Whangarei Harbour (Whangarei Port and Marsden Point)

Baseline survey for non-indigenous marine species (Research Project ZBS 2000/04)

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Executive Summary

This report describes the results of a November 2002 survey to provide a baseline inventory of native, non indigenous and cryptogenic marine species within the Port of Whangarei, located near the city of Whangarei, and shipping terminals at Marsden Point operated by Northport and the New Zealand Refining Company.

- 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 habitats within the two Whangarei Harbour facilities. 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 Whangarei and Marsden Point facility 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 207 species or higher taxa was identified from the Whangarei Port and Marsden Point survey. They consisted of 128 native species, 19 non-indigenous species, 38 cryptogenic species (those whose geographic origins are uncertain) and 22 species indeterminata (taxa for which there is insufficient taxonomic or systematic information available to allow identification to species level).

- Eighteen species of marine organisms collected from the two Whangarei Harbour facilities have not previously been described from New Zealand waters. One of these was a newly discovered non-indigenous species of bryozoan (*Celleporaria sp.1*). Fourteen of the other 17 newly recorded species do not match existing taxonomic descriptions within New Zealand or overseas and may be new to science.

- The 19 non-indigenous organisms described from the Port of Whangarei and Marsden Point facility included representatives of six phyla. The non-indigenous species detected (ordered alphabetically by phylum, class, order, family, genus and species) were: (Annelida) *Ficopomatus enigmaticus*, *Polydora hoplura*, *Pseudopolydora kempi* and *Pseudopolydora paucibranchiata*, (Bryozoa) *Bugula flabellata, Bugula neritina, Bugula stolonifera, Tricellaria inopinata, Cryptosula pallasiana, Celleporaria sp.1, Schizoporella errata* and *Watersipora subtorquata*, (Cnidaria) *Obelia longissima*, (Crustacea) *Jassa slatteryi* and *Pyromaia tuberculata,* (Mollusca) *Crassostrea gigas* and *Theora lubrica,* (Porifera) *Vosmaeropsis* cf *macera* and *Cliona celata.*

- None of the species from the Whangarei Harbour is currently listed on the New Zealand register of unwanted marine organisms. Resting cysts of the cryptogenic toxin-producing dinoflagellate, *Gymnodinium catenatum* was recorded in sediment samples taken from Marsden Point. *G. catenatum* is one of four toxic dinoflagellates listed on the Australian ABWMAC list of unwanted marine pests.

- Most non-indigenous species located in the Harbour are likely to have been introduced to New Zealand accidentally by international shipping. Approximately 69 % (13 of 19 species) of NIS in the Whangarei Harbour are likely to have been introduced in hull fouling assemblages, 5 % via ballast water and 26 % could 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 Whangarei and Marsden Point facility (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.

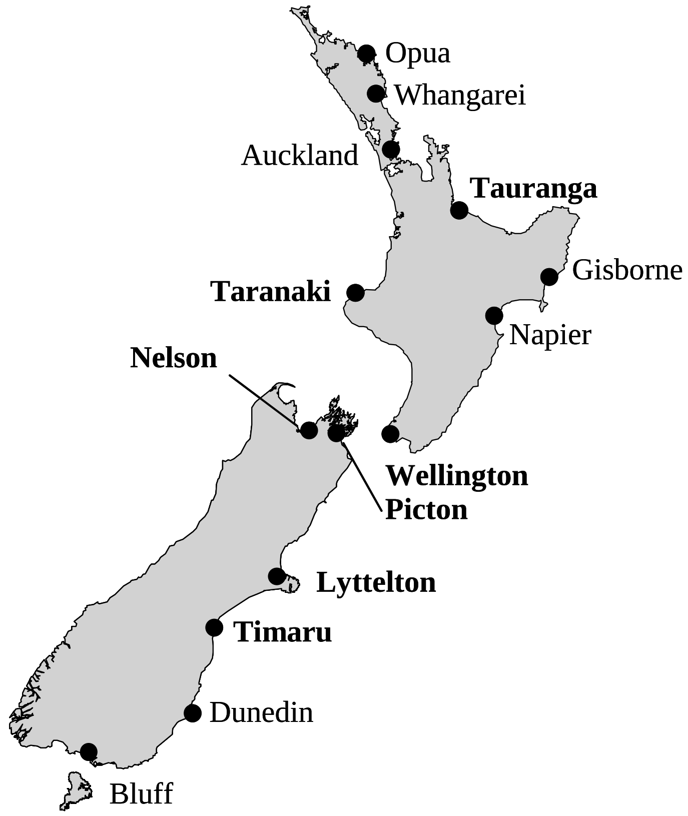

Figure 1: Commercial shipping ports in New Zealand where baseline non-indigenous species surveys have been conducted. Group 1 ports surveyed in the summer of 2001/2002 are indicated in bold and group 2 ports surveyed in the summer of 2002/2003 are indicated in plain font. Marinas were also surveyed for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

This report summarises the results of the Whangarei Harbour survey and provides an inventory of species present in Whangarei Port and at Marsden Point. 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 PORT WHANGAREI AND MARSDEN POINT

Whangarei Harbour is a large drowned river estuary situated in Northland on the east coast of the North Auckland peninsula (Fig. 1). There are three ports within the confines of the

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

harbour: Marsden Point, Portland Cement Terminal and Port Whangarei. Port Whangarei is located immediately south of Kissing Point in the upper Whangarei Harbour, while Marsden Point is situated at the south-east mouth of the harbour (Fig. 2). These facilities are the most northern multi-purpose ports in New Zealand and the closest ports to the majority of New Zealand's international markets. Portland has one jetty which serves the Golden Bay Cement Company cement works. Currently one specialised bulk cement vessel uses this facility on a regular basis (www.northport.co.nz).

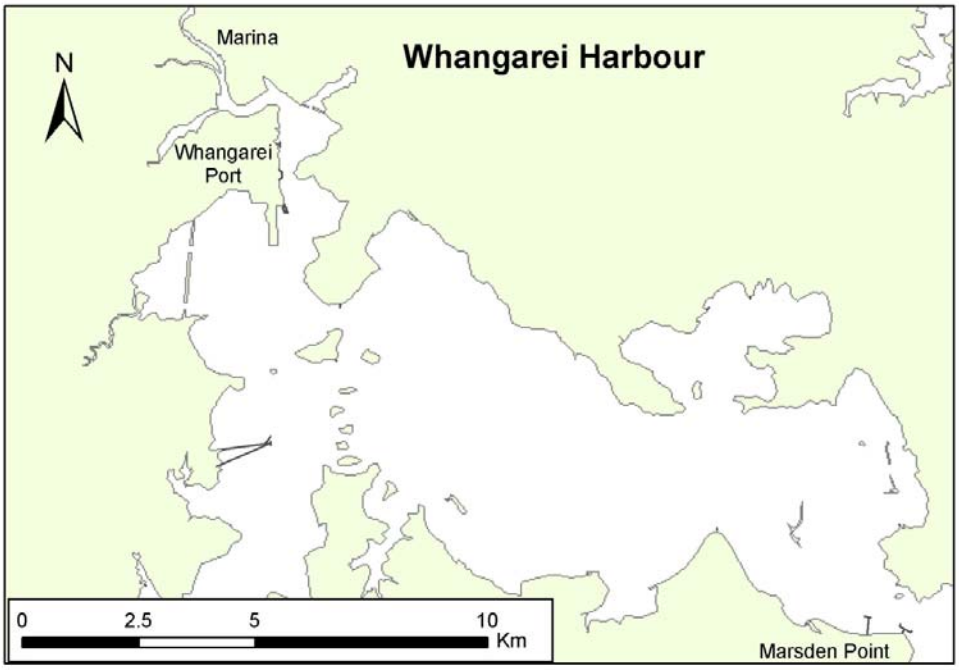

Figure 2: Whangarei Harbour map

PORT WHANGAREI AND MARSDEN POINT OPERATIONS AND SHIPPING MOVEMENTS

NorthPort Ltd is the port operating company for the ports of Whangarei and Marsden Point, and is jointly owned by Northland Port Corporation and Port of Tauranga on a 50/50 basis (www.northport.co.nz). Whangarei Port and Marsden Point both serve as a major export/import hub for the forestry, horticulture and agricultural sectors of the region, and a wide variety of cargoes can be handled at each facility. These include: coal, clinker, bagged cement, bulk fertiliser, gypsum, kiwifruit, logs, meat, veneer, triboard, and woodchip. Port Whangarei is served by road and rail whilst Marsden Point is a deep water port served by a road connection.

Port Whangarei (35°45'S, 174°21'E) (Fig. 3) was largely developed during the 1920's to 1940's, and is currently a commercial port for cargoes other than those handled at Marsden Point. The three main berths are constructed of reinforced concrete pilings with wooden fenders. Details of the berthing facilities available in the Port of Whangarei are also provided in Table 1. Port Whangarei is running out of space to dispose of dredgings needed to keep the wharf basin and upper harbour channel deep enough for cargo vessels and the wharves are ageing and do not have the load-bearing strength required for modern, efficient cargo-handling machinery. In addition, the berthing basin and channel are too small to service the larger ships now needed for the export trade. Hence, it is anticipated that further development of the Marsden Point facility will replace the requirement for this facility when NorthPort's lease expires in 2007.

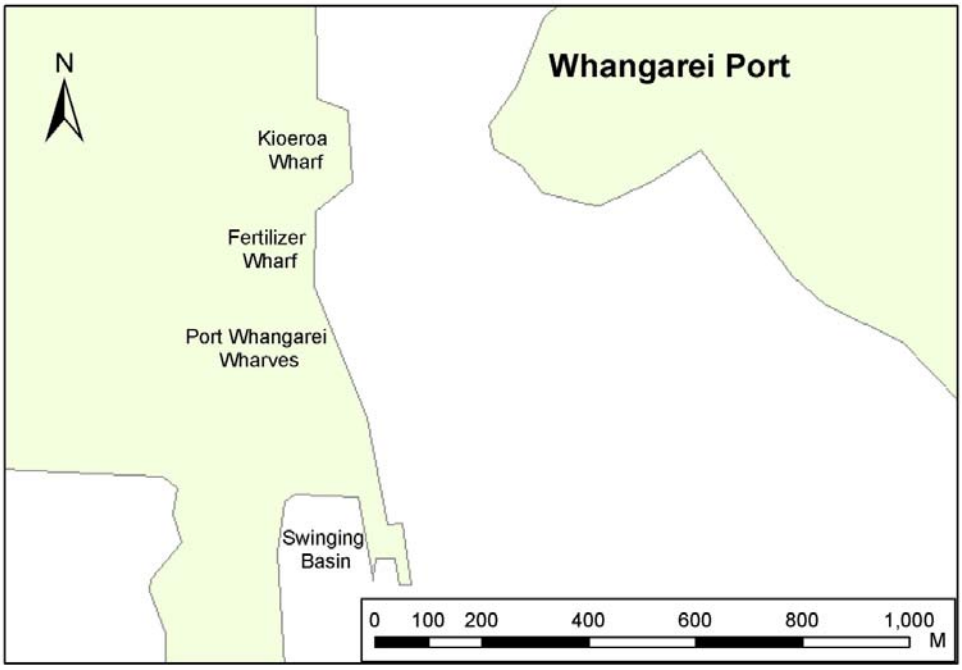

Figure 3: Whangarei Harbour: Whangarei Port map

Marsden Point (35°50'S, 174°30'E) (Fig. 4) has two oil jetties which serve the New Zealand Refining Company. Northport Ltd owns a three berth port facility at Marsden Point up harbour of the two oil jetties, together with adjacent backup land. Construction on NorthPort's Marsden Point facility first commenced in 2000, and is on-going. Although primarily for the export of forest products, the terminal is a flexible facility catering for large multi-purpose vessels (www.northport.co.nz) and has a turning basin of 45 ha. Vessels of greater than 180m LOA and/or greater than 10m draft may be restricted to slack water arrivals or sailings at Marsden Point. The main berths are comprised of a reinforced concrete deck on top-driven steel pipe piles and 30 m deep rear retaining wall of 23 m long tie-back anchors and continuous 7.5 m deep deadman (www.fcc.co.nz/project/80). The multipurpose wharf is an old structure from the 1960's (originally associated with the Marsden Point Oil Refinery) with reinforced concrete pilings and wooden fenders. Details of the berthing facilities available at Marsden Point are provided in Table 1.

Recent analyses of shipping arrivals to Marsden Point and Port Whangarei show that these two facilities received a combined 226 international ship visits during 2002/2003 (180 merchant, 40 pleasure, three fishing, two passenger, and one barge/tug vessels). Half of the commercial vessels entering Marsden Point during 2002/2003 arrived from Australia (50%). Other major vessel sources include the north-west Pacific (23%), and 5% each from the east Asia and the south Pacific (Campbell 2004). During the same period, most vessels entering Port Whangarei arrived from the north-west Pacific (39 %), the south Pacific (18 %), Australia (12 %), east Asian (9 %), and Arabian seas(4 %) (Campbell 2004). In both facilities, 14 % of vessels arrived from unresolved locations. In 1998, Port Whangarei handled 600,000 tonnes of logs and forestry products alone, with this expected to rise to 2.4 million tonnes in 2004 (with a larger proportion of this forestry trade moving to Marsden Point), with a capacity of 2.8 million tonnes with the full development of the Marsden Point deepwater port (www.northlandportcorp.co.nz).

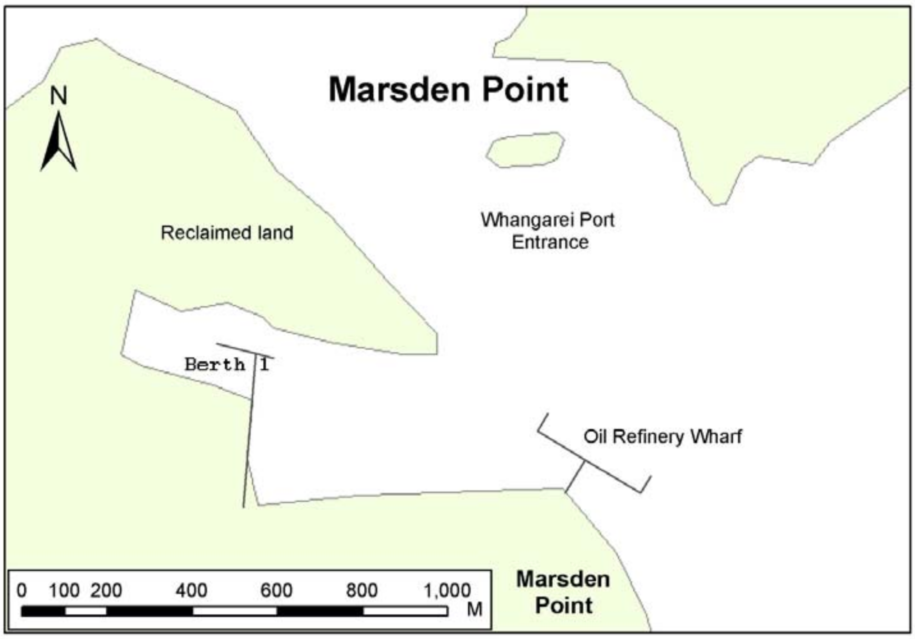

Figure 4: Whangarei Harbour: Marsden Point map

For large vessels anchoring outside of Port Whangarei and Marsden Point and awaiting pilotage, there is an anchoring position one mile east-south-east of the fairway buoy (35°53.24'S, 174°33.15'E). With the exception of the bulk cement vessel trading to Portland, all vessels 100 GRT or over have compulsory pilotage.

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 294,656 m^3 of ballast water was discharged in the Port of Whangarei in 1999, with the largest country-of-origin volumes of 66,087 m^3 from Japan, 26,218 m^3 from South Korea, 17,638 m^3 from Hong Kong, and 169,333 m^3 unspecified.

Within Whangarei Harbour, maintenance dredging of the main channel approaches in the upper harbour adjacent to Port Whangarei requires the removal of up to 155,000 m^3 of spoil per year. This material is pumped into NorthPort's dredge ponds at the rear of the port area by cutter suction dredge (www.nrc.govt.nz/planning/documents/rcp22.pdf) and is planned to be used for further reclamation development. Maintenance dredging of the lower harbour channel is infrequent, and methods for disposal vary.

The approach to the Marsden Point refinery jetties has a minimum depth of 14.7 m at chart datum adjacent to Home Point south-east of Marsden Point. The minimum width of 190 m is between No 3 and No. 6 buoys. Tidal streams are strongest in the area of No. 7 buoy (adjacent to Home Point southeast of Marsden Point) where rates up to 3 knots may be experienced. For vessels proceeding to NorthPort's No 1 and No 2 Marsden Point cargo berths the controlling depth is 12.6m at chart datum which is the dredged swinging basin off the berths. When completed, this swinging basin will have a maximum width of 420m. For vessels proceeding to NorthPort's Marsden Point jetty berth, the controlling depth is 8.4m at chart datum. From One Tree Point up to Port Whangarei the channel is shallower and narrower with a channel minimum depth of 7.2 m. The minimum width for most of its length is 90 m. The minimum charted depth to Portland is 4.6 m. Tidal streams at Port Whangarei are around 1 knot.

In terms of future development, NorthPort Ltd is still developing its deep water general/bulk cargo facility at Marsden Point. This is a 50:50 joint venture with the Port of Tauranga, with the additional reclamation of 35 ha. With ever-increasing cargo volumes coming out of Northland, and Port Whangarei unable to handle the large volumes of timber exports expected, the decision was made in 1995 to commence development at Marsden Point when initial resource consent applications were made. These applications were provisionally granted resource consent in 1997 (www.nrc.govt.nz). Development of the new port is on-going but the first two berths are operational and the resource consent process is underway for additional berths to handle the balance of the existing business currently at Port Whangarei. There is the potential for the Marsden Point facility to be equipped for large-scale container traffic, which would provide Northland with a significant import/export alternative to Auckland. For the land adjacent to the Marsden Point berthing facilities, there is development of an industrial park, and also a proposal for a canal/residential development (Marsden Cove) (www.northlandportcorp.co.nz) which, if it goes ahead would see an increase in recreational vessel movements in the immediate area.

In terms of future expansion at Port Whangarei, a developer has recently purchased 85 ha on Port Road, with plans to develop a "marine precinct" on the land with deep water access, travel lift and extra berths for recreational vessels and super yachts, with marine servicing and ship construction activities anticipated.

PHYSICAL ENVIRONMENT OF WHANGAREI HARBOUR

Whangarei Harbour is a large estuarine system, some 24 kilometres in length and 100 km^2 in extent. It includes a diverse range of habitats including 54 km^2 of intertidal flats, 14 km^2 of mangroves and 2 km^2 of saltmarsh. The main harbour channel enters from the open coast between Marsden Point and Lort Point, with water depths of 15–31 m. The seafloor of the harbour entrance and middle harbour are dominated by coarse sands and muddy sands. The middle harbour is 4–5 km wide, with the main channel on the northern side, and extensive intertidal flats to the south. The channel divides near Onerahi, with one arm going north along the Hatea River channel, and the other going southeast into the Portland arm. From the 1920's to the 1970's a major source of mud into the upper harbour was waste material from the Portland cement works which were directly discharged into the Portland arm of the upper harbour. The lower (south eastern end) of the harbour is generally deeper, with wider channels and small areas of intertidal flats. Sediments in this area of the harbour are mainly fine-medium sands that have been deposited via the harbour entrance. Mean grain size decreases up-harbour and away from the main channels, reflecting a decrease in dispersal energy and current velocities (Millar 1980).

Whangarei Harbour has a mean tidal range of 1.7 m (neap tides) to 2.3 m (spring tides). The residence times calculated for water masses in Whangarei Harbour range from 24 days in winter to 120 days in summer. Residence times typically decrease with increasing freshwater input into the harbour, although freshwater input is generally low due to the small size of the surrounding catchment (Millar, 1980). Salinity increases up-harbour with only small vertical variations, and the greatest salinity variations occur near the port area. During summer most of the harbour is well mixed, while in winter the lower harbour is well mixed and the upper harbour is partially mixed. High freshwater input causes a salt-wedge structure in the Port Whangarei area and causes the lower harbour to become partially mixed. Current velocities gradually decrease up-harbour from around 1 ms^{-1} at Marsden Point to 0.8 ms^{-1} at Limestone Island (Millar 1980).

EXISTING BIOLOGICAL INFORMATION

Over the last three decades a number of biological surveys have been carried out in Whangarei Harbour, although none of these surveys has specifically focused on collecting and identifying non-indigenous marine species. We briefly review these studies and their findings below.

Bioresearches Ltd (1976) divided the harbour into seventeen zones based on the distribution of dominant organisms, the nature of the surface sediment and the tidal height of the substrate. For example they defined a "*Macrophthalmus* zone" as having abundant *Macrophthalmus hirtipes* and an intertidal level ranging from low water neap to sub littoral with soft sediments comprised of very fine sand and mud. The zone extends from below the mangrove zone into the muddy channels of the inner harbour, and merges with the *Chione-Tellina* zone in the middle harbour. Both *Macrophthalmus hirtipes* and *Theora lubrica* (a non-indigenous species of bivalve) were common throughout the zone, while species such as *Nucula hartvigiana* and *Pleuromeris zelandica* were noted as being generally common but having a widespread distribution within the zone.

Mason and Ritchie (1979) carried out an ecological study of the benthos and fishes in Whangarei Harbour for the Northland Harbour Board. They collected macrofauna samples at intersections of a grid marked on a harbour map and conducted intertidal transects in areas of different shore types. The data from each sample location were used to allocate it to one of the seventeen zones previously described by Bioresearches Ltd (1976). They also conducted a survey of the occurrence, distribution, feeding habits and reproductive state of fishes within the Whangarei Harbour. They reported that the shallow upper harbour area with extensive mangrove stands and mudflats had the highest overall utilisation by fish, the highest abundance of commercially important fish, and was used by more species than the central and outer harbour areas. It was also suggested that there was a higher degree of food selectivity in the upper harbour areas and that many fish travel great distances to feed in these areas.

These authors also discussed changes in the harbour ecology and noted for example, that much of the original maritime marsh zone and mangrove zone had been destroyed by drainage and reclamation. Recommendations for minimising damage to the ecology of the harbour were given.

The Northland Harbour Board (1981) reported on the intertidal and sublittoral habitats at Marsden Point as part of an environmental impact report for the proposed port development. Intertidal samples were collected at various distances ranging from 5-250m offshore along five transects. A total of 61 species was recorded from the intertidal zone. The distribution of intertidal biota was found to be patchy and diversity was highest at the eastern end of the study area, and declined toward the west. Species were typical of organisms usually present on intertidal sand flats. Populations of edible-sized shellfish were noted to have reached moderate densities, but only in localised patches. Sublittoral samples were also taken 500 m and 700 m offshore on all five transects and contained a diverse array of species typical of sublittoral habitats with shell/gravel substrates. Generally the samples taken 500 m offshore were characterised by hermit crabs, whereas turret shells and hermit crabs were equally abundant at 700 m offshore. The 700 m samples also contained a higher diversity of sponge species, although most species were found in low densities and with patchy distributions.

In a confidential client report for Environmental Quality Consultants, Hayden (1997) compiled a breakdown of ballasted ship movements in Port Whangarei for the years 1992-1996, estimating the ballast capacity of vessels visiting Whangarei as first port of call and estimating the actual ballast discharge of those vessels in Whangarei.

Taylor and MacKenzie (2001) Port Whangarei for the presence of the toxic blooming dinoflagellate *Gymnodinium catenatum*, but did not detect any resting cysts (sediment samples) or motile cells (phytoplankton samples).

Morrison (2003) described the results of part of a large scale, estuarine fish survey of northern New Zealand (FRST research programme CO1X022 - "Fish usage of estuarine and coastal habitats") that included survey sites in upper Whangarei Harbour. The survey used small beach seines (9 mm mesh) deployed from intertidal flats. The muddier upper areas of Whangarei Harbour tended to support a wider range of fish species than the sandflats of the middle and lower harbour. Catches with the beach seine were dominated by anchovy (*Engraulis australis*), yellow-eyed mullet (*Aldrichetta forsteri*), exquisite goby (*Favinogobius exquisitus*), sand goby (*F. lentiginosus*), and juveniles of commercially important species, such as sole (*Peltorhampus latus*), flounder (*Rhombosolea plebia* and *R. leporina*) and snapper (*Pagrus auratus*). A number of individuals of the non-indigenous bridled goby (*Arenigobius bifrenatus*) were also captured in the upper harbour during the surveys.

In a confidential client report for Northland Regional Council, Cummings and Hatton (2003) reviewed the suitability of several sites identified by the council as potential sites for shellfish reseeding. This report reviewed existing information on the intertidal benthic communities (specifically shellfish) and habitat types at the identified sites, and conducted additional quantitative work on these aspects. The review highlighted the importance as habitat for various bivalves according to Mason and Ritchie (1979), Dickie (1984), Poynter and Kessing (2002), and Cryer *et al.* (2003). Cummings *et al.* (2004) subsequently initiated a consultative process with the Whangarei Harbour Kaitiaki Roopu, and conducted preliminary reseeding trials with cockles (*Austrovenus stutchburyi*) at several sites.

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 dinoflagellates. Below, we describe the methods and sampling effort used for the Whangarei survey. The survey was undertaken between November 11th and 18th, 2002. Most sampling was concentrated on the following key berths: Main Wharves 1 and 2 at Port Whangarei, and Wharf 1 and the oil refinery wharf at Marsden Point. A summary of sampling effort within the harbour 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. 5). 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.

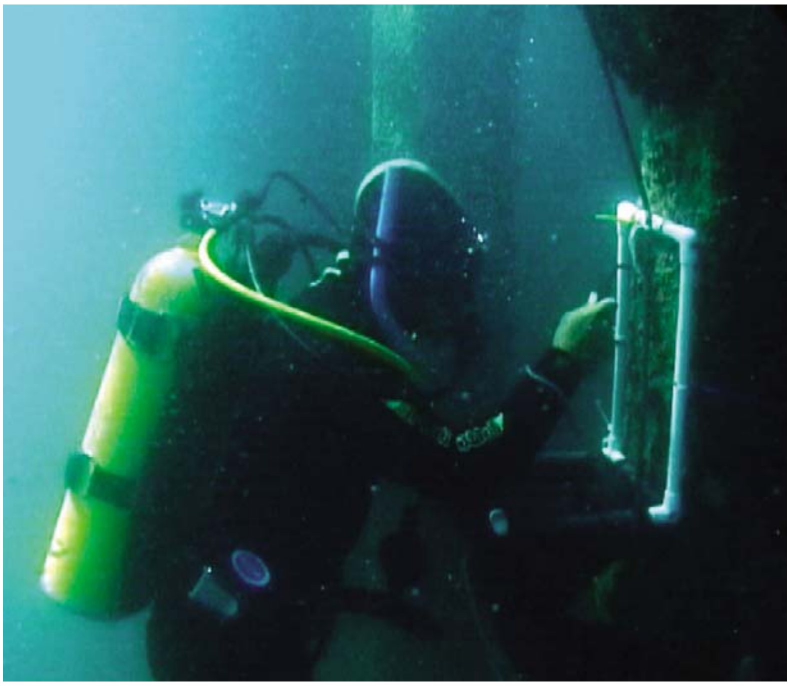

Figure 5: Diver sampling organisms on pier piles.

BENTHIC INFAUNA

Benthic infauna was sampled using a Shipek grab sampler deployed from a research vessel moored adjacent to the berth (Fig. 6), 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 6: 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. 7). 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.

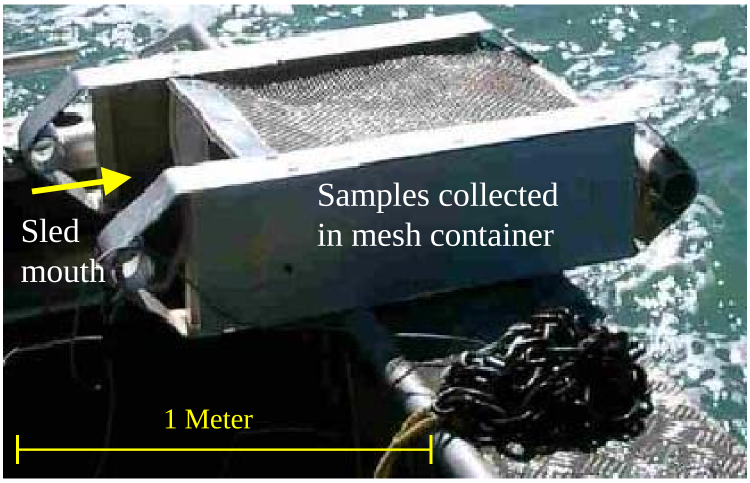

Figure 7: Benthic sled

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. 8). The corer consists of a 1 m long x 1cm 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 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).

