Dunedin Harbour (Port Otago and Port Chalmers)

Baseline survey for non-indigenous marine species (Research Project ZBS2000/4)

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Executive Summary

This report describes the results of a February 2003 survey to provide a baseline inventory of native, non indigenous and cryptogenic marine species within the Port of Dunedin (this includes Port Otago, located near the city of Dunedin, and the Port Chalmers facility).

- 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 Port of Dunedin. 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 Dunedin 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 275 species or higher taxa was identified from the Dunedin Port survey. They consisted of 169 native species, 18 non-indigenous species, 38 cryptogenic species (those whose geographic origins are uncertain) and 50 species indeterminata (taxa for which there is insufficient taxonomic or systematic information available to allow identification to species level).

- Twenty-five species of marine organisms collected from the Port of Dunedin have not previously been described from New Zealand waters. Two of these were newly discovered non-indigenous species (a polychaete worm, *Spirobranchus polytrema*, and a sponge, *Leucosolenia* cf. *discoveryi*), and 23 are considered cryptogenic.

- The 18 non-indigenous organisms described from the Port of Dunedin included representatives of six phyla. The non-indigenous species detected (ordered alphabetically by phylum, class, order, family, genus and species) were: (Annelida) *Spirobranchus polytrema*, *Polydora hoplura*, (Bryozoa) *Bugula flabellata*, *Bugula neritina*, *Cryptosula pallasiana*, *Watersipora subtorquata*, (Crustacea) *Apocorophium acutum*, *Monocorophium acherusicum*, *Jassa marmorata*, (Mollusca) *Crassostrea gigas*, (Phycophyta) *Cutleria multifida*, *Undaria pinnatifida*, *Polysiphonia brodiaei*, *Polysiphonia subtilissima*, *Champia affinis*, (Porifera) *Grantessa intusarticulata*, *Leucosolenia* cf. *discoveryi*, and *Halisarca dujardini*.

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

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

- Approximately 83 % (15 of 18 species) of NIS in the Port of Dunedin are likely to have been introduced in hull fouling assemblages, 6 % via ballast (one species) water and 11 % (two species) 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 Dunedin (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.

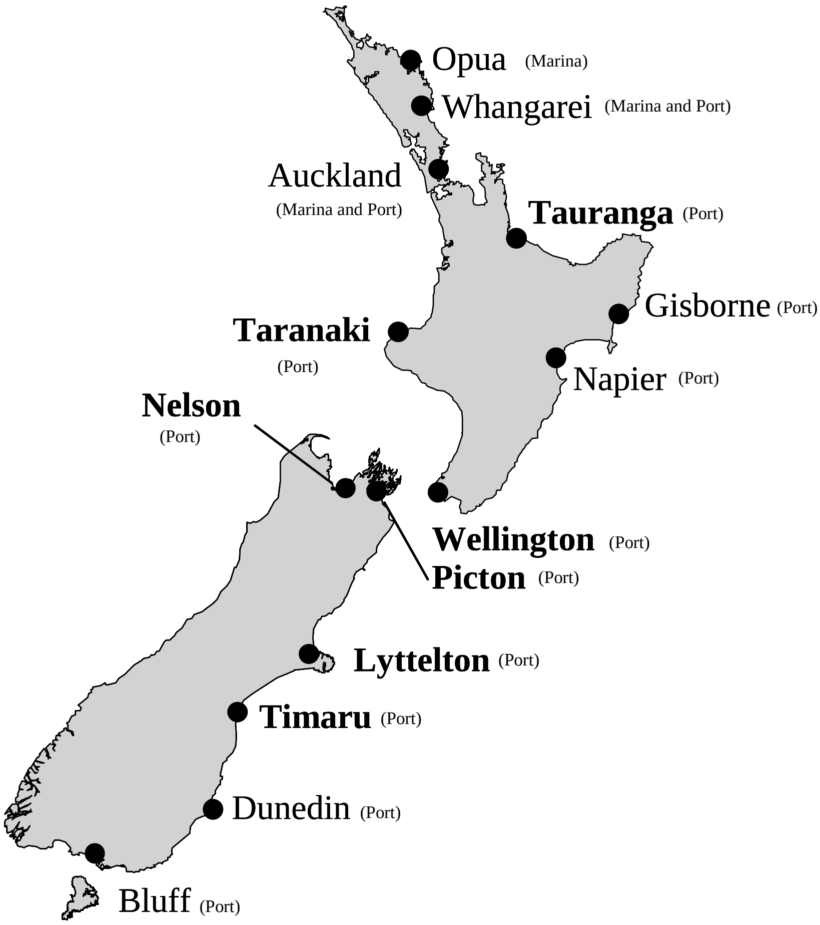

Figure 1: Commercial shipping ports in New Zealand where baseline non-indigenous species surveys have been conducted. Group 1 ports surveyed in the summer of 2001/2002 are indicated in bold and group 2 ports surveyed in the summer of 2002/2003 are indicated in plain font. Marinas were also surveyed for 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 Port of Dunedin survey (this includes Port Otago, located near the city of Dunedin, and the Port Chalmers facility) and provides an inventory of species detected in the Port. It identifies and categorises native, introduced ("non-indigenous") and cryptogenic species. Organisms that could not be identified to species level are also listed as species indeterminata.

