Ascidiella aspersa* is found from intertidal to shallow subtidal waters to 50m depth, attached to clay, stones, rocks, algae and wharf piles, where it can be the dominant fouling species. In the southern hemisphere, populations are particularly abundant in the inner-reaches of estuaries and harbours in protected or semi-enclosed marine embayments. Although it is a solitary ascidian (i.e. not colonial) it is often found in dense clumps. During the baseline surveys it was recovered from the ports of Gisborne and Napier, and from Gulf Harbour Marina. It has no known documented impacts. In the Port of Napier, it occurred in pile scrape samples taken from Higgins Wharf (Fig. 22).

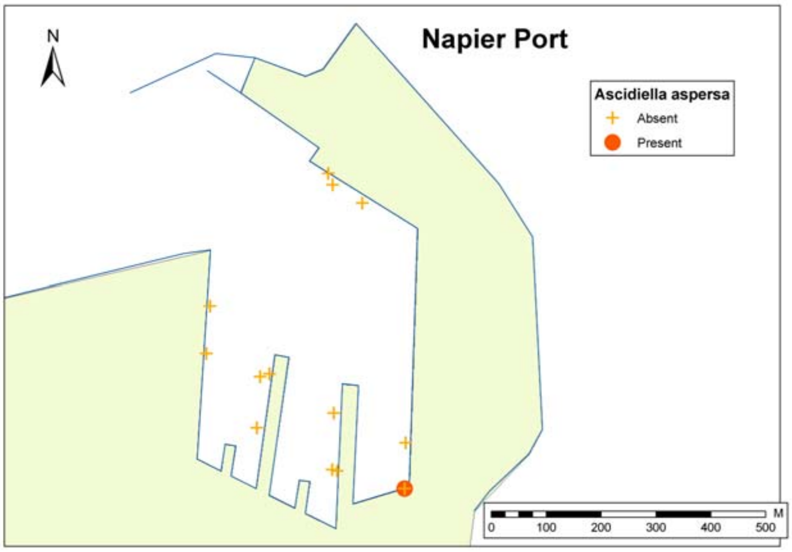

Figure 22: ***Ascidiella aspersa* distribution in the Port of Napier**

SPECIES INDETERMINATA

Fourty-one organisms from the Port of Napier were classified as species indeterminata. If each of these organisms is considered a species of unresolved identity, then together they represent 20.6 % of all species collected from this survey (Fig 11). Species indeterminata from the Port of Napier included 15 Annelida, two Cnidaria, four Crustacea, three Mollusca, 14 Phycophyta, two Urochordata and one Vertebrata species (Table 9).

NOTIFIABLE AND UNWANTED SPECIES

Of the ten non-indigenous species identified from the Port of Napier, only the Asian seaweed *Undaria pinnatifida* is currently listed as an unwanted species on either the New Zealand register of unwanted organisms (Table 5a), or the ABWMAC Australian list of pest species (Table 5b). Cysts of the toxin-producing dinoflagellate *Gymnodinium catenatum* were detected in sediment samples taken from the port entrance, near Geddis Wharf and in the central port basin. *Gymnodinium catenatum* is one of four toxic dinoflagellate species on the ABWMAC Australian list of pest species (Table 5b). It is considered cryptogenic in New Zealand.

PREVIOUSLY UNDESCRIBED SPECIES IN NEW ZEALAND

Seven species collected from the Port of Napier during this study had not previously been described from New Zealand waters. These species are classified either as Category 2 cryptogenics in Table 7, or are marked as new records in the non-indigenous species list (Table 8). Previously undescribed cryptogenic species included one species of crustacean, three sponges and one ascidian species (Table 7). The NIS that were previously unknown from New Zealand waters were the polychaete *Spirobranchus polytrema* (see section 3.3.1 above) and the hydroid *Eudendrium generale* (see section 3.3.6).

CYST-FORMING SPECIES

Resting cysts of six species of dinoflagellates (members of the Pyrrophycophyta) were collected during this survey in the Port of Napier. Five of these species are native dinoflagellates (Table 6). The sixth species - the cryptogenic dinoflagellate *Gymnodinium catenatum* – was detected in sediment samples taken from the port entrance, near Geddis Wharf and in the central port basin (Table 7). Toxins produced by the motile form of *G. catenatum* can cause Paralytic Shellfish Poisoning (PSP) and are a significant public health problem. Blooms of *G. catenatum* can cause problems for aquaculture and recreational harvesting of shellfish.

POSSIBLE VECTORS FOR THE INTRODUCTION OF NON-INDIGENOUS SPECIES TO THE PORT

The non-indigenous species located in the Port of Napier are thought to have arrived in New Zealand via international shipping. Table 8 indicates the possible vectors for the introduction of each NIS into the Port. Likely vectors of introduction are largely derived from Cranfield *et al.* (1998). Six of the ten non-indigenous species (60%) probably arrived via hull fouling, with 1 (10%) via ballast water and 3 (30%) could have arrived via either of these mechanisms.

COMPARISON WITH OTHER PORTS

Sixteen locations (13 ports and three marinas) were surveyed during the summers of 2001/2002 and 2002/2003 (Fig. 1). The total number of species identified in these surveys varied from 336 in the Port of Wellington to 56 in Whangarei town basin marina (Fig. 23a). The number of species recorded in each location reflects sampling effort (Table 3c), and local patterns of marine biodiversity within the ports and marinas. Sampling effort alone (expressed as the total number of registered samples in each port), accounted for significant proportions of variation in the numbers of native (linear regression; $F_{1,14} = 33.14$, $P < 0.001$, $R^2 = 0.703$), Cryptogenic 1 ($F_{1,14} = 5.94$, $P = 0.029$, $R^2 = 0.298$) and Cryptogenic 2 ($F_{1,14} = 7.37$, $P = 0.017$, $R^2 = 0.345$) species recorded in the different locations. However differing sampling effort between locations did not explain differences in the numbers of NIS found there ($F_{1,14} = 0.77$, $P = 0.394$, $R^2 = 0.052$). Largest numbers of NIS were reported from the ports of Lyttelton and Whangarei, but significantly more Cryptogenic 1 species were recorded in Whangarei port than in other surveyed locations (Fig 24c, Studentised residual = 3.87). Allowing for sampling effort, the Port of Napier had fewer NIS and cryptogenic species, and an average diversity of natives compared to other ports and marinas surveyed (Fig 24).

Native organisms represented over 60% of the species diversity sampled in each location, with a minimum contribution of 61% in the Port of Lyttelton and a maximum of 68.8% in Picton (Fig. 23b). Species indeterminata organisms represented between 10.6% and 25.2% of the sampled diversity in each location. Non-indigenous and category 1 and 2 cryptogenic species were present in each port and marina, although their relative contributions differed between locations (Fig. 23b). Non-indigenous species represented between 3.6% of all identified species in Bluff and 16.1% in Whangarei Marina. NIS comprised 5.0% of the total sampled diversity in the Port of Napier (Fig. 23b), ranking it 12th highest in percentage composition of NIS from the sixteen locations surveyed.

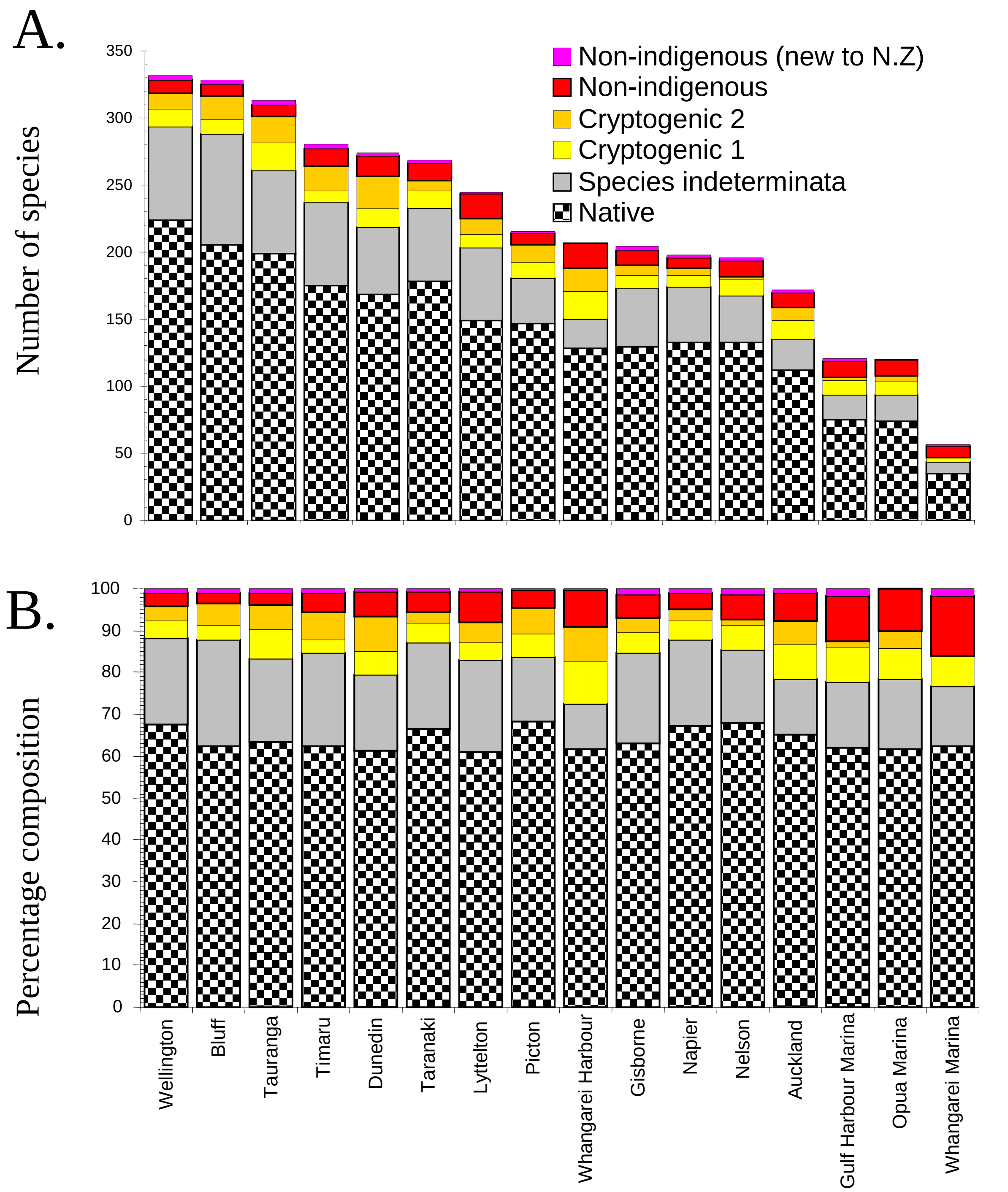

Figure 23: **Differences in (a) the number of species, and (b) the relative proportions of non-indigenous, cryptogenic, species indeterminata and native categories among the sixteen locations sampled over the summers of 2001 – 2002, and 2002-2003. Locations are presented in order of decreasing species diversity sampled.**