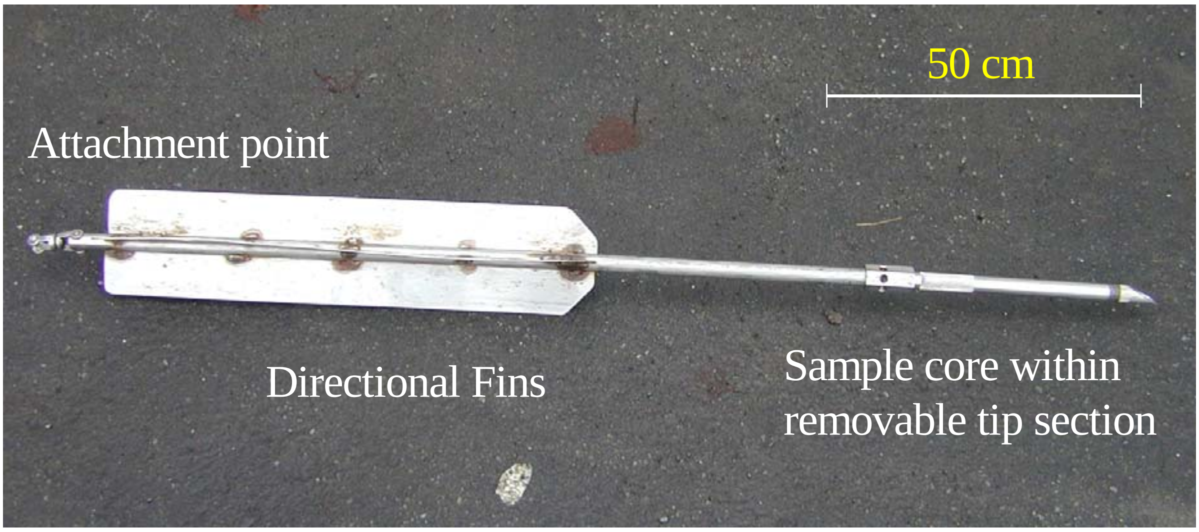

Figure 8: Javelin corer

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. 9). 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 one 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

Fukui designed box traps (63 cm x 42 cm x 20 cm) with a 1 cm mesh netting were used to sample mobile crabs and other small epibenthic scavengers (Fig.9). 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. 9). These are circular hoop traps with a basal diameter of 100 cm and an opening on the top of 60 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.

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.

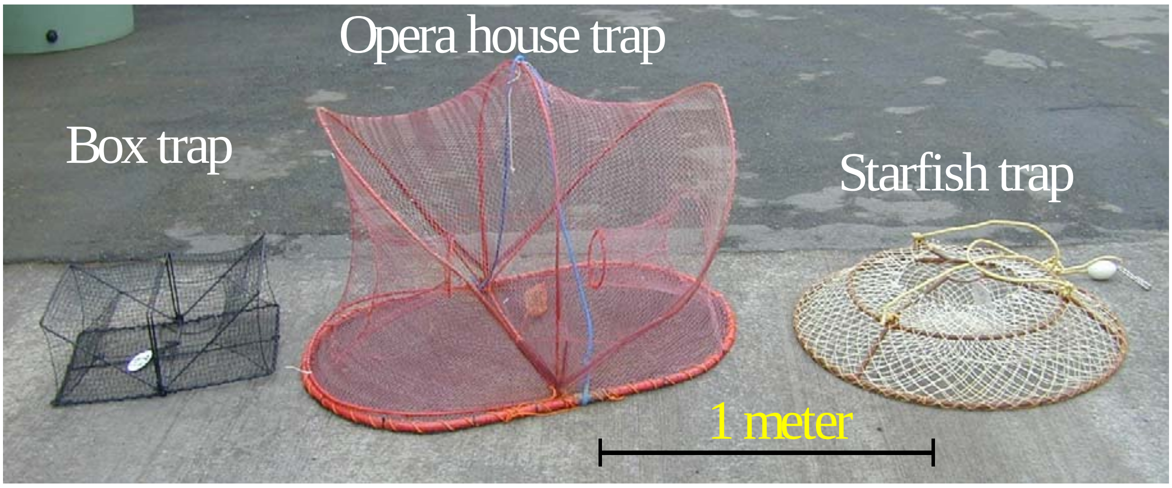

Figure 9: Trap types deployed in the port.

SAMPLING EFFORT

A summary of sampling effort within the Whangarei Port and Marsden Point facility is provided in Tables 3 a,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 number of quadrats sampled on each pile relative to 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 for each of the sample methods in the Port of Whangarei and Marsden Point is indicated in the following figures: diver pile scrapings and javelin cyst coring (Figs. 10 and 11), benthic sledding and Shipek grab sampling (Figs. 12 and 13), box, starfish, shrimp and opera house fish trapping (Fig. 14 and 15). Sampling effort was varied between ports and marinas on the basis of risk assessments (Inglis 2001) to maximise the search efficiency for NIS nationwide. Sampling effort in each of the 13 ports and three marinas surveyed over two summers is summarised in Table 3c.

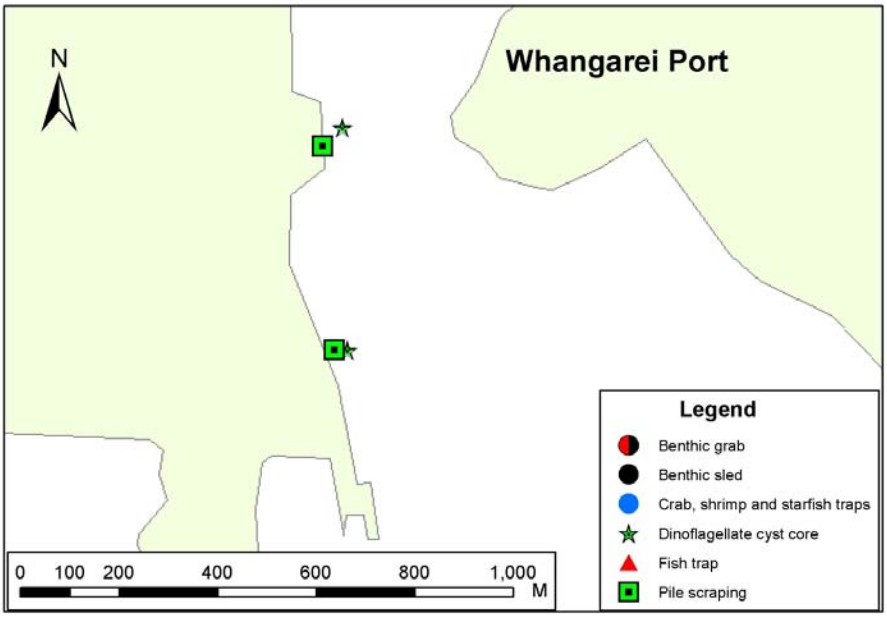

Figure 10: Diver pile scrape sites and dinoflagellate cyst sample sites at Whangarei Port

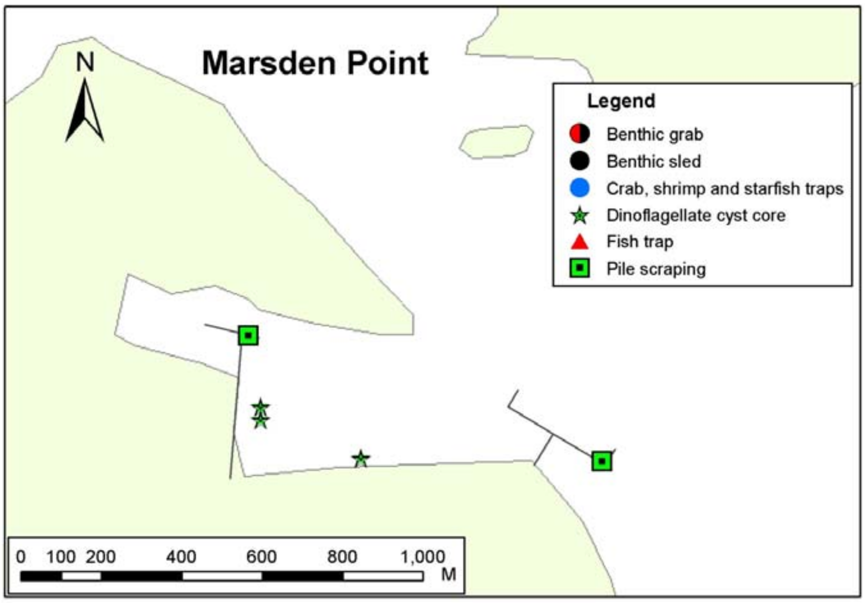

Figure 11: Diver pile scrape sites and dinoflagellate cyst sample sites at Marsden Point

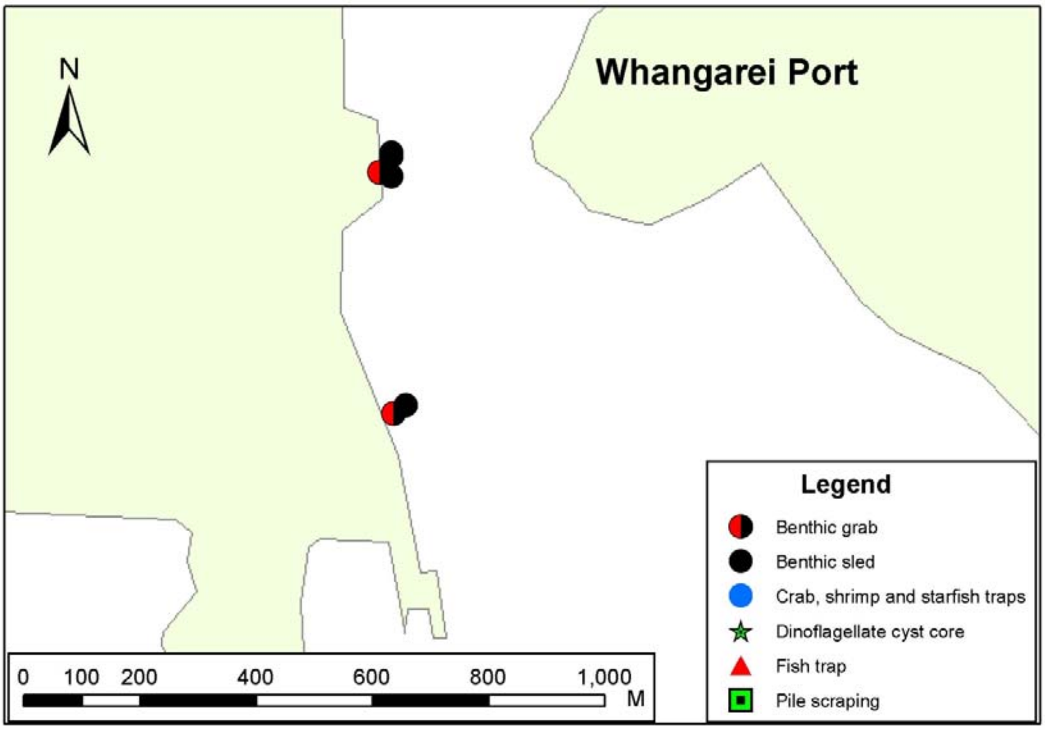

Figure 12: Benthic sled and benthic grab sites at Whangarei Port

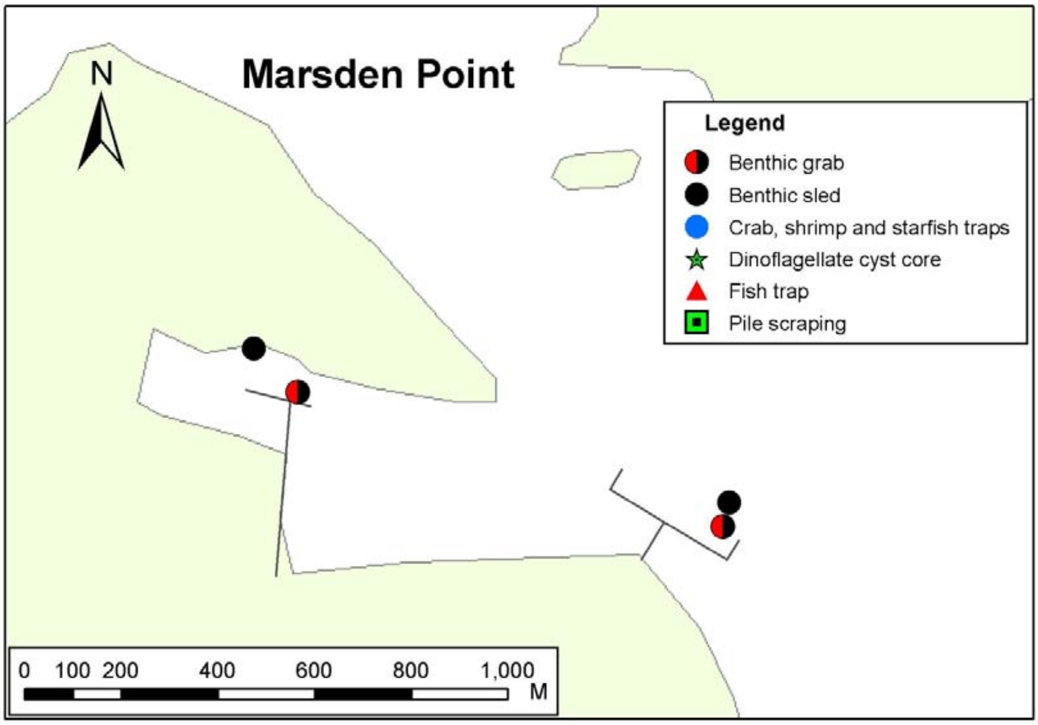

Figure 13: Benthic sled and benthic grab sites at Marsden Point

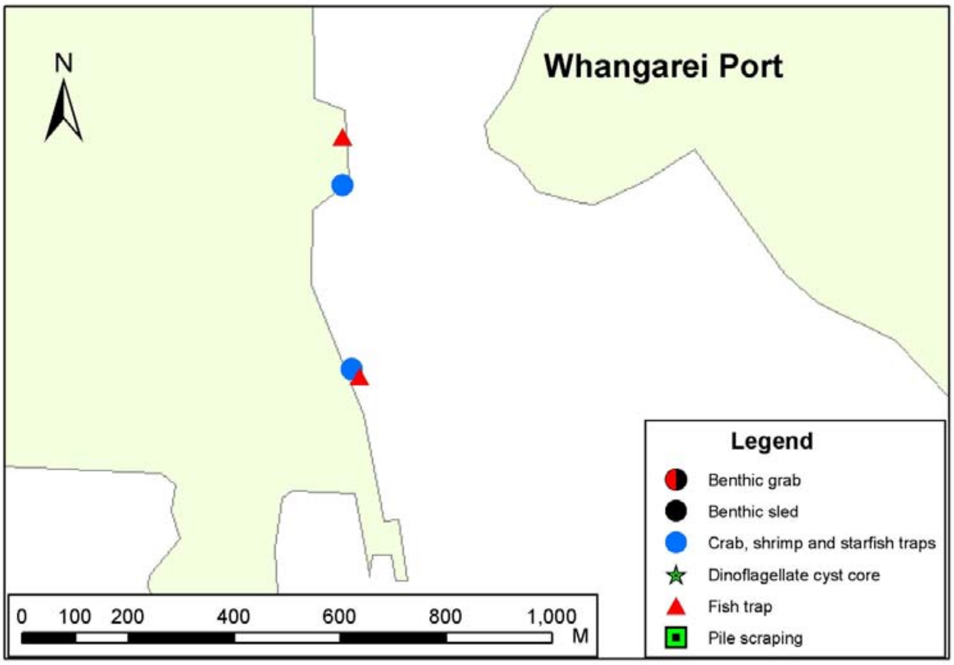

Figure 14: **Sites at Whangarei Port trapped with box (crab), shrimp and starfish traps and opera house fish traps**

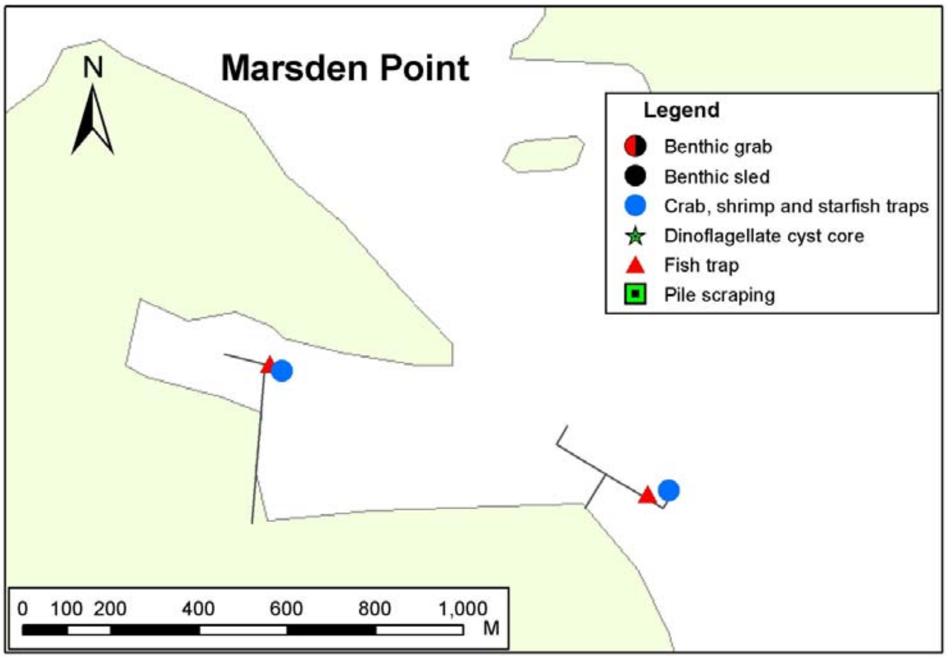

Figure 15: **Sites at Marsden Point trapped with box (crab), shrimp and starfish traps and opera house fish traps**

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 NATIVE, NON-INDIGENOUS AND CRYPTOGENIC SPECIES

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 of 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 new to 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 crucial 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

A total of 207 species or higher taxa was identified from the survey of Whangarei Port and Marsden Point. This collection consisted of 128 native (Table 6), 38 cryptogenic (Table 7), 19 non-indigenous species (Table 8) and 22 species indeterminata (Table 9, Fig. 16). The biota included a diverse array of organisms from 11 Phyla (Fig. 17). Eighteen species from the Port of Whangarei and Marsden Point had not previously been recorded from New Zealand waters.

NATIVE SPECIES

A total of 128 native species was identified from the Port of Whangarei and Marsden Point. Native species represented 62 % of all species identified from the harbour (Table 6) and included highly diverse assemblages of Annelida (34 species), Crustacea (34 species), Mollusca (23 species) and Urochordata (11 species. A number of other less diverse phyla were also sampled from the harbour (Table 6).

CRYPTOGENIC SPECIES

Thirty-eight cryptogenic species were discovered in Whangarei Harbour, which represents 19 % of all species or higher taxa identified from the Port and Marsden Point facilities. The cryptogenic organisms identified included 21 Category 1 and 17 Category 2 species as defined in Section 2.9 above. These organisms included one Annelid (the tubeworm, *Chaetopterus* sp. A), one Bryozoan (*Scruparia ambigua*), two Cnidaria (the hydroids *Plumularia setacea*, and *Bougainvillia muscus*), six Crustacea (the barnacles, *Amphibalanus variagatus* and *Balanus trigonus*; two crabs *Pilumnopeus serratifrons* and *Plagusia chabrus*;

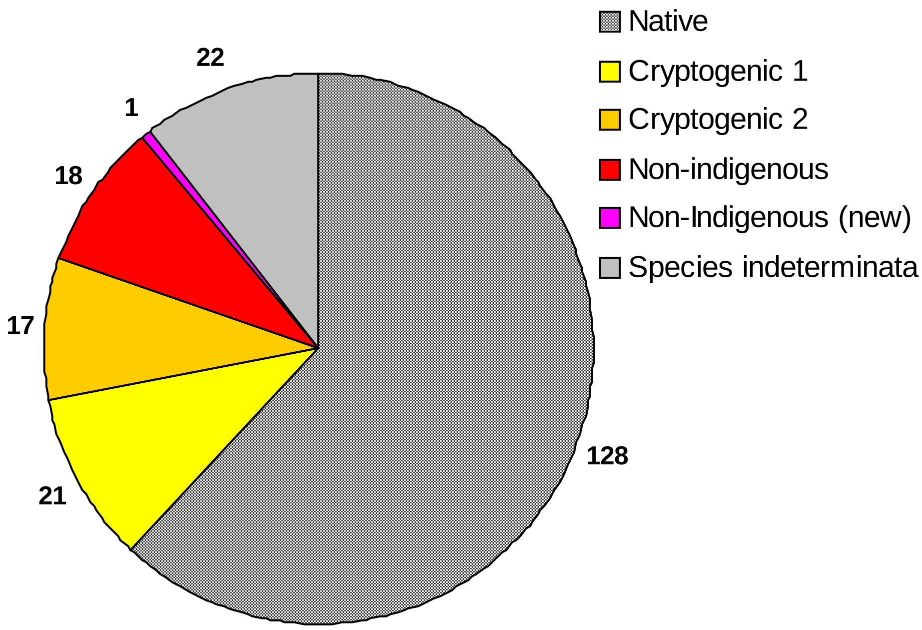

Figure 16: **Diversity of marine species sampled in the Port of Whangarei and Marsden Point, grouped according to their native, cryptogenic or non-indigenous status. Values indicate the number of species in each category.**

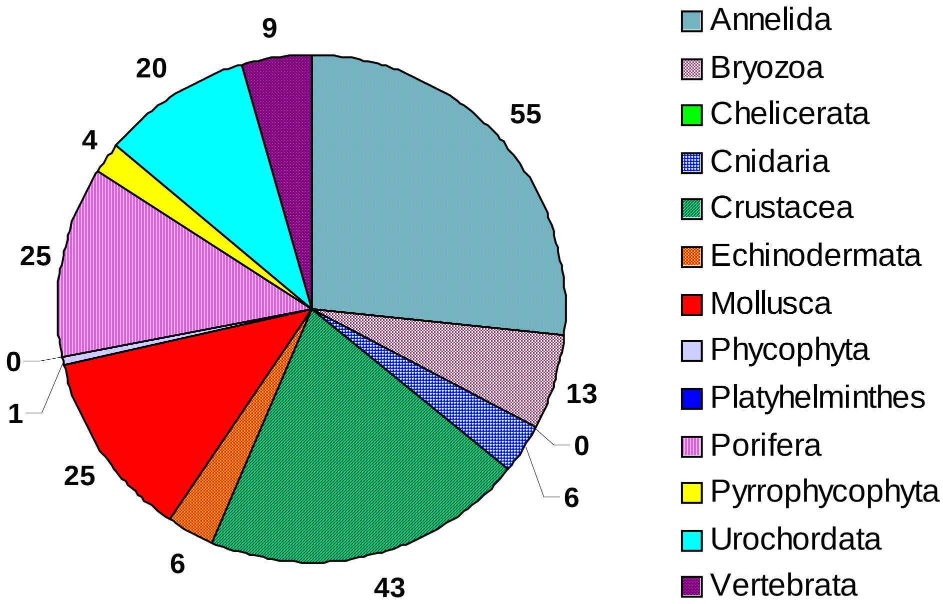

Figure 17: **Diversity of marine species sampled in the Port of Whangarei and Marsden Point grouped by Phyla. Values indicate the number of species in each Phylum. For general descriptions of the main groups of organisms (Phyla) encountered during this study refer to Appendix 2.**

and two amphipods *Gammaropsis* sp. aff. *G. tawahi* and *Parawaldeckia* sp. aff. *P. karaka*), 19 Porifera (six Category 1 species - *Callyspongia ramosa*, *Crella* (*Pytheas*) *incrustans*, *Euplacella communis*, *Halichondria panicea*, *Hymeniacidon perleve*, *Lissodendoryx isodictyalis* – and 13 Catgeory 2 species - *Adocia* n. sp. 4, *Callyspongia* n. sp. 2, *Callyspongia* n. sp. 3, *Callyspongia* n. sp. 4, *Dendrilla* n. sp. 1, *Echinochalina* n. sp. 1, *Euryspongia* n. sp. 1, *Euryspongia* n. sp. 3, *Halichondria* n. sp. 4, *Haliclona* n. sp. 3, *Halisarca* n. sp. 1, *Iophon* n. sp. 1, *Scopalina* n. sp. 1), one Pyrrophycophyta (*Gymnodinium catenatum*) and eight Urochordata species (six Category 1 species - *Aplidium phortax*, *Asterocarpa cerea*, *Botrylliodes leachii*, *Corella eumyota*, *Diplosoma listerianum*, *Styela plicata* – and two Category 2 species - *Microcosmus squamiger*, *Pyura* n.sp.2; Table 7).

Many of the Category 1 cryptogenic species, such as the ascidians *Aplydium phortax*, *Asterocarpa cerea*, *Botrylloides leachii*, and *Corella eumyota*, and the hydroid *Plumularia setacea*, have 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.)

The large, tube-building polychaete, *Chaetopterus* sp. A was also considered cryptogenic. This species came to the attention of New Zealand scientists in 1997 when commercial scallop fishers reported dense tube mats that appeared suddenly in scallop grounds in the Hauraki Gulf. It subsequently spread rapidly to other coastal areas of northeastern New Zealand from Bream Head, in the north, to the Motiti Islands in the South (Tricklebank *et al.* 2001). There is some uncertainty about the taxonomy of this species, since museum specimens and holotypes are often poorly preserved making comparisons with other species difficult. In the Port of Whangarei, *Chaetopterus* sp. A was a dominant component of fouling assemblages on wharf piles at Marsden Point. It occurred in most pile scrapes taken at, and below 3m depth at the Marsden Point Wharf and the oil refinery jetty.

NON-INDIGENOUS SPECIES

Nineteen non-indigenous species (NIS) were recorded from the Port of Whangarei and Marsden Point (Table 8). NIS represented 9.2 % of all identified species from Whangarei Harbour. One of these species, the bryozoan *Celleporaria* sp.1, was not previously known from New Zealand. NIS included four annelids (the polychaetes *Ficopomatus enigmaticus*, *Polydora hoplura*, *Pseudopolydora kempi*, *Pseudopolydora paucibranchiata*), eight bryozoans (*Bugula flabellata*, *Bugula neritina*, *Bugula stolonifera*, *Celleporaria* sp. 1, *Cryptosula pallasiana*, *Schizoporella errata*, *Tricellaria inopinata*, *Watersipora subtorquata*), one cnidarian (*Obelia longissima*), two crustaceans (an amphipod, *Jassa slatteryi*, and a crab, *Pyromaia tuberculata*), two molluscs (the bivalves *Crassostrea gigas* and *Theora lubrica*) and two sponges (*Cliona celata* and *Vosmaeropsis* cf *macera*).

A list of Chapman and Carlton’s (1994) criteria (see Section 2.9.2) that were met by the non-indigenous species sampled in this survey 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 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.

***Ficopomatus enigmaticus* (Fauvel, 1923)**

Image and information:
Joint Nature Conservation Committee (available online at: http://www.jncc.gov.uk/page-1700); Hewitt *et al.* (1999)

Ficopomatus enigmaticus is a serpulid polychaete. The worm lives within a white calcareous tube, and aggregation of tubes can lead to the formation of serpulid "reefs". *F. enigmaticus* has a very high tolerance to low salinities and requires water with fluctuating salinities to reproduce and spawn. It is a temperate-subtropical species that inhabits estuaries and lagoons. In the right conditions it is capable of forming massive aggregations of tubes. In Argentina's Mar Chiquita Coastal Lagoon, large masses of *F. enigmaticus* form circular reefs up to 7 m in diameter and 0.5 m deep, scattered over hundreds of hectares (Cohen 2005).

Ficopomatus enigmaticus occurs in most of the world's oceans but its exact native range is uncertain due to systematic difficulties. The type specimen was described from Canal de Caen on the Atlantic coast of France (Read and Gordon 1991). Populations of *F. enigmaticus* have been reported from the United Kingdom, Denmark, Netherlands, Spain, Mediterranean Sea, Black Sea, Caspian Sea, USA (California and Texas), Uruguay, northern Argentina, South Africa, southern and western Australia, New Zealand, Japan, and Hawaii (Cohen 2005). It first appeared in New Zealand in the 1960s when it formed extensive nuisance growths on vessel hulls and navigational structures in Whangarei Marina (Read and Gordon 1991). It has since been reported from Waitemata Harbour, Tamaki Estuary and Hawkes Bay (Cranfield *et al.* 1998). Large populations of *F. enigmaticus* may remove suspended particulate matter, reduce excess nutrient loads and improve oxygen levels in boat basins or enclosed waters with poor water quality (Eno *et al.* 1997). In Tamaki Estuary *F. enigmaticus* tubes cause severe fouling of cooling water intake pipes at the Otahuhu Power Station.

During the baseline survey *F. enigmaticus* was recorded only from Whangarei Town Basin Marina and the Port of Whangarei. In the Port of Whangarei, it occurred in pile scrape samples taken from the Kioeroa Wharf (Fig. 18). It was not found at Marsden Point.

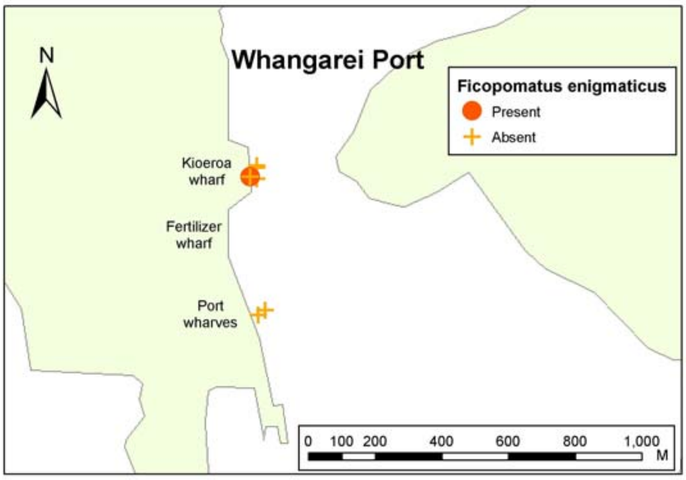

Figure 18: *Ficopomatus enigmaticus* distribution in the Port of Whangarei.