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

DESCRIPTION OF THE PORT OF DUNEDIN

Dunedin Harbour is located on the south-eastern seaboard of New Zealand's South Island (45^o 50'S. 170^o 38'E) (Fig 1). Two peninsulas and two islands effectively divide the harbour into upper and lower basins, connected by the shipping channel with a narrow entrance situated between Heyward Point and Taiaroa head (Rainer, 1981). This physical aspect of the land has resulted in the Port of Dunedin operating two wharf systems – Port Chalmers in the lower harbour and Port of Otago in the upper. The lower harbour extends 9.6 kilometres from the heads to Port Chalmers, where the container facilities are located, with Dunedin city located at the far western end of the harbour a further 12 km from Port Chalmers (Fig 2).

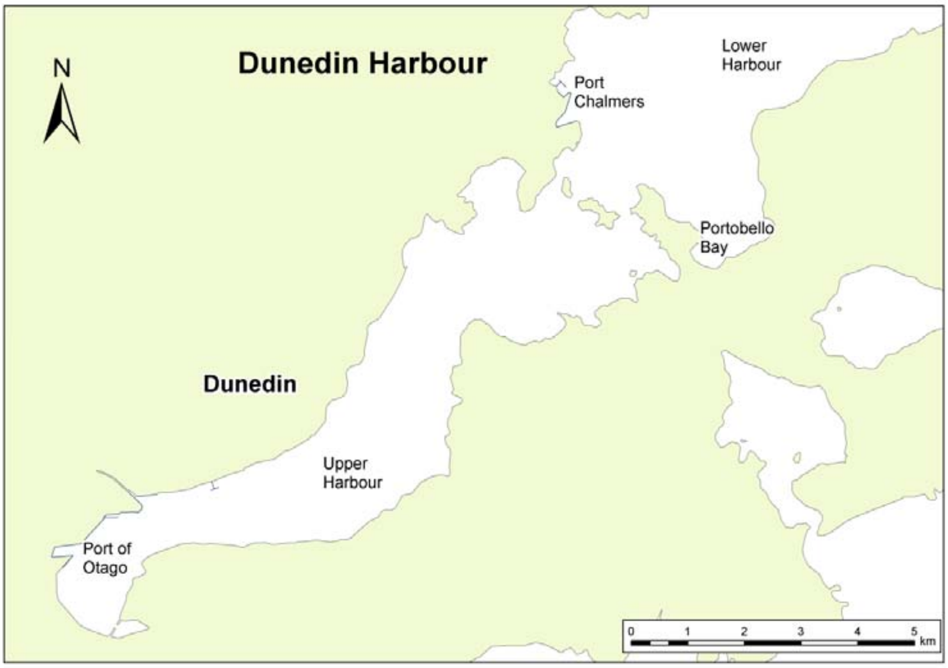

Figure 2: Dunedin Harbour overview map

PORT OPERATIONS AND SHIPPING MOVEMENTS

Following the establishment of whaling stations in the 1830's, the first major development of the port started in the late 1840's following European settlement and establishment of Port Chalmers and Dunedin, with modification of the harbour entrance, deepening of the channel to Port Chalmers, and dredging a new channel (Victoria) to Dunedin itself. In 1872, with increasing development of Port Chalmers a private railway was constructed linking Dunedin and Port Chalmers. The first cargo of frozen meat for the London market left Port Chalmers in 1882. In the 1960's primary exports from the port were meat and wool, and primary imports were petroleum products, manures, rock phosphate, iron and steel (www.teara.govt.nz/1966). In the 1990's major reclamation were undertaken at the Port of Otago to increase storage and handling capacity.

Currently, the Port of Dunedin (operated by Port Otago Ltd) operates two wharf systems – Port Chalmers (Fig. 3) and Port of Otago (Fig. 4), with the main container facilities and handling at Port Chalmers.