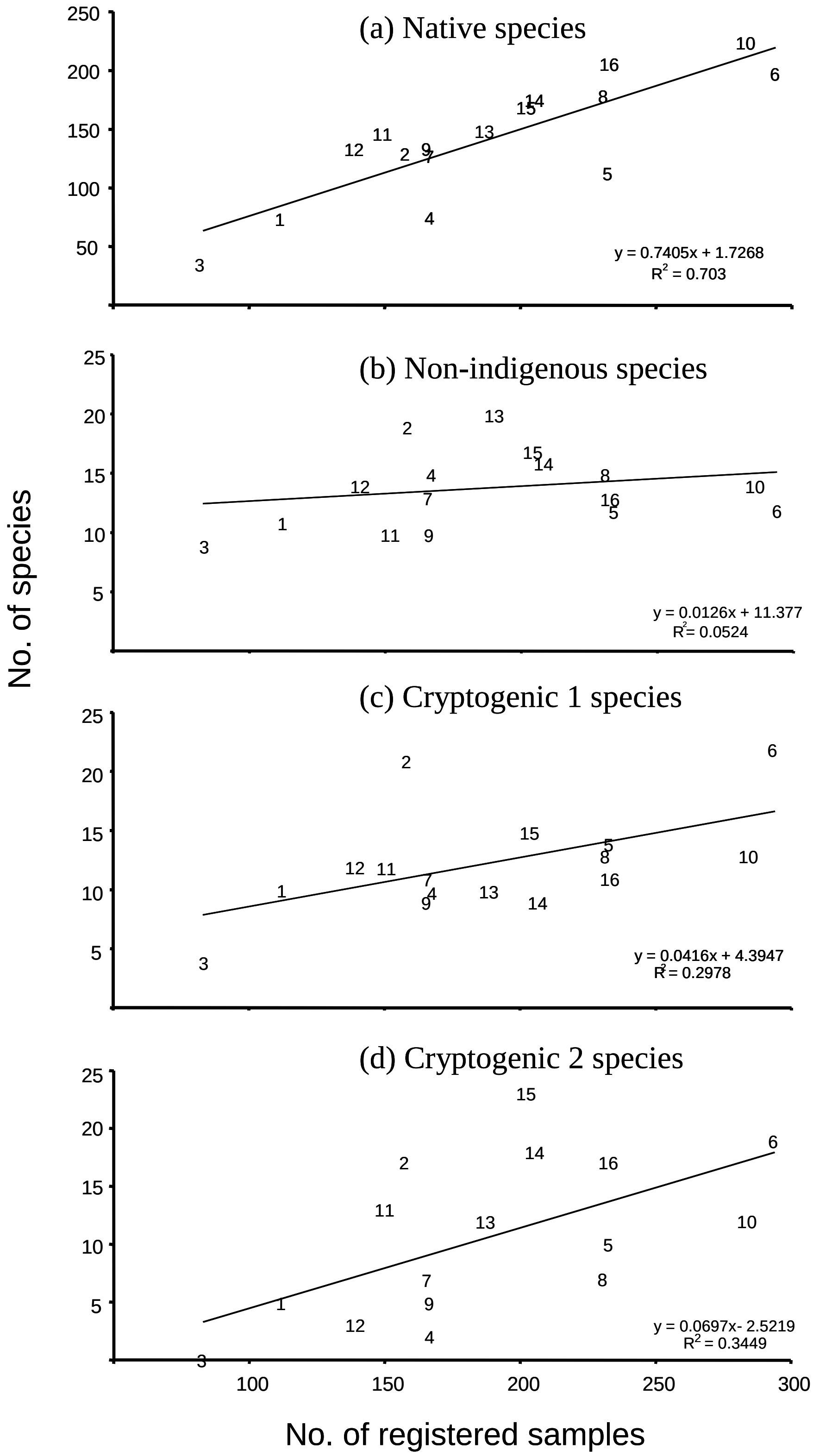

Figure 24: **Linear regression equations relating numbers of species detected to sample effort at the 16 locations surveyed nation-wide. Location codes are as follows; 1 = Opua Marina, 2 = Whangarei Port, 3 = Whangarei Marina, 4 = Gulf Harbour Marina, 5 = Auckland Port, 6 = Tauranga Port, 7 = Gisborne Port, 8 = Taranaki Port, 9 = Napier Port, 10 = Wellington Port, 11 = Picton Port, 12 = Nelson Port, 13 = Lyttelton Port, 14 = Timaru Port, 15 = Dunedin Port, 16 = Bluff Port**

Assessment of the risk of new introductions to the port

Many NIS introduced to New Zealand ports through hull fouling, ships' sea chests, or ballast water, do not survive to establish self-sustaining local populations. Those that do survive often come from coastlines that have similar marine environments to New Zealand. For example, approximately 80% of the marine NIS known to be present within New Zealand are native to temperate coastlines of Europe, the north-west Pacific, and southern Australia (Cranfield *et al*. 1998).

Commercial shipping arriving in the Port of Napier from overseas comes predominantly from temperate regions of the north-west Pacific (59%), Australia (8%) and north-east Pacific (8%) (Campbell 2004), environments which are broadly compatible with those in the Port of Napier. The port handles a wide variety of refrigerated cargo in container and bulk form, seafood, forestry products, oils and liquids, cement, fertiliser, and cars. However the Port of Napier receives relatively little ballast water. In 1999 it received the third lowest volume of reported ballast discharge (8,141 m^3) of the 16 New Zealand ports investigated (Inglis 2001). Ballast water came predominantly from Japan (49%), Australia (15%), China (10%) and Hong Kong (4%). Shipping from these regions presents an on-going risk of introduction of new NIS to the Port of Napier.

Assessment of translocation risk for non-indigenous species in the port

The Port of Napier is connected directly to the ports of Bluff and Gisborne by regular coastal shipping (> 1 visit per month) and is indirectly connected to most other domestic ports throughout mainland New Zealand (Dodgshun *et al.* 2004). The Port of Napier also serves as a regular staging post for fishing and cargo vessels visiting the Chatham Islands, due east of Christchurch. Given the presence of many non-indigenous and cryptogenic species in the Port of Napier, shipping connection to the Chatham Islands presents a high risk of translocation of these NIS to sensitive environments offshore.

Although many of the non-indigenous species found in the Port of Napier survey have been recorded previously in New Zealand, several species currently have relatively restricted New Zealand distributions. For example, the hydroid *Eudendrium generale* has so far only been reported from the Port of Napier, as a result of the current port survey. It is not known to occur elsewhere in New Zealand. Similarly, the polychaete worms *Barantolla lepte* (Napier, Taranaki and Timaru) and *Spirobranchus polytrema* (Napier, Wellington, and Dunedin) occur in only a few ports nationawide. Little is currently known about the ecology of these species, and there is no information on the risks they pose to New Zealand's native ecosystems and species.

The highly invasive alga, *Undaria pinnatifida* has been present in the Port of Napier since 1993 (Sinner et al 2000). It has been spread through shipping and other vectors to 11 of the 16 ports and marinas surveyed nationwide during the baseline surveys. The five surveyed locations where *U. pinnatifida* has not yet established are Opua Marina, Whangarei Port and Marina, Gulf Harbour Marina and Tauranga Port. A control programme in Bluff Harbour has subsequently removed populations established there in 1998. Nevertheless, vessels departing from the Port of Napier may pose a significant risk of spreading this species to ports within New Zealand that remain uninfested. The risk of translocation of *U. pinnatifida* and other fouling NIS is highest for slow-moving vessels, such as yachts and barges, and vessels that have long residence times in port. In Napier barges, recreational craft or seasonal fishing vessels that are laid up for significant periods of time pose a particular risk for the spread of these species.

Although no surveys for NIS have been undertaken in the Chatham Islands, it is thought to be relatively free of marine pests and its marine environments are valued for their fisheries productivity and unique biodiversity (including species endemic to the Chatham Islands). The invasive alga *Undaria pinnatifida*, which is present throughout the Port of Napier, has not yet established wild populations in the Chatham Islands, but has been the subject of a successful incursion response there (Wotton *et al.*). Shipping departing the port of Napier, particularly slow-moving barges, or vessels that have been laid up within Napier, poses a continuing threat of spreading this and other NIS to the Chatham Islands.

Management of existing non-indigenous species in the Port of Napier

Most of the NIS detected in this survey, with the possible exception of the *E. generale*, *S. polytrema* and *B. lepte*, appear to be well established in the port. It is unclear whether viable populations of these species have established in Napier, since fewer than three records of each species were made during the port survey. In the absence of further information on their ecology, it is also unclear whether these species pose sufficient risk to justify active management.

For most marine NIS eradication by physical removal or chemical treatment is not yet a cost-effective option. Many of the species recorded in the Port of Napier are widespread and local population controls are unlikely to be effective. Management should be directed toward preventing spread of species that are established in the Port of Napier to locations where they do not presently occur. Such management will require better understanding of the frequency of movements by vessels of different types from Napier to other domestic and international locations and improved procedures for hull maintenance and domestic ballast transfer by vessels leaving this port.

Prevention of new introductions

Interception of unwanted species transported by shipping is best achieved offshore, through control and treatment of ships destined for the Port of Napier from high-risk locations elsewhere in New Zealand or overseas. Under the Biosecurity Act 1993, the New Zealand Government has developed an Import Health Standard for ballast water that requires large ships to exchange foreign coastal ballast water with oceanic water prior to entering New Zealand, unless exempted on safety grounds. This procedure ("ballast exchange") does not remove all risk, but does reduce the abundance and diversity of coastal species that may be discharged with ballast. Ballast exchange requirements do not currently apply to ballast water that is uptaken domestically. Globally, shipping nations are moving toward implementing the International Convention for the Control and Management of Ships Ballast Water & Sediments that was recently adopted by the International Maritime Organisation (IMO). By 2016 all merchant vessels will be required to meet discharge standards for ballast water that are stipulated within the agreement.

Options are currently lacking, however, for effective in-situ treatment of biofouling and sea-chests. Biosecurity New Zealand has recently embarked on a national survey of hull fouling on vessels entering New Zealand from overseas. The study will characterise risks from this pathway (including high risk source regions and vessel types) and identify predictors of risk that may be used to manage problem vessels. Shipping companies and vessel owners can reduce the risk of transporting NIS in hull fouling or sea chests through regular maintenance and antifouling of their vessels.

Overseas studies have suggested that changes in trade routes can herald an influx of new NIS from regions that have not traditionally had major shipping links with the country or port (Carlton 1987). The growing number of baseline port surveys internationally and an associated increase in published literature on marine NIS means that information is becoming available that will allow more robust risk assessments to be carried out for new shipping routes. We recommend that port companies consider undertaking such assessments for their ports when new import or export markets are forecast to develop. The assessment would allow potential problem species to be identified and appropriate management and monitoring requirements to be put in place.

Conclusions and recommendations

The national biological baseline surveys have significantly increased our understanding of the identity, prevalence and distribution of introduced species in New Zealand's shipping ports. They represent a first step towards a comprehensive assessment of the risks posed to native coastal marine ecosystems from non-indigenous marine species. Although measures are being taken by the New Zealand government to reduce the rate of new incursions, foreign species are likely to continue being introduced to New Zealand waters by shipping, especially considering the lack of management options for hull fouling introductions. There is a need for continued monitoring of marine NIS in port environments to allow for (1) early detection and control of harmful or potentially harmful non-indigenous species, (2) to provide on-going evaluation of the efficacy of management activities, and (3) to allow trading partners to be notified of species that may be potentially harmful. Baseline inventories, like this one, facilitate the second and third of these two purposes. They become outdated when new introductions occur and, therefore, should be repeated on a regular basis to ensure they remain current. Hewitt and Martin (2001) recommend an interval of three to five years between repeat surveys.

The predominance of hull fouling as a likely introduction vector for NIS encountered in the Port of Napier (probably responsible for 60 to 80% of the NIS introductions) is consistent with previous findings from a range of overseas locations. For instance, Hewitt et al (1999) attributed the introduction of 77 % of the 99 NIS encountered in Port Phillip Bay (Australia) to hull fouling, and only 20 % to ballast water. Similarly, 61 % of the 348 marine and brackish water NIS established in the Hawaiian Islands are thought to have arrived on ships' hulls, but only 5 % in ballast water (Eldredge and Carlton 2002). However, ballast water is thought to be responsible for the introduction of 30 % of the 212 marine NIS established in San Fransisco Bay (USA), compared to 34 % for hull fouling (Cohen and Carlton 1995). The high percentages of NIS thought to have been introduced by hull fouling in Australasia may reflect the fact that hull fouling has a far longer history (~200 years) as an introduction vector than ballast water (~40 years; Hewitt et al. 1999). However, the fact that some of New Zealand and Australia's most recent marine NIS introductions (e.g. *Undaria pinnatifida*, *Codium fragile sp. tomentosoides*) have been facilitated by hull fouling suggests that it has remained an important transport mechanism (Cranfield et al 1998; Hewitt et al 1999).

Non-indigenous marine species can have a range of adverse impacts through interactions with native organisms. For instance, NIS can cause ecological impacts through competition, predator-prey interactions, hybridisation, parasitism or toxicity and can modify the physical environment through altering habitat structure (Ruiz et al 1999; Ricciardi 2001). Assessing the impact of a NIS in a given location ideally requires information on a range of factors, including the mechanism of their impact and their local abundance and distribution (Parker et al 1999). To predict or quantify NIS impacts over larger areas or longer time scales requires additional information on the species' seasonality, population size and mechanisms of dispersal (Mack et al 2000). Further studies may be warranted to establish the abundance and potential impacts of the non-indigenous species encountered in this port to determine if management actions are necessary or possible.

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Tables

Table 1: Berthage facilities in the Port of Napier.