***Polydora hoplura* (Claparède, 1870)**

No image available.

Polydora hoplura is a spionid polychaete worm that bores into the shells of molluscs. It is a common pest of shellfish mariculture as its burrows cause blisters in the shells of farmed oysters, mussels and abalone (Pregenzer 1983, Handley 1995, Lleonart *et al.* 2003). The type specimen for this species was recorded from the Gulf of Naples, Italy (Claparède, E. 1870). Its native range is thought to be the Atlantic coast of Europe and the Mediterranean (Cranfield *et al.* 1998). *P. hoplura* has also been recorded from South Africa, South Eastern Australia (Bass Strait and Victoria; central, east coast and southern gulf coast, and Tasmania; Australian Faunal Directory 2005) and New Zealand where it is thought to have been introduced. It is not known when *P. hoplura* first arrived in New Zealand. In Europe and New Zealand, *P. hoplura* is often associated with shells of the introduced Pacific oyster *Crassostrea gigas* (Handley 1995).

Polydora hoplura had previously been recorded from Wellington and the Marlborough Sounds (Cranfield *et al.* 1998) and was recorded from Whangarei, Tauranga, Wellington, Picton, Nelson and Dunedin during the baseline port surveys (Table 10). In the Whangarei Harbour it occurred in pile scrape samples taken from the Marsden Point Wharf and Refinery Jetty (Fig. 19). It was not found in the Port of Whangarei.

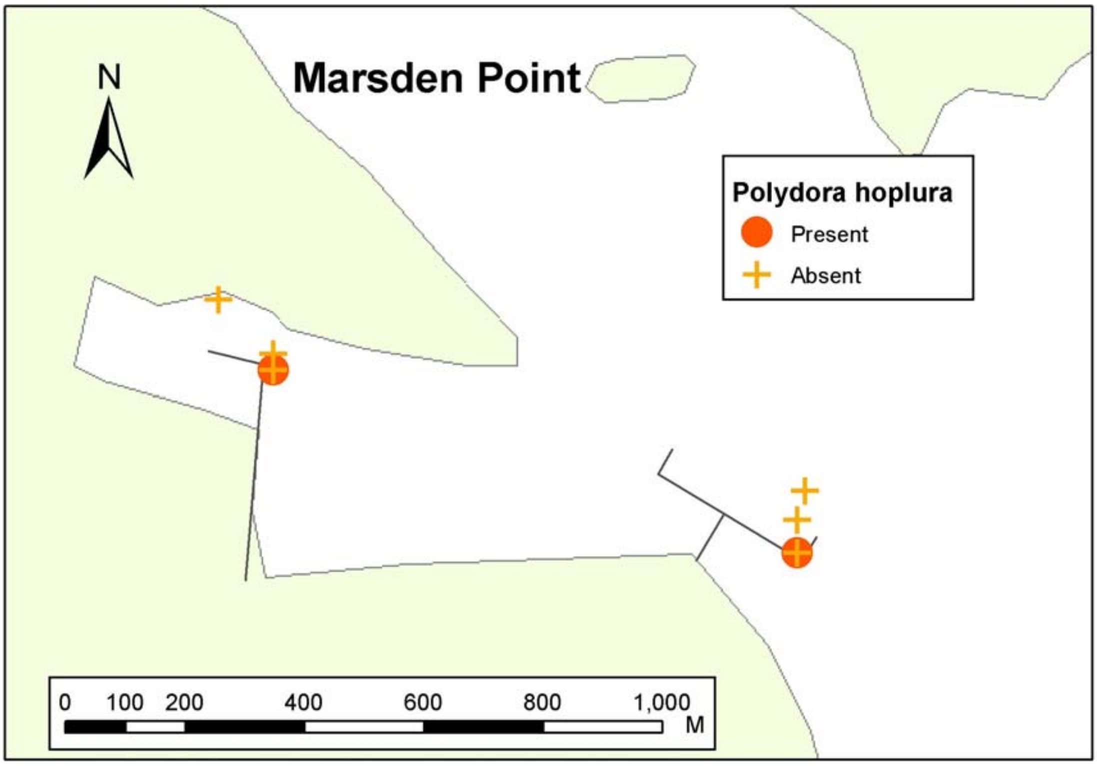

Figure 19: *Polydora hoplura* distribution at Marsden Point.

***Pseudopolydora kempi* (Southern, 1921)**

No image available.

Pseudopolydora kempi is a spionid polychaete whose natural range is thought to be Japan, the Indian Ocean and the north-westPacific, and has been introduced to the USA (Fuller and

O'Connell 2005). There is a reasonable amount of taxonomic resolution required to clarify the classification of this species (Radashevsky & Hsieh, 2000). *Pseudopolydora kempi* inhabits intertidal and subtidal marine and estuarine sandflats. Inhabiting mud tubes, this species is a tentacular surface deposit-feeder. Its impacts are unknown. During the port baseline surveys, *P. kempi* occurred in benthic grab samples taken near the Marsden Point Wharf (Fig. 20). It was not recorded in the Port of Whangarei.

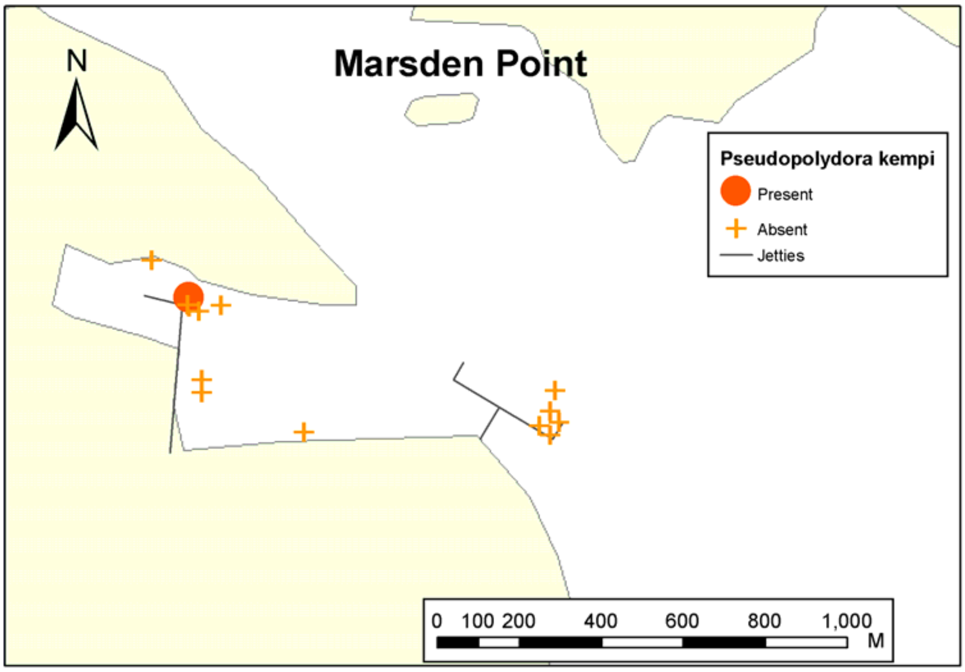

Figure 20: *Pseudopolydora kempi* distribution at Marsden Point.

***Pseudopolydora paucibranchiata* (Okuda, 1937)**

No image available.

Pseudopolydora paucibranchiata is a burrowing, sedentary spionid polychaete worm that constructs its tube from sand and silt. It is thought to be native to the north-west Pacific, from China to the coast of Russia, and has been introduced to the north-east Atlantic, the west Coast of the U.S.A., southern Australia and New Zealand. *P. paucibranchiata* was first recorded in Australia in 1972, where it was possibly introduced with Pacific oysters (*Crassostrea gigas*) (Australian Faunal Directory 2005). It has been present in New Zealand since at least 1975 (Read 1975).

P. paucibranchiata is a creamy colour, with yellow-white bands. The first segment is reduced, with no hairs (notosetae). The fifth segment is not enlarged or modified, but has distinct parapodial (foot) lobes with major spines placed in a U-shaped line. *Pseudopolydora paucibranchiata* can be found in sand and mudflats (but prefers fine sediments). It is most abundant in the low tidal zone, but also occurs subtidally. This species can be a dominant member of the infaunal community, causing changes in habitat and faunal composition. It is also an inhabitant of oyster shells and fouling communities (NIMPIS 2002e). During the port baseline surveys it was recorded from the Port of Gisborne and Marsden Point, Whangarei. At Marsden Point it occurred in benthic grab samples taken near the Marsden Wharf (Fig. 21).

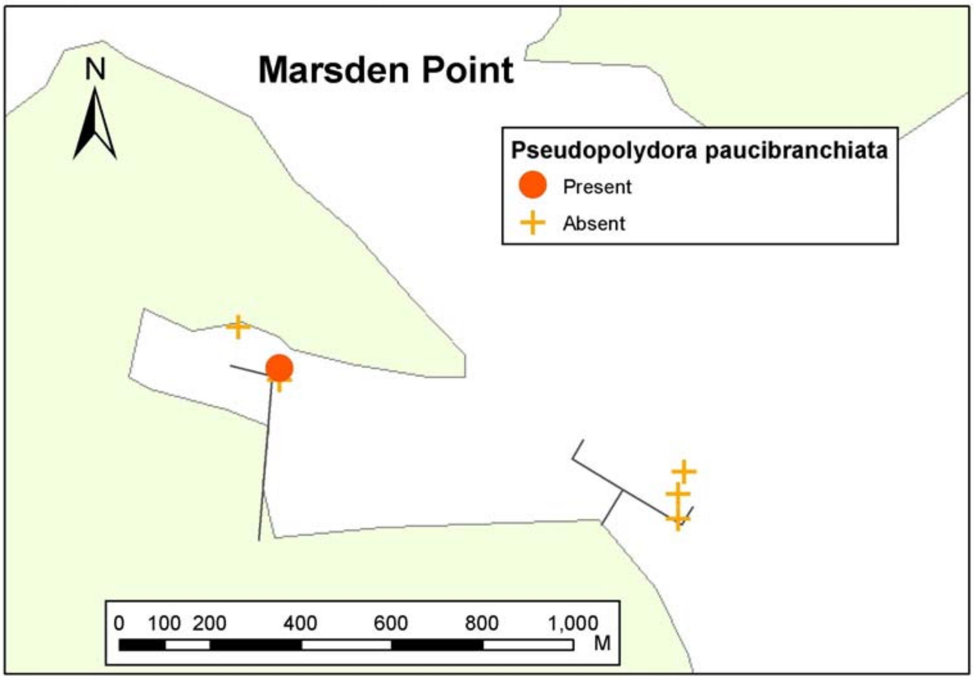

Figure 21: ***Pseudopolydora paucibranchiata* distribution at Marsden Point.**

Bugula flabellata (Thompson in Gray, 1847)

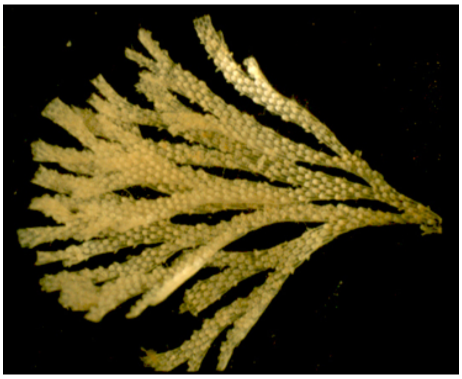

Image and information: NIMPIS (2002a)

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. *Bugula flabellata* is a major fouling bryozoan in ports and harbours, particularly on vessel hulls, pilings and pontoons and has also been reported from off-shore oil platforms. 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. There have been no recorded impacts from *B. flabellata*. *B. flabellata* is known from all New Zealand ports. In Whangarei, *B. flabellata* occurred in pile scrape samples taken from the Marsden Point Wharf and Oil Jetty (Fig. 22) and from the Kioeroa Wharf at Whangarei Port (Fig. 23).

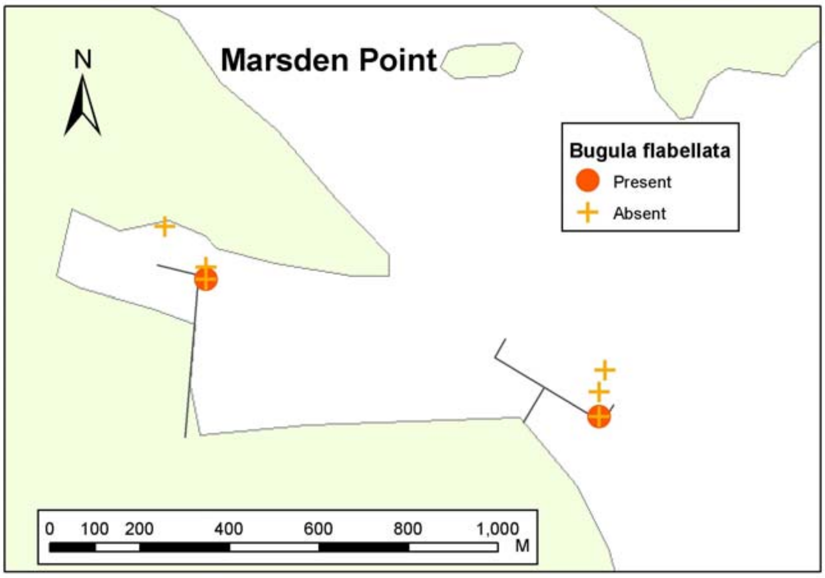

Figure 22: ***Bugula flabellata*** **distribution at Marsden Point.**

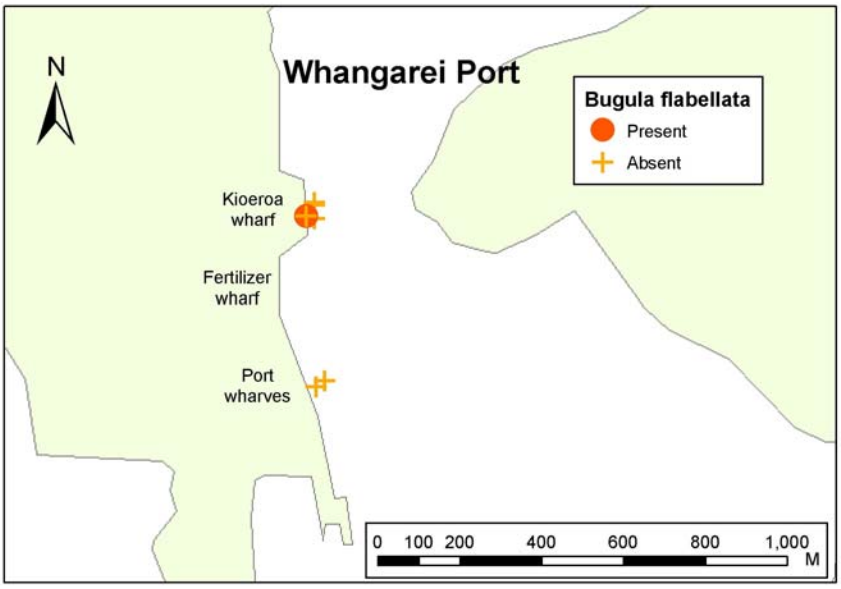

Figure 23: ***Bugula flabellata*** **distribution in the Port of Whangarei.**

Bugula neritina (Linnaeus, 1758)

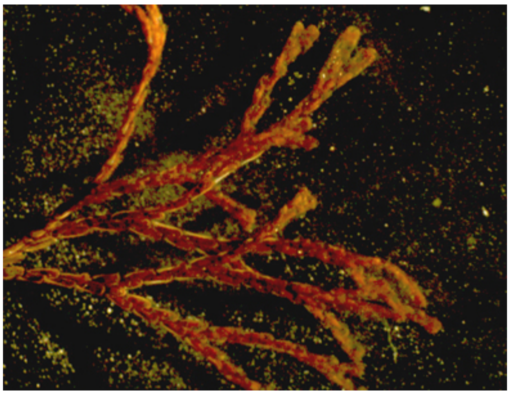

Image and information: NIMPIS (2002b)

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 in colour. 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 Japan 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 and Matawari 1992). In Whangarei Harbour, *B. neritina* occurred in pile scrape samples taken from the Refinery Jetty and Marsden Point Wharf (Fig. 24) and from the Kioeroa Wharf at Whangarei Port (Fig. 25).

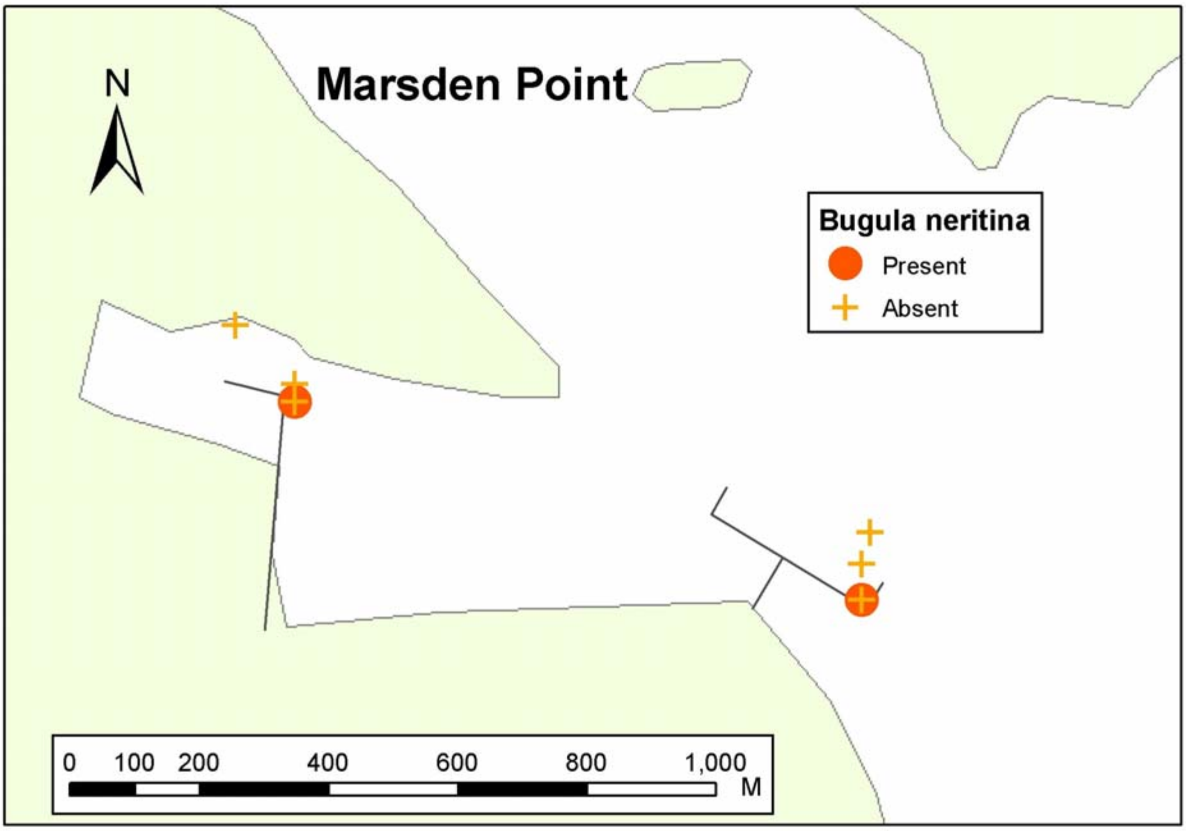

Figure 24: *Bugula neritina* distribution in at Marsden Point.

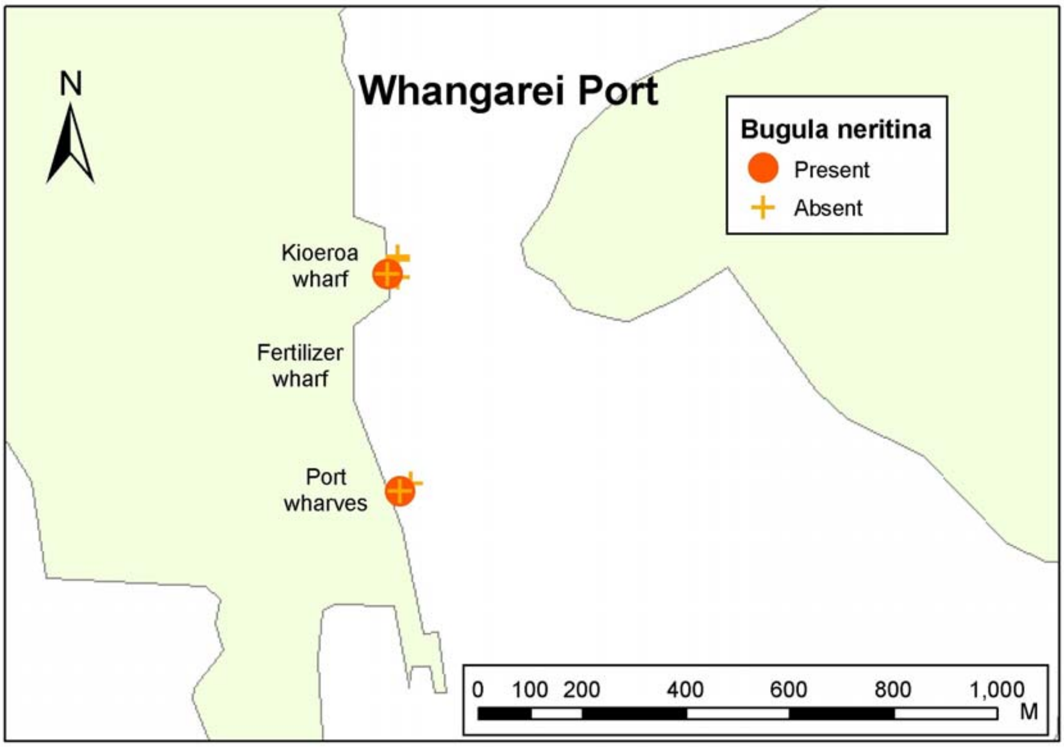

Figure 25: *Bugula neritina* distribution in the Port of Whangarei.

Bugula stolonifera (Ryland, 1960)

Image: California Academy of Sciences.

Information:
O'Connell and Fuller (2005)
Smithsonian Institution (2001)

Bugula stolonifera forms dense tufted colonies of 30-40 mm high. It is a greyish buff and lives attached to the substratum by rhyzoids. Its basal and lateral walls are lightly calcified. Young colonies take on a fan or funnel shape, while established colonies form dense tufts. The zooids of *B. stolonifera* are smaller than those of *B. neritina*, yet they still taper proximally. *Bugula stolonifera* is native to southern Britain. It has been introduced to California, Hawaii, Mexico, Brazil, the Mediterranean and the eastern Atlantic. Like other species within the genus, *B. stolonifera* is a prolific fouling organism that readily occupies available hard substrata, as well as the exposed shells or carapaces of other organisms. The impacts of *B. stolonifera* on native benthic assemblages are unknown. During the port baseline surveys, *B. stolonifera* was recorded from the ports of Taranaki and Whangarei, although it is also known from Auckland, Napier, Nelson, Lyttelton, Timaru and Bluff (Gordon and Matawari 1992). In Whangarei Port *B. stolonifera* occurred in pile scrape samples taken from the M1 Wharf in the Port of Whangarei (Fig. 26); it was not found at Marsden Point.

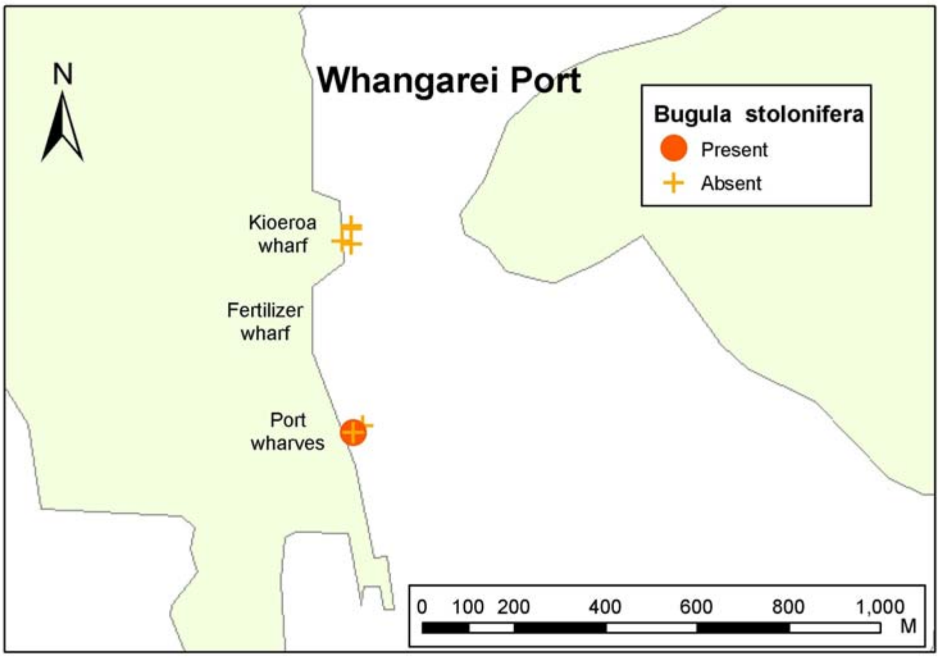

Figure 26: ***Bugula stolonifera* distribution in the Port of Whangarei.**

***Tricellaria inopinata* (d'Hondt and Occhipinti Ambrogi, 1985)**

Image: RMIT University, Australia.
Information: Dyrynda *et al.* (2000), Occhipinti Ambrogi (2000), NIMPIS (2002g)

Tricellaria inopinata is an erect bryozoan. An assessment of samples and literature from various global regions suggests that Atlantic and Adriatic *T. inopinata* correspond with a morphospecies known to be invasive in New Zealand, and cryptogenic in Pacific North America, Japan and Australia. The morphospecies in question has usually been referred to as *T. occidentalis* (Trask, 1857) and, in at least one instance, as *T. porteri* (MacGillivray, 1889). *Tricellaria inopinata*'s widespread Pacific distribution and the possibility of anthropogenic dispersal there in historical times precludes the more precise identification of its source region. *Tricellaria inopinata* is a prolific fouling species with a high reproductive output. It has documented impacts on the abundance of native bryozoan species: *T. inopinata*'s invasion of the Laguna di Venezia (Italy) resulted in a sharp decline in the abundance of native bryozoans whose populations had been stable prior to *T. inopinata*'s introduction. During the port baseline surveys, *T. inopinata* was reported from the ports of Lyttelton, Taranaki, Gisborne, and Whangarei. In Whangarei Harbour it occurred in pile scrape samples taken from the Marsden Point (Fig. 27); it was not found in Whangarei Port.

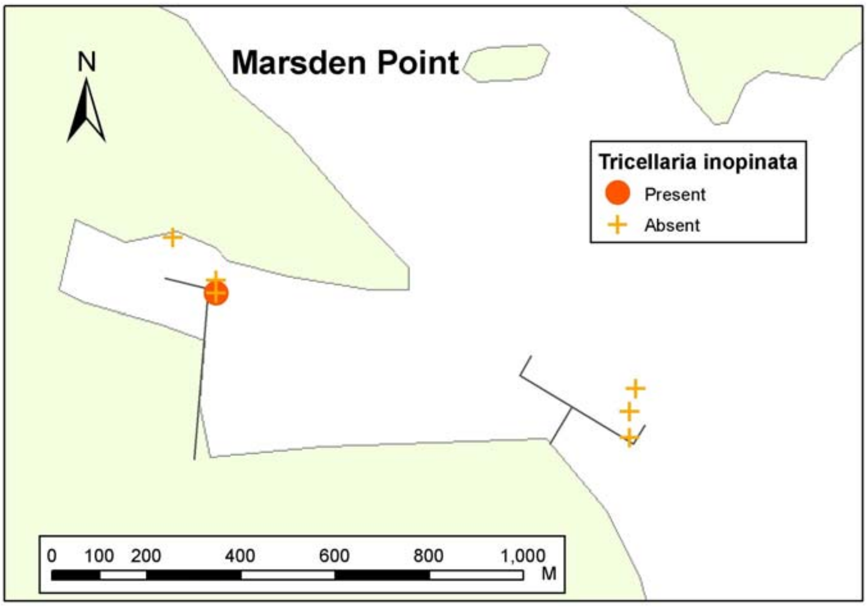

Figure 27: ***Tricellaria inopinata*** **distribution in at Marsden Point.**

Cryptosula pallasiana (von Moll, 1803)

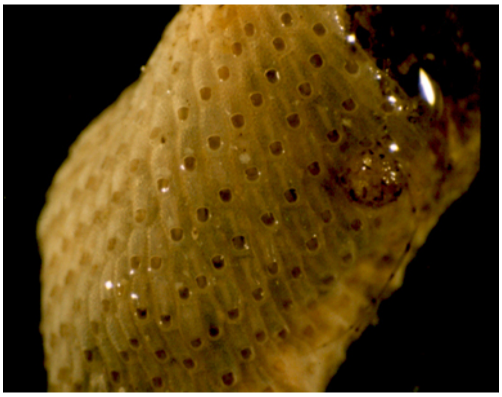

Image and information: NIMPIS (2002d)

Cryptosula pallasiana is an encrusting bryozoan, white-pink with orange crusts. The colonies sometimes rise into frills towards the edges. Zooids are hexagonal in shape, measuring on average 0.8 mm in length and 0.4 mm in width. The frontal surface of the zooid is heavily calcified, and has large pores set into it. Colonies may sometimes appear to have a beaded surface due to zooids having a suboral umbo (ridge). The aperture is bell shaped, and occasionally sub-oral avicularia (defensive structures) are present. There are no ovicells (reproductive structures) or spines present on the colony. *Cryptosula pallasiana* is native to Florida, the east coast of Mexico and the northeast Atlantic. It has been introduced to the northwest coast of the USA, the Sea of Japan, Australia and New Zealand. It is cryptogenic in the Mediterranean. *Cryptosula pallasiana* is a common fouling organism on a wide variety of substrata. Typical habitats include seagrasses, drift algae, oyster reef, artificial structures such as piers and breakwaters, man-made debris, rock, shells, ascidians, glass and vessel hulls. It has been reported from depths of up to 35 m. There have been no recorded impacts of *Cryptosula pallasiana* throughout its introduced range. However, in the USA, it has been noted as one of the most competitive fouling organisms in ports and harbours it occurs in. Within Australia, colonies generally do not reach a large size or cover large areas of substrata.