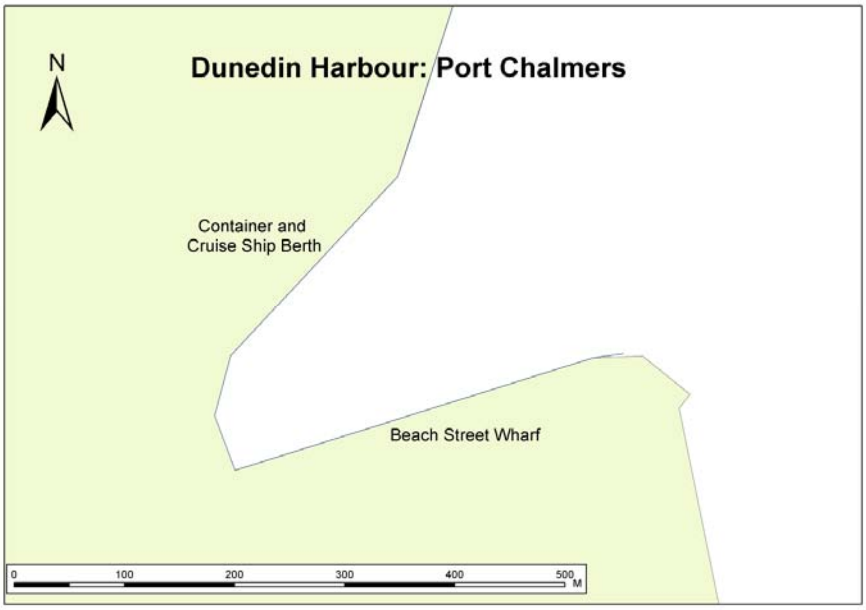

Figure 3: Dunedin Harbour: Port Chalmers map

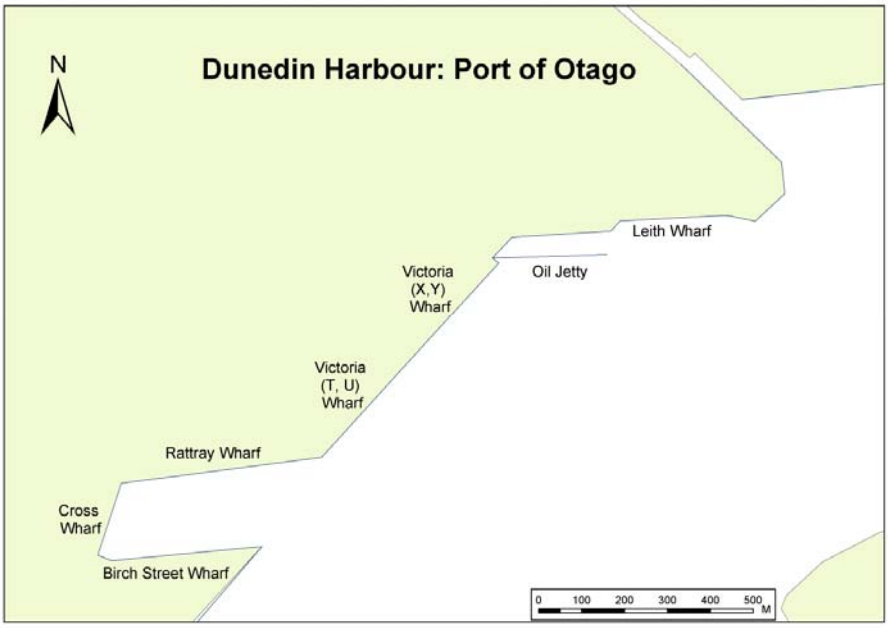

Figure 4: Dunedin Harbour: Port of Otago map.

Port Chalmers has three berths, suitable for handling containerised, multipurpose, conventional, and RoRo vessels. Berths are constructed predominantly of concrete decking on steel piles, although the Beach Street Forestry berth is composed of sand-filled sunken concrete casings supporting a concrete deck. Details of the Port Chalmers berthing facilities are provided in Table 1a. The inner and outer berths at George Street are the heart of the Port of Dunedin's container facilities, but are also suitable for geared and conventional vessels.

The Beach Street forestry berth is suitable for all classes of geared and conventional vessels, and is ideal for the large volumes of logs, lumber and other forestry products that are exported from Port Chalmers. A swinging basin with 700 m diameter and 12.5 m depth enables a wide turning facility for berthing. In 2000, there were 14 registered fishing vessels, and the Otago Yacht Club possessed 35 pile moorings in Port Chalmers (Sinner et al 2000).

The Port of Otago wharf system is suitable for vessels up to 190 m LOA and 31.5 m beam and consists of seven principal berths, suitable for vessels with a shallower draught. Berths construction is a mixture of concrete or wooden decking on Australian hardwood or steel piles. Details of the Port of Otago berthing facilities are provided in Table 1b. Tankers, fishing vessels and smaller conventional vessels are the principal users. In 2000, there were 21 registered fishing vessels in Port Otago (Sinner et al 2000).