Berth	Berth No.	Purpose	Construction	Length of Berth (m)	Depth (m below chart datum)
Cassidy (1)	1	Forestry/fertiliser	Concrete deck/concrete piles + steel sheet piling	250	11.3
Higgins (2)	2	Forestry/fertilizer/oil/diesel	Concrete deck/concrete piles, wooden fendering + sloped aggregate backfill	460	11.3
Geddis (3)	2	Meat/Produce	Concrete deck/wood piles	168	9.0
Herrick (4)	2	Meat/Produce/containers	Concrete deck/wood piles	187	9.8
Kirkpatrick (5)	2	Containers	North - Concrete deck/concrete piles+ graded aggregate backfill South - Concrete deck/concrete piles + wood fendering	360	10.4

Table 2. Comparison of survey methods used in this study with the CRIMP protocols (Hewitt and Martin 2001), indicating modifications made to the protocols following recommendations from a workshop of New Zealand scientists. Full details of the workshop recommendations can be found in Gust et al. (2001).

	CRIMP Protocol		NIWA Method		
Taxa sampled	Survey method	Sample procedure	Survey method	Sample procedure	Notes
Dinoflagellate cysts	Small hand core	Cores taken by divers from locations where sediment deposition occurs	TFO Gravity core ("javelin" core)	Cores taken from locations where sediment deposition occurs	Use of the javelin core eliminated the need to expose divers to unnecessary hazards (poor visibility, snags, boat movements, repetitive dives > 10 m). It is a method recommended by the WESTPAC/IOC Harmful Algal Bloom project for dinoflagellate cyst collection (Matsuoka and Fukuyo 2000)
Benthic infauna	Large core	3 cores close to (0 m) and 3 cores away (50 m) from each berth	Shipek benthic grab	3 cores within 10 m of each sampled berth and at sites in the port basin	Use of the benthic grab eliminated need to expose divers to unnecessary hazards (poor visibility, snags, boat movements, repetitive dives > 10 m).
Dinoflagellates	20um plankton net	Horizontal and vertical net tows	Not sampled	Not sampled	Plankton assemblages spatially and temporally variable, time-consuming and difficult to identify to species. Workshop recommended using resources to sample other taxa more comprehensively
Zooplankton and/ phytoplankton	100 um plankton net	Vertical net tow	Not sampled	Not sampled	Plankton assemblages spatially and temporally variable, time-consuming and difficult to identify to species. Workshop recommended using resources to sample other taxa more comprehensively
Crab/shrimp	Baited traps	3 traps of each kind left overnight at each site	Baited traps	4 traps (2 line x 2 traps) of each kind left overnight at each site	

Taxa sampled	CRIMP Protocol Survey method	 Sample procedure	NIWA Method Survey method	 Sample procedure	Notes
Macrobiota	Qualitative visual survey	Visual searches of wharves & breakwaters for target species	Qualitative visual survey	Visual searches of wharves & breakwaters for target species	
Sedentary / encrusting biota	Quadrat scraping	0.10 m2 quadrats sampled at -0.5 m, -3.0 m and -7.0 m on 3 outer piles per berth	Quadrat scraping	0.10 m2 quadrats sampled at -0.5 m, -1.5 m, -3.0 m and -7 m on 2 inner and 2 outer piles per berth	Workshop recommended extra quadrat in high diversity algal zone (-1.5 m) and to sample inner pilings for shade tolerant species
Sedentary / encrusting biota	Video / photo transect	Video transect of pile/rockwall facing. Still images taken of the three 0.10 m2 quadrats	Video / photo transect	Video transect of pile/rockwall facing. Still images taken of the four 0.10 m2 quadrats	
Mobile epifauna	Beam trawl or benthic sled	1 x 100 m or timed trawl at each site	Benthic sled	2 x 100 m (or 2 min.) tows at each site	
Fish	Poison station	Divers & snorkelers collect fish from poison stations	Opera house fish traps	4 traps (2 lines x 2 traps) left for min. 1 hr at each site	Poor capture rates anticipated from poison stations because of low visibility in NZ ports. Some poisons also an OS&H risk to personnel and may require resource consent.
Fish/mobile epifauna	Beach seine	25 m seine haul on sand or mud flat sites	Opera house fish traps / Whayman Holdsworth starfish traps	4 traps (2 lines x 2 traps) of left at each site (Whayman Holdworth starfish traps left overnight)	Few NZ ports have suitable intertidal areas to beach seine.

Table 3a: Summary of the Port of Napier sampling effort.

Sample method	Number of shipping berths sampled	Number of replicate samples taken
Benthic Sled Tows	5	10
Benthic Grab (Shipek)	5	15
Box traps	5	18
Diver quadrat scraping	4	59
Opera house fish traps	5	20
Starfish traps	5	18
Shrimp traps	5	18
Javelin cores	N/A	8

Table 3b: Pile scraping sampling effort in the Port of Napier. Number of replicate quadrats scraped on Outer (unshaded) and Inner (shaded) pier piles at four depths. Pile materials scraped are indicated. Miscellaneous samples are opportunistic additional specimens collected from piles outside of the scraped quadrat areas.

Sample Depth (M)	Outer Piles	Inner Piles
0.5	2 concrete, 6 wood	8 concrete
1.5	2 concrete, 6 wood	8 concrete
3.5	2 concrete, 6 wood	8 concrete
7	2 concrete, 6 wood	2 concrete
Miscellaneous	0	1 concrete

Table 3c: Summary of sampling effort in Ports and Marinas surveyed during the austral summers of 2001-2002 (shown in bold type), and 2002-2003 (shown in plain type). The number of shipping berths sampled is indicated, along with the total numbers of samples taken (in brackets).

Survey Location	Benthic sled tows	Benthic grab	Box traps	Diver quadrat scraping	Opera house traps	Starfish traps	Shrimp traps	Javelin cores
Port of Lyttelton	5 (10)	5 (15)	6 (20)	5 (77)	5 (20)	6 (20)	6 (19)	(8)
Port of Nelson	4 (8)	1 (2) *	4 (16)	4 (55)	4 (16)	4 (16)	4 (16)	(8)
Port of Picton	3 (6)	*	3 (18)	3 (53)	3 (16)	3 (24)	3 (24)	(6)
Port of Taranaki	6 (12)	6 (21)	7 (25)	4 (66)	6 (24)	6 (24)	6 (24)	(14)
Port of Tauranga	6 (18)	6 (28)	8 (32)	6 (107)	6 (25)	7 (28)	7 (28)	(8)
Port of Timaru	6 (12)	4 (14)	5 (20)	4 (58)	5 (20)	5 (20)	5 (20)	(8)
Port of Wellington	7 (13)	6 (18)	7 (28)	6 (98)	7 (34)	7 (28)	7 (28)	(6)
Port of Auckland	6 (12)	6 (18)	6 (24)	6 (101)	6 (24)	6 (24)	5 (20)	(10)
Port of Bluff	6 (21)	7 (21)	7 (29)	5 (75)	6 (24)	7 (28)	7 (24)	(12)
Dunedin Harbour	5 (10)	5 (15)	5 (20)	5 (75)	5 (20)	5 (20)	5 (18)	(9)
Port of Gisborne	5 (10)	6 (18)	5 (20)	4 (50)	5 (20)	5 (20)	5 (20)	(8)
Gulf Harbour Marina	(17)	4 (12)	4 (16)	4 (66)	4 (16)	4 (16)	4 (16)	(8)
Port of Napier	5 (10)	5 (15)	5 (18)	4 (59)	5 (20)	5 (18)	5 (18)	(8)
Opua Marina	(10)	4 (12)	4 (12)	4 (46)	4 (8)	4 (8)	4 (8)	(8)
Whangarei Marina	3 (6)	2 (6)	2 (8)	4 (33)	2 (8)	2 (8)	2 (8)	(6)
Whangarei Harbour	4 (9)	4 (12)	4 (16)	4 (65)	4 (16)	4 (16)	4 (16)	(7)

* Shipek grab malfunctioned in the Ports of Nelson and Picton

Table 4: Preservatives used for the major taxonomic groups of organisms collected during the port survey. [1] indicates photographs were taken before preservation, and [2] indicate they were relaxed in magnesium chloride or menthol prior to preservation.

5 % Formalin solution	10 % Formalin solution	70 % Ethanol solution	Air dried
Phycophyta	Asteroidea	Alcyonacea [2]	Bryozoa
	Brachiopoda	Ascidiacea [1, 2]	
	Crustacea (large)	Crustacea (small)	
	Ctenophora [1]	Holothuria [1, 2]	
	Echinoidea	Mollusca (with shell)	
	Hydrozoa	Mollusca [1, 2] (without shell)	
	Nudibranchia [1]	Platyhelminthes [1]	
	Ophiuroidea	Porifera [1]	
	Polychaeta	Zoantharia [1, 2]	
	Scleractinia		
	Scyphozoa [1, 2]		
	Vertebrata [1] (pisces)		

Table 5a: Marine pest species listed on the New Zealand register of unwanted organisms under the Biosecurity Act 1993.

Phylum	Class/Order	Genus and Species
Annelida	Polychaeta	*Sabella spallanzanii*
Arthropoda	Decapoda	*Carcinus maenas*
Arthropoda	Decapoda	*Eriocheir sinensis*
Echinodermata	Asteroidea	*Asterias amurensis*
Mollusca	Bivalvia	*Potamocorbula amurensis*
Phycophyta	Chlorophyta	*Caulerpa taxifolia*
Phycophyta	Phaeophyceae	*Undaria pinnatifida*

Table 5b: Marine pest species listed on the Australian Ballast Water Management Advisory Council's (ABWMAC) schedule of non-indigenous pest species.

Phylum	Class/Order	Genus and Species
Annelida	Polychaeta	*Sabella spallanzanii*
Arthropoda	Decapoda	*Carcinus maenas*
Echinodermata	Asteroidea	*Asterias amurensis*
Mollusca	Bivalvia	*Corbula gibba*
Mollusca	Bivalvia	*Crassostrea gigas*
Mollusca	Bivalvia	*Musculista senhousia*
Phycophyta	Dinophyceae	*Alexandrium catenella*
Phycophyta	Dinophyceae	*Alexandrium minutum*
Phycophyta	Dinophyceae	*Alexandrium tamarense*
Phycophyta	Dinophyceae	*Gymnodinium catenatum*

Table 6: Native species recorded from the Port of Napier survey.

Phylum, Class	Order	Family	Genus and species
Annelida			
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea australiensis*
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos loveni*
Polychaeta	Eunicida	Eunicidae	*Eunice australis*
Polychaeta	Eunicida	Eunicidae	*Lysidice ninetta*
Polychaeta	Eunicida	Lumbrineridae	*Abyssoninoe galatheae*
Polychaeta	Eunicida	Lumbrineridae	*Lumbricalus aotearoae*
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris sphaerocephala*
Polychaeta	Phyllodocida	Glyceridae	*Glycera lamelliformis*
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus angustifrons*
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus verrilli*
Polychaeta	Phyllodocida	Nereididae	*Neanthes kerguelensis*
Polychaeta	Phyllodocida	Nereididae	*Nereis falcaria*
Polychaeta	Phyllodocida	Nereididae	*Perinereis camiguinoides*
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia capensis*
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus jacksoni*
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus polychromus*
Polychaeta	Phyllodocida	Sigalionidae	*Labiosthenolepis laevis*
Polychaeta	Sabellida	Oweniidae	*Owenia petersenae*
Polychaeta	Sabellida	Sabellidae	*Branchiomma curta*
Polychaeta	Sabellida	Sabellidae	*Demonax aberrans*
Polychaeta	Sabellida	Sabellidae	*Megalomma suspiciens*
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla alba*
Polychaeta	Sabellida	Serpulidae	*Galeolaria hystrix*
Polychaeta	Sabellida	Serpulidae	*Spirobranchus cariniferus*
Polychaeta	Scolecida	Opheliidae	*Armandia maculata*
Polychaeta	Scolecida	Scalibregmatidae	*Hyboscolex longiseta*
Polychaeta	Spionida	Spionidae	*Boccardia lamellata*
Polychaeta	Terebellida	Acrocirridae	*Acrocirrus trisectus*
Polychaeta	Terebellida	Ampharetidae	*Ampharete kerguelensis*
Polychaeta	Terebellida	Cirratulidae	*Chaetozone Chaetozone-1*
Polychaeta	Terebellida	Cirratulidae	*Timarete anchylochaetus*
Polychaeta	Terebellida	Flabelligeridae	*Pherusa parmata*
Polychaeta	Terebellida	Pectinariidae	*Pectinaria australis*
Polychaeta	Terebellida	Terebellidae	*Nicolea armilla*
Polychaeta	Terebellida	Terebellidae	*Pista pegma*
Polychaeta	Terebellida	Terebellidae	*Pseudopista rostrata*
Polychaeta	Terebellida	Terebellidae	*Streblosoma toddae*