C. pallasiana has been recorded from all New Zealand ports (Cranfield *et al.* 1998). In the survey of Whangarei Harbour, it occurred in pile scrape samples taken from the Marsden Point Wharf (Fig. 28); it was not recorded from the Port of Whangarei.

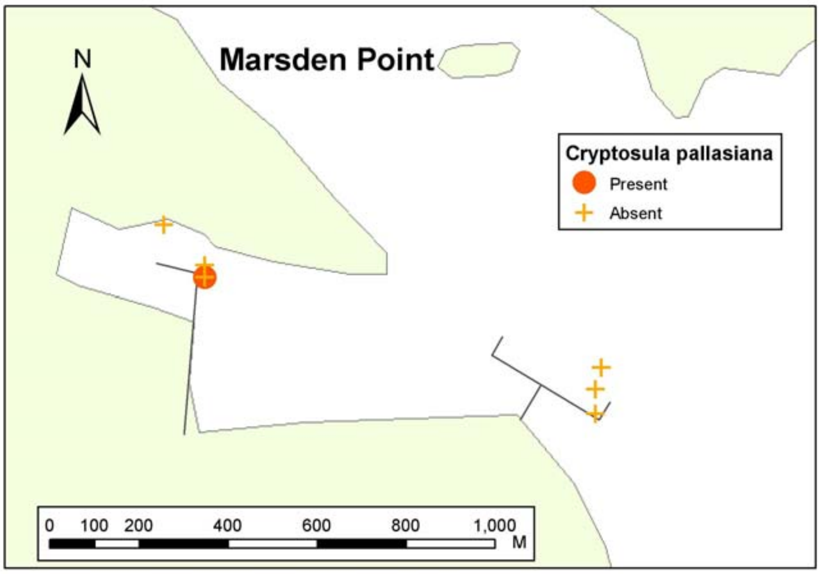

Figure 28: *Cryptosula pallasiana* distribution at Marsden Point.

Celleporaria sp 1.

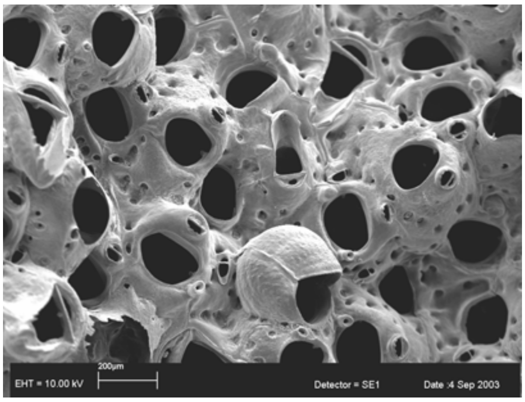

Image and information: Dennis Gordon, NIWA (*pers. comm.*)

This species of *Celleporaria* does not match existing species descriptions from this genus in New Zealand and is likely to have been introduced. Features typical of the genus include an encrusting, irregular, mounded colony form, with multiple layers of zooids through frontal budding and self-overgrowth. There are usually small adventitious avicularia (zooidal polymorphs) and large, somewhat columnar vicarious avicularia. Zooidal orifices have a straight or gently concave proximal rim. Some species have oral spines. Permutations and combinations of these characters are the basis of species discrimination. There are scores of described nominal species in this genus worldwide, with many more likely to be discovered. The genus is badly in need of taxonomic revision.

Celleporaria is the same genus as "Tasman Bay coral" (*C. agglutinans*), which provides habitat for a range of cryptic invertebrates. The non-indigenous species of *Celleporaria* found in Whangarei forms thick crusts. Its impacts are unknown. During the Port baseline surveys it was also recorded from the Port of Auckland. In Whangarei, this species occurred in pile scrape samples taken from the Marsden Point Wharf and Refinery Jetty (Fig. 29). It was also present on piles at the Kioeroa Wharf in the Port of Whangarei (Fig 30).

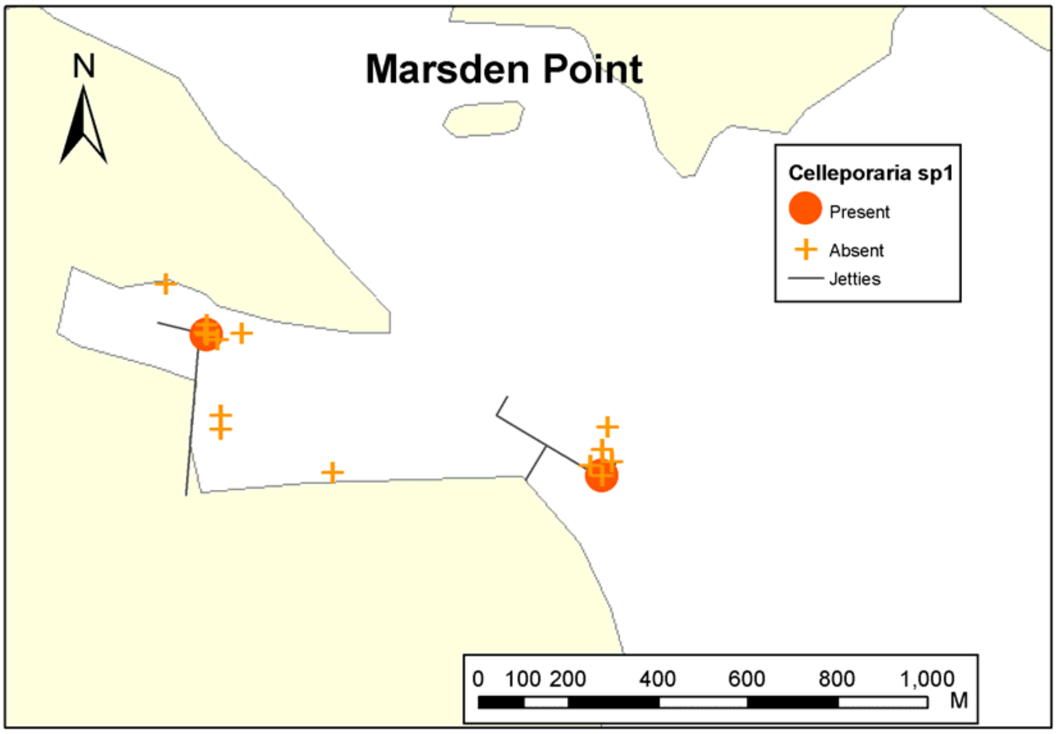

Figure 29: ***Celleporaria* sp 1 distribution at Marsden Point.**

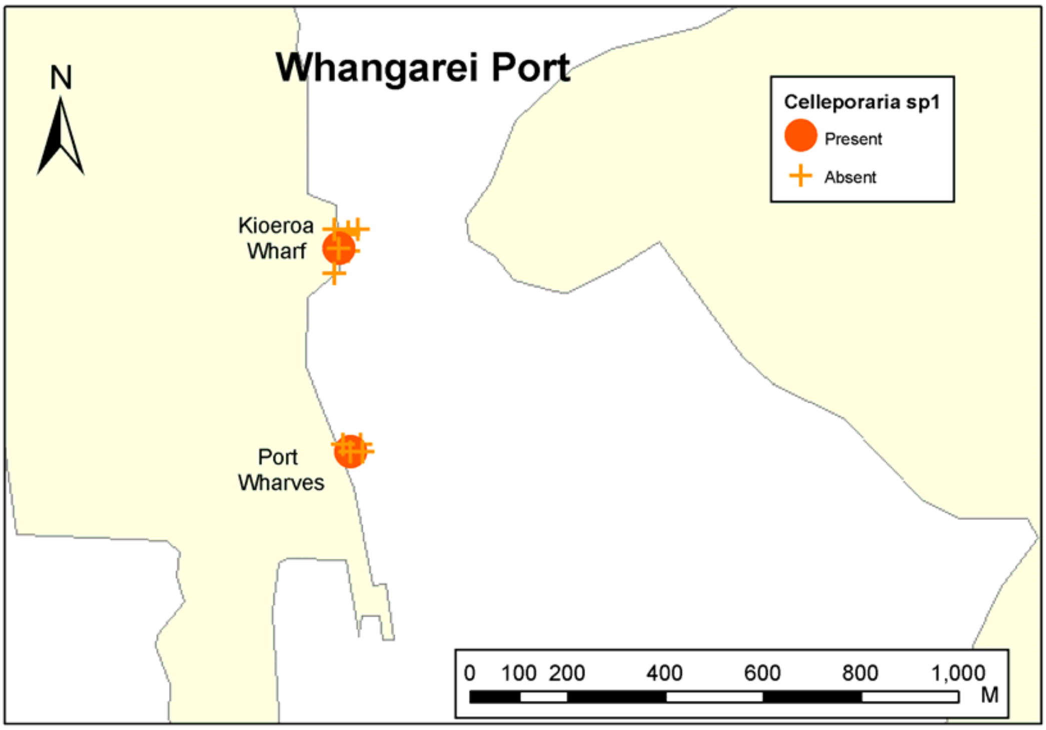

Figure 30: ***Celleporaria* sp 1 distribution at Port of Whangarei.**

***Schizoporella errata* (Waters, 1878)**

Image: O. Floerl 2003
Information: Eldredge and Smith (2001*)*

Schizoporella errata is a heavily calcified, encrusting bryozoan that is typically dark brick red with orange-red growing margins. It assumes the shape of whatever it overgrows. This species may form heavy knobbly incrustations on flexible surfaces such as algae or worm tubes, turning them into solid, sometimes erect branching structures. The thickness of the growth is dependent upon the age of the colony. Multilaminar encrustations 1cm thick are common. The frontal surface of the zoecium (secreted exoskeleton housing individual zooids) is porous with a wide semicircular aperture and proximal sinus. It also has single avicularia on the right or left side of the aperture sinus.

Schizoporella errata is thought to be native to the Mediterranean. It has been introduced to many locations worldwide in warm temperate-subtropical seas. It has been reported from West Africa, the Red Sea, the Persian Gulf, South Australia, New Zealand, the Hawaiian Islands, the Pacific coast of North America, the east coast of North America through to the Caribbean and Brazil. *S. errata* occurs in shallow water on various hard substrates (pilings, hulls, coral rubble, etc.) in harbours and embayments. It is also occasionally found on rocky or coral reefs. *S. errata* can compete with other fouling organisms for space and large encrustations of this species are known to smother other biota (Cocito *et al.* 2000). It is present in Waitemata Harbour and the Bay of Islands and was also recorded from Nelson and Gulf Harbour Marina during the baseline port surveys (Table 10). *S. errata* occurred in pile scrape samples taken from the Kioeroa Wharf in the Port of Whangarei (Fig. 31); it was not recorded at Marsden Point.

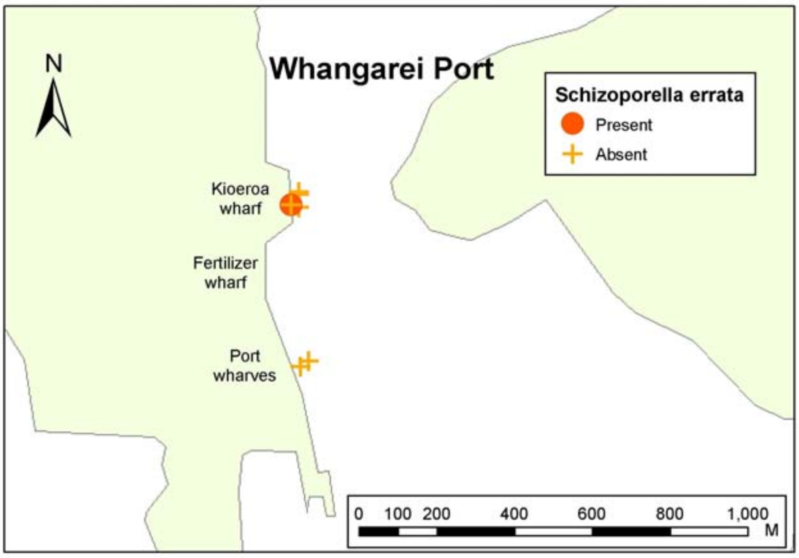

Figure 31: *Schizoporella errata* distribution in the Port of Whangarei.

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

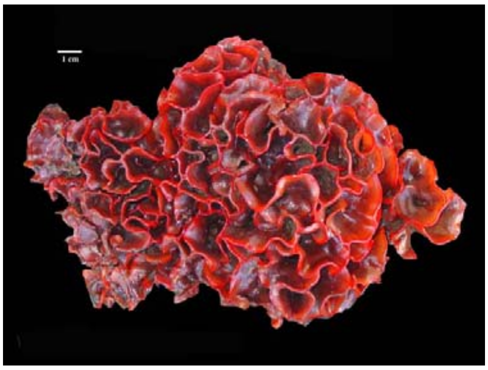

Image: California Academy of Sciences.
Information: Gordon and Matawari (1992)

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). It occurred in pile scrape samples taken from the Marsden Point Wharf (Fig. 32) and from the M1 and M3 (Kioeroa Wharves) in the Port of Whangarei (Fig. 33).

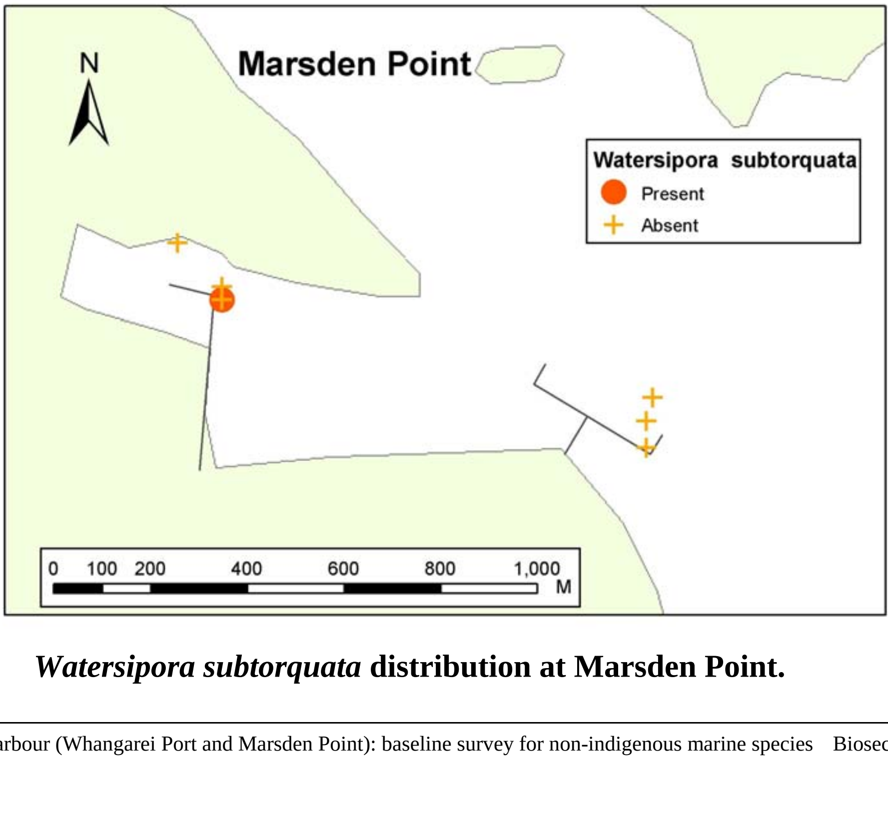

Figure 32: *Watersipora subtorquata* distribution at Marsden Point.

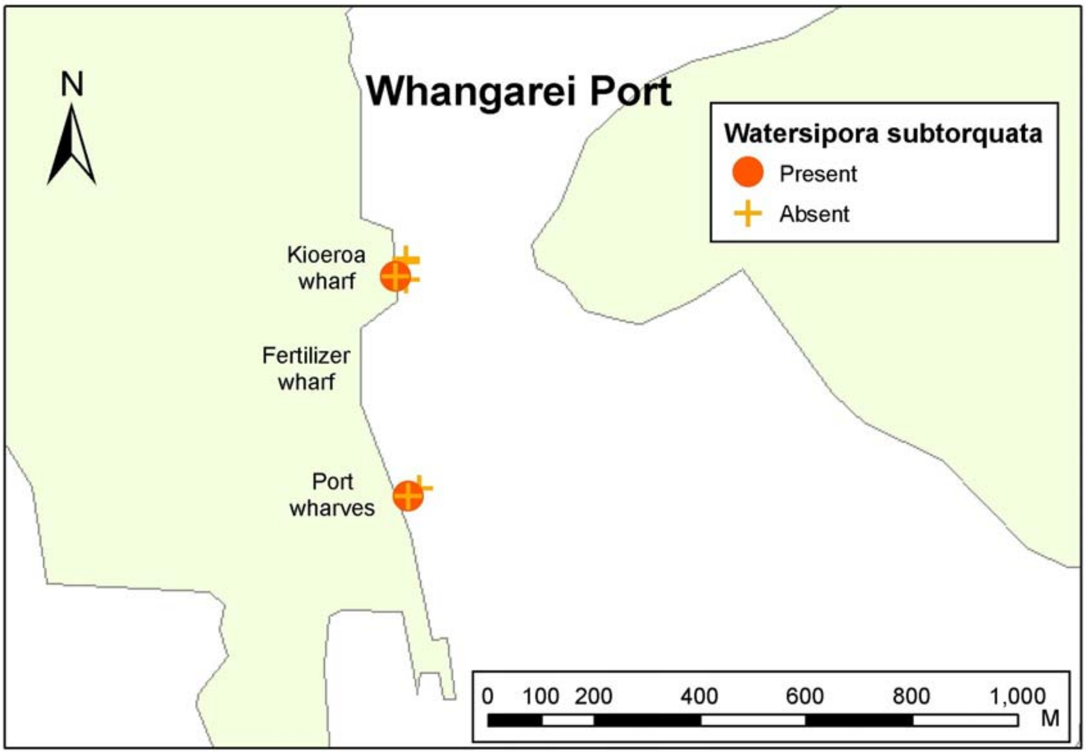

Figure 33: ***Watersipora subtorquata* distribution in the Port of Whangarei.**

***Obelia longissima* (Pallas, 1766)**

No image available.

Obelia longissima is a long, flexible hydroid (family Campanulariidae) with a prominent main stem and branches. It usually reaches up to 20 cm in length but may reach 35 cm. The main stem is long, reddish brown and unforked but may become forked in older colonies. *Obelia longissima* is found growing on algae and hard substrata. It is normally subtidal but can occasionally be found growing in intertidal rockpools and at extreme low water of spring tides. Subtidal colonies that become detached may continue to grow if washed into rockpools and entangled with other species such as mussels. It is a suspension feeder that feeds upon small zooplankton, small crustaceans, oligochaetes, insect larvae and probably detritus. *O. longissima* exhibits a typical leptolid life cycle consisting of a sessile colonial, vegetative hydroid stage, a free-living sexual medusoid stage, and a planula larval stage.

Obelia longissima has a near cosmopolitan distribution. It was thought to be a predominantly cold water species, present in the north-east and north-west Pacific, north-east and north-west Atlantic, the Artic Circle and the Black Sea, and, in the southern hemisphere, in Argentina, Chile, and New Zealand (Stepanjants 1998). However, numerous Indo-Pacific records may also be this species (Cornelius 1995). In New Zealand, *O. longissima* has previously been recorded from Christchurch and Dunedin (Watson, *pers. comm*.). During the port baseline surveys, it occurred in the Port of Auckland, Opua Marina, and Whangarei. In Whangarei, it occurred in pile scrape samples taken from the Refinery Jetty at Marsden Point (Fig. 34); it was not recorded in the Port of Whangarei.

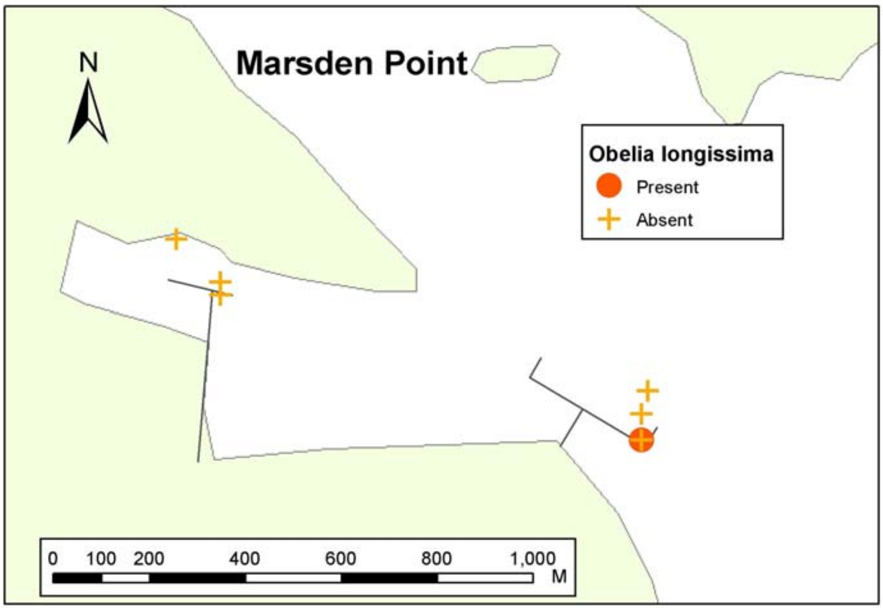

Figure 34: ***Obelia longissima*** **distribution at Marsden Point.**

Jassa slatteryi **(Conlan, 1990)**

No image available.

Jassa slatteryi is an amphipod in the family Ischyroceridae. It is a cosmopolitan species. The type specimen was recorded from California, but it is known to be present in the Atlantic and Pacific Oceans and the Mediterranean Sea. Its habitat requirements and impacts are unknown. *J. slatteryi* also occurs in south-east Australia and New Zealand. During the baseline port surveys it was recorded from the ports of Whangarei, Lyttelton and Timaru. In Whangarei, it occurred in pile scrape samples taken from the Refinery Jetty at Marsden Point (Fig. 35); it was not recorded in the Port of Whangarei.

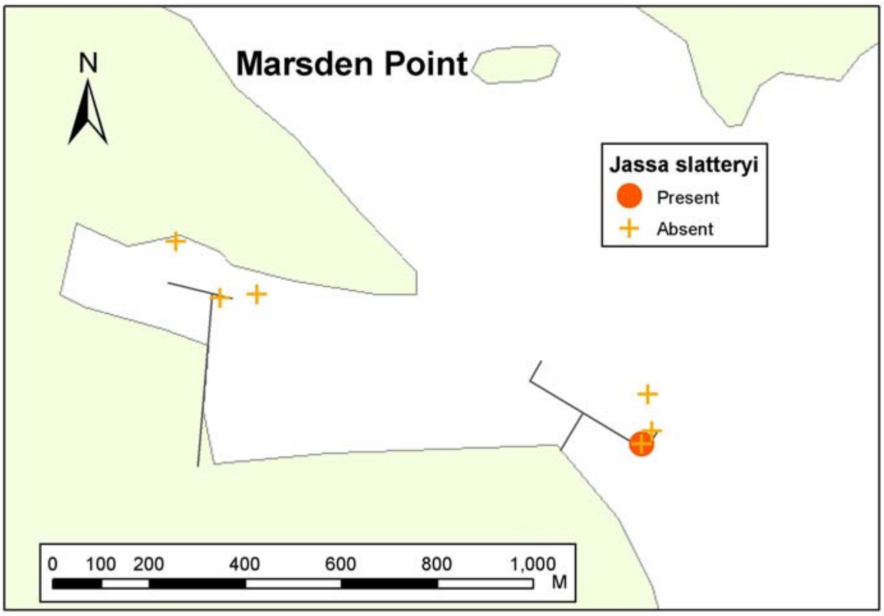

Figure 35: ***Jassa slatteryi*** **distribution at Marsden Point.**

***Pyromaia tuberculata*(Lockington, 1877)**

Image and information: NIMPIS (2002f)

Pyromaia tuberculata is a pear-shaped crab that grows up to 20 mm long. It has a single spine projecting forwards from between the eyes. Its eyes are without orbits, and they are non-retractable. It has four walking legs that are long and spindly, the front ones being the longest. It is a brown-yellow colour and has fine hairs on the surface of the carapace. It is found in a variety of habitats, including rocky reefs with large seaweed communities, or wharf pilings and protected piles. The species is often found associated with tunicates and/or algae. In Australia, it has been found to depths of 20 m, although it has been recorded as deep as 450 m in other areas of the world. *Pyromaia tuberculata* is native to the Pacific coast of Mexico and the USA. It has been introduced to Brazil, the Japanese and China Seas, Australia and New Zealand. It has no known impacts.

P. tuberculata has been present in the Hauraki Gulf and Firth of Thames since 1975 (Cranfield *et al.* 1998), the specimens recovered in Whangarei during the port baseline survey of Whangarei Harbour and in the associated Summer 1 (November 2002) targeted surveillance surveys (Biosecurity NZ Project ZBS2001-01) the were the first known records of this species outside these two areas. In the port baseline survey, *P. tuberculata* occurred in pile scrape samples taken from the Kioeroa Wharf in the Port of Whangarei (Fig. 36); it was not found at Marsden Point.

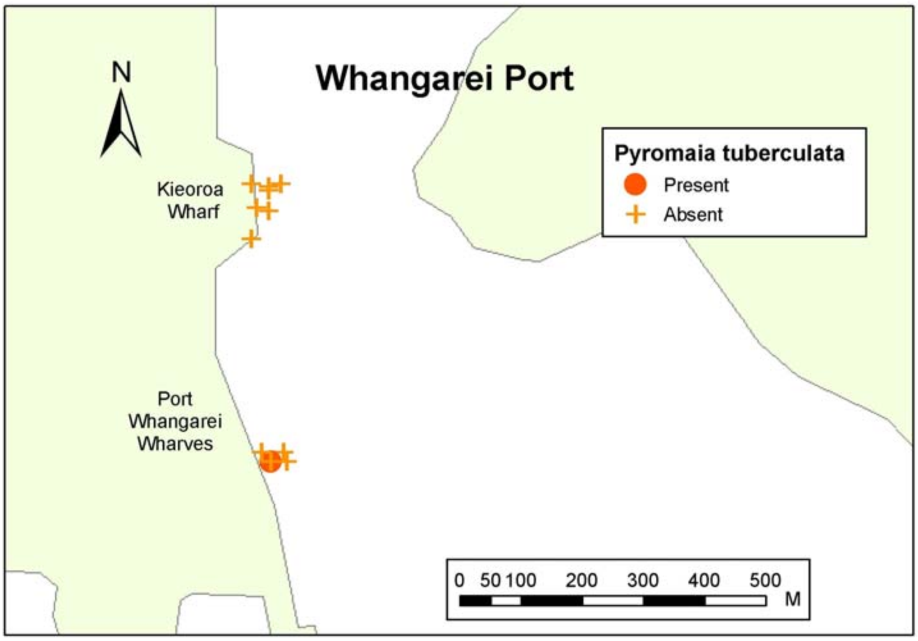

Figure 36: *Pyromaia tuberculata* distribution in the Port of Whangarei.

Crassostrea gigas (Thunberg, 1793)

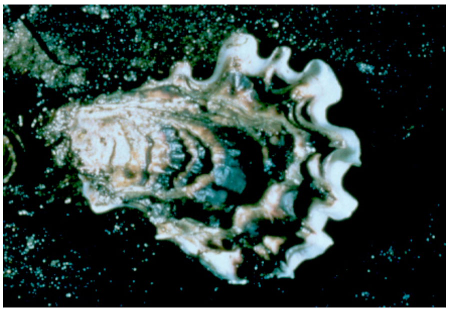

Image and information: NIMPIS (2002c)

The Pacific oyster, *Crassostrea gigas*, is an important aquaculture species throughout the world, including New Zealand. It has a white elongated shell, with a maximum size of 150-200 mm. The two valves are solid, but unequal in size and shape. The left valve is slightly convex and the right valve is quite deep and cup shaped. One valve is usually entirely cemented to the substratum. The shells are sculpted with large, irregular, rounded, radial folds.

Crassostrea gigas is native to the Japan and China Seas and the northwest Pacific. It has been introduced to the west coast of both North and South America, the West African coast, the northeast Atlantic, the Mediterranean, Australia, New Zealand, Polynesia and Micronesia. It is cryptogenic in Alaska. *Crassostrea gigas* will attach to almost any hard surface in sheltered waters. Whilst they usually attach to rocks, the oysters can also be found in muddy or sandy areas. Oysters will also settle on adult oysters of the same or other species. They prefer sheltered waters in estuaries where they are found in the intertidal and shallow subtidal zones, to a depth of about 3 m. *Crassostrea gigas* settles in dense aggregations in the intertidal zone, resulting in the limitation of food and space available for other intertidal species.

C. gigas has been present in New Zealand since the early 1960s. Little is known about the impacts of this species in New Zealand, but it is now a dominant structural component of fouling assemblages and intertidal shorelines in northern harbours of New Zealand and the upper South Island. *C. gigas* is now the basis of New Zealand's oyster aquaculture industry, having displaced the native rock oyster, *Saccostrea glomerata*. *C. gigas* was recorded from Opua Marina, Whangarei Harbour, Gulf Harbour Marina, Auckland, Taranaki, Nelson and Dunedin during the port baseline surveys (Table 10). In the Whangarei survey it occurred in pile scrape samples taken from the M1 and M3 (Kioeroa) Wharves (Fig. 37); it was not recorded from Marsden Point.

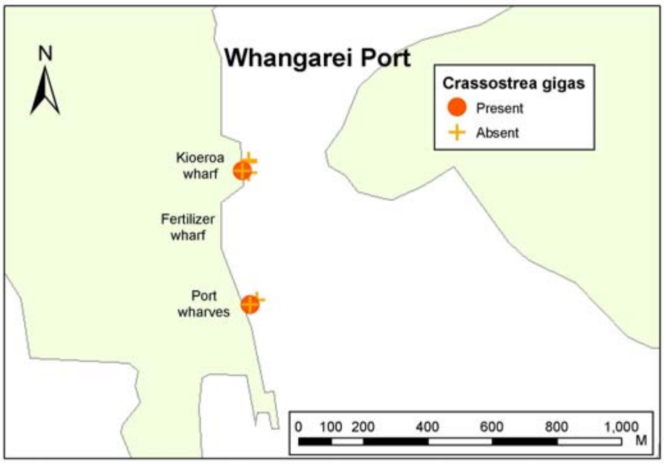

Figure 37: _Crassostrea gigas_ distribution in the Port of Whangarei.

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

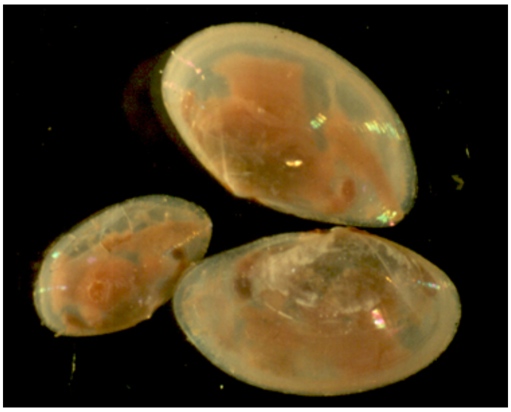

Image and information: NIMPIS (2002h)

Theora lubrica is a small bivalve with an almost transparent shell. The shell is very thin, elongated and has fine concentric ridges. *T. 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 Japan 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. *T. 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 Marina, Whangarei Port and Marina, Gulf Harbour Marina, Auckland, Gisborne, Napier, Taranaki, Nelson, and Lyttelton. In Whangarei, *T. lubrica* was recorded in benthic grab samples taken from the Kioeroa Wharf in the Port of Whangarei, and from benthic sled samples taken near these two locations (Fig. 38). It was not recorded from samples taken at Marsden Point.

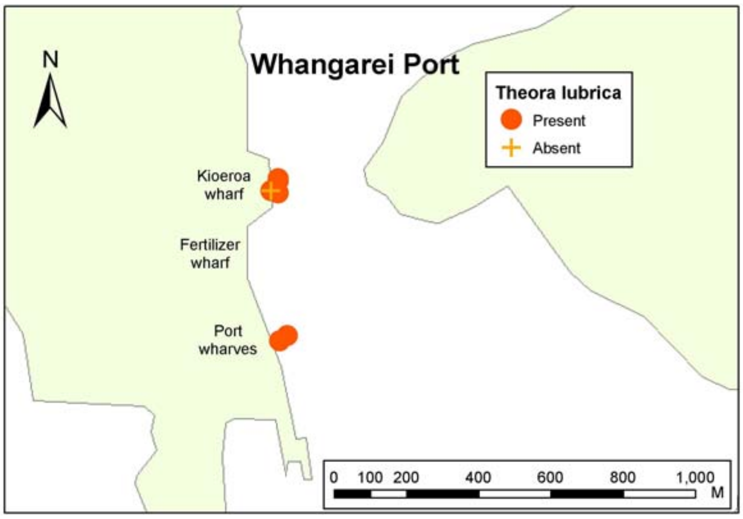

Figure 38: ***Theora lubrica* distribution in the Port of Whangarei.**

***Vosmaeropsis* cf *macera* (Carter, 1886)**

No image available.

Vosmaeropsis cf macera is a sponge in the family Heteropiidae. The type locality for this species is Port Phillip Heads, Australia (Carter 1886). It has previously been reported from Lyall Bay, in Wellington, but was not known from other New Zealand locations. Calcareous sponges, like *V.* cf. *macera* are notorious hull foulers that grow best in sheltered, dark places, and proliferate in pipes and inlets in marine infrastructure. During the port baseline surveys *V.* cf. *macera* was recorded in Whangarei Harbour and Gulf Harbour Marina. *Vosmaeropsis* cf *macera* occurred in pile scrape samples taken from the Marsden Point Wharf (Fig. 39); it was not found in the Whangarei Port.

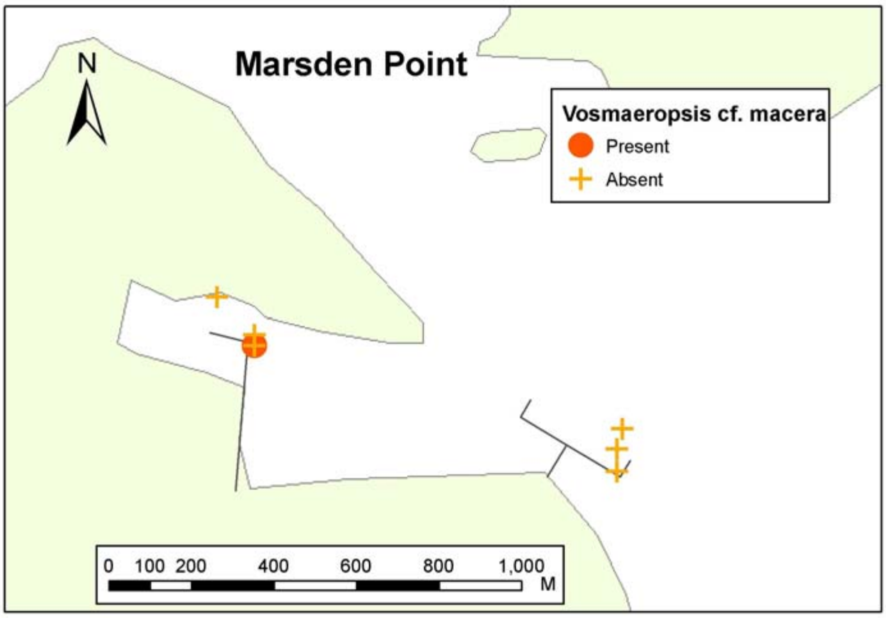

Figure 39: *Vosmaeropsis* cf. *macera* distribution at Marsden Point.

***Cliona celata* (Grant, 1826)**

Image and information: Encyclopedia of Marine Life of Britain and Ireland [http://www.habitas.org.uk/marinelife/]

Cliona celata is a bright yellow boring sponge that excavates tunnels in calcareous material such as the shells of bivalves and other molluscs. The exposed part of colonies can reach 20 cm in diameter. *Cliona celata* is common around the Arctic, Atlantic coast of Europe and North America, West Indies, Indian Ocean, the Red Sea, Malaya, Australia and New Guinea. The type specimen for this species was described from the North Atlantic. *C. celata* is present throughout New Zealand coastal waters and was recorded from Whangarei and Tauranga during the port baseline surveys. It occurred in pile scrape samples taken from the Marsden Point Oil Refinery Wharf (Fig. 40), but was not recorded in the Port of Whangarei.

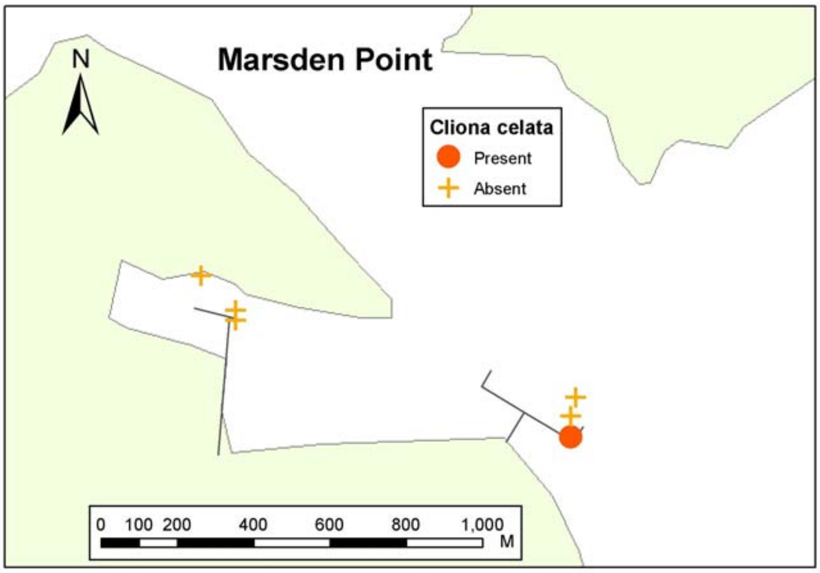

Figure 40: ***Cliona celata* distribution at Marsden Point.**

SPECIES INDETERMINATA

Twenty-two organisms from Whangarei Port and Marsden Point were classified as species indeterminata. If each of these organisms is considered a species of unresolved identity, then together they represent 10.6 % of all species collected from this survey (Fig. 16). Species indeterminata from Whangarei Harbour included 16 Annelida, two vertebrate (fish) species, and a single species each of Cnidaria, Crustacea, Phycophyta and Urochordata (Table 9).

NOTIFIABLE AND UNWANTED SPECIES

Of the non-indigenous species identified from the Whangarei Harbour, none are currently listed on the New Zealand register of unwanted organisms (Table 5a). The bivalve mollusc *Crassostrea gigas*, found at two locations within Port Whangarei, is currently listed as an unwanted species on the ABWMAC Australian list of pest species (Table 5b).

PREVIOUSLY UNDESCRIBED SPECIES IN NEW ZEALAND

Eighteen species from the Whangarei Port and Marsden Point had not previously been recorded from New Zealand waters. These species are classified either as Category 2 cryptogenic species in Table 7, or are marked as new records in the non-indigenous species list (Table 8). The cryptogenic species included two amphipod crustaceans (*Gammaropsis* sp. aff. *G. tawahi*; *Parawaldeckia* sp. aff. *P. karaka*), thirteen porifera (*Adocia* n. sp. 4; *Callyspongia* n. sp. 2, *Callyspongia* n. sp. 3, *Callyspongia* n. sp. 4, *Dendrilla* n. sp. 1, *Echinochalina* n. sp. 1, *Euryspongia* n. sp. 1, *Euryspongia* n. sp. 3, *Halichondria* n. sp. 4, *Haliclona* n. sp. 3, *Halisarca* n. sp. 1, *Iophon* n. sp. 1, *Scopalina* n. sp. 1) and two species of urochordata (*Microcosmus squamiger*, *Pyura* n. sp.2) (Table 7). The 13 species of sponge and *Pyura* sp. 2 do not match existing species descriptions from New Zealand or overseas and may be new to science. Nine of the sponge species have so far, been recorded only from Whangarei. One previously undescribed non-indigenous species from New Zealand waters was found in the Whangarei Harbour: a bryozoan, *Celleporaria sp. 1* (see section 3.3.10 above).

CYST-FORMING SPECIES

Cysts of three native species of dinoflagellate were collected during this survey. They are indicated as members of the Pyrrophycophyta (Table 6). Cysts of one cryptogenic species

(*Gymnodinium catenatum*) were also collected from samples taken near the Marsden Point Wharf. *G. catenatum* is listed on the ABWMAC Australian list of pest species (Table 5b). Motile forms of *G. catenatum* produce toxins that can cause Paralytic Shellfish Poisoning (PSP) and are a significant public health problem. Toxins produced by a second species of dinoflagellate recorded from Marsden Point, *Lingulodinium polyedrum*, can potentially cause Diarrhetic Shellfish Poisoning (DSP). Blooms of each species can cause problems for aquaculture and recreational harvesting of shellfish.

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

The non-indigenous species located in Whangarei Port and Marsden Point are thought to have arrived in New Zealand via international shipping. Table 8 indicates the possible vectors for the introduction of each NIS. Likely vectors of introduction are largely derived from Cranfield *et al.* (1998) and indicate that approximately 5 % probably arrived via ballast water, 69 % via hull fouling and 26 % 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. 41a). 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, differences in sampling effort did not explain differences in the numbers of NIS found in each location ($F_{1,14} = 0.77$, $P = 0.394$, $R^2 = 0.052$). When sample effort was adjusted for, Whangarei had an average diversity of native species relative to other ports and marinas (Fig 42a), but significantly more NIS, Cryptogenic 1 and Cryptogenic 2 species (Fig 42b, c, d).

Native organisms represented over 60 % of the species diversity sampled in each surveyed location, with a minimum contribution of 61.0 % in the Port of Lyttelton and a maximum of 68.5 % in Picton (Fig. 41b). Species indeterminata organisms represented between 10.6 % and 25.6 % 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. 41b). Non-indigenous species represented 9.2 % of the total sampled diversity in the Whangarei Harbour (Port Whangarei and Marsden Point) (Fig. 41b), ranking it fourth highest in percentage composition of NIS from the sixteen locations surveyed.

Interestingly, there was comparatively limited overlap in the species assemblages recorded at the three major nodes for international shipping in Whangarei Harbour – Marsden Point, Port of Whangarei and Whangarei Town Basin Marina. For example, of the 25 NIS recorded from Whangarei Harbour during the port baseline surveys, 6 occurred only in samples from the Town Basin Marina, 5 occurred only in samples from wharves in the upper harbour section of the port, and 7 occurred only in samples from wharves at Marsden Point. It appears that different suites of NIS inhabit the three different nodes for shipping in the harbour and that the differences in the assemblages correspond with broad scale changes in environmental conditions and habitat from the lower- to upper-harbour.

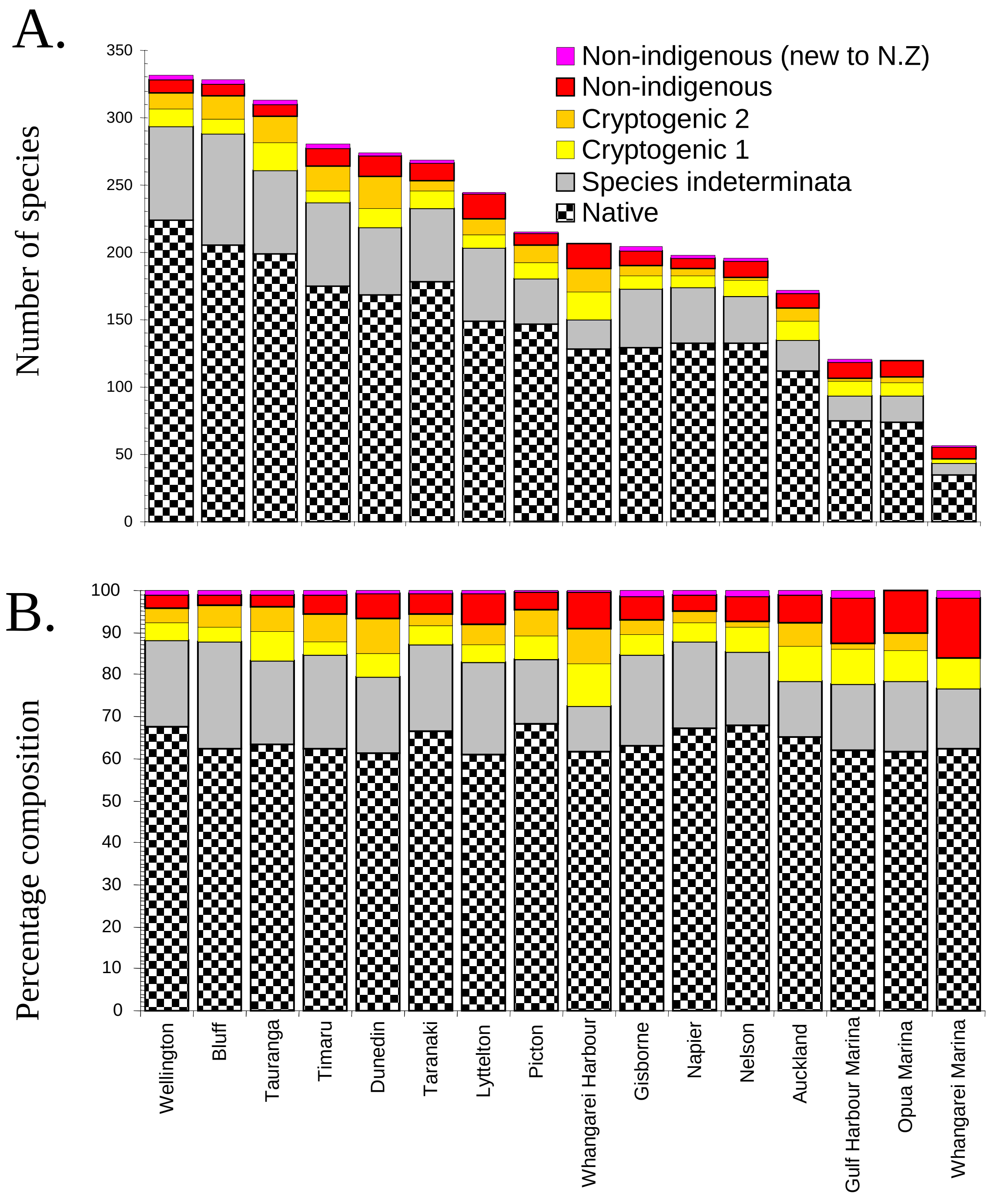

Figure 41: **Differences in (a) the number of species, and (b) the relative proportions of non-indigenous, cryptogenic, species indeterminata and native categories among the sixteen locations sampled over the summers of 2001 – 2002, and 2002-2003. Locations are presented in order of decreasing species diversity sampled.**

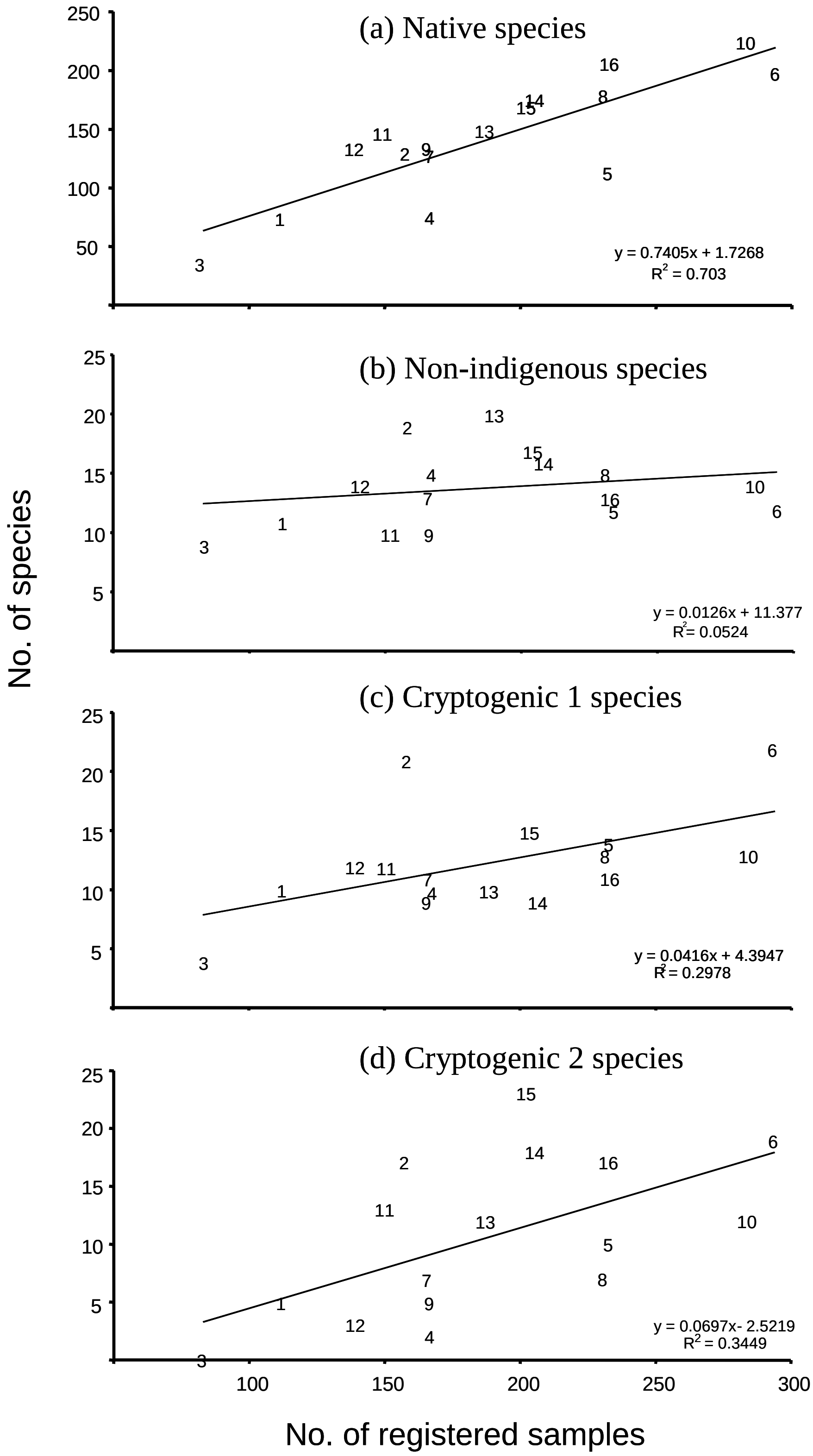

Figure 42. **Linear regression equations relating numbers of species detected to sample effort at the 16 locations surveyed nation-wide. Location codes are as follows; 1 = Opua Marina, 2 = Whangarei Harbour, 3 = Whangarei Marina, 4 = Gulf Harbour Marina, 5 = Auckland Port, 6 = Tauranga Port, 7 = Gisborne 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 harbour

Many NIS introduced to New Zealand ports, through hull fouling, ships' sea chests, or ballast water discharge, do not survive to establish self-sustaining local populations. Those that do, 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 Whangarei from overseas comes predominantly from temperate regions of the north-west Pacific (39%), south Pacific (18%), Australia (12%) and east Asia (9%) (New Zealand Customs Service, unpubl. data). At Marsden Point, overseas arrivals are primarily from Australia (50%) and the north-west Pacific (23%). All of these environments are broadly compatible with those in Whangarei Harbour. Relative to other ports in New Zealand, Whangarei Port and Marsden Point have a fairly large trade volume of bulk cargoes, including exports of timber, meat and fruit, and imports of minerals and mineral fuels (Statistics NZ 2004). This is reflected in the relatively high volume of ballast that is discharged in Whangarei Harbour. According to Inglis (2001), Whangarei received the fifth highest volume of reported ballast discharge (294,656 m^3) of New Zealand ports, which came predominantly from Japan (22%), South Korea (9%) and Hong Kong (6%). Shipping from these regions, and the additional 57% of ballast water discharges into the harbour from unspecified locations, presents an on-going risk of introduction of new NIS to Whangarei Harbour.

Assessment of translocation risk for non-indigenous species found in the harbour

The Ports at Whangarei and Marsden Point are connected directly to the ports of Tauranga, Auckland and Nelson by regular coastal shipping and, indirectly, to most other domestic ports throughout mainland New Zealand (Dodgshun *et al.* 2004). All of the non-indigenous species found in the Whangarei survey, with the exception of the bryozoan *Celleporaria* sp. 1, have been recorded previously in New Zealand. *Celleporaria* sp. 1 was first described from New Zealand waters during these port surveys, and in addition to its presence in Whangarei Harbour (both at the Port and the Marsden Point facility) it was also recorded in the Port of Auckland. Little is currently known about this species, or what impacts it may have on native ecosystems.

Several other species recorded from Whangarei (e.g. the polychaetes *Ficopomatus enigmaticus*, *Chaetopterus* sp. A, *Pseudopolydora kempi* and *P. paucibranchiata*; the sponge *Vosmaeropsis* cf. *macera*; the majid crab, *Pyromaia tuberculata*, and the amphipod, *Jassa slatteryi*) appear to have limited geographic distributions within New Zealand. Vessels departing from Whangarei may pose a significant risk of spreading these species to other ports within New Zealand, particularly to the Ports of Tauranga and Auckland.

In November 2003, a single, mature female of the large (max. carapace width > 100 cm) non-indigenous portunid *Charybdis japonica* was captured in a starfish trap at the Main Wharf at Port Whangarei during targeted surveillance surveys for marine pests (Biosecurity NZ Project ZBS2001-01). Subsequent delimitation and surveillance surveys throughout Whangarei Harbour and surrounding estuaries, involving more than more than 17000 trap hours, did not recover any additional specimens (Inglis *et al.* in press). A non-indigenous population of *C. japonica* has been present in Waitemata Harbour since at least 2000 and appears to be well-established there (Gust and Inglis, in press). It is likely that the specimen captured within Whangarei Harbour had been transported there by shipping from the Auckland population.

Management of existing non-indigenous species in the harbour

Most of the NIS detected in this survey were only sampled in one or two locations within the Port and Marsden Point facilities, so it is unclear whether a viable population of each species has established in Whangarei Harbour. Further surveys, targeting these species, are necessary to determine the true extent of their population in each port.

For most marine NIS eradication by physical removal or chemical treatment is not yet a cost-effective option. For species that are already widespread in Whangarei Harbour, local population controls are unlikely to be effective. Management should be directed toward preventing spread of species from Whangarei Harbour to locations where they do not presently occur. This may be particularly relevant to species found in the Whangarei Harbour that currently have limited distributions within New Zealand. Such management will require better understanding of the frequency of movements by vessels and other potential pathways of spread of these species to other domestic and international locations. Encouraging better hull maintenance (including antifouling protection) and domestic ballast water management by vessels leaving the Whangarei Port and Marsden Point facility may help to mitigate this risk.

Prevention of new introductions

Interception of unwanted species transported by shipping is best achieved offshore, through control and treatment of ships destined for Whangarei 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 taken up 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 Whangarei and Marsden Point (probably responsible for 95% of the NIS introductions) is consistent with previous findings from New Zealand (Cranfield *et al.* 1998), and 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 Francisco 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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References

AMOG Consulting (2002). Hull fouling as a vector for the translocation of marine organisms. Phase I: Hull fouling research. Ballast Water Research Series, Report No. 14., Department of Agriculture, Fisheries and Forestry Australia, Canberra.

Andrews, D.; Whayman, G.; Edgar, G. (1996). Assessment of optimal trapping techniques to control densities of the northern Pacific seastars on marine farm leases. Report No. FRDC 95/066

Australian Faunal Directory. (2005). Australian Biological Resources Study. Viewed 22 July 2005. http://www.deh.gov.au/biodiversity/abrs/online-resources/fauna/afd/index.html

Bioresearches Ltd (1976). Aspects of the ecology of the areas surrounding the oil refinery at Marsden Point. Bioresearches Ltd, Auckland.

Campbell, M. (2004). Analysis of vessel entries into New Zealand between 1998 and 2003. Unpublished report, Ministry of Fisheries, Wellington.

Carlton, J.T. (1985). Transoceanic and inter-oceanic dispersal of coastal marine organisms: the biology of ballast water. *Oceanography and Marine Biology Annual Reviews 23*: 313-371.

Carlton J.T. (1987) Patterns of transoceanic marine biological invasions in the Pacific Ocean. Bulletin of Marine Science 41:452-465

Carlton, J.T. (1992). Blue immigrants: the marine biology of maritime history. *The Log of Mystic Seaport Museum 44*: 31-36.

Carlton, J.T (1996). Biological invasions and cryptogenic species. *Ecology 77*:1653-1655.

Carlton, J.T. (1999). The scale and ecological consequences of biological invasions in the world's oceans. Pp. 195-212. *In*: Invasive species and biodiversity management. Sandlund, T.; Schei, P.J.; Viken, A. (Eds.). Kluwer Academic, Dordrecht.

Carlton, J.T.; Geller, J. (1993). Ecological roulette: The global transport of non-indigenous marine organisms. *Science 261*: 78-82.

Carter, H.J. (1886). Description of sponges from the neighbourhood of Port Phillip Heads, South Australia. *Annual Magazine of Natural History* (5)17: 40-53, 112-127

Chapman, J.W.; Carlton, J.T. (1991). A test of criteria for introduced species: the global invasion by the isopod *Synidotea laevidorsalis* (Miers, 1881). *Journal of Crustacean Biology 11*: 386-400.

Chapman, J.W.; Carlton, J.T. (1994). Predicted discoveries of the introduced isopod *Synidotea laevidorsalis* (Miers, 1881). *Journal of Crustacean Biology 14*: 700-714.

Cocito, S; Ferdeghini, F; Morri, C; Bianchi, C.N. (2000). Patterns of bioconstruction in the cheilostome bryozoan *Schizoporella errata*: The influence of hydrodynamics and associated biota. *Marine Ecology Progress Series* 192: 153-161.