Phylum, Class	Order	Family	Genus and species
Bryozoa			
Gymnolaemata	Cheilostomata	Beaniidae	*Beania n.sp.*
Gymnolaemata	Cheilostomata	Beaniidae	*Beania plurispinosa*
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula dentata*
Gymnolaemata	Cheilostomata	Candidae	*Caberea rostrata*
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperiopsis cervicornis*
Stenolaemata	Cyclostomata	Crisiidae	*Crisia tenuis*
Crustacea			
Cirripedia	Thoracica	Balanidae	*Austrominius modestus*
Cirripedia	Thoracica	Chthamalidae	*Chaemosipho columna*
Malacostraca	Amphipoda	Aoridae	*Haplocheira barbimana*
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine pacifica*
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe trailli*
Malacostraca	Amphipoda	Phoxocephalidae	*Torridoharpinia hurleyi*
Malacostraca	Anomura	Paguridae	*Pagurus albidianthus*
Malacostraca	Anomura	Paguridae	*Pagurus novizealandiae*
Malacostraca	Anomura	Porcellanidae	*Petrolisthes novaezelandiae*
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus cookii*
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus innominatus*
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus varius*
Malacostraca	Brachyura	Hymenosomatidae	*Hymenosoma depressum*
Malacostraca	Brachyura	Majidae	*Notomithrax minor*
Malacostraca	Brachyura	Ocypodidae	*Macrophthalmus hirtipes*
Malacostraca	Brachyura	Pinnotheridae	*Pinnotheres novaezelandiae*
Malacostraca	Brachyura	Portunidae	*Nectocarcinus antarcticus*
Malacostraca	Brachyura	Xanthidae	*Pilumnus lumpinus*
Malacostraca	Brachyura	Xanthidae	*Pilumnus novaezelandiae*
Malacostraca	Caridea	Crangonidae	*Pontophilus australis*
Malacostraca	Caridea	Palemonidae	*Periclimenes yaldwyni*
Malacostraca	Isopoda	Cirolanidae	*Natatolana narica*
Malacostraca	Isopoda	Cirolanidae	*Natatolana rossi*
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma campbellensis*
Malacostraca	Isopoda	Sphaeromatidae	*Sphaeroma laurensi*
Malacostraca	Palinura	Palinuridae	*Jasus edwardsi*
Echinodermata			
Asteroidea	Valvatida	Asterinidae	*Patiriella regularis*
Echinoidea	Spatangoida	Loveniidae	*Echinocardium cordatum*
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus mollis*

Phylum, Class	Order	Family	Genus and species
Mollusca			
Bivalvia	Myoida	Hiatellidae	*Hiatella arctica*
Bivalvia	Mytiloida	Mytilidae	*Aulacomya maoriana*
Bivalvia	Mytiloida	Mytilidae	*Modiolarca impacta*
Bivalvia	Mytiloida	Mytilidae	*Perna canaliculus*
Bivalvia	Mytiloida	Mytilidae	*Trichomusculus barbatus*
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus pulex*
Bivalvia	Nuculoida	Nuculidae	*Nucula nitidula*
Bivalvia	Ostreoida	Anomiidae	*Pododesmus zelandicus*
Bivalvia	Ostreoida	Ostreidae	*Ostrea chilensis*
Bivalvia	Pterioida	Pectinidae	*Talochlamys zelandiae*
Bivalvia	Veneroida	Semelidae	*Leptomya retiaria*
Bivalvia	Veneroida	Veneridae	*Irus reflexus*
Bivalvia	Veneroida	Veneridae	*Tawera spissa*
Gastropoda	Cephalaspidea	Philinidae	*Philine auriformis*
Gastropoda	Littorinimorpha	Calyptraeidae	*Maoricrypta sodalis*
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella novaezelandiae*
Gastropoda	Littorinimorpha	Turritellidae	*Maoricolpus roseus*
Gastropoda	Neogastropoda	Buccinidae	*Cominella adspersa*
Gastropoda	Neogastropoda	Muricidae	*Xymene plebeius*
Gastropoda	Nudibranchia	Chromodorididae	*Chromodoris aureomarginata*
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris lanuginata*
Gastropoda	Vetigastropoda	Fissurellidae	*Tugali suteri*
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus porosus*
Phycophyta			
Rhodophyceae	Ceramiales	Ceramiaceae	*Anotrichium crinitum*
Rhodophyceae	Ceramiales	Deleseriaceae	*Apoglossum montagneanum*
Rhodophyceae	Ceramiales	Delesseriaceae	*Caloglossa leprieurii*
Rhodophyceae	Plocamiales	Plocamiaceae	*Plocamium cirrhosum*
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria caespitosa*
Porifera			
Demospongiae	Dendrocertatida	Dictyodendrillidae	*Dictyodendrilla dendyi*
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia cf. arenaria*
Demospongiae	Hadromerida	Suberitidae	*Homaxinella erecta*
Demospongiae	Haplosclerida	Chalinidae	*Adocia cf. parietalioides*
Pyrrophycophyta			

Phylum, Class	Order	Family	Genus and species
Dinophyceae	Gymnodiniales	Gymnodiniacea	*Cochlodinium sp.*
Dinophyceae	Peridiniales	Gonyaulacaceae	*Gonyaulax grindleyi*
Dinophyceae	Peridiniales	Peridiniaceae	*Lingulodinium polyedrum*
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium sp.*
Dinophyceae	Peridiniales	Peridiniaceae	*Scrippsiella trochoidea*
Urochordata			
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum notti*
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium adamsi*
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula mortenseni*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura cancellata*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura carnea*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura pulla*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura rugata*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura subuculata*
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa coerulea*
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa bicornuta*
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa nisiotus*
Vertebrata			
Actinopterygii	Anguilliformes	Congridae	*Conger wilsoni*
Chondrichthyes	Carcharhiniformes	Triakidae	*Galeorhinus australis*
Actinopterygii	Gadiformes	Moridae	*Lotella rhacinus*
Actinopterygii	Gadiformes	Moridae	*Pseudophycis bachus*
Actinopterygii	Mugiliformes	Mugilidae	*Parapercis colias*
Actinopterygii	Perciformes	Carangidae	*Caranx georgianus*
Actinopterygii	Perciformes	Carangidae	*Trachurus novaezelandiae*
Actinopterygii	Perciformes	Cheilodactylidae	*Nemadactylus macropterus*
Actinopterygii	Perciformes	Labridae	*Notolabrus celidotus*
Actinopterygii	Perciformes	Labridae	*Notolabrus fucicola*
Actinopterygii	Perciformes	Labridae	*Notolabrus miles*
Actinopterygii	Perciformes	Scorpidinae	*Scorpis lineolata*
Actinopterygii	Perciformes	Sparidae	*Pagrus auratus*
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina capito*

Table 7. Cryptogenic marine species recorded from the Port of Napier survey. Category 1 cryptogenic species (C1); Category 2 cryptogenic species (C2). Refer to section 2.9 for definitions.

Phylum, Class	Order	Family	Genus and species	
Bryozoa				
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia ambigua*	C1
Crustacea				
Malacostraca	Amphipoda	Lysianassidae	*Orchomene sp. aff. O. aahu*	C2
Porifera				
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia n. sp. 2*	C2
Demospongiae	Halichondrida	Halichondriidae	*Amorphinopsis n. sp. 1*	C2
Demospongiae	Halichondrida	Halichondriidae	*Halichondria panicea*	C1
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia ramosa*	C1
Demospongiae	Poecilosclerida	Ancinoiidae	*Crella (Pytheas) incrustans*	C1
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella n. sp. 1*	C2
Pyrrophycophyta				
Dinophyceae	Gymnodiniales	Gymnodiniacea	*Gymnodinium catenatum*	C1
Urochordata				
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium phortax*	C1
Ascidiacea	Phlebobranchia	Pyuridae	*Microcosmus squamiger*	C2
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella eumyota*	C1
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes leachii*	C1
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa cerea*	C1

Table 8: Non-indigenous marine species recorded from the Port of Napier survey. Likely vectors of introduction are largely derived from Cranfield et al (1998), where H = Hull fouling and B = Ballast water transport. Novel NIS not listed in Cranfield et al (1998) or previously encountered by taxonomic experts in New Zealand waters are marked as New Records (NR). For these species and others for which information is scarce, we provide dates of first detection rather than probable dates of introduction.

Phylum, Class	Order	Family	Genus and species	Probable means of introduction	Date of introduction or detection (d)
Annelida					
Polychaeta	Sabellida	Serpulidae	*Spirobranchus polytrema* **(NR)**	H	Nov. 2001 [d]
Polychaeta	Scolecida	Capitellidae	*Barantolla lepte*	H or B	Unknown [1]
Bryozoa					
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula flabellata*	H	Pre-1948
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula neritina*	H	1949
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora subtorquata*	H or B	Pre-1982
Cnidaria					
Hydrozoa	Hydroida	Eudendriidae	*Eudendrium generale* **(NR)**	H[2]	Jan. 2003 [d]
Mollusca					
Bivalvia	Veneroida	Semelidae	*Theora lubrica*	B	1971
Phycophyta					
Phaeophyceae	Laminariales	Alariaceae	*Undaria pinnatifida*	H or B	Pre-1987
Urochordata					
Ascidiacea	Aplousobranchia	Cionidae	*Ciona intestinalis*	H	Pre-1950
Ascidiacea	Phlebobranchia	Ascidiidae	*Ascidiella aspersa*	H	1900s

[1] Date of introduction currently unknown but species had been encountered in New Zealand prior to the present survey.
[2] Based on Cranfield et al's (1998) estimation for a congeneric species *Eudendrium ritchiei*

Table 9: Species indeterminata recorded from the Port of Napier survey. This group includes: (1) organisms that were damaged or juvenile and lacked crucial morphological characteristics, and (2) taxa for which there is not sufficient taxonomic or systematic information available to allow positive identification to species level. As such these identifications are the best available at this time.

Phylum, Class	Order	Family	Genus and species
Annelida			
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris Indet*
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris Lumbrineris-B-of-Orensanz*
Polychaeta	Phyllodocida	Hesionidae	*Hesionidae Indet*
Polychaeta	Phyllodocida	Nereididae	*Platynereis Platynereis_australis_group*
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia Eulalia-NIWA-2*
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides Mystides-B*
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodocidae-unknown Phyllodocidae-01*
Polychaeta	Phyllodocida	Syllidae	*Autolytin-unknown Autolytin-unknown-A*
Polychaeta	Phyllodocida	Syllidae	*Eusyllin-unknown Indet*
Polychaeta	Sabellida	Oweniidae	*Oweniidae Indet*
Polychaeta	Terebellida	Terebellidae	*Artacama Artacama-A*
Polychaeta	Terebellida	Terebellidae	*Lanassa Lanassa-A*
Polychaeta	Terebellida	Terebellidae	*Terebella Terebella-B*
Polychaeta	Terebellida	Terebellidae	*Terebellidae Indet*
Polychaeta			*Exogonin-unknown Indet*
Cnidaria			
Anthozoa	Corallimorpharia	Corallimorphidae	*Corynactis sp.*
Anthozoa			*Anthozoa sp.*
Malacostraca	Amphipoda	Aoridae	*Aoridae sp.*
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis indet.*
Malacostraca	Anomura	Paguridae	*Pagurus sp.*
Malacostraca	Brachyura	Majidae	*Notomithrax sp.*
Mollusca			
Cephalopoda	Octopoda	Octopodidae	*Octopodidae sp.*

Phylum, Class	Order	Family	Genus and species
Gastropoda	Notaspidea	Pleurobranchidae	*Pleurobranchaea sp.*
Polyplacophora	Ischnochitonina	Chitonidae	*Ischnochitonina sp.*
Phycophyta			
Bryopsidophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis sp.*
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora sp.*
Cladophorophyceae	Cladophorales	Cladophoraceae	*Rhizoclonium sp.*
Rhodophyceae	Ceramiales	Ceramiaceae	*Callithamnion sp.*
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium sp.*
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia sp.*
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia teges?*
Rhodophyceae	Ceramiales	Dasyaceae	*Dasya sp.*
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesserian sp. A*
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesserian sp. B*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia sp.*
Rhodophyceae	Gelidiales	Gelidiaceae	*Gelidiaceae indet.*
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria sp.*
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha sp.*
Urochordata			
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum sp.*
Ascidiacea	Aplousobranchia	Holozoidae	*Distaplia s.p.*
Vertebrata			
Actinopterygii	Perciformes	Carangidae	*?Trachurus sp.*

Table 10: Non-indigenous marine organisms recorded from the Port of Napier survey and the techniques used to capture each species. Species distributions throughout the port, and in other ports around New Zealand are indicated.