Cohen, A.N. (2005). Guide to the Exotic Species of San Francisco Bay. San Francisco Estuary Institute, Oakland, CA, www.exoticsguide.org <viewed 27/08/05>.

Cohen, A.N.; Carlton, J.T. (1995). Non-indigenous Aquatic Species in a United States Estuary: A Case Study of the Biological Invasions of the San Francisco Bay and Delta.

Cornelius, P.F.S. (1995). North-west European thecate hydroids and their medusae. Part 2. Sertulariidae to Campanulariidae. In, Barnes, R.S.K.; Crothers, J.H. (Eds), Synopses of the British Fauna (New Series), The Linnean Society of London. Shrewsbury: Field Studies Council. [Synopses of the British Fauna no. 50].

Coutts, A.; Moore, K.; Hewitt, C. (2003). Ships' sea chests: an overlooked transfer mechanisms for non-indigenous marine species? *Marine Pollution Bulletin 46*: 1504-1515.

Cranfield, H.; Gordon, D.; Willan, R.; Marshall, B.; Battershill, C.; Francis, M.; Glasby, G.; Read, G. (1998). Adventive marine species in New Zealand. *NIWA Wellington Technical Report No. 34*.

Cryer, M.; Smith, M.; Parkinson, D.; MacKay, G.; Tasker, R. (2003). Biomass survey of cockles in Whangarei Harbour, 2002: stock assessment of cockles in Whangarei Harbour, including Snake Bank. Research progress report for Ministry of Fisheries research project COC2001/01 Objective 3. 6p.

Cummings, V.; Hatton, S. (2003). Towards the long term enhancement of shellfish beds in the Whangarei Harbour. I: identifying suitable habitat and methodologies for reseeding. NIWA Client Report HAM2003-042. Prepared for Northland Regional Council.

Cummings, V.; Reeves, P.; Halliday, J.; Chiaroni, L. (2004). Towards the long term enhancement of shellfish beds in the Whangarei Harbour. II: community consultation and initial reseeding.. NIWA Client Report HAM2004-092. Prepared for Northland Regional Council.

Dickie, B. (1984). Soft shore investigations. Whangarei Harbour Study. Technical Report 4. 134p.

Dodgshun T, Taylor M, Forrest B (2004) Human-mediated pathways of spread for non-indigenous marine species in New Zealand. Cawthron Report 700, prepared for the Department of Conservation. Cawthron Institute, Nelson. 39 pp.

Dyrynda, P.E.J.; Fairall, V.R.; d'Hondt, J.L.; Occhipinti Ambrogi, A. (2000). The distribution, origins and taxonomy of *Tricellaria inopinata* d'Hondt and *Occhipinti Ambrogi*, 1985, an invasive bryozoan new to the Atlantic. *Journal of Natural History 34*: 1993-2006.

Eldredge, L.; Carlton, J.T. (2002). Hawaiian marine bioinvasions: a preliminary assessment. *Pacific Science 56*: 211-212.

Eldredge, L.; Smith, C. (2001). A guidebook of introduced marine species in Hawaii. Bishop Museum Technical Report 21. Bishop Museum, Honolulu

Eno, C.N., Clark, R.A., Sanderson, W.G., (1997). Non-native marine species in British waters: a review and directory. Joint Nature Conservation Committee (JNCC), Peterborough.

Ferrell, D.; Avery, R.; Blount, C.; Hayes, L.; Pratt, R. (1994). The utility of small, baited traps for surveys of snapper (*Pagrus auratus*) and other demersal fishes. NSW Fisheries Research Institute Report. NSW Fisheries Research Institute, Cronulla, NSW, Australia.

Fuller, P.; Oçonnell, D. (2005). *Pseudopolydora kempi*. USGS Nonindigenous Aquatic Species Database, Gainesville, Florida. http://nas.er.usgs.gov/queries/FactSheet.asp?speciesID=1186; accessed 3/08/05.

Gordon, D.; Matawari, S. (1992). Atlas of marine fouling bryozoa of New Zealand Ports and Harbours. Miscellaneous Publications of the New Zealand Oceanographic Institute. New Zealand Oceanographic Institute. 52 p.

Grosholz, E. (2002). Ecological and evolutionary consequences of coastal invasions. *Trends in Ecology and Evolution 17*:22-27.

Gust, N.; Inglis, G.J. (in press). Adaptive multi-scale sampling to determine an invasive crab’s habitat usage and range in New Zealand. *Biological Invasions*

Gust, N.; Inglis, G.; Hayden, B. (2001). Design of baseline surveys for exotic marine organisms. Final research report for MFISH project ZBS2000/04. National Institute of Water and Atmospheric Research, Christchurch.

Handley, S. (1995). Spionid polychaetes in Pacific oysters, *Crassostrea gigas* (Thunberg) from Admiralty Bay, Marlborough Sounds, New Zealand. *New Zealand Journal of Marine and Freshwater Research* 29: 305-309.

Hayden, B. (1997). Ballasted ship movements in Port Whangarei 1992-1996. NIWA Client Report CHC97/43. Prepared for Environmental Quality Consultants.

Hewitt, C.; Campbell, M.; Thresher, R.; Martin, R. (1999). Marine biological invasions of Port Phillip Bay, Victoria. Report No. 20, Centre for Research on Introduced Marine Pests, Hobart.

Hewitt C, Martin R (1996) Port surveys for introduced marine species - background considerations and sampling protocols. CRIMP technical report no 4. CSIRO Division of Fisheries, Hobart.

Hewitt, C.; Martin, R. (2001). Revised protocols for baseline surveys for introduced marine species- survey design, sampling protocols and specimen handling. Report No. 22, Centre for Research on Introduced Marine Pests, Hobart.

Inglis, G. (2001). Criteria for selecting New Zealand ports and other points of entry that have a high risk of invasion by new exotic marine organisms. Final research report for Ministry of Fisheries research project ZBS2000/01A, objectives 1 & 2. NIWA, Wellington. 27pgs.

Leppäkoski, E.; Gollasch, S.; Gruszka, P.; Ojaveer, H.; Olenin, S.; Panov, V. (2002). The Baltic - a sea of invaders. *Canadian Journal of Fisheries and Aquatic Sciences 59*: 1175-1188.

Lleonart, M; Handlinger, J; Powell, M. (2003). Spionid mudworm infestation of farmed abalone (*Haliotis spp.*). *Aquaculture* 221: 85-96.

MacGillivray, P.H. (1889). On some South Australian Polyzoa. *Transactions and Proceedings and Report of the Royal Society of South Australia.* 12: 24-30.

Mack, R.; Simberloff, D.; Lonsdale, W.; Evans, H.; Clout, M.; Bazzaz, F. (2000). Biotic invasions: causes, epidemiology, global consequences and control. *Ecological Applications 10*: 689-710.

Mason, R.; Ritchie, L. (1979). Aspects of the ecology of Whangarei Harbour. Prepared by Fisheries Management Division, Ministry of Agriculture and Fisheries, Whangarei, December 1979. 88p.

Matsuoka K, Fukuyo Y (2000) Technical guide for modern dinoflagellate cyst study. Report prepared for the WESTPAC-HAB Project. WESTPAC-HAB/WESTPAC/IOC <http://dinos.anesc.u-tokyo.ac.jp/technical_guide/main.pdf> 77p.

Millar, A.S. (1980). Hydrology and surficial sediments of Whangarei Harbour. Unpublished MSc thesis, University of Waikato, New Zealand.

Morrison, M. 2003. A review of the natural marine features and ecology of Whangarei harbour. NIWA Client Report AKL2003-122. A report prepared by NIWA for the Department of Conservation. 52p.

NIMPIS (2002a). *Bugula flabellata* species summary. National Introduced Marine Pest Information System. Hewitt, C.L.; Martin, R.B.; Sliwa, C.; McEnnulty, F.R.; Murphy, N.E.; Jones, T.; Cooper, S. (Eds.:). Web publication http://crimp.marine.csiro.au/nimpis, Date of access: 3/24/2004

NIMPIS (2002b). *Bugula neritina* species summary. National Introduced Marine Pest Information System. Hewitt, C.L.; Martin, R.B.; Sliwa, C.; McEnnulty, F.R.; Murphy, N.E.; Jones, T.; Cooper, S. (Eds.:). Web publication http://crimp.marine.csiro.au/nimpis, Date of access: 3/24/2004

NIMPIS (2002c). *Crassostrea gigas* species summary. National Introduced Marine Pest Information System (Eds: Hewitt CL, Martin RB, Sliwa C, McEnnulty FR, Murphy NE, Jones T & Cooper S). Web publication http://crimp.marine.csiro.au/nimpis, Date of access: 3/24/2004

NIMPIS (2002d). *Cryptosula pallasiana* species summary. National Introduced Marine Pest Information System. Hewitt, C.L.; Martin, R.B.; Sliwa, C.; McEnnulty, F.R.; Murphy, N.E.; Jones, T.; Cooper, S. (Eds:.). Web publication http://crimp.marine.csiro.au/nimpis Date of access: 3/25/2004

NIMPIS (2002e). *Pseudopolydora paucibranchiata* species summary. National Introduced Marine Pest Information System (Eds: Hewitt CL, Martin RB, Sliwa C, McEnnulty FR, Murphy NE, Jones T & Cooper S). Web publication http://crimp.marine.csiro.au/nimpis, Date of access: 3/25/2004.

NIMPIS (2002f). *Pyromaia tuberculata* species summary. National Introduced Marine Pest Information System (Eds: Hewitt CL, Martin RB, Sliwa C, McEnnulty FR, Murphy NE, Jones T & Cooper S). Web publication http://crimp.marine.csiro.au/nimpis, Date of access: 3/25/2004.

NIMPIS (2002g). *Tricellaria inopinata* species summary. National Introduced Marine Pest Information System. Hewitt, C.L.; Martin, R.B.; Sliwa, C.; McEnnulty, F.R.; Murphy, N.E.; Jones, T.; Cooper, S. (Eds:.). Web publication http://crimp.marine.csiro.au/nimpis, Date of access: 3/25/2004

NIMPIS (2002h). *Theora lubrica* species summary. National Introduced Marine Pest Information System. Hewitt, C.L.; Martin, R.B.; Sliwa, C.; McEnnulty, F.R.; Murphy, N.E.; Jones, T.; Cooper, S. (Eds:.). Web publication http://crimp.marine.csiro.au/nimpis, Date of access: 3/24/2004

Northland Harbour Board (1981). Northland Forestry Port, Marsden Point: Environmental Impact Report. 265p

Occhipinti Ambrogi, A. (2000). Biotic Invasions in a Mediterranean Lagoon. *Biological Invasions 2*: 165-176

O'Connell, D. Fuller, P. (2005). *Bugula stolonifera*. USGS Non-indigenous Aquatic Species Database, Gainsville, FL (http://nas.er.usgs.gov/queries/SpFactSheet.asp?speciesID=268).

Parker, I.; Simberloff, D.; Lonsdale, W.; Goodell, K.; Wonham, M.; Kareiva, P.; Williamson, M.; Holle, B.V.; Moyle, P.; Byers, J.; Goldwasser, L. (1999). Impact: Toward a Framework for Understanding the Ecological Effects of Invaders. *Biological Invasions 1*: 3-19.

Poynter, M.; Kessing, V. (2002). Marsden Point deepwater port. Marine intertidal benthos sampling 1997-2002. Summary baseline report. Prepared by: Poynter and Associates Environmental Ltd and Boffa Miskell Ltd. December 2002. 15p + Appendices.

Pregenzer, C. (1983). Survey of metazoan symbionts of Mytilus edulis (Mollusca: Pelecypoda) in Southern Australia. *Australian Journal of Marine amd Freshwater Research* 34: 387-396.

Radashevsky, V.I.; Hsieh, H-L. (2000). *Pseudopolydora* (Polychaeta: Spionidae) species from Taiwan. *Zoological Studies 39(3)*: 218-235.

Read, G.B. (1975). Systematics and biology of polydorid species (Polychaeta: Spionidae) from Wellington Harbour. *Journal of the Royal Society of New Zealand* 5: 395-419.

Read, G.B.; Gordon, D.P. (1991) Adventive occurrence of the fouling serpulid *Ficopomatus enigmaticus* (Polychaeta) in New Zealand. *N.Z. Journal of Marine and Freshwater Research* 25:269-273

Ricciardi, A. (2001). Facilitative interactions among aquatic invaders: is an "invasional meltdown" occurring in the Great Lakes? *Canadian Journal of Fisheries and Aquatic Sciences 58*: 2513-2525.

Ruiz, G.; Fofonoff, P. Hines, A.; Grosholz, E. (1999). Non-indigenous species as stressors in estuarine and marine communities: assessing invasion impacts and interactions. *Limnology and Oceanography 44*: 950-972.

Smithsonian Institution (2001). Smithsonian Marine Station. Taxonomic database (http://www.sms.si.edu/irlspec/Bugula_stolon.htm).

Stepanjants, S.D. (1998). Obelia (Cnidaria, Medusozoa, Hydrozoa): phenomenon, aspects of investigations, perspectives for utilization. *Oceanography and Marine Biology: an Annual Review* 36: 179-215.

Taylor, M.; MacKenzie, L. (2001). Delimitation survey of the toxic dinoflagellate *Gymnodinium catenatum* in New Zealand. Cawthron Report 661, 12pp. Prepared for Ministry of Fisheries.

Thrush, S.F.; Schultz, D.; Hewitt, J.E.; Talley, D. (2002). Habitat structure in soft sediment environments and abundance of juvenile snapper *Pagrus auratus*. *Marine Ecology Progress Series 245*: 273-280.

Tricklebank, K. A.; Nesbit, G.; Read, G.; Acosta, H. 2001. The distribution of the parchment tubeworm *Chaetopterus* off the coast of northeastern New Zealand. Final Research Report to the Ministry of Fisheries. Auckland Uniservices Ltd, Auckland, New Zealand. 47 p.

Warwick RM (1996) Marine biodiversity: a selection of papers presented at the conference "Marine Biodiversity: causes and consequences", York, U.K. 30 August - 2 September 1994. Journal of Experimental Marine Biology and Ecology 202:IX-X

Wilcove, D.; Rothstein, D.; Dubow, J.; Phillips, A.; Losos, E. (1998). Quantifying threats to imperiled species in the United States. *Bioscience 48*: 607-615.

<www.fcc.co.nz/project/80>: Website of the Fletcher Construction Company Limited, accessed 07/06/05.

<www.fish.govt.nz/sustainability/biosecurity>: Ministry of Fisheries website, accessed 7/6/05.

<www.northlandportcorp.co.nz>: Website of the Northland Port Corporation Limited, accessed 7/06/05.

<www.northport.co.nz>: Website of Northport Limited - the port operating company for the ports of Whangarei and Marsden Point, jointly owned by Northland Port Corporation and Port of Tauranga. Accessed 09/05/2005.

<www.nrc.govt.nz>: Northland Regional Council website, accessed 7/06/2005.

<www.nrc.govt.nz/planning/documents/rcp22.pdf>: Regional Coastal Plan document, accessed 7/06/05

Tables

Table 1: Berthage facilities in the Port of Whangarei and Marsden Point.

Facility	Wharf	Purpose	Construction	Length of Berth (m)	Maximum length of vessel (m)	Depth (m below chart datum)
Port Whangarei	Main 1	General Cargo	Concrete pilings	146	190	9.5
Port Whangarei	Main 2	General/Bulk Cargo	Concrete pilings	134	190	9.5
Port Whangarei	Main 3	Bulk Cargo	Concrete pilings	155	200	9.5
Marsden Point	No. 1 & 2	General/Bulk Cargo	Steel pipe pilings	390	240	13.0
Marsden Point	MP wharf	General Cargo	Concrete pilings	134	150	8.4

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	
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	Quadrat scraping	0.10 m2 quadrats sampled at -0.5 m, -1.5 m, -3.0 m and -7 m on 2 inner	Workshop recommended extra quadrat in high diversity algal zone (-1.5 m) and to sample inner pilings for shade tolerant species

	CRIMP Protocol		NIWA Method		
Taxa sampled	Survey method	Sample procedure	Survey method	Sample procedure	Notes
		per berth		and 2 outer piles per berth	
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 Holdsworth starfish traps left overnight)	Few NZ ports have suitable intertidal areas to beach seine.

Table 3a: Summary of the Whangarei Harbour sampling effort. Numbers are totals for the Port of Whangarei and Marsden Point.

Sample method	Number of shipping berths sampled	Number of replicate samples taken
Benthic Sled Tows	4	9
Benthic Grab (Shipek)	4	12
Box traps	4	16
Diver quadrat scraping	4	68
Opera house fish traps	4	16
Starfish traps	4	16
Shrimp traps	4	16
Javelin cores	N/A	7

Table 3b: Pile scraping sampling effort in Whangarei Harbour. Numbers are totals for the Port of Whangarei and Marsden Point. 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 wood, 4 steel	4 wood, 2 steel, 4 concrete
1.5	2 wood, 2 steel	4 wood, 2 steel, 4 concrete
3.5	2 wood, 4 steel	4 wood, 2 steel, 4 concrete
7	2 wood, 4 steel	4 wood, 2 steel, 4 concrete
Miscellaneous	4 steel	1 steel, 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] indicates 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 Whangarei survey.

Phylum, Class	Order	Family	Genus and species
Annelida			
Polychaeta	Eunicida	Dorvilleidae	Schistomeringos loveni
Polychaeta	Eunicida	Eunicidae	Eunice australis
Polychaeta	Eunicida	Lumbrineridae	Lumbricalus aotearoae
Polychaeta	Eunicida	Lumbrineridae	Lumbrineris sphaerocephala
Polychaeta	Phyllodocida	Chrysopetalidae	Chrysopetalum Chrysopetalum-1
Polychaeta	Phyllodocida	Hesionidae	Ophiodromus angustifrons
Polychaeta	Phyllodocida	Nereididae	Neanthes cricognatha
Polychaeta	Phyllodocida	Nereididae	Nereis falcaria
Polychaeta	Phyllodocida	Nereididae	Nicon aestuariensis
Polychaeta	Phyllodocida	Phyllodocidae	Pterocirrus brevicornis
Polychaeta	Phyllodocida	Polynoidae	Harmothoe macrolepidota
Polychaeta	Phyllodocida	Polynoidae	Lepidastheniella comma
Polychaeta	Phyllodocida	Polynoidae	Lepidonotus polychromus
Polychaeta	Phyllodocida	Sigalionidae	Labiosthenolepis laevis
Polychaeta	Phyllodocida	Syllidae	Trypanosyllis zebra
Polychaeta	Phyllodocida	Syllidae	Typosyllis prolifera
Polychaeta	Sabellida	Sabellidae	Megalomma suspiciens
Polychaeta	Sabellida	Sabellidae	Pseudopotamilla laciniosa
Polychaeta	Sabellida	Serpulidae	Galeolaria hystrix
Polychaeta	Scolecida	Capitellidae	Heteromastus filiformis
Polychaeta	Scolecida	Maldanidae	Macroclymenella stewartensis
Polychaeta	Scolecida	Opheliidae	Armandia maculata
Polychaeta	Scolecida	Orbiniidae	Phylo novazealandiae
Polychaeta	Scolecida	Orbiniidae	Proscoloplos bondi
Polychaeta	Scolecida	Scalibregmatidae	Hyboscolex longiseta
Polychaeta	Spionida	Spionidae	Prionospio australiensis
Polychaeta	Terebellida	Cirratulidae	Protocirrineris nuchalis
Polychaeta	Terebellida	Flabelligeridae	Pherusa parmata
Polychaeta	Terebellida	Pectinariidae	Pectinaria australis
Polychaeta	Terebellida	Terebellidae	Amaeana antipoda
Polychaeta	Terebellida	Terebellidae	Nicolea armilla
Polychaeta	Terebellida	Terebellidae	Pseudopista rostrata
Polychaeta	Terebellida	Terebellidae	Streblosoma toddae
Polychaeta	Terebellida	Trichobranchidae	Terebellides narribri
Bryozoa			
Gymnolaemata	Cheilostomata	Beaniidae	Beania n.sp.
Gymnolaemata	Cheilostomata	Beaniidae	Beania plurispinosa
Gymnolaemata	Cheilostomata	Candidae	Caberea rostrata
Gymnolaemata	Cheilostomata	Romancheinidae	Escharoides angela
Cnidaria			
Hydrozoa	Hydroida	Sertulariidae	Sertularella robusta
Hydrozoa	Hydroida	Solanderiidae	Solanderia ericopsis
Crustacea			
Cirripedia	Thoracica	Balanidae	Austrominius modestus
Cirripedia	Thoracica	Balanidae	Megabalanus tintinnabulum linzei
Cirripedia	Thoracica	Balanidae	Notomegabalanus decorus
Cirripedia	Thoracica	Chthamalidae	Chaemosipho columna
Cirripedia	Thoracica	Pachylasmidae	Epopella plicata
Malacostraca	Amphipoda	Aoridae	Haplocheira barbimana

Phylum, Class	Order	Family	Genus and species
Malacostraca	Amphipoda	Dexaminidae	Paradexamine pacifica
Malacostraca	Amphipoda	Isaeidae	Gammaropsis chiltoni
Malacostraca	Amphipoda	Ischyroceridae	Ventojassa frequens
Malacostraca	Amphipoda	Leucothoidae	Leucothoe trailli
Malacostraca	Amphipoda	Liljeborgiidae	Liljeborgia akaroica
Malacostraca	Amphipoda	Liljeborgiidae	Liljeborgia barhami
Malacostraca	Amphipoda	Melitidae	Melita festiva
Malacostraca	Amphipoda	Podoceridae	Podocerus cristatus
Malacostraca	Anomura	Diogenidae	Paguristes pilosus
Malacostraca	Anomura	Diogenidae	Paguristes setosus
Malacostraca	Anomura	Paguidae	Pagurus traversi
Malacostraca	Anomura	Paguridae	Pagurus novizealandiae
Malacostraca	Anomura	Porcellanidae	Petrolisthes novaezelandiae
Malacostraca	Brachyura	Grapsidae	Hemigrapsus crenulatus
Malacostraca	Brachyura	Hymenosomatidae	Halicarcinus cookii
Malacostraca	Brachyura	Hymenosomatidae	Halicarcinus varius
Malacostraca	Brachyura	Hymenosomatidae	Halicarcinus whitei
Malacostraca	Brachyura	Majidae	Notomithrax minor
Malacostraca	Brachyura	Ocypodidae	Macrophthalmus hirtipes
Malacostraca	Brachyura	Xanthidae	Pilumnus novaezelandiae
Malacostraca	Caridea	Alpheidae	Alpheus richardsoni
Malacostraca	Caridea	Alpheidae	Alpheus socialis
Malacostraca	Caridea	Crangonidae	Pontophilus australis
Malacostraca	Caridea	Palemonidae	Palaemon affinis
Malacostraca	Caridea	Palemonidae	Periclimenes yaldwyni
Malacostraca	Isopoda	Cirolanidae	Natatolana narica
Malacostraca	Isopoda	Sphaeromatidae	Pseudosphaeroma campbellensis
Malacostraca	Palinura	Palinuridae	Jasus edwardsi
Echinodermata			
Asteroidea	Forcipulata	Asteriidae	Coscinasterias muricata
Asteroidea	Valvatida	Asterinidae	Patiriella regularis
Holothuroidea	Apodida	Synaptidae	Rynkatorpa uncinata
Holothuroidea	Aspidochirotida	Stichopodidae	Stichopus mollis
Ophiuroidea	Ophiurida	Ophiactidae	Ophiactis resiliens
Ophiuroidea	Ophiurida	Ophionereididae	Ophionereis fasciata
Mollusca			
Bivalvia	Myoida	Hiatellidae	Hiatella arctica
Bivalvia	Mytiloida	Mytilidae	Modiolarca impacta
Bivalvia	Mytiloida	Mytilidae	Xenostrobus pulex
Bivalvia	Ostreoida	Ostreidae	Ostrea aupouria
Bivalvia	Pterioida	Pectinidae	Talochlamys zelandiae
Bivalvia	Veneroida	Kelliidae	Kellia cycladiformis
Bivalvia	Veneroida	Veneridae	Irus reflexus
Bivalvia	Veneroida	Veneridae	Ruditapes largillierti
Bivalvia	Veneroida	Veneridae	Tawera spissa
Gastropoda	Cephalaspidea	Philinidae	Philine auriformis
Gastropoda	Littorinimorpha	Calyptraeidae	Maoricrypta costata
Gastropoda	Littorinimorpha	Calyptraeidae	Sigapatella novaezelandiae
Gastropoda	Littorinimorpha	Littorinidae	Austrolittorina antipodum
Gastropoda	Neogastropoda	Buccinidae	Cominella adspersa
Gastropoda	Neogastropoda	Buccinidae	Cominella glandiformis
Gastropoda	Neogastropoda	Buccinidae	Cominella quoyana
Gastropoda	Neogastropoda	Muricidae	Dicithais orbita
Gastropoda	Neotaenioglossa	Velutinidae	Lamellaria ophione

Phylum, Class	Order	Family	Genus and species
Gastropoda	Notaspidea	Pleurobranchidae	Pleurobranchaea maculata
Gastropoda	Nudibranchia	Chromodorididae	Ceratostoma amoena
Gastropoda	Nudibranchia	Dorididae	Alloiodoris lanuginata
Gastropoda	Systellomatophora	Onchidiidae	Onchidella nigricans
Polyplacophora	Acanthochitonina	Acanthochitonidae	Cryptoconchus porosus
Porifera			
Demospongiae	Dictyoceratida	Dysideidae	Euryspongia cf. arenaria
Demospongiae	Haplosclerida	Callyspongiidae	Callyspongia cf. irregularis
Demospongiae	Poecilosclerida	Microcionidae	Clathria (Microciona) dendyi
Demospongiae	Poecilosclerida	Microcionidae	Ophlitospongia reticulata
Pyrrophycophyta			
Dinophyceae	Peridiniales	Peridiniaceae	Lingulodinium polyedrum
Dinophyceae	Peridiniales	Peridiniaceae	Protoperidinium sp.
Dinophyceae	Peridiniales	Peridiniaceae	Scrippsiella trochoidea
Urochordata			
Ascidiacea	Aplousobranchia	Polyclinidae	Aplidium adamsi
Ascidiacea	Stolidobranchia	Molgulidae	Molgula amokurae
Ascidiacea	Stolidobranchia	Molgulidae	Molgula mortenseni
Ascidiacea	Stolidobranchia	Pyuridae	Microcosmus australis
Ascidiacea	Stolidobranchia	Pyuridae	Microcosmus hirsutus
Ascidiacea	Stolidobranchia	Pyuridae	Pyura cancellata
Ascidiacea	Stolidobranchia	Pyuridae	Pyura carnea
Ascidiacea	Stolidobranchia	Pyuridae	Pyura rugata
Ascidiacea	Stolidobranchia	Pyuridae	Pyura subuculata
Ascidiacea	Stolidobranchia	Styelidae	Cnemidocarpa bicornuta
Ascidiacea	Stolidobranchia	Styelidae	Cnemidocarpa nisiotus
Vertebrata			
Actinopterygii	Anguilliformes	Anguillidae	Anguilla dieffenbachii
Actinopterygii	Perciformes	Gobiidae	Favonigobius exquisitus
Actinopterygii	Perciformes	Labridae	Notolabrus celidotus
Actinopterygii	Perciformes	Labridae	Notolabrus celidotus
Actinopterygii	Perciformes	Sparidae	Pagrus auratus
Actinopterygii	Perciformes	Trypterigiidae	Forsterygion varium
Actinopterygii	Pleuronectiformes	Pleuronectidae	Peltorhamphus latus

Table 7. Cryptogenic marine species recorded from the Port of Whangarei and Marsden Point 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	
Annelida				
Polychaeta	Spionida	Chaetopteridae	Chaetopterus Chaetopterus-A	C1
Bryozoa				
Gymnolaemata	Cheilostomata	Scrupariidae	Scruparia ambigua	C1
Cnidaria				
Hydrozoa	Hydroida	Bougainvilliidae	Bougainvillia muscus	C1
Hydrozoa	Hydroida	Plumulariidae	Plumularia setacea	C1
Crustacea				
Cirripedia	Thoracica	Balanidae	Amphibalanus variagatus	C1
Cirripedia	Thoracica	Balanidae	Balanus trigonus	C1
Malacostraca	Amphipoda	Isaeidae	Gammaropsis sp. aff. G. tawahi	C2
Malacostraca	Amphipoda	Lysianassidae	Parawaldeckia sp. aff. P. karaka	C2
Malacostraca	Brachyura	Grapsidae	Plagusia chabrus	C1
Malacostraca	Brachyura	Xanthidae	Pilumnopeus serratifrons	C1
Porifera				
Demospongiae	Dendroceratida	Darwinellidae	Dendrilla n. sp. 1	C2
Demospongiae	Dictyoceratida	Dysideidae	Euryspongia n. sp. 1	C2
Demospongiae	Dictyoceratida	Dysideidae	Euryspongia n. sp. 3	C2
Demospongiae	Halichondrida	Dictyonellidae	Scopalina n. sp. 1	C2
Demospongiae	Halichondrida	Halichondriidae	Halichondria n. sp. 4	C2
Demospongiae	Halichondrida	Halichondriidae	Halichondria panicea	C1
Demospongiae	Halichondrida	Halichondriidae	Hymeniacidon perleve	C1
Demospongiae	Halisarcida	Halisarcidae	Halisarca n. sp. 1	C2
Demospongiae	Haplosclerida	Callyspongiidae	Callyspongia n. sp. 2	C2
Demospongiae	Haplosclerida	Callyspongiidae	Callyspongia n. sp. 3	C2

Phylum, Class	Order	Family	Genus and species	
Demospongiae	Haplosclerida	Callyspongiidae	Callyspongia n. sp. 4	C2
Demospongiae	Haplosclerida	Callyspongiidae	Callyspongia ramosa	C1
Demospongiae	Haplosclerida	Callyspongiidae	Euplacella communis	C1
Demospongiae	Haplosclerida	Chalinidae	Adocia n. sp. 4	C2
Demospongiae	Haplosclerida	Chalinidae	Haliclona n. sp. 3	C2
Demospongiae	Poecilosclerida	Acarnidae	Iophon n. sp. 1	C2
Demospongiae	Poecilosclerida	Ancinoiidae	Crella (Pytheas) incrustans	C1
Demospongiae	Poecilosclerida	Coelosphaeridae	Lissodendoryx isodictyalis	C1
Demospongiae	Poecilosclerida	Microcionidae	Echinochalina (Protolithospongia) n. sp. 1	C2
Pyrrophycophyta				
Dinophyceae	Gymnodiniales	Gymnodiniacea	Gymnodinium catenatum	C1
Urochordata				
Ascidiacea	Aplousobranchia	Didemnidae	Diplosoma listerianum	C1
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
Ascidiacea	Stolidobranchia	Styelidae	Pyura n.sp.2	C2
Ascidiacea	Stolidobranchia	Styelidae	Styela plicata	C1

Table 8: Non-indigenous marine species recorded from the Whangarei Harbour 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	*Ficopomatus enigmaticus*	H or B	1967
Polychaeta	Spionida	Spionidae	*Polydora hoplura*	H	Unknown [1]
Polychaeta	Spionida	Spionidae	*Pseudopolydora kempi*	H or B	Unknown [1]
Polychaeta	Spionida	Spionidae	*Pseudopolydora paucibranchiata*	H or B	Pre-1975
Bryozoa					
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula flabellata*	H	Pre-1948
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula neritina*	H	1949
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula stolonifera*	H	1962
Gymnolaemata	Cheilostomata	Candidae	*Tricellaria inopinata*	H	Pre-1964
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula pallasiana*	H	1890s
Gymnolaemata	Cheilostomata	Lepraliellidae	*Celleporaria sp. 1* ***NR***	H	Nov. 2002 [d]
Gymnolaemata	Cheilostomata	Schizoporellidae	*Schizoporella errata*	H	Pre-1960
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora subtorquata*	H or B	Pre-1982
Cnidaria					
Hydrozoa	Hydroida	Campanulariidae	*Obelia longissima*	H	Pre-1928
Crustacea					
Malacostraca	Amphipoda	Ischyroceridae	*Jassa slatteryi*	H	Unknown [1]
Malacostraca	Brachyura	Majidae	*Pyromaia tuberculata*	H	1975
Mollusca					
Bivalvia	Ostreoida	Ostreidae	*Crassostrea gigas*	H	1961
Bivalvia	Veneroida	Semelidae	*Theora lubrica*	B	1971
Porifera					
Calcarea	Leucosolenida	Heteropiidae	*Vosmaeropsis cf macera*	H	Unknown [1]
Demospongiae	Hadromerida	Clionaidae	*Cliona celata*	H or B	Unknown [1]

[1] Date of introduction currently unknown but species had been encountered in New Zealand prior to the present survey.

Table 9: Species indeterminata recorded from the Port of Whangarei 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.

Phylum, Class	Order	Family	Genus and species
Annelida			
Polychaeta	Eunicida	Eunicidae	Marphysa Indet
Polychaeta	Phyllodocida	Hesionidae	Harmothoin-unplaced Indet
Polychaeta	Phyllodocida	Nereididae	Nereididae Indet
Polychaeta	Phyllodocida	Phyllodocidae	Eulalia Eulalia-NIWA-2
Polychaeta	Phyllodocida	Phyllodocidae	Mystides Mystides-B
Polychaeta	Phyllodocida	Syllidae	Eusyllis Eusyllis-E
Polychaeta	Phyllodocida	Syllidae	Syllidae Indet
Polychaeta	Phyllodocida	Syllidae	Syllin-unknown indet
Polychaeta	Phyllodocida	Syllidae	Typosyllis Typosyllis-B
Polychaeta	Sabellida	Sabellidae	Branchiomma Branchiomma-B
Polychaeta	Sabellida	Sabellidae	Sabellidae Indet
Polychaeta	Spionida	Chaetopteridae	Chaetopteridae-[Not Chaetopterus] Indet
Polychaeta	Spionida	Spionidae	Polydora-group Indet
Polychaeta	Terebellida	Cirratulidae	Cirratulus Cirratulus-A
Polychaeta	Terebellida	Terebellidae	Polycirrus Indet
Polychaeta	Terebellida	Terebellidae	Terebellidae Indet
Cnidaria			
Hydrozoa	Hydroida	Campanulariidae	Obelia sp.
Crustacea			
Malacostraca	Anomura	Paguridae	Pagurus sp.
Phycophyta			
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	Rhodymenia sp.
Urochordata			
Ascidiacea	Aplousobranchia	Holozoidae	Distaplia s.p.
Vertebrata			
Actinopterygii	Anguilliformes	Anguillidae	Anguillidae sp.
Actinopterygii	Perciformes	Percophidae	Hemerocoetes sp.

Table 10: Non-indigenous marine organisms recorded from the Whangarei Harbour survey, and the techniques used to capture each species. Species distributions are indicated for the Port of Whangarei (Port) and Marsden Point (M. Pt). Species national distributions are also indicated in ports and marinas around New Zealand.

Non-indigenous species	Capture technique in Harbour	Locations detected in Harbour	Detected in other locations in ZBS2000_04
Ficopomatus enigmaticus	Pile scrape	M3 (Kioeroa Wharf) Port. See Fig 18	Whangarei Marina
Polydora hoplura	Pile scrape	Oil Refinery Wharf; MP Wharf M.Pt. See Fig 19	Dunedin, Nelson, Picton, Tauranga, Wellington
Pseudopolydora kempi	Benthic grab	MP Wharf M.Pt. See Fig 20	None
Pseudopolydora paucibranchiata	Benthic grab	MP Wharf M.Pt. See Fig 21	Gisborne
Bugula flabellata	Pile scrape	Oil Refinery Wharf; MP Wharf M.Pt. See Fig 22 M3 (Kioeroa Wharf) Port. See Fig 23	Auckland, Bluff, Dunedin, Lyttleton, Napier, Nelson, Opua Marina, Picton, Taranaki, Tauranga, Timaru, Wellington
Bugula neritina	Pile scrape	Oil Refinery Wharf; MP Wharf M.Pt. See Fig 24 M1; M3 (Kioeroa Wharf) Port. See Fig 25	Auckland, Dunedin, Gisborne, Gulf Harbour Marina, Lyttleton, Napier, Opua Marina, Taranaki, Tauranga, Timaru, Whangarei Marina
Bugula stolonifera	Pile scrape	M1 Port. See Fig 26	Taranaki
Tricellaria inopinata	Pile scrape	MP Wharf M.Pt. See Fig 27	Lyttleton, Taranaki, Gisborne
Cryptosula pallasiana	Pile scrape	MP Whar M.Pt. See Fig 28	Dunedin, Gisborne, Lyttleton, Taranaki, Timaru, Wellington
Celleporaria sp. 1	Pile scrape	Oil Refinery Wharf; MP Wharf M.Pt. See Fig 29 M1; M3 (Kioeroa Wharf) Port. See Fig 30	Auckland
Schizoporella errata	Pile scrape	M3 (Kioeroa Wharf) Port. See Fig 31	Nelson, Gulf Harbour Marina

Non-indigenous species	Capture technique in Harbour	Locations detected in Harbour	Detected in other locations in ZBS2000_04
Watersipora subtorquata	Pile scrape	MP Wharf M.Pt. See Fig 32 M1; M3 (Kioeroa Wharf) Port. See Fig 33	Bluff, Dunedin, Gisborne, Gulf Harbour Marina, Lyttleton, Napier, Nelson, Opua Marina, Taranaki, Tauranga, Timaru, Wellington
Obelia longissima	Pile scrape	Oil Refinery Wharf M.Pt. See Fig 34	Auckland, Opua Marina
Jassa slatteryi	Pile scrape	Oil Refinery Wharf M.Pt. See Fig 35	Lyttleton, Timaru
Pyromaia tuberculata	Pile scrape	M3 (Kioeroa Wharf) Port. See Fig 36	None
Crassostrea gigas	Pile scrape	M1; M3 (Kioeroa Wharf) Port. See Fig 37	Auckland, Dunedin, Gulf Harbour Marina, Nelson, Opua Marina, Taranaki
Theora lubrica	Benthic grab, Benthic sled	M1; M3 (Kioeroa Wharf) Port. See Fig 38	Auckland, Gisborne, Gulf Harbour Marina, Lyttleton, Napier, Nelson, Opua Marina, Taranaki, Whangarei Marina
Vosmaeropsis cf macera	Pile scrape	MP Wharf M.Pt. See Fig 39	Gulf Harbour Marina
Cliona celata	Pile scrape	MP Wharf M.Pt. See Fig 40	Tauranga

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 Rotman	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 representative groups of the main 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 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: List of Chapman and Carlton's (1994) nine criteria (C1 – C9) for assigning non-indigenous species status that were met by the non-indigenous species sampled in the Whangarei Harbour.

Criteria that apply to each species are indicated by (+). Cranfield *et al.*'s (1998) analysis was used for species previously known from New Zealand waters. For non-indigenous species that were 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.

Phylum and species	C1	C2	C3	C4	C5	C6	C7	C8	C9
Annelida									
Ficopomatus enigmaticus	+	+	+		+	+	+	+	+
Polydora hoplura			+		+	+	+	+	+
Pseudopolydora kempi	+		+					+	+
Pseudopolydora paucibranchiata	+		+		+	+	+	+	+
Bryozoa									
Bugula flabellata	+	+	+		+	+	+	+	+
Bugula neritina	+				+	+	+	+	+
Bugula stolonifera	+	+	+		+	+	+	+	+
Tricellaria inopinata	+	+	+		+	+		+	+
Cryptosula pallasiana	+	+	+		+	+	+	+	+
Celleporaria sp. 1	+		+		+	+		+	+
Schizoporella errata	+	+	+			+	+	+	+
Watersipora subtorquata	+	+	+		+	+	+	+	+
Cnidaria									
Obelia longissima	+	+	+						+
Crustacea									
Jassa slatteryi	+		+			+		+	+
Pyromaia tuberculata	+	+	+			+	+	+	+
Mollusca									
Crassostrea gigas	+	+	+			+	+	+	+
Theora lubrica	+	+			+	+	+	+	+
Porifera									
Vosmaeropsis cf macera	+				+		+	+	+
Cliona celata			+				+	+	

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 Whangarei

Terminal	Site	Eastings	Northings	NZ Latitude	NZ Longitude	Survey Method	No. of sample units
Whangarei_Port	M1	2632704	6604245	-35.75632	174.34924	BGRB	3
Whangarei_Port	M1	2632725	6604260	-35.75618	174.34947	BSLD	3
Whangarei_Port	M1	2632689	6604260	-35.75618	174.34907	CRBTP	4
Whangarei_Port	M1	2632730	6604245	-35.75632	174.34953	CYST	2
Whangarei_Port	M1	2632704	6604245	-35.75632	174.34924	FSHTP	4
Whangarei_Port	M1	2632704	6604245	-35.75632	174.34924	PSC	16
Whangarei_Port	M1	2632689	6604260	-35.75618	174.34907	SHRTP	4
Whangarei_Port	M1	2632689	6604260	-35.75618	174.34907	STFTP	4
Whangarei_Port	M3	2632680	6604661	-35.75257	174.34890	BGRB	3
Whangarei_Port	M3	2632700	6604695	-35.75226	174.34911	BSLD	1
Whangarei_Port	M3	2632700	6604655	-35.75262	174.34912	BSLD	1
Whangarei_Port	M3	2632700	6604689	-35.75232	174.34912	BSLD	1
Whangarei_Port	M3	2632672	6604609	-35.75304	174.34882	CRBTP	4
Whangarei_Port	M3	2632720	6604700	-35.75222	174.34934	CYST	2
Whangarei_Port	M3	2632672	6604700	-35.75222	174.34880	FSHTP	4
Whangarei_Port	M3	2632680	6604661	-35.75257	174.34890	PSC	16
Whangarei_Port	M3	2632672	6604609	-35.75304	174.34882	SHRTP	4
Whangarei_Port	M3	2632672	6604609	-35.75304	174.34882	STFTP	4
Marsden_Point	ME	2645323	6595158	-35.83626	174.49051	BGRB	3
Marsden_Point	ME	2645232	6595249	-35.83545	174.48948	BSLD	1
Marsden_Point	ME	2645346	6595125	-35.83656	174.49076	CRBTP	4
Marsden_Point	ME	2645603	6594957	-35.83803	174.49364	CYST	1
Marsden_Point	ME	2645354	6594829	-35.83922	174.49091	CYST	1
Marsden_Point	ME	2645354	6594926	-35.83835	174.49089	CYST	1
Marsden_Point	ME	2645319	6595140	-35.83643	174.49046	FSHTP	4
Marsden_Point	ME	2645323	6595135	-35.83647	174.49051	PSC	19
Marsden_Point	ME	2645401	6595139	-35.83643	174.49137	SHRTP	4
Marsden_Point	ME	2645401	6595139	-35.83643	174.49137	STFTP	4
Marsden_Point	REF 1	2646203	6594880	-35.83862	174.50029	BGRB	3
Marsden_Point	REF 1	2646216	6594930	-35.83818	174.50043	BSLD	2
Marsden_Point	REF 1	2646225	6594852	-35.83887	174.50054	CRBTP	4
Marsden_Point	REF 1	2646177	6594844	-35.83896	174.50001	FSHTP	4
Marsden_Point	REF 1	2646203	6594821	-35.83916	174.50030	PSC	15
Marsden_Point	REF 1	2646225	6594852	-35.83887	174.50054	SHRTP	4
Marsden_Point	REF 1	2646225	6594852	-35.83887	174.50054	STFTP	4

*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

					Terminal	Whangarei_Port																			
					Berth code	M1																M3			
					Pile replicate	1								2								1			
					Pile position	IN				OUT				IN				OUT				IN			
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Ascidiacea	Aplousobranchia	Didemnidae	*Diplosoma*	*listerianum*	C1	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
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
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	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	1	1	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	0	0	0	1	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	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*amokurae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*rugata*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*subuculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus*	*australis*	N	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus*	*hirsutus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Styela*	*plicata*	C1	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
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Pyura*	*n.sp.2 (small stalked # 2)*	C2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	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
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus*	*pulex*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Modiolarca*	*impacta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*aupouria*	N	0	0	1	1	0	0	1	1	0	0	0	0	0	1	0	0	0	1	1	1
Bivalvia	Ostreoida	Ostreidae	*Crassostrea*	*gigas*	A	1	1	1	0	0	1	0	0	1	1	1	1	0	0	0	0	0	1	1	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
Bivalvia	Veneroida	Kelliidae	*Kellia*	*cycladiformis*	N	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	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Ruditapes*	*largillierti*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calcarea	Leucosolenida	Heteropiidae	*Vosmaeropsis*	*cf macera*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Paguidae	*Pagurus*	*traversi*	N	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
Crustacea	Brachyura	Grapsidae	*Plagusia*	*chabrus*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*whitei*	N	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	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Pyromaia*	*tuberculata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Crustacea	Brachyura	Xanthidae	*Pilumnopeus*	*serratifrons*	C1	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0	0	0	1	1	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
Crustacea	Caridea	Alpheidae	*Alpheus*	*socialis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Palemonidae	*Periclimenes*	*yaldwyni*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Palinura	Palinuridae	*Jasus*	*edwardsi*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Balanus*	*trigonus*	C1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Amphibalanus*	*variagatus*	C1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Megabalanus*	*tintinnabulum linzei*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Notomegabalanus*	*decorus*	N	0	0	0	0	0	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	0	0	0	0	0
Crustacea	Thoracica	Pachylasmidae	*Epopella*	*plicata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dendroceratida	Darwinellidae	*Dendrilla*	*n. sp. 1 (soft thumb)*	C2	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	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

					Terminal	Whangarei_Port																			
					Berth code	M1																M3			
					Pile replicate	1								2								1			
					Pile position	IN				OUT				IN				OUT				IN			
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
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
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 1 (soft spikey tan cushion)*	C2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 3 (fleshy brown fingery)*	C2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Hadromerida	Clionaidae	*Cliona*	*celata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Dictyonellidae	*Scopalina*	*n. sp. 1 (soft encrusting)*	C2	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	1	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
Demospongiae	Halichondrida	Halichondriidae	*Hymeniacidon*	*perleve*	C1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halisarcida	Halisarcidae	*Halisarca*	*n. sp. 1 (thin rubber)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Callyspongiidae	*Euplacella*	*communis*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*ramosa*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*cf. irregularis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*n. sp. 4 (plump smooth big oscules)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Ancinoiidae	*Crella (Pytheas)*	*incrustans*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Coelosphaeridae	*Lissodendoryx*	*isodictyalis*	C1	0	0	1	0	1	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0
Demospongiae	Poecilosclerida	Microcionidae	*Clathria (Microciona)*	*dendyi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Microcionidae	*Ophlitospongia*	*reticulata*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Demospongiae	Poecilosclerida	Microcionidae	*Echinochalina (Protolithospongia)*	*n. sp. 1 (palmate C. bathami)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Maoricrypta*	*costata*	N	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Littorinimorpha	Littorinidae	*Austrolittorina*	*antipodum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Neogastropoda	Buccinidae	*Cominella*	*glandiformis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Neogastropoda	Buccinidae	*Cominella*	*quoyana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Neogastropoda	Muricidae	*Dicithais*	*orbita*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Neotaenioglossa	Velutinidae	*Lamellaria*	*ophione*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Ceratostoma*	*amoena*	N	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
Gastropoda	Systellomatophora	Onchidiidae	*Onchidella*	*nigricans*	N	1	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	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	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	1	1	0	0	1	1	1	0	1	1	0	0	1	1	0	0	1	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*stolonifera*	A	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*rostrata*	N	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1
Gymnolaemata	Cheilostomata	Candidae	*Tricellaria*	*inopinata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula*	*pallasiana*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Lepraliellidae	*Celleporaria*	*sp. 1*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides*	*angela*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Schizoporellidae	*Schizoporella*	*errata*	A	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
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	0	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	1	0
Holothuroidea	Apodida	Synaptidae	*Rynkatorpa*	*uncinata*	N	0	0	0	0	0	0	0	0	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
Hydrozoa	Hydroida	Bougainvilliidae	*Bougainvillia*	*muscus*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*longissima*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*setacea*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Sertularella*	*robusta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Solanderiidae	*Solanderia*	*ericopsis*	N	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	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
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*chiltoni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*sp. aff. G. tawahi*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa*	*frequens*	N	0	0	0	0	0	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

Class	Orders	Family	Genus	Species																					
					Terminal	Whangarei_Port																			
					Berth code	M1																M3			
					Pile replicate	1								2								1			
					Pile position	IN				OUT				IN				OUT				IN			
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*slatteryi*	A	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
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*akaroica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*barhami*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*sp. aff. P. karaka*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Malacostraca	Amphipoda	Melitidae	*Melita*	*festiva*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*cristatus*	N	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ophiuroidea	Ophiurida	Ophiactidae	*Ophiactis*	*resiliens*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ophiuroidea	Ophiurida	Ophionereididae	*Ophionereis*	*fasciata*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos*	*loveni*	N	0	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	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Eunicidae	*Marphysa*	*Indet*	SI	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
Polychaeta	Phyllodocida	Chrysopetalidae	*Chrysopetalum*	*Chrysopetalum-1*	N	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereididae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*cricognatha*	N	0	0	0	0	0	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	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
Polychaeta	Phyllodocida	Phyllodocidae	*Pterocirrus*	*brevicornis*	N	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	1	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidastheniella*	*comma*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoin-unplaced*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis*	*Typosyllis-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis*	*zebra*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Syllidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-E*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Syllin-unknown*	*indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis*	*prolifera*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*Branchiomma-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla*	*laciniosa*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Sabellidae*	*Indet*	SI	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Ficopomatus*	*enigmaticus*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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
Polychaeta	Scolecida	Maldanidae	*Macroclymenella*	*stewartensis*	N	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
Polychaeta	Scolecida	Orbiniidae	*Proscoloplos*	*bondi*	N	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
Polychaeta	Spionida	Chaetopteridae	*Chaetopterus*	*Chaetopterus-A*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Chaetopteridae	*Chaetopteridae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*hoplura*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*Indet*	SI	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Cirratulus*	*Cirratulus-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris*	*nuchalis*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	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	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*armilla*	N	0	0	0	0	0	0	0	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	1	0	0	1	1	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Pseudopista*	*rostrata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Polycirrus*	*Indet*	SI	0	0	0	0	0	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

					Terminal	Whangarei_Port																			
					Berth code	M1																M3			
					Pile replicate	1								2								1			
					Pile position	IN				OUT				IN				OUT				IN			
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
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
Polychaeta	Terebellida	Trichobranchidae	*Terebellides*	*narribri*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus*	*porosus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia*	*sp.*	SI	0	0	0	0	0	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

					Terminal	Marsden_Point																			
					Berth code	ME																			
					Pile replicate	2								1											
					Pile position	OUT				IN				OUT				IN				OUT			
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Ascidiacea	Aplousobranchia	Didemnidae	*Diplosoma*	*listerianum*	C1	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
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
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	1	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	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*amokurae*	N	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*rugata*	N	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*subuculata*	N	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus*	*australis*	N	0	1	0	0	0	0	1	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	0	0	0	0	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
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus*	*hirsutus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1
Ascidiacea	Stolidobranchia	Styelidae	*Styela*	*plicata*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1
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
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Pyura*	*n.sp.2 (small stalked # 2)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	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	1	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus*	*pulex*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
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	0
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*aupouria*	N	0	0	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	1
Bivalvia	Ostreoida	Ostreidae	*Crassostrea*	*gigas*	A	0	1	0	0	0	1	1	0	0	0	0	0	0	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	1	0	0	0	0
Bivalvia	Veneroida	Kelliidae	*Kellia*	*cycladiformis*	N	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	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Ruditapes*	*largillierti*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calcarea	Leucosolenida	Heteropiidae	*Vosmaeropsis*	*cf macera*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Paguidae	*Pagurus*	*traversi*	N	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	1	0	0	0	0
Crustacea	Brachyura	Grapsidae	*Plagusia*	*chabrus*	C1	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*whitei*	N	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	1	0	0	0	0
Crustacea	Brachyura	Majidae	*Pyromaia*	*tuberculata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*Pilumnopeus*	*serratifrons*	C1	0	0	1	0	0	0	1	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
Crustacea	Caridea	Alpheidae	*Alpheus*	*socialis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Palemonidae	*Periclimenes*	*yaldwyni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Palinura	Palinuridae	*Jasus*	*edwardsi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Balanus*	*trigonus*	C1	0	1	1	1	0	0	0	0	0	1	1	1	0	1	1	0	0	1	1	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	1	0	0	0
Crustacea	Thoracica	Balanidae	*Amphibalanus*	*variagatus*	C1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Megabalanus*	*tintinnabulum linzei*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Notomegabalanus*	*decorus*	N	0	0	0	0	0	0	0	0	0	0	0	0	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	0	1	0	0	0	0	0
Crustacea	Thoracica	Pachylasmidae	*Epopella*	*plicata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dendroceratida	Darwinellidae	*Dendrilla*	*n. sp. 1 (soft thumb)*	C2	0	0	0	0	0	1	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

				Terminal																Marsden_Point									
				Berth code																ME									
				Pile replicate						2										1									
				Pile position		OUT				IN				OUT						IN				OUT					
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	4	1	2	3	4			1	2	3	4	1	2	3	4		
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		
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 1 (soft spikey tan cushion)*	C2	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. 3 (fleshy brown fingery)*	C2	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Hadromerida	Clionaidae	*Cliona*	*celata*	A	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Halichondrida	Dictyonellidae	*Scopalina*	*n. sp. 1 (soft encrusting)*	C2	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	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Halichondrida	Halichondriidae	*Hymeniacidon*	*perleve*	C1	0	1	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Halisarcida	Halisarcidae	*Halisarca*	*n. sp. 1 (thin rubber)*	C2	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Haplosclerida	Callyspongiidae	*Euplacella*	*communis*	C1	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*ramosa*	C1	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*cf. irregularis*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*n. sp. 4 (plump smooth big oscules)*	C2	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Poecilosclerida	Ancinoiidae	*Crella (Pytheas)*	*incrustans*	C1	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Poecilosclerida	Coelosphaeridae	*Lissodendoryx*	*isodictyalis*	C1	0	0	0	1	0	0	0	0	0	0	0	1			0	0	0	0	0	0	0	0		
Demospongiae	Poecilosclerida	Microcionidae	*Clathria (Microciona)*	*dendyi*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Poecilosclerida	Microcionidae	*Ophlitospongia*	*reticulata*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Demospongiae	Poecilosclerida	Microcionidae	*Echinochalina (Protolithospongia)*	*n. sp. 1 (palmate C. bathami)*	C2	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Gastropoda	Littorinimorpha	Calyptraeidae	*Maoricrypta*	*costata*	N	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	0	0	0	0	0	0	0	0	0	0	0			0	0	0	1	0	0	0	0		
Gastropoda	Littorinimorpha	Littorinidae	*Austrolittorina*	*antipodum*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Gastropoda	Neogastropoda	Buccinidae	*Cominella*	*glandiformis*	N	0	0	0	1	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Gastropoda	Neogastropoda	Buccinidae	*Cominella*	*quoyana*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Gastropoda	Neogastropoda	Muricidae	*Dicithais*	*orbita*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Gastropoda	Neotaenioglossa	Velutinidae	*Lamellaria*	*ophione*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Gastropoda	Nudibranchia	Chromodorididae	*Ceratostoma*	*amoena*	N	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		
Gastropoda	Systellomatophora	Onchidiidae	*Onchidella*	*nigricans*	N	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	1	1	0	0	0	0	0		
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*plurispinosa*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	1	1	0	0	0	0	0		
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	1	0	0	1	1	0	0	0	0	1			0	0	0	0	0	0	0	0		
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	0	0	0	0	0	0	0	0	0	0	0			0	1	1	0	0	1	1	1		
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*stolonifera*	A	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*rostrata*	N	0	0	0	0	0	0	0	0	0	0	0	1			0	0	0	0	0	0	0	0		
Gymnolaemata	Cheilostomata	Candidae	*Tricellaria*	*inopinata*	A	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	1	0	0		
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula*	*pallasiana*	A	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Gymnolaemata	Cheilostomata	Lepraliellidae	*Celleporaria*	*sp. 1*	A	0	0	0	0	0	0	0	0	0	0	0	1			0	0	1	0	0	1	1	0		
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides*	*angela*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	1	1	0		
Gymnolaemata	Cheilostomata	Schizoporellidae	*Schizoporella*	*errata*	A	0	0	1	0	0	0	0	0	0	1	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	1	0		
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	0	1	1	0	1	1	1	0	0	1	0	0			0	0	0	0	0	0	0	0		
Holothuroidea	Apodida	Synaptidae	*Rynkatorpa*	*uncinata*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	0	1	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		
Hydrozoa	Hydroida	Bougainvilliidae	*Bougainvillia*	*muscus*	C1	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*longissima*	A	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*setacea*	C1	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Hydrozoa	Hydroida	Sertulariidae	*Sertularella*	*robusta*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Hydrozoa	Hydroida	Solanderiidae	*Solanderia*	*ericopsis*	N	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	0	0			0	0	0	0	0	0	0	0		
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine*	*pacifica*	N	0	0	0	0	0	0	0	0	1	0	0	0			0	0	0	0	0	0	0	0		
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*chiltoni*	N	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*sp. aff. G. tawahi*	C2	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0		
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa*	*frequens*	N	0	0	0	0	0	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

					Terminal													Marsden_Point							
					Berth code													ME							
					Pile replicate					2								1							
					Pile position	OUT				IN				OUT				IN				OUT			
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*slatteryi*	A	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	1	1	0	0	0	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*akaroica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*barhami*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*sp. aff. P. karaka*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Melitidae	*Melita*	*festiva*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*cristatus*	N	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	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ophiuroidea	Ophiurida	Ophiactidae	*Ophiactis*	*resiliens*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ophiuroidea	Ophiurida	Ophionereididae	*Ophionereis*	*fasciata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos*	*loveni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Polychaeta	Eunicida	Eunicidae	*Eunice*	*australis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Eunicidae	*Marphysa*	*Indet*	SI	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
Polychaeta	Phyllodocida	Chrysopetalidae	*Chrysopetalum*	*Chrysopetalum-1*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0	1
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Polychaeta	Phyllodocida	Nereididae	*Nereididae*	*Indet*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*cricognatha*	N	0	0	0	0	0	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	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	1	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Pterocirrus*	*brevicornis*	N	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	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidastheniella*	*comma*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoin-unplaced*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis*	*Typosyllis-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis*	*zebra*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Syllidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-E*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Syllin-unknown*	*indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis*	*prolifera*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*Branchiomma-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla*	*laciniosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Sabellidae*	*Indet*	SI	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Ficopomatus*	*enigmaticus*	A	0	0	0	1	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
Polychaeta	Scolecida	Maldanidae	*Macroclymenella*	*stewartensis*	N	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Orbiniidae	*Proscoloplos*	*bondi*	N	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	1
Polychaeta	Spionida	Chaetopteridae	*Chaetopterus*	*Chaetopterus-A*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1
Polychaeta	Spionida	Chaetopteridae	*Chaetopteridae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*hoplura*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Cirratulus*	*Cirratulus-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris*	*nuchalis*	N	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*armilla*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Polychaeta	Terebellida	Terebellidae	*Pseudopista*	*rostrata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Polycirrus*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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