Non-indigenous species	Capture techniques in Port of Napier	Locations detected in Port	Detected in other locations surveyed in ZBS2000_04
Spirobranchus polytrema	Pile scrape	Higgins Wharf (See Fig 13)	Dunedin, Wellington
Barantolla lepte	Benthic grab	Herrick Wharf (See Fig 14)	Taranaki, Timaru
Bugula flabellata	Benthic sled, Pile scrape	Cassidy Wharf; Geddis Wharf; Herrick Wharf; Higgins Wharf (See Fig 15)	Auckland, Bluff, Dunedin, Lyttleton, Nelson, Opua Marina, Picton, Taranaki, Tauranga, Timaru, Whangarei Harbour, Wellington
Bugula neritina	Benthic sled, Pile scrape	Cassidy Wharf; Geddis Wharf; Herrick Wharf; Higgins Wharf (See Fig 16)	Auckland, Dunedin, Gisborne, Gulf Harbour Marina, Lyttleton, Opua Marina, Taranaki, Tauranga, Timaru, Whangarei Harbour, Whangarei Marina
Watersipora subtorquata	Pile scrape	Cassidy Wharf; Geddis Wharf; Herrick Wharf; Higgins Wharf (See Fig 17)	Bluff, Dunedin, Gisborne, Gulf Harbour Marina, Lyttleton, Nelson, Opua Marina, Picton, Taranaki, Tauranga, Timaru, Whangarei Harbour, Wellington
Eudendrium generale	Pile scrape	Cassidy Wharf (See Fig 18)	None
Theora lubrica	Benthic grab, Benthic sled	Geddis Wharf ; Herrick Wharf; Higgins Wharf; Kirkpatrick Wharf (See Fig 19)	Auckland, Gisborne, Gulf Harbour Marina, Lyttleton, Nelson, Opua Marina, Taranaki, Whangarei Harbour, Whangarei Marina, Wellington
Undaria pinnatifida	Pile scrape	Geddis Wharf; Herrick Wharf (See Fig 20)	Dunedin, Gisborne, Lyttleton, Picton, Timaru, Wellington
Ciona intestinalis	Benthic sled	Higgins Wharf (See Fig 21)	Lyttleton, Nelson, Timaru
Ascidiella aspersa	Pile scrape	Higgins Wharf (See Fig 22)	Gulf Harbour Marina, Gisborne

Appendices

Appendix 1: Specialists engaged to identify specimens obtained from the New Zealand Port surveys.

Phylum	Class	Specialist	Institution
Annelida	Polychaeta	Geoff Read, Jeff Forman	NIWA Greta Point
Bryozoa	Gymnolaemata	Dennis Gordon	NIWA Greta Point
Chelicerata	Pycnogonida	David Staples	Melbourne Museum, Victoria, Australia
Cnidaria	Anthozoa	Adorian Ardelean	West University of Timisoara, Timisoara, 1900, Romania
Cnidaria	Hydrozoa	Jan Watson	Hydrozoan Research Laboratory, Clifton Springs, Victoria, Australia
Crustacea	Amphipoda	Graham Fenwick	NIWA Christchurch
Crustacea	Cirripedia	Graham Fenwick, Isla Fitridge John Buckeridge[1]	NIWA Christchurch and [1]Auckland University of Technology
Crustacea	Decapoda	Colin McLay[1] Graham Fenwick, Nick Gust	[1]University of Canterbury and NIWA Christchurch
Crustacea	Isopoda	Niel Bruce	NIWA Greta Point
Crustacea	Mysidacea	Fukuoka Kouki	National Science Museum, Tokyo
Echinodermata	Asteroidea	Don McKnight	NIWA Greta Point
Echinodermata	Echinoidea	Don McKnight	NIWA Greta Point
Echinodermata	Holothuroidea	Niki Davey	NIWA Nelson
Echinodermata	Ophiuroidea	Don McKnight, Helen Rottman	NIWA Greta Point
Echiura	Echiuroidea	Geoff Read	NIWA Greta Point
Mollusca	Bivalvia. Cephalopoda, Gastropoda, Polyplacophora	Bruce Marshall	Museum of NZ Te Papa Tongarewa
Nemertea	Anopla, Enopla	Geoff Read	NIWA Greta Point
Phycophyta	Phaeophyceae, Rhodophyceae, Ulvophyceae	Wendy Nelson, Kate Neill	NIWA Greta Point
Platyhelminthes	Turbellaria	Sean Handley	NIWA Nelson
Porifera	Demospongiae, Calcarea	Michelle Kelly-Shanks	NIWA Auckland
Priapula	Priapulidae	Geoff Read	NIWA Greta Point
Pyrrophycophyta	Dinophyceae	Hoe Chang, Rob Stewart	NIWA Greta Point
Urochordata	Ascidiacea	Mike Page, Anna Bradley Patricia Kott[1]	NIWA Nelson and [1]Queensland Museum
Vertebrata	Osteichthyes	Clive Roberts, Andrew Stewart	Museum of NZ Te Papa Tongarewa

Appendix 2: Generic descriptions of marine phyla collected during sampling.

Phylum Annelida

Polychaetes: The polychaetes are the largest group of marine worms and are closely related to the earthworms and leeches found on land. Polychaetes are widely distributed in the marine environment and are commonly found under stones and rocks, buried in the sediment or attached to submerged natural and artificial surfaces including rocks, pilings, ropes and the shells or carapaces of other species. All polychaete worms have visible legs or bristles. Many species live in tubes secreted by the body or assembled from debris and sediments, while others are free-living. Depending on species, polychaetes feed by filtering small food particles from the water or by preying upon smaller creatures.

Phylum Bryozoa

Bryozoans: This group of organisms is also referred to as ‘moss animals’ or ‘lace corals’. Bryozoans are sessile and live attached to submerged natural and artificial surfaces including rocks, pilings, ropes and the shells or carapaces of other species. They are all colonial, with individual colonies consisting of hundreds of individual ‘zooids’. Bryozoans can have encrusting growth forms that are sheet-like and approximately 1 mm thick, or can form erect or branching structures several centimetres high. Bryozoans feed by filtering small food particles from the water column, and colonies grow by producing additional zooids.

Phylum Chelicerata

Pycnogonids: The pycnogonids, or sea spiders, are a group within the Arthropoda, and closely related to land spiders. They are commonly encountered living among sponges, hydroids and bryozoans on the seafloor. They range in size from a few mm to many cm and superficially resemble spiders found on land.

Phylum Cnidaria

Hydroids: Hydroids can easily be mistaken for erect and branching bryozoans. They are also sessile organisms that live attached to submerged natural and artificial surfaces including rocks, pilings, ropes and the shells or carapaces of other species. All hydroids are colonial, with individual colonies consisting of hundreds of individual ‘polyps’. Like bryozoans, they feed by filtering small food particles from the water column.

Phylum Crustacea

Crustaceans: The crustaceans represent one of the sea’s most diverse groups of organisms, well known examples include shrimps, crabs and lobsters. Most crustaceans are motile (capable of movement) although there are also a variety of sessile species (e.g. barnacles). All crustaceans are protected by an external carapace, and most can be recognised by having two pairs of antennae.

Phylum Echinodermata

Echinoderms: This phylum contains a range of predominantly motile organisms – sea stars, brittle stars, sea urchins, sea cucumbers, sand dollars, feather stars and sea lilies. Echinoderms feed by filtering small food particles from the water column or by extracting food particles from sediment grains or rock surfaces.

Phylum Mollusca

Molluscs: The molluscs are a highly diverse group of marine animals characterised by the presence of an external or internal shell. This phyla includes the bivalves (organisms with hinged shells e.g. mussels, oysters, etc), gastropods (marine snails, e.g. winkles, limpets, topshells), chitons, sea slugs and sea hares, as well as the cephalopods (squid, cuttlefish and octopus).

Phylum Phycophyta

Algae: These are the marine plants. Several types were encountered during our survey. Large *macroalgae* were sampled that live attached to submerged natural and artificial surfaces including rocks, pilings, ropes and the shells or carapaces of other species. These include the green algae (Ulvophyceae), red algae (Rhodophyceae) and brown algae (Phaecophyceae). We also encountered microscopic algal species called *dinoflagellates* (phylum Pyrrophycophyta), single-celled algae that live in the water column or within the sediments.

Phylum Porifera

Sponges: Sponges are very simple colonial organisms that live attached to submerged natural and artificial surfaces including rocks, pilings, ropes and the shells or carapaces of other species. They vary greatly in colour and shape, and include sheet-like encrusting forms, branching forms and tubular forms. Sponge surfaces have thousands of small pores to through which water is drawn into the colony, where small food particles are filtered out before the water is again expelled through one or several other holes.

Phylum Pyrrophycophyta

Dinoflagellates: Dinoflagellates are a large group of unicellular algae common in marine plankton. About half of all dinoflagellates are capable of photosynthesis and some are symbionts, living inside organisms such as jellyfish and corals. Some dinoflagellates are phosphorescent and can be responsible for the phosphorescence visible at night in the sea. The phenomenon known as red tide occurs when the rapid reproduction of certain dinoflagellate species results in large brownish red algal blooms. Some dinoflagellates are highly toxic and can kill fish and shellfish, or poison humans that eat these infected organisms.

Phylum Urochordata

Ascidians: This group of organisms is sometimes referred to as 'sea squirts'. Adult ascidians are sessile (permanently attached to the substrate) organisms that live on submerged natural and artificial surfaces including rocks, pilings, ropes and the shells or carapaces of other species. Ascidians can occur as individuals (solitary ascidians) or merged together into colonies (colonial ascidians). They are soft-bodied and have a rubbery or jelly-like outer coating (test). They feed by pumping water into the body through an inhalant siphon. Inside the body, food particles are filtered out of the water, which is then expelled through an exhalant siphon. Ascidians reproduce via swimming larvae (ascidian tadpoles) that retain a notochord, which explains why these animals are included in the phylum Chordata along with vertebrates.

Phylum Vertebrata

Fishes: Fishes are an extremely diverse group of the verterbrates, and are familiar to most people. Approximately 200 families of fish are represented in New Zealand waters ranging from tropical and subtropical groups in the north to subantarctic groups in the south. Fishes can be classified according to their depth preferences. Fish that live on or near the sea floor are considered demersal while those living in the upper water column are termed pelagics.

Appendix 3: Criteria for assigning non-indigenous status to species sampled from the Port of Napier.

Criteria that apply to each species are indicated by (+). Criteria (C1-C9) were developed by Chapman and Carlton (1994). Here we apply Cranfield et al's (1998) analysis to species previously known from New Zealand waters. For non-indigenous species first detected during the present study, criteria were assigned using advice from the taxonomists that identified them. Refer to footnote for a full description of C1–C9 criteria.

Phylum and species	C1	C2	C3	C4	C5	C6	C7	C8	C9
Annelida									
Spirobranchus polytrema	+		+		+				+
Barantolla lepte	+		+					+	
Bryozoa									
Bugula flabellate	+	+	+		+	+	+	+	+
Bugula neritina	+				+	+	+	+	+
Watersipora subtorquata	+	+	+		+	+	+	+	+
Cnidaria									
Eudendrium generale	+		+		+	+		+	
Mollusca									
Theora lubrica	+	+			+	+	+	+	+
Phycophyta									
Undaria pinnatifida	+	+	+		+	+	+	+	+
Urochordata									
Ciona intestinalis	+		+		+	+	+	+	+
Ascidiella aspersa	+	+	+	+	+	+	+	+	+

Criterion 1: Has the species suddenly appeared locally where it has not been found before?
Criterion 2: Has the species spread subsequently?
Criterion 3: Is the species' distribution associated with human mechanisms of dispersal?
Criterion 4: Is the species associated with, or dependent on, other introduced species?
Criterion 5: Is the species prevalent in, or restricted to, new or artificial environments?
Criterion 6: Is the species' distribution restricted compared to natives?
Criterion 7: Does the species have a disjunct worldwide distribution?
Criterion 8: Are dispersal mechanisms of the species inadequate to reach New Zealand, and is passive dispersal in ocean currents unlikely to bridge ocean gaps to reach New Zealand?
Criterion 9: Is the species isolated from the genetically and morphologically most similar species elsewhere in the world?