					Terminal	Marsden_Point																			
					Berth code	ME																			
					Pile replicate					2								1							
					Pile position	OUT				IN				OUT				IN				OUT			
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
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
Polychaeta	Terebellida	Trichobranchidae	*Terebellides*	*narribri*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus*	*porosus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia*	*sp.*	SI	0	0	0	0	0	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

					Terminal																		
					Berth code												REF 1						
					Pile replicate		2										1						
					Pile position		IN					OUT					IN			OUT			
Class	Orders	Family	Genus	Species	*Status	MISC	1	2	3	4	MISC	1	2	3	4	MISC	1	3	4	1	3	4	MISC
Ascidiacea	Aplousobranchia	Didemnidae	*Diplosoma*	*listerianum*	C1	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	1
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	1	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Pyuridae	*Microcosmus*	*squamiger*	C2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*amokurae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*rugata*	N	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*subuculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus*	*australis*	N	0	0	0	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	0	0	0	0	0	0	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*carnea*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus*	*hirsutus*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	0	1	1	1	0	1	0	1	1	0	0	1	0	0	0	1	0
Ascidiacea	Stolidobranchia	Styelidae	*Styela*	*plicata*	C1	0	0	0	1	0	0	1	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	1	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	0	1	0
Ascidiacea	Stolidobranchia	Styelidae	*Pyura*	*n.sp.2 (small stalked # 2)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	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	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus*	*pulex*	N	0	1	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Modiolarca*	*impacta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*aupouria*	N	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	1	0
Bivalvia	Ostreoida	Ostreidae	*Crassostrea*	*gigas*	A	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0
Bivalvia	Veneroida	Kelliidae	*Kellia*	*cycladiformis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Irus*	*reflexus*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
Bivalvia	Veneroida	Veneridae	*Ruditapes*	*largillierti*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calcarea	Leucosolenida	Heteropiidae	*Vosmaeropsis*	*cf macera*	A	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Paguidae	*Pagurus*	*traversi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1
Crustacea	Brachyura	Grapsidae	*Plagusia*	*chabrus*	C1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*whitei*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Pyromaia*	*tuberculata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*Pilumnopeus*	*serratifrons*	C1	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	1	0	1	1	0
Crustacea	Caridea	Alpheidae	*Alpheus*	*socialis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Palemonidae	*Periclimenes*	*yaldwyni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Palinura	Palinuridae	*Jasus*	*edwardsi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Balanus*	*trigonus*	C1	0	0	1	0	1	0	1	0	1	0	0	0	1	1	0	1	1	1
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	0	1	1	1	0	0	0	1	1	0	0	1	0	0	1	0	0	0
Crustacea	Thoracica	Balanidae	*Amphibalanus*	*variagatus*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Megabalanus*	*tintinnabulum linzei*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Notomegabalanus*	*decorus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Chthamalidae	*Chaemosipho*	*columna*	N	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Crustacea	Thoracica	Pachylasmidae	*Epopella*	*plicata*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Demospongiae	Dendroceratida	Darwinellidae	*Dendrilla*	*n. sp. 1 (soft thumb)*	C2	0	0	0	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

Class	Orders	Family	Genus	Species																				
					Terminal																			
					Berth code												REF 1							
					Pile replicate		2												1					
					Pile position		IN						OUT					IN				OUT		
					*Status	MISC	1	2	3	4	MISC	1	2	3	4	MISC	1	3	4	1	3	4	MISC	
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*cf. arenaria*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 1 (soft spikey tan cushion)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 3 (fleshy brown fingery)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Demospongiae	Hadromerida	Clionaidae	*Cliona*	*celata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	
Demospongiae	Halichondrida	Dictyonellidae	*Scopalina*	*n. sp. 1 (soft encrusting)*	C2	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	0	0	0	0	0	1	0	1	0	0	
Demospongiae	Halichondrida	Halichondriidae	*Hymeniacidon*	*perleve*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Demospongiae	Halisarcida	Halisarcidae	*Halisarca*	*n. sp. 1 (thin rubber)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
Demospongiae	Haplosclerida	Callyspongiidae	*Euplacella*	*communis*	C1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*ramosa*	C1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*cf. irregularis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*n. sp. 4 (plump smooth big oscules)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Demospongiae	Poecilosclerida	Ancinoiidae	*Crella (Pytheas)*	*incrustans*	C1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	
Demospongiae	Poecilosclerida	Coelosphaeridae	*Lissodendoryx*	*isodictyalis*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Demospongiae	Poecilosclerida	Microcionidae	*Clathria (Microciona)*	*dendyi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
Demospongiae	Poecilosclerida	Microcionidae	*Ophlitospongia*	*reticulata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Demospongiae	Poecilosclerida	Microcionidae	*Echinochalina (Protolithospongia)*	*n. sp. 1 (palmate C. bathami)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gastropoda	Littorinimorpha	Calyptraeidae	*Maoricrypta*	*costata*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	
Gastropoda	Littorinimorpha	Littorinidae	*Austrolittorina*	*antipodum*	N	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	
Gastropoda	Neogastropoda	Buccinidae	*Cominella*	*glandiformis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gastropoda	Neogastropoda	Buccinidae	*Cominella*	*quoyana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
Gastropoda	Neogastropoda	Muricidae	*Dicithais*	*orbita*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	
Gastropoda	Neotaenioglossa	Velutinidae	*Lamellaria*	*ophione*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	
Gastropoda	Nudibranchia	Chromodorididae	*Ceratostoma*	*amoena*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris*	*lanuginata*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	
Gastropoda	Systellomatophora	Onchidiidae	*Onchidella*	*nigricans*	N	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	1	0	1	0	1	0	1	0	1	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	
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	1	1	
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	1	0	0	1	1	0	1	0	0	0	0	0	1	0	1	1	1	1	
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*stolonifera*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*rostrata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gymnolaemata	Cheilostomata	Candidae	*Tricellaria*	*inopinata*	A	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula*	*pallasiana*	A	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Gymnolaemata	Cheilostomata	Lepraliellidae	*Celleporaria*	*sp. 1*	A	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides*	*angela*	N	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	
Gymnolaemata	Cheilostomata	Schizoporellidae	*Schizoporella*	*errata*	A	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	
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Holothuroidea	Apodida	Synaptidae	*Rynkatorpa*	*uncinata*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus*	*mollis*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	
Hydrozoa	Hydroida	Bougainvilliidae	*Bougainvillia*	*muscus*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*longissima*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*setacea*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	
Hydrozoa	Hydroida	Sertulariidae	*Sertularella*	*robusta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	
Hydrozoa	Hydroida	Solanderiidae	*Solanderia*	*ericopsis*	N	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	0	0	0	0	0	0	1	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	
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*chiltoni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*sp. aff. G. tawahi*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa*	*frequens*	N	0	0	0	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

					Terminal																		
					Berth code													REF 1					
					Pile replicate		2											1					
					Pile position		IN					OUT						IN			OUT		
Class	Orders	Family	Genus	Species	*Status	MISC	1	2	3	4	MISC	1	2	3	4	MISC		1	3	4	1	3	4	MISC
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*slatteryi*	A	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	1	0	0	1	0	0	0	0	0	0	0	1	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*akaroica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*barhami*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*sp. aff. P. karaka*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Melitidae	*Melita*	*festiva*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*cristatus*	N	0	0	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	0	1	0	0	0	1	0	0	0	0	0	0
Ophiuroidea	Ophiurida	Ophiactidae	*Ophiactis*	*resiliens*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Ophiuroidea	Ophiurida	Ophionereididae	*Ophionereis*	*fasciata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos*	*loveni*	N	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Eunicidae	*Marphysa*	*Indet*	SI	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	1	1	0
Polychaeta	Phyllodocida	Chrysopetalidae	*Chrysopetalum*	*Chrysopetalum-1*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	1	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	1	0	0	1	1	0	0	0	0	0	0	0	0	1	0	1	1	1
Polychaeta	Phyllodocida	Nereididae	*Nereididae*	*Indet*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*cricognatha*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*Eulalia-NIWA-2*	SI	1	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1
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
Polychaeta	Phyllodocida	Phyllodocidae	*Pterocirrus*	*brevicornis*	N	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	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidastheniella*	*comma*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Polychaeta	Phyllodocida	Polynoidae	*Harmothoin-unplaced*	*Indet*	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis*	*Typosyllis-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis*	*zebra*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Polychaeta	Phyllodocida	Syllidae	*Syllidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-E*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Syllidae	*Syllin-unknown*	*indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis*	*prolifera*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*Branchiomma-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla*	*laciniosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Sabellidae*	*Indet*	SI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Megalomma*	*suspiciens*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Ficopomatus*	*enigmaticus*	A	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	1
Polychaeta	Scolecida	Maldanidae	*Macroclymenella*	*stewartensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Polychaeta	Scolecida	Opheliidae	*Armandia*	*maculata*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Orbiniidae	*Proscoloplos*	*bondi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Polychaeta	Scolecida	Scalibregmatidae	*Hyboscolex*	*longiseta*	N	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1
Polychaeta	Spionida	Chaetopteridae	*Chaetopterus*	*Chaetopterus-A*	C1	1	0	0	1	1	0	0	0	0	1	0	0	1	1	0	1	1	1
Polychaeta	Spionida	Chaetopteridae	*Chaetopteridae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*hoplura*	A	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Cirratulus*	*Cirratulus-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris*	*nuchalis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Polychaeta	Terebellida	Flabelligeridae	*Pherusa*	*parmata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*armilla*	N	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	1	1	1
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Terebellida	Terebellidae	*Pseudopista*	*rostrata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0
Polychaeta	Terebellida	Terebellidae	*Polycirrus*	*Indet*	SI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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

					Terminal																		
					Berth code													REF 1					
					Pile replicate		2											1					
					Pile position		IN					OUT						IN			OUT		
Class	Orders	Family	Genus	Species	*Status	MISC	1	2	3	4	MISC	1	2	3	4	MISC		1	3	4	1	3	4	MISC
Polychaeta	Terebellida	Terebellidae	*Terebellidae*	*Indet*	SI	0	0	0	0	1	0	0	0	0	0	0		0	0	0	0	0	0	0
Polychaeta	Terebellida	Trichobranchidae	*Terebellides*	*narribri*	N	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	1
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus*	*porosus*	N	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1	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

					Terminal								
					Berth code								
					Pile replicate	2							
					Pile position	IN				OUT			
Class	Orders	Family	Genus	Species	*Status	1	3	4	MISC	1	3	4	MISC
Ascidiacea	Aplousobranchia	Didemnidae	*Diplosoma*	*listerianum*	C1	0	0	1	0	0	0	0	1
Ascidiacea	Aplousobranchia	Holozoidae	*Distaplia*	*s.p.*	SI	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	0	1	0	0	0	1	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Pyuridae	*Microcosmus*	*squamiger*	C2	0	0	0	0	0	1	0	1
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	1	0	0	0	1	1	1
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*amokurae*	N	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*rugata*	N	0	0	0	0	0	1	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*subuculata*	N	0	1	1	0	0	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus*	*australis*	N	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	0	0	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*carnea*	N	0	0	0	0	0	0	0	1
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus*	*hirsutus*	N	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	1	1	0	0	1	1	0
Ascidiacea	Stolidobranchia	Styelidae	*Styela*	*plicata*	C1	0	0	0	0	0	0	1	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*nisiotus*	N	0	1	1	1	0	1	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	1	0	0	0	1	1	0
Ascidiacea	Stolidobranchia	Styelidae	*Pyura*	*n.sp.2 (small stalked # 2)*	C2	0	0	0	0	0	0	0	0
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	0	0	0	0	0	0	1	0
Bivalvia	Myoida	Hiatellidae	*Hiatella*	*arctica*	N	0	0	0	0	0	1	1	0
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus*	*pulex*	N	1	0	0	0	1	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Modiolarca*	*impacta*	N	0	0	1	0	0	1	1	0
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*aupouria*	N	0	1	1	0	0	1	1	1
Bivalvia	Ostreoida	Ostreidae	*Crassostrea*	*gigas*	A	0	0	0	0	0	0	0	0
Bivalvia	Pterioida	Pectinidae	*Talochlamys*	*zelandiae*	N	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Kelliidae	*Kellia*	*cycladiformis*	N	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Irus*	*reflexus*	N	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Ruditapes*	*largillierti*	N	0	0	0	0	0	0	0	1
Calcarea	Leucosolenida	Heteropiidae	*Vosmaeropsis*	*cf macera*	A	0	0	0	0	0	0	0	0
Crustacea	Anomura	Paguidae	*Pagurus*	*traversi*	N	0	0	0	0	0	1	0	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*novaezelandiae*	N	0	0	1	1	0	0	0	1
Crustacea	Brachyura	Grapsidae	*Plagusia*	*chabrus*	C1	0	0	0	0	0	1	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	1	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	0	0	1	0	0	0	1	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*whitei*	N	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	1	0	0	0	1
Crustacea	Brachyura	Majidae	*Pyromaia*	*tuberculata*	A	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*Pilumnopeus*	*serratifrons*	C1	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*Pilumnus*	*novaezelandiae*	N	0	1	1	0	0	1	1	1
Crustacea	Caridea	Alpheidae	*Alpheus*	*socialis*	N	0	0	1	0	0	0	0	1
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	0	0	0	0
Crustacea	Caridea	Palemonidae	*Periclimenes*	*yaldwyni*	N	0	0	0	0	0	0	0	0
Crustacea	Palinura	Palinuridae	*Jasus*	*edwardsi*	N	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Balanus*	*trigonus*	C1	0	1	1	0	0	1	1	1
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	1	0	0	0	1	0	0	0
Crustacea	Thoracica	Balanidae	*Amphibalanus*	*variagatus*	C1	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Megabalanus*	*tintinnabulum linzei*	N	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Notomegabalanus*	*decorus*	N	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Chthamalidae	*Chaemosipho*	*columna*	N	0	0	0	0	1	0	0	0
Crustacea	Thoracica	Pachylasmidae	*Epopella*	*plicata*	N	0	0	0	0	0	0	0	0
Demospongiae	Dendroceratida	Darwinellidae	*Dendrilla*	*n. sp. 1 (soft thumb)*	C2	0	0	0	0	0	0	0	0

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

				Terminal								
				Berth code								
				Pile replicate	2							
				Pile position	IN				OUT			
Class	Orders	Family	Genus	Species	*Status	1	3	4	MISC	1	3	4	MISC
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*cf. arenaria*	N	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 1 (soft spikey tan cushion)*	C2	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 3 (fleshy brown fingery)*	C2	0	0	0	0	0	0	0	0
Demospongiae	Hadromerida	Clionaidae	*Cliona*	*celata*	A	0	0	0	1	0	0	0	0
Demospongiae	Halichondrida	Dictyonellidae	*Scopalina*	*n. sp. 1 (soft encrusting)*	C2	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*panicea*	C1	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Hymeniacidon*	*perleve*	C1	0	0	0	0	0	0	0	0
Demospongiae	Halisarcida	Halisarcidae	*Halisarca*	*n. sp. 1 (thin rubber)*	C2	0	0	1	0	0	0	0	0
Demospongiae	Haplosclerida	Callyspongiidae	*Euplacella*	*communis*	C1	0	0	0	1	0	0	0	0
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*ramosa*	C1	0	1	0	0	0	1	0	0
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*cf. irregularis*	N	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*n. sp. 4 (plump smooth big oscules)*	C2	0	0	1	0	0	0	0	0
Demospongiae	Poecilosclerida	Ancinoiidae	*Crella (Pytheas)*	*incrustans*	C1	0	0	0	1	0	0	0	0
Demospongiae	Poecilosclerida	Coelosphaeridae	*Lissodendoryx*	*isodictyalis*	C1	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Microcionidae	*Clathria (Microciona)*	*dendyi*	N	0	0	0	0	0	1	0	0
Demospongiae	Poecilosclerida	Microcionidae	*Ophlitospongia*	*reticulata*	N	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Microcionidae	*Echinochalina (Protolithospongia)*	*n. sp. 1 (palmate C. bathami)*	C2	0	0	0	0	0	0	0	1
Gastropoda	Littorinimorpha	Calyptraeidae	*Maoricrypta*	*costata*	N	0	1	0	0	0	1	0	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella*	*novaezelandiae*	N	0	1	0	0	0	0	1	0
Gastropoda	Littorinimorpha	Littorinidae	*Austrolittorina*	*antipodum*	N	1	0	0	0	1	0	0	0
Gastropoda	Neogastropoda	Buccinidae	*Cominella*	*glandiformis*	N	0	0	0	0	0	0	0	0
Gastropoda	Neogastropoda	Buccinidae	*Cominella*	*quoyana*	N	0	0	0	0	0	0	0	0
Gastropoda	Neogastropoda	Muricidae	*Dicithais*	*orbita*	N	0	0	0	0	0	0	0	0
Gastropoda	Neotaenioglossa	Velutinidae	*Lamellaria*	*ophione*	N	0	0	1	0	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Ceratostoma*	*amoena*	N	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris*	*lanuginata*	N	0	0	0	0	0	0	0	0
Gastropoda	Systellomatophora	Onchidiidae	*Onchidella*	*nigricans*	N	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*n.sp.*	N	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*plurispinosa*	N	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	1	0	0	0	1	1	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	1	1	0	0	0	1	1
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*stolonifera*	A	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*rostrata*	N	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Tricellaria*	*inopinata*	A	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula*	*pallasiana*	A	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Lepraliellidae	*Celleporaria*	*sp. 1*	A	0	0	0	0	0	0	1	0
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides*	*angela*	N	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Schizoporellidae	*Schizoporella*	*errata*	A	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia*	*ambigua*	C1	0	1	1	0	0	0	0	1
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	0	0	0	0	0	0	0	0
Holothuroidea	Apodida	Synaptidae	*Rynkatorpa*	*uncinata*	N	0	0	0	0	0	0	0	0
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus*	*mollis*	N	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Bougainvilliidae	*Bougainvillia*	*muscus*	C1	0	0	0	0	0	0	1	0
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*longissima*	A	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*sp.*	SI	0	0	0	0	0	0	0	1
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*setacea*	C1	0	0	0	0	0	0	0	1
Hydrozoa	Hydroida	Sertulariidae	*Sertularella*	*robusta*	N	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Solanderiidae	*Solanderia*	*ericopsis*	N	0	0	0	0	0	0	0	1
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	0	1	0	0	0	1	1	1
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine*	*pacifica*	N	0	0	0	0	0	0	0	1
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*chiltoni*	N	0	1	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*sp. aff. G. tawahi*	C2	0	0	0	0	0	0	0	1
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa*	*frequens*	N	0	1	0	0	0	1	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

					Terminal								
					Berth code								
					Pile replicate	2							
					Pile position	IN				OUT			
Class	Orders	Family	Genus	Species	*Status	1	3	4	MISC	1	3	4	MISC
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*slatteryi*	A	0	0	0	0	0	0	0	1
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*trailli*	N	0	1	0	0	0	1	0	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*akaroica*	N	1	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*barhami*	N	0	0	0	0	0	1	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*sp. aff. P. karaka*	C2	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Melitidae	*Melita*	*festiva*	N	0	1	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*cristatus*	N	0	0	0	0	0	0	0	1
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*campbellensis*	N	1	0	0	0	1	0	0	0
Ophiuroidea	Ophiurida	Ophiactidae	*Ophiactis*	*resiliens*	N	0	0	0	0	0	0	0	0
Ophiuroidea	Ophiurida	Ophionereididae	*Ophionereis*	*fasciata*	N	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos*	*loveni*	N	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Eunicidae	*Eunice*	*australis*	N	0	0	1	0	0	0	0	0
Polychaeta	Eunicida	Eunicidae	*Marphysa*	*Indet*	SI	0	0	1	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*sphaerocephala*	N	0	1	0	1	0	1	1	1
Polychaeta	Phyllodocida	Chrysopetalidae	*Chrysopetalum*	*Chrysopetalum-1*	N	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	1	1	1	0	1	0	1
Polychaeta	Phyllodocida	Nereididae	*Nereididae*	*Indet*	SI	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*cricognatha*	N	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*Eulalia-NIWA-2*	SI	0	0	0	1	0	1	1	0
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides*	*Mystides-B*	SI	0	0	0	0	0	1	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Pterocirrus*	*brevicornis*	N	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*polychromus*	N	0	0	0	0	0	1	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidastheniella*	*comma*	N	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoin-unplaced*	*Indet*	SI	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis*	*Typosyllis-B*	SI	0	0	0	1	0	1	1	0
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis*	*zebra*	N	0	1	0	1	0	1	0	0
Polychaeta	Phyllodocida	Syllidae	*Syllidae*	*Indet*	SI	0	0	0	1	0	1	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-E*	SI	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Syllin-unknown*	*indet*	SI	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis*	*prolifera*	N	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*Branchiomma-B*	SI	0	0	1	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla*	*laciniosa*	N	0	1	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Sabellidae*	*Indet*	SI	0	1	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Megalomma*	*suspiciens*	N	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Ficopomatus*	*enigmaticus*	A	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Galeolaria*	*hystrix*	N	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Maldanidae	*Macroclymenella*	*stewartensis*	N	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Opheliidae	*Armandia*	*maculata*	N	0	0	0	0	0	0	1	0
Polychaeta	Scolecida	Orbiniidae	*Proscoloplos*	*bondi*	N	0	0	0	1	0	1	0	0
Polychaeta	Scolecida	Scalibregmatidae	*Hyboscolex*	*longiseta*	N	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Chaetopteridae	*Chaetopterus*	*Chaetopterus-A*	C1	0	1	1	1	0	1	1	1
Polychaeta	Spionida	Chaetopteridae	*Chaetopteridae*	*Indet*	SI	0	0	0	0	0	1	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*hoplura*	A	0	1	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*Indet*	SI	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Cirratulus*	*Cirratulus-A*	SI	0	0	0	0	0	1	0	0
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris*	*nuchalis*	N	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Flabelligeridae	*Pherusa*	*parmata*	N	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*armilla*	N	0	0	1	1	0	1	1	0
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	0	1	0	1	0	0
Polychaeta	Terebellida	Terebellidae	*Pseudopista*	*rostrata*	N	0	0	1	0	0	0	1	0
Polychaeta	Terebellida	Terebellidae	*Polycirrus*	*Indet*	SI	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

					Terminal								
					Berth code								
					Pile replicate	2							
					Pile position	IN				OUT			
Class	Orders	Family	Genus	Species	*Status	1	3	4	MISC	1	3	4	MISC
Polychaeta	Terebellida	Terebellidae	*Terebellidae*	*Indet*	SI	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Trichobranchidae	*Terebellides*	*narribri*	N	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus*	*porosus*	N	0	0	0	0	0	1	0	0
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia*	*sp.*	SI	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 5b. Results from the benthic grab samples.

				Terminal	Marsden_Point					Whangarei_Port					
				Berth code	ME			REF 1		M1			M3		
Class	Order	Family	Genus	Species	*Status	1	2	3	1	2	1	2	3	1	2	3
Bivalvia	Veneroida	Semelidae	*Theora*	*lubrica*	A	0	0	0	0	0	1	1	1	0	0	1
Bivalvia	Veneroida	Veneridae	*Tawera*	*spissa*	N	0	0	0	1	0	0	0	0	0	0	0
Crustacea	Anomura	Diogenidae	*Paguristes*	*setosus*	N	0	0	0	1	0	0	0	0	0	0	0
Crustacea	Anomura	Paguridae	*Pagurus*	*novizealandiae*	N	0	0	0	1	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*rostrata*	N	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbricalus*	*aotearoae*	N	0	0	0	0	0	1	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nicon*	*aestuariensis*	N	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Sigalionidae	*Labiosthenolepis*	*laevis*	N	0	0	0	0	0	1	0	1	0	0	0
Polychaeta	Scolecida	Capitellidae	*Heteromastus*	*filiformis*	N	0	1	0	0	0	0	0	0	1	0	0
Polychaeta	Spionida	Spionidae	*Prionospio*	*australiensis*	N	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Pseudopolydora*	*kempi*	A	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Pseudopolydora*	*paucibranchiata*	A	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Pectinariidae	*Pectinaria*	*australis*	N	0	0	1	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Amaeana*	*antipoda*	N	0	0	0	0	0	0	0	0	0	0	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.

					Terminal	Marsden_Point			Whangarei_Port					
					Berth code	ME	REF 1		M1			M3		
Class	Order	Family	Genus	Species	*Status	1	1	2	1	2	3	1	2	3
Actinopterygii	Perciformes	Gobiidae	*Favonigobius*	*exquisitus*	N	0	0	0	0	1	0	0	0	0
Actinopterygii	Perciformes	Percophidae	*Hemerocoetes*	*sp.*	SI	0	0	1	0	0	0	0	0	0
Actinopterygii	Pleuronectiformes	Pleuronectidae	*Peltorhamphus*	*latus*	N	0	0	0	0	0	0	1	0	0
Bivalvia	Veneroida	Semelidae	*Theora*	*lubrica*	A	0	0	0	1	1	1	1	1	1
Crustacea	Anomura	Diogenidae	*Paguristes*	*pilosus*	N	0	1	0	0	0	0	0	0	0
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	0	0	0	0	0	0	0	0	1
Crustacea	Caridea	Alpheidae	*Alpheus*	*richardsoni*	N	0	0	0	1	1	1	1	0	0
Crustacea	Caridea	Crangonidae	*Pontophilus*	*australis*	N	0	1	0	0	1	0	1	0	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	1	0	1	0	0
Gastropoda	Cephalaspidea	Philinidae	*Philine*	*auriformis*	N	0	0	0	0	0	0	0	1	0
Polychaeta	Scolecida	Opheliidae	*Armandia*	*maculata*	N	0	0	1	0	0	0	0	0	0
Polychaeta	Scolecida	Orbiniidae	*Phylo*	*novazealandiae*	N	0	0	0	0	1	0	0	0	0
Polychaeta	Terebellida	Pectinariidae	*Pectinaria*	*australis*	N	0	0	0	0	0	0	1	0	1

*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.

				Terminal	Marsden_Point			Whangarei_Port			
				Berth code	ME			M1		M3	
Class	Order	Family	Genus	Species	*Status	1	2	3	1	2	1	2
Dinophyceae	Gonyaulacales	Peridiniaceae	*Scrippsiella*	*trochoidea*	N	0	0	1	0	0	1	0
Dinophyceae	Gymnodiniales	Gymnodiniacea	*Gymnodinium*	*catenatum*	C1	0	0	1	0	0	0	0
Dinophyceae	Gymnodiniales	Peridiniaceae	*Lingulodinium*	*polyedrum*	N	0	0	1	0	0	0	0
Dinophyceae	Gymnodiniales	Peridiniaceae	*Protoperidinium*	*sp.*	N	0	0	0	1	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.

					Terminal	Marsden_Point								Whangarei_Port							
					Berth code	ME				REF 1				M1				M3			
					Line No.	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
Actinopterygii	Anguilliformes	Anguillidae	*Anguillidae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
Actinopterygii	Perciformes	Sparidae	*Pagrus*	*auratus*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0
Crustacea	Caridea	Palemonidae	*Periclimenes*	*yaldwyni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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.

					Terminal	Marsden_Point								Whangarei_Port							
					Berth code	ME				REF 1				M1				M3			
					Line no.	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
Actinopterygii	Anguilliformes	Anguillidae	*Anguilla*	*dieffenbachii*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Anguilliformes	Anguillidae	*Anguillidae*	*sp.*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Holozoidae	*Distaplia*	*s.p.*	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Ostreoida	Ostreidae	*Crassostrea*	*gigas*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Crustacea	Anomura	Paguridae	*Pagurus*	*sp.*	SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Grapsidae	*Hemigrapsus*	*crenulatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*Pilumnopeus*	*serratifrons*	C1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0
Crustacea	Palinura	Palinuridae	*Jasus*	*edwardsi*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dendroceratida	Darwinellidae	*Dendrilla*	*n. sp. 1 (soft thumb)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Gastropoda	Neogastropoda	Buccinidae	*Cominella*	*adspersa*	N	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gastropoda	Notaspidea	Pleurobranchidae	*Pleurobranchaea*	*maculata*	N	1	0	0	0	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.

Appendix 5g. Results from the starfish trap samples.

						Marsden_Point								Whangarei_Port							
					Site code	ME				REF 1				M1				M3			
					Line No.	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
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
Crustacea	Anomura	Diogenidae	*Paguristes*	*setosus*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Paguridae	*Pagurus*	*novizealandiae*	N	0	0	0	0	0	0	1	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	1	0	1	0	0
Gastropoda	Notaspidea	Pleurobranchidae	*Pleurobranchaea*	*maculata*	N	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.

				Terminal	Marsden_Point								Whangarei_Port							
				Berth code	ME				REF 1				M1				M3			
				Line No.	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
Actinopterygii	Perciformes	Trypterigiidae	*Forsterygion*	*varium*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Gastropoda	Neogastropoda	Buccinidae	*Cominella*	*glandiformis*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Cirolanidae	*Natatolana*	*narica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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).