Appendix 4. Geographic locations of the sample sites in the port of Napier

Site	Eastings	Northings	NZ Latitude	NZ Longitude	Survey Method	No. of sample units
CASSIDY	2847160	6185113	-39.47385	176.91950	BSLD	1
CASSIDY	2847214	6185080	-39.47413	176.92014	BSLD	1
CASSIDY	2847160	6185113	-39.47385	176.91950	CRBTP	4
CASSIDY	2847160	6185143	-39.47358	176.91948	FSHTP	4
CASSIDY	2847152	6185134	-39.47367	176.91939	PSC	14
CASSIDY	2847160	6185113	-39.47385	176.91950	SHRTP	4
CASSIDY	2847160	6185113	-39.47385	176.91950	STFTP	4
ENTRANCE	2847023	6185094	-39.47408	176.91791	CYST	2
GEDDIS	2847095	6184734	-39.47729	176.91894	BGRB	3
GEDDIS	2847159	6184597	-39.47850	176.91975	BSLD	1
GEDDIS	2847162	6184700	-39.47757	176.91973	BSLD	1
GEDDIS	2847159	6184662	-39.47791	176.91972	CRBTP	2
GEDDIS	2847161	6184643	-39.47808	176.91975	CRBTP	2
GEDDIS	2847111	6184599	-39.47850	176.91919	CYST	2
GEDDIS	2847141	6184668	-39.47787	176.91951	FSHTP	4
GEDDIS	2847168	6184595	-39.47851	176.91985	PSC	14
GEDDIS	2847159	6184662	-39.47791	176.91972	SHRTP	2
GEDDIS	2847161	6184643	-39.47808	176.91975	SHRTP	2
GEDDIS	2847159	6184662	-39.47791	176.91972	STFTP	2
GEDDIS	2847161	6184643	-39.47808	176.91975	STFTP	2
HERRICK	2846977	6184693	-39.47771	176.91759	BGRB	3
HERRICK	2847022	6184673	-39.47787	176.91812	BSLD	1
HERRICK	2847028	6184766	-39.47702	176.91814	BSLD	1
HERRICK	2847043	6184581	-39.47869	176.91841	CRBTP	2
HERRICK	2847051	6184765	-39.47702	176.91841	CRBTP	2
HERRICK	2846998	6184700	-39.47764	176.91783	CYST	2
HERRICK	2847028	6184796	-39.47675	176.91812	FSHTP	4
HERRICK	2847045	6184771	-39.47698	176.91834	PSC	15
HERRICK	2847043	6184581	-39.47869	176.91841	SHRTP	2
HERRICK	2847051	6184765	-39.47702	176.91841	SHRTP	2
HERRICK	2847043	6184581	-39.47869	176.91841	STFTP	2
HERRICK	2847051	6184765	-39.47702	176.91841	STFTP	2
HERRICK END	2847066	6184893	-39.47587	176.91852	BGRB	3
HIGGINS	2847241	6184636	-39.47811	176.92068	BGRB	3
HIGGINS	2847291	6184563	-39.47875	176.92130	BSLD	1
HIGGINS	2847293	6184646	-39.47800	176.92128	BSLD	1
HIGGINS	2847291	6184563	-39.47875	176.92130	CRBTP	2
HIGGINS	2847296	6184616	-39.47827	176.92133	CRBTP	2
HIGGINS	2847291	6184593	-39.47848	176.92129	FSHTP	4
HIGGINS	2847291	6184563	-39.47875	176.92130	PSC	16
HIGGINS	2847291	6184563	-39.47875	176.92130	SHRTP	2
HIGGINS	2847296	6184616	-39.47827	176.92133	SHRTP	2
HIGGINS	2847291	6184563	-39.47875	176.92130	STFTP	2
HIGGINS	2847296	6184616	-39.47827	176.92133	STFTP	2
KIRKPATRICK	2846982	6185089	-39.47414	176.91744	BGRB	3
KIRKPATRICK	2846930	6184808	-39.47669	176.91698	BSLD	1
KIRKPATRICK	2846937	6184894	-39.47591	176.91702	BSLD	1
KIRKPATRICK	2846937	6184894	-39.47591	176.91702	CRBTP	2
KIRKPATRICK	2846937	6184924	-39.47564	176.91701	FSHTP	4

Site	Eastings	Northings	NZ Latitude	NZ Longitude	Survey Method	No. of sample units
KIRKPATRICK	2846937	6184894	-39.47591	176.91702	SHRTP	2
KIRKPATRICK	2846937	6184894	-39.47591	176.91702	STFTP	2
MID PORT	2847119	6184895	-39.47583	176.91914	CYST	2

*Survey methods: PSC = pile scrape, BSLD = benthic sled, BGRB = benthic grab, CYST = dinoflagellate cyst core, CRBTP = crab trap, FSHTP = fish trap, STFTP = starfish trap, SHRTP = shrimp trap.

Appendix 5a. Results from the diver collections and pile scrapings

				Berth code	CASSIDY														GEDDIS								
				Pile replicate	1							2							1							2
				Pile position	IN			OUT				IN			OUT				IN			OUT				IN
Class	Orders	Family	Genus	Species	*Status	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Corallimorpharia	Corallimorphidae	*Corynactis*	*sp.*	SI	0	1	1	0	1	1	1	0	1	1	0	0	1	1	1	1	0	1	0	1	1	1
Anthozoa			*Anthozoa*	*sp.*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum*	*notti*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Holozoidae	*Distaplia*	*s.p.*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Ascidiidae	*Ascidiella*	*aspersa*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Pyuridae	*Microcosmus*	*squamiger*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	1	0	0	1	1	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	1	1	1	0	0	0	0	0	1	0	0	1	1	1	1	0	1	0	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*rugata*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*subuculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*carnea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pulla*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*coerulea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*nisiotus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Myoida	Hiatellidae	*Hiatella*	*arctica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Perna*	*canaliculus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1
Bivalvia	Mytiloida	Mytilidae	*Modiolarca*	*impacta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
Bivalvia	Mytiloida	Mytilidae	*Aulacomya*	*maoriana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus*	*pulex*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Trichomusculus*	*barbatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Ostreoida	Anomiidae	*Pododesmus*	*zelandicus*	N	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0
Bivalvia	Pterioida	Pectinidae	*Talochlamys*	*zelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Semelidae	*Theora*	*lubrica*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Irus*	*reflexus*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	1	0
Bryopsidophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Rhizoclonium*	*sp.*	SI	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Paguridae	*Pagurus*	*novizealandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*innominatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	1
Crustacea	Brachyura	Pinnotheridae	*Pinnotheres*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*Pilumnus*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*Pilumnus*	*lumpinus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	1	1	1	1	0	0	0	1	1	0	1	0	1	0	0	0	0	1	1	0	0	0
Crustacea	Thoracica	Chthamalidae	*Chaemosipho*	*columna*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dendrocertatida	Dictyodendrillidae	*Dictyodendrilla*	*dendyi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 2 (pale blue bushy encrusting)*	C2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*cf. arenaria*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Hadromerida	Suberitidae	*Homaxinella*	*erecta*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*panicea*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Amorphinopsis*	*n. sp. 1 (fragile encrusting)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Chalinidae	*Adocia*	*cf. parietalioides*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), C1 = cryptogenic category 1, C2 = cryptogenic category 2, N = native, SI = species indeterminata. See text for details.

Appendix 5a. Results from the diver collections and pile scrapings

				Berth code	CASSIDY														GEDDIS							
				Pile replicate	1							2							1							2
				Pile position	IN			OUT				IN			OUT				IN			OUT				IN
Class	Orders	Family	Genus	Species	*Status	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Chromodoris*	*aureomarginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris*	*lanuginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Vetigastropoda	Fissurellidae	*Tugali*	*suteri*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*n.sp.*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*plurispinosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	1	1	0	1	1	1	0	1	1	0	1	1	1	0	1	0	1	1	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	0	0	0	0	1	1	0	0	0	1	1	0	1	1	0	1	0	0	1	0	1
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*dentata*	N	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*rostrata*	N	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperiopsis*	*cervicornis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia*	*ambigua*	C1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus*	*mollis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Eudendriidae	*Eudendrium*	*generale*	A	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Malacostraca	Amphipoda	Aoridae	*Aoridae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine*	*pacifica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*indet.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*trailli*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Orchomene*	*sp. aff. O. aahu*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*campbellensis*	N	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea*	*australiensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos*	*loveni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Polychaeta	Eunicida	Eunicidae	*Eunice*	*australis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1
Polychaeta	Eunicida	Eunicidae	*Lysidice*	*ninetta*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*Lumbrineris-B-of-Orensanz*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*sphaerocephala*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Hesionidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*kerguelensis*	N	0	1	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*camiguinoides*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*Eulalia-NIWA-2*	SI	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodocidae-unknown*	*Phyllodocidae-01*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*capensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides*	*Mystides-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*polychromus*	N	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*jacksoni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Autolytin-unknown*	*Autolytin-unknown-A*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllin-unknown*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Polychaeta	Sabellida	Sabellidae	*Megalomma*	*suspiciens*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*curta*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Demonax*	*aberrans*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla*	*alba*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Galeolaria*	*hystrix*	N	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Spirobranchus*	*cariniferus*	N	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Spirobranchus*	*polytrema*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Opheliidae	*Armandia*	*maculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Scalibregmatidae	*Hyboscolex*	*longiseta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Appendix 5a. Results from the diver collections and pile scrapings

				Berth code	CASSIDY														GEDDIS							
				Pile replicate	1							2							1							2
				Pile position	IN			OUT				IN			OUT				IN			OUT				IN
Class	Orders	Family	Genus	Species	*Status	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1
Polychaeta	Spionida	Spionidae	*Boccardia*	*lamellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Acrocirridae	*Acrocirrus*	*trisectus*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Timarete*	*anchylochaetus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Chaetozone*	*Chaetozone-1*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Polychaeta	Terebellida	Flabelligeridae	*Pherusa*	*parmata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
Polychaeta	Terebellida	Pectinariidae	*Pectinaria*	*australis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Pseudopista*	*rostrata*	N	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	1	0	0	1	1	0
Polychaeta	Terebellida	Terebellidae	*Lanassa*	*Lanassa-A*	SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*armilla*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Pista*	*pegma*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebella*	*Terebella-B*	SI	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebellidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta			*Exogonin-unknown*	*Indet*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*sp.*	SI	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Callithamnion*	*sp.*	SI	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Anotrichium*	*crinitum*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*teges?*	SI	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Rhodophyceae	Ceramiales	Dasyaceae	*Dasya*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Apoglossum*	*montagneanum*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Caloglossa*	*leprieurii*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesserian*	*sp. A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesserian*	*sp. B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*sp.*	SI	1	0	0	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gelidiales	Gelidiaceae	*Gelidiaceae*	*indet.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria*	*caespitosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stenolaemata	Cyclostomata	Crisiidae	*Crisia*	*tenuis*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*sp.*	SI	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Appendix 5a. Results from the diver collections and pile scrapings

				Berth code									HERRICK															HIGGINS
				Pile replicate									1							2								1
				Pile position				OUT			IN				OUT				IN				OUT				IN	
Class	Orders	Family	Genus	Species	*Status	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4		1
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Anthozoa	Corallimorpharia	Corallimorphidae	*Corynactis*	*sp.*	SI	1	1	0	1	1	1	0	1	1	1	1	1	1	0	1	0	1	1	1	0	1		1
Anthozoa			*Anthozoa*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum*	*notti*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Ascidiacea	Aplousobranchia	Holozoidae	*Distaplia*	*s.p.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	0	0		0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Ascidiacea	Phlebobranchia	Ascidiidae	*Ascidiella*	*aspersa*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Ascidiacea	Phlebobranchia	Pyuridae	*Microcosmus*	*squamiger*	C2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0		0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	1	1	0	1	1	0	0	0	1	0	1	0	0	0	1	1	0	0	1	1	0		1
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0		1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	1	0	0	0	0	0	0	1	0	1	0	1	1	0	1	1	0	0	0	1	0		0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*rugata*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0		1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*subuculata*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0		0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*carnea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pulla*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	1	0	0	1	0	0	0	0	1	1	0	1	0	0	0	0	1	1	1	1	0		1
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	1	0	0	1	1	0	0	1	1	0	0	0	0	0	1	0	1	1	1	0		1
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*coerulea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*nisiotus*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Bivalvia	Myoida	Hiatellidae	*Hiatella*	*arctica*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1
Bivalvia	Mytiloida	Mytilidae	*Perna*	*canaliculus*	N	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0		1
Bivalvia	Mytiloida	Mytilidae	*Modiolarca*	*impacta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0		0
Bivalvia	Mytiloida	Mytilidae	*Aulacomya*	*maoriana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0		1
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus*	*pulex*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0		0
Bivalvia	Mytiloida	Mytilidae	*Trichomusculus*	*barbatus*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Bivalvia	Ostreoida	Anomiidae	*Pododesmus*	*zelandicus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0		1
Bivalvia	Pterioida	Pectinidae	*Talochlamys*	*zelandiae*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Bivalvia	Veneroida	Semelidae	*Theora*	*lubrica*	A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0		0
Bivalvia	Veneroida	Veneridae	*Irus*	*reflexus*	N	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0		0
Bryopsidophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis*	*sp.*	SI	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Rhizoclonium*	*sp.*	SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Crustacea	Anomura	Paguridae	*Pagurus*	*novizealandiae*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*novaezelandiae*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0		0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0		0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0		0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*innominatus*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0		0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0		0
Crustacea	Brachyura	Pinnotheridae	*Pinnotheres*	*novaezelandiae*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Crustacea	Brachyura	Xanthidae	*Pilumnus*	*novaezelandiae*	N	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0		0
Crustacea	Brachyura	Xanthidae	*Pilumnus*	*lumpinus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	0	0	0	0	0	0	1	0	1	1	0	0	0	1	0	0	0	1	0	0	0		0
Crustacea	Thoracica	Chthamalidae	*Chaemosipho*	*columna*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		0
Demospongiae	Dendrocertatida	Dictyodendrillidae	*Dictyodendrilla*	*dendyi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0		0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 2 (pale blue bushy encrusting)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*cf. arenaria*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Demospongiae	Hadromerida	Suberitidae	*Homaxinella*	*erecta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*panicea*	C1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0		0
Demospongiae	Halichondrida	Halichondriidae	*Amorphinopsis*	*n. sp. 1 (fragile encrusting)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Demospongiae	Haplosclerida	Chalinidae	*Adocia*	*cf. parietalioides*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0

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Appendix 5a. Results from the diver collections and pile scrapings

				Berth code							HERRICK																HIGGINS
				Pile replicate							1							2									1
				Pile position			OUT			IN				OUT				IN				OUT					IN
Class	Orders	Family	Genus	Species	*Status	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4	1
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella*	*novaezelandiae*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Chromodoris*	*aureomarginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris*	*lanuginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
Gastropoda	Vetigastropoda	Fissurellidae	*Tugali*	*suteri*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*n.sp.*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*plurispinosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	1	1	1	0	0	1	1	1	1	0	0	0	0	1	0	0	0	1	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	1	1	0	1	0	0	0	0	1	1	0	0	1	0	0	1	0	0	1	1	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*dentata*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*rostrata*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperiopsis*	*cervicornis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia*	*ambigua*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus*	*mollis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Eudendriidae	*Eudendrium*	*generale*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aoridae*	*sp.*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine*	*pacifica*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*indet.*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*traill*i	N	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Malacostraca	Amphipoda	Lysianassidae	*Orchomene*	*sp. aff. O. aahu*	C2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*campbellensis*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea*	*australiensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos*	*loveni*	N	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Eunicidae	*Eunice*	*australis*	N	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	1	1	0	0	1	0
Polychaeta	Eunicida	Eunicidae	*Lysidice*	*ninetta*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*Lumbrineris-B-of-Orensanz*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*sphaerocephala*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Polychaeta	Phyllodocida	Hesionidae	*Hesionidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*kerguelensis*	N	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	1	1	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*camiguinoides*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*Eulalia-NIWA-2*	SI	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodocidae-unknown*	*Phyllodocidae-01*	SI	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*capensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides*	*Mystides-B*	SI	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*polychromus*	N	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	1	1	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*jacksoni*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Autolytin-unknown*	*Autolytin-unknown-A*	SI	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllin-unknown*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Megalomma*	*suspiciens*	N	1	1	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*curta*	N	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	1	0	0
Polychaeta	Sabellida	Sabellidae	*Demonax*	*aberrans*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla*	*alba*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Galeolaria*	*hystrix*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Spirobranchus*	*cariniferus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Spirobranchus*	*polytrema*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Opheliidae	*Armandia*	*maculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Scalibregmatidae	*Hyboscolex*	*longiseta*	N	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

*Status: A = non-indigenous (highlighted by shading), C1 = cryptogenic category 1, C2 = cryptogenic category 2, N = native, SI = species indeterminata. See text for details.

Appendix 5a. Results from the diver collections and pile scrapings

					Berth code							HERRICK															HIGGINS
					Pile replicate							1							2								1
					Pile position			OUT				IN			OUT				IN				OUT				IN
Class	Orders	Family	Genus	Species	*Status	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4	1
Polychaeta	Spionida	Spionidae	*Boccardia*	*lamellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Acrocirridae	*Acrocirrus*	*trisectus*	N	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Timarete*	*anchylochaetus*	N	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Chaetozone*	*Chaetozone-1*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Flabelligeridae	*Pherusa*	*parmata*	N	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1
Polychaeta	Terebellida	Pectinariidae	*Pectinaria*	*australis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Pseudopista*	*rostrata*	N	0	0	0	1	0	0	0	0	1	0	0	1	1	0	1	1	1	1	0	1	1	0
Polychaeta	Terebellida	Terebellidae	*Lanassa*	*Lanassa-A*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*armilla*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Pista*	*pegma*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebella*	*Terebella-B*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebellidae*	*Indet*	SI	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta			*Exogonin-unknown*	*Indet*	SI	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Callithamnion*	*sp.*	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Anotrichium*	*crinitum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*teges?*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Dasyaceae	*Dasya*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Apoglossum*	*montagneanum*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Caloglossa*	*leprieurii*	N	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesserian*	*sp. A*	SI	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesserian*	*sp. B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*sp.*	SI	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Rhodophyceae	Gelidiales	Gelidiaceae	*Gelidiaceae*	*indet.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria*	*sp.*	SI	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria*	*caespitosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Stenolaemata	Cyclostomata	Crisiidae	*Crisia*	*tenuis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*sp.*	SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), C1 = cryptogenic category 1, C2 = cryptogenic category 2, N = native, SI = species indeterminata. See text for details.

Appendix 5a. Results from the diver collections and pile scrapings

					Berth code															
					Pile replicate								2							
					Pile position				OUT				IN				OUT			
Class	Orders	Family	Genus	Species	*Status	2	3	MISC	1	2	3	4	1	2	3	4	1	2	3	4
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Corallimorpharia	Corallimorphidae	*Corynactis*	*sp.*	SI	1	0	0	0	0	1	1	1	1	1	1	0	0	0	1
Anthozoa			*Anthozoa*	*sp.*	SI	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum*	*notti*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Holozoidae	*Distaplia*	*s.p.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Ascidiidae	*Ascidiella*	*aspersa*	A	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Pyuridae	*Microcosmus*	*squamiger*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*rugata*	N	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*subuculata*	N	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*carnea*	N	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pulla*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	1	0	0	0	0	0	0	1	0	1	0	0	0	1
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	1	0	0	1	0	0	0	1	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*coerulea*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*nisiotus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Myoida	Hiatellidae	*Hiatella*	*arctica*	N	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Perna*	*canaliculus*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Modiolarca*	*impacta*	N	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Aulacomya*	*maoriana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus*	*pulex*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Trichomusculus*	*barbatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Ostreoida	Anomiidae	*Pododesmus*	*zelandicus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Bivalvia	Pterioida	Pectinidae	*Talochlamys*	*zelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Semelidae	*Theora*	*lubrica*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Irus*	*reflexus*	N	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Bryopsidophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Rhizoclonium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Paguridae	*Pagurus*	*novizealandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*innominatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Pinnotheridae	*Pinnotheres*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*Pilumnus*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*Pilumnus*	*lumpinus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Chthamalidae	*Chaemosipho*	*columna*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dendrocertatida	Dictyodendrillidae	*Dictyodendrilla*	*dendyi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 2 (pale blue bushy encrusting)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*cf. arenaria*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Hadromerida	Suberitidae	*Homaxinella*	*erecta*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*panicea*	C1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Amorphinopsis*	*n. sp. 1 (fragile encrusting)*	C2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Chalinidae	*Adocia*	*cf. parietalioides*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), C1 = cryptogenic category 1, C2 = cryptogenic category 2, N = native, SI = species indeterminata. See text for details.

Appendix 5a. Results from the diver collections and pile scrapings

					Berth code								2							
					Pile replicate															
					Pile position				OUT				IN				OUT			
Class	Orders	Family	Genus	Species	*Status	2	3	MISC	1	2	3	4	1	2	3	4	1	2	3	4
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Chromodoris*	*aureomarginata*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris*	*lanuginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Vetigastropoda	Fissurellidae	*Tugali*	*suteri*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*n.sp.*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*plurispinosa*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	1	1	0	1	1	1	1	1	0	1	0	1	1	1	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	1	0	0	0	0	1	0	1	1	1	0	0	0	1
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*dentata*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*rostrata*	N	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperiopsis*	*cervicornis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia*	*ambigua*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus*	*mollis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Eudendriidae	*Eudendrium*	*generale*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aoridae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine*	*pacifica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*indet.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*trailli*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Orchomene*	*sp. aff. O. aahu*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*campbellensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea*	*australiensis*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos*	*loveni*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Eunicida	Eunicidae	*Eunice*	*australis*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Eunicidae	*Lysidice*	*ninetta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*Lumbrineris-B-of-Orensanz*	SI	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*sphaerocephala*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Hesionidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*kerguelensis*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*camiguinoides*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*Eulalia-NIWA-2*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodocidae-unknown*	*Phyllodocidae-01*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*capensis*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides*	*Mystides-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*polychromus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*jacksoni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Autolytin-unknown*	*Autolytin-unknown-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllin-unknown*	*Indet*	SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Megalomma*	*suspiciens*	N	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*curta*	N	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Demonax*	*aberrans*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla*	*alba*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Galeolaria*	*hystrix*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Spirobranchus*	*cariniferus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Spirobranchus*	*polytrema*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Scolecida	Opheliidae	*Armandia*	*maculata*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Scolecida	Scalibregmatidae	*Hyboscolex*	*longiseta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), C1 = cryptogenic category 1, C2 = cryptogenic category 2, N = native, SI = species indeterminata. See text for details.

Appendix 5a. Results from the diver collections and pile scrapings

					Berth code																
					Pile replicate								2								
					Pile position				OUT				IN				OUT				
Class	Orders	Family	Genus	Species	*Status	2	3	MISC	1	2	3	4	1	2	3	4	1	2	3	4
Polychaeta	Spionida	Spionidae	*Boccardia*	*lamellata*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Terebellida	Acrocirridae	*Acrocirrus*	*trisectus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Timarete*	*anchylochaetus*	N	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Chaetozone*	*Chaetozone-1*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Polychaeta	Terebellida	Flabelligeridae	*Pherusa*	*parmata*	N	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0
Polychaeta	Terebellida	Pectinariidae	*Pectinaria*	*australis*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Pseudopista*	*rostrata*	N	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Lanassa*	*Lanassa-A*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*armilla*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Pista*	*pegma*	N	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebella*	*Terebella-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebellidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta			*Exogonin-unknown*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*sp.*	SI	0	0	0	1	1	1	0	0	0	0	0	0	1	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Callithamnion*	*sp.*	SI	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Anotrichium*	*crinitum*	N	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*teges?*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Dasyaceae	*Dasya*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Apoglossum*	*montagneanum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Caloglossa*	*leprieurii*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesserian*	*sp. A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesserian*	*sp. B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*sp.*	SI	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gelidiales	Gelidiaceae	*Gelidiaceae*	*indet.*	SI	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria*	*caespitosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stenolaemata	Cyclostomata	Crisiidae	*Crisia*	*tenuis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

*Status: A = non-indigenous (highlighted by shading), C1 = cryptogenic category 1, C2 = cryptogenic category 2, N = native, SI = species indeterminata. See text for details.

Appendix 5b. Results from the benthic grab samples

					Berth code	GEDDIS			HERRICK			HERRICK END			HIGGINS			KIRKPATRICK		
Class	Order	Family	Genus	Species	*Status	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Anthozoa	Corallimorpharia	Corallimorphidae	*Corynactis*	*sp.*	SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Semelidae	*Theora*	*lubrica*	A	0	1	0	1	1	1	1	0	1	1	1	0	0	1	1
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Echinoidea	Spatangoida	Loveniidae	*Echinocardium*	*cordatum*	N	0	1	1	0	0	0	1	0	1	0	0	1	0	0	1
Gastropoda	Cephalaspidea	Philinidae	*Philine*	*auriformis*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Neogastropoda	Muricidae	*Xymene*	*plebeius*	N	0	1	0	0	0	0	1	0	0	1	0	0	0	0	1
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Malacostraca	Amphipoda	Phoxocephalidae	*Torridoharpinia*	*hurleyi*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
Malacostraca	Isopoda	Cirolanidae	*Natatolana*	*narica*	N	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbricalus*	*aotearoae*	N	1	0	1	0	1	1	1	1	1	0	1	1	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Abyssoninoe*	*galatheae*	N	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0
Polychaeta	Phyllodocida	Glyceridae	*Glycera*	*lamelliformis*	N	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus*	*verrilli*	N	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Sigalionidae	*Labiosthenolepis*	*laevis*	N	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1
Polychaeta	Sabellida	Oweniidae	*Owenia*	*petersenae*	N	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Sabellida	Oweniidae	*Oweniidae*	*Indet*	SI	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Polychaeta	Scolecida	Capitellidae	*Barantolla*	*lepte*	A	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Polychaeta	Scolecida	Opheliidae	*Armandia*	*maculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Polychaeta	Terebellida	Pectinariidae	*Pectinaria*	*australis*	N	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Artacama*	*Artacama-A*	SI	1	1	0	1	0	1	1	1	1	0	1	0	0	1	1

*Status: A = non-indigenous (highlighted by shading), N = native, C1 = cryptogenic category 1, C2 = cryptogenic category 2, SI = species indeterminata. See text for details.

Appendix 5c. Results from the benthic sled samples.

Class	Order	Family	Genus	Species	Berth code *Status	CASSIDY 1	CASSIDY 2	GEDDIS 1	GEDDIS 2	HERRICK 1	HERRICK 2	HIGGINS 1	HIGGINS 2	KIRKPATRICK 3	KIRKPATRICK 4
Anthozoa	Corallimorpharia	Corallimorphidae	*Corynactis*	*sp.*	SI	0	0	1	0	0	0	0	1	0	0
Ascidiacea	Aplousobranchia	Cionidae	*Ciona*	*intestinalis*	A	0	0	0	0	0	0	0	1	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	0	0	0	1	0	1	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	0	0	0	0	0	0	1	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	0	0	0	0	0	0	1	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	1	0	0	0	0	1	0	1	0
Bivalvia	Mytiloida	Mytilidae	*Perna*	*canaliculus*	N	0	0	0	0	0	0	0	0	1	0
Bivalvia	Nuculoida	Nuculidae	*Nucula*	*nitidula*	N	0	0	0	0	0	0	0	1	0	0
Bivalvia	Veneroida	Semelidae	*Theora*	*lubrica*	A	0	0	1	1	1	1	1	1	1	1
Bivalvia	Veneroida	Semelidae	*Leptomya*	*retiaria*	N	0	0	0	0	1	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Tawera*	*spissa*	N	0	0	0	0	0	0	0	0	0	1
Crustacea	Anomura	Paguridae	*Pagurus*	*albidianthus*	N	0	1	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	0	0	0	0	0	0	0	1	1	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	0	1	0	0	0	0	1	0
Crustacea	Brachyura	Hymenosomatidae	*Hymenosoma*	*depressum*	N	0	0	0	0	0	0	0	1	0	0
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	1	0	0	0	0	1	0	0	0	0
Crustacea	Brachyura	Portunidae	*Nectocarcinus*	*antarcticus*	N	0	1	0	0	0	0	0	0	0	0
Crustacea	Caridea	Crangonidae	*Pontophilus*	*australis*	N	0	0	1	0	0	0	1	1	0	0
Crustacea	Caridea	Palemonidae	*Periclimenes*	*yaldwyni*	N	0	0	0	0	0	0	0	1	0	0
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*ramosa*	C1	0	0	0	0	0	0	1	0	0	0
Demospongiae	Poecilosclerida	Ancinoiidae	*Crella (Pytheas)*	*incrustans*	C1	0	0	0	0	0	0	0	0	0	1
Echinoidea	Spatangoida	Loveniidae	*Echinocardium*	*cordatum*	N	0	0	1	1	1	0	0	0	1	1
Gastropoda	Littorinimorpha	Calyptraeidae	*Maoricrypta*	*sodalis*	N	1	0	0	0	0	0	0	0	0	0
Gastropoda	Littorinimorpha	Turritellidae	*Maoricolpus*	*roseus*	N	0	1	0	0	0	0	0	0	0	0
Gastropoda	Neogastropoda	Muricidae	*Xymene*	*plebeius*	N	0	0	1	0	0	1	1	1	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	1	0	0	1	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	0	0	0	0	1	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*rostrata*	N	0	0	0	0	0	0	0	1	0	0
Malacostraca	Amphipoda	Phoxocephalidae	*Torridoharpinia*	*hurleyi*	N	0	0	0	0	0	1	0	1	0	0
Malacostraca	Isopoda	Cirolanidae	*Natatolana*	*narica*	N	0	0	1	0	0	0	0	0	0	0
Malacostraca	Isopoda	Cirolanidae	*Natatolana*	*rossi*	N	0	0	0	0	0	1	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Sphaeroma*	*laurensi*	N	0	0	0	0	0	0	1	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus*	*verrilli*	N	1	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Sigalionidae	*Labiosthenolepis*	*laevis*	N	0	0	1	1	1	1	1	1	1	1
Polychaeta	Phyllodocida	Syllidae	*Eusyllin-unknown*	*Indet*	SI	0	0	0	0	0	0	0	0	1	0
Polychaeta	Sabellida	Oweniidae	*Owenia*	*petersenae*	N	0	0	1	0	0	1	0	0	0	1
Polychaeta	Terebellida	Ampharetidae	*Ampharete*	*kerguelensis*	N	0	0	0	0	1	0	0	0	0	0
Polychaeta	Terebellida	Flabelligeridae	*Pherusa*	*parmata*	N	0	0	0	0	0	0	1	0	0	0
Polychaeta	Terebellida	Pectinariidae	*Pectinaria*	*australis*	N	1	0	1	1	0	0	0	0	1	0
Rhodophyceae	Plocamiales	Plocamiaceae	*Plocamium*	*cirrhosum*	N	1	0	0	0	0	1	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), N = native, C! = cryptogenic category 1, C2 = cryptogenic category 2, SI = species indeterminata. See text for details.

Appendix 5d. Results from the dinoflagellate cyst core samples.

					Berth code	ENTRANCE		GEDDIS		HERRICK		MID PORT	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2
Dinophyceae	Gymnodiniales	Gymnodiniacea	*Gymnodinium*	*catenatum*	C1	0	1	1	0	0	0	1	0
Dinophyceae	Gymnodiniales	Gymnodiniacea	*Cochlodinium*	*sp.*	N	0	1	0	0	1	0	0	0
Dinophyceae	Peridiniales	Gonyaulacaceae	*Gonyaulax*	*grindleyi*	N	1	0	0	1	0	0	0	0
Dinophyceae	Peridiniales	Peridiniaceae	*Lingulodinium*	*polyedrum*	N	0	1	1	1	0	1	1	0
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium*	*sp.*	N	1	0	0	0	1	1	0	0
Dinophyceae	Peridiniales	Peridiniaceae	*Scrippsiella*	*trochoidea*	N	0	1	1	1	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), N = native, C1 = cryptogenic category 1, C2 = cryptogenic category 2, SI = species indeterminata. See text for details.

Appendix 5e. Results from the fish trap samples.

					Berth code	CASSIDY				GEDDIS				HERRICK				HIGGINS				KIRKPATRICK			
					Line No.	1		2		1		2		1		2		1		2		1		2	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Actinopterygii	Anguilliformes	Congridae	*Conger*	*wilsoni*	N	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	0	0	0
Actinopterygii	Gadiformes	Moridae	*Lotella*	*rhacinus*	N	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Actinopterygii	Gadiformes	Moridae	*Pseudophycis*	*bachus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Actinopterygii	Mugiliformes	Mugilidae	*Parapercis*	*colias*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Actinopterygii	Perciformes	Carangidae	*Caranx*	*georgianus*	N	0	0	1	0	1	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0
Actinopterygii	Perciformes	Carangidae	*?Trachurus*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Carangidae	*Trachurus*	*novaezelandiae*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Cheilodactylidae	*Nemadactylus*	*macropterus*	N	1	0	0	0	1	1	1	1	1	0	1	0	0	1	1	0	1	1	1	1
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	0	1	1	0	1	1	1	1	0	1	1	1	1	0	1	0	1	1	1	1
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*miles*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Actinopterygii	Perciformes	Scorpidinae	*Scorpis*	*lineolata*	N	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Actinopterygii	Perciformes	Sparidae	*Pagrus*	*auratus*	N	0	0	1	0	0	0	0	0	0	1	1	1	0	0	1	0	0	1	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Chondrichthyes	Carcharhiniformes	Triakidae	*Galeorhinus*	*australis*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), N = native, C1 = cryptogenic category 1, C2 = cryptogenic category 2, SI = species indeterminata. See text for details.

Appendix 5f. Results from the crab trap samples.

					Berth code	CASSIDY				GEDDIS				HERRICK				HIGGINS				KIRKPATRICK	
					Line no.	1		2		1		2		1		2		1		2		1	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Actinopterygii	Anguilliformes	Congridae	*Conger*	*wilsoni*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Actinopterygii	Gadiformes	Moridae	*Pseudophycis*	*bachus*	N	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	1	0	0
Actinopterygii	Gadiformes	Moridae	*Lotella*	*rhacinus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	1	0	0	0	1	1	0	0	0	0	1	1	1	0	0	1	0	1
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*fucicola*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	1	0	1	1	1	1	0	1	0	0	1	0	1	1	1	1	0	0
Cephalopoda	Octopoda	Octopodidae	*Octopodidae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Crustacea	Anomura	Paguridae	*Pagurus*	*novizealandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Crustacea	Anomura	Paguridae	*Pagurus*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Crustacea	Palinura	Palinuridae	*Jasus*	*edwardsi*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Gastropoda	Neogastropoda	Buccinidae	*Cominella*	*adspersa*	N	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1
Gastropoda	Notaspidea	Pleurobranchidae	*Pleurobranchaea*	*sp.*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus*	*porosus*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Polyplacophora	Ischnochitonina	Chitonidae	*Ischnochitonina*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), N = native, C1 = cryptogenic category 1, C2 = cryptogenic category 2, SI = species indeterminata. See text for details.

Appendix 5g. Results from the starfish trap samples.

					Site code	CASSIDY				GEDDIS				HERRICK				HIGGINS				KIRKPATRICK	
					Line No.	1		2		1		2		1		2		1		2		1	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	0	1	0	1	1	1	1	1	1	1	1	0	0	1	0	0	0
Crustacea	Palinura	Palinuridae	*Jasus*	*edwardsi*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1
Crustacea	Anomura	Paguridae	*Pagurus*	*novizealandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Crustacea	Anomura	Paguridae	*Pagurus*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gastropoda	Notaspidea	Pleurobranchidae	*Pleurobranchaea*	*sp.*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), N = native, C1 = cryptogenic category 1, C2 = cryptogenic category 2, SI = species indeterminata. See text for details.

Appendix 5h. Results from the shrimp trap samples.

				Berth code		CASSIDY				GEDDIS				HERRICK				HIGGINS				KIRKPATRICK	
					Line No.	1		2		1		2		1		2		1		2		1	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Malacostraca	Isopoda	Cirolanidae	*Natatolana*	*rossi*	N	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0	1
Malacostraca	Isopoda	Cirolanidae	*Natatolana*	*narica*	N	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Gastropoda	Neogastropoda	Muricidae	*Xymene*	*plebeius*	N	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*subuculata*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), N = native, C1 = cryptogenic category 1, C2 = cryptogenic category 2, SI = species indeterminata. See text for details.

Addendum

After completing these reports we were advised of changes in the identification of one species. The ascidian *Cnemidocarpa sp*. refered to in this report as a new introduction to New Zealand has been revised to *Cnemidocarpa nisiotus* (status: native).