Located between Port Chalmers and Port of Otago is the Ravensbourne fertiliser pier, used by Ravensdown Fertiliser Ltd for discharge of their raw materials to the adjacent manufacturing facility (www.portotago.co.nz).

In 2000, Port Chalmers and Port Otago handled $2 billion of exports in primary products like meat, dairy, fish, wool and timber, and manufactured goods to markets throughout the South Pacific, Europe, North America, Australia, and Asia, and imported $200 million of products (www.cityofdunedin.co.nz). Port Chalmers and Port Otago handled 2.8 million tonnes of cargo in the year 2004, with a total of 537 vessel visits (www.portotago.co.nz).

Recent analyses of shipping arrivals to the Port show that the Ports Chalmers and Otago received 29 international ship visits during 2002/2003 (16 merchant and 13 passenger vessels). During this period, most commercial vessels entering the port arrived from Australia (82.4 %), the NW Pacific (11.8 %), and the Northwest Atlantic (5.9 %) (Campbell 2004). Vessels unable to be berthed immediately in the Port of Dunedin may anchor outside the harbour, west of the harbour entrance towards Blueskin Bay (approximately 45°43’16”S, 170°37’31”E).

Vessels are expected to comply with the Voluntary Controls on the Discharge of Ballast Water in New Zealand (http://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 33,364 m^3 of ballast water was discharged in the Port of Dunedin in 1999, with the largest country-of-origin volumes of 18,697 m^3 from Japan, 7,806 m^3 from Taiwan, 2,028 m^3 from Australia, and 4,834 m^3 unspecified.

Regular on-going maintenance dredging is carried out in the shipping channels (trailer suction dredge) and vessel berths (grab dredge) to maintain the required depth. This results in an annual removal or 200-250,000 m^3 of spoil. There are 3 spoil disposal sites (marked on nautical chart 6612) at, and outside the harbour entrance: Shelley Beach for clean sand disposal (acts as sand replenishment to counter beach erosion), and Spit beach and off Hayward Point for the majority of spoil disposal.

In terms of future developments, Port Otago Ltd is concentrating on continuing investment in the port’s existing infrastructure, with upgrades to storage and handling areas, and new straddle carriers and a new container crane.

THE PHYSICAL ENVIRONMENT OF THE PORT OF DUNEDIN

Dunedin Harbour is approximately 22 km long from the eastern harbour entrance to the city of Dunedin in the west and is generally between 1 and 4.5 km wide with a minimum width of only 400 m at the entrance adjacent to Harington Point. The harbour is bounded at the entrance by an artificial mole extending seawards from the Aramoana sand spit on the western side and a basaltic headland on the east extending out to Tairoa Head. A narrow shipping channel (maintained to 12.5 m) leads to Port Chalmers, enabling the largest container ships in the New Zealand trade to utilise the Port, and the channel shallows to 8 m towards the Port of Otago wharf system. The harbour was formed by the gradual build up of a low sandy isthmus that joined a volcanic island (now the Otago peninsula) to the mainland (Thompson 1981). The harbour is generally shallow, less than 2 m deep, with extensive intertidal mudflats with seagrass beds. Near the midway point of the harbour, it is restricted by two islands (Goat and Quarantine Islands) and the Portabello Peninsula.

Tides within the harbour are semi-diurnal, with mean sea level 1.1m above chart datum. Mean low water springs are 0.1m and high water springs 1.8m above chart datum, resulting in a spring tide range of 1.7m. Current speeds in the harbour are estimated to be between 50 and 75cm/sec in the outer harbour and less than 50cm/sec in the inner harbour (Rainer, 1981). Water in the upper harbour has a considerably longer residence time than that in the lower harbour – 4 to 14 days in the upper compared to 1.2 tidal cycles in the lower. Flushing time for the upper harbour is influenced more by freshwater input than by tidal movement. The latter merely moves the same water back and forth (Grove and Probert 1999). Sediments in the harbour vary from silt to coarse shell-sand, with the coarsest sediments found within the shipping channel, particularly near the heads (Rainer 1981).

EXISTING BIOLOGICAL INFORMATION

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

Early studies were undertaken in the 1940's and 1950's, but tended to focus in the area of the harbour surrounding Portobello Marine Biological Station and the species and communities present there (e.g. Brewin 1946 on ascidians, Ralph and Yaldwyn 1956 on benthic fauna).

In the 1970's, the Otago Harbour Board commissioned the University of Otago to report on the marine environmental implications of proposed reclamation work at Port Chalmers (Probert 1975). The study sampled the bottom deposits and larger animals and plants of the seabed in the reclamation area by dredge and trawl. Soft muddy sediment was recovered at each sample station and a total species list for the proposed reclamation area generated. No non-indigenous species were recorded in the species lists.

Quinn (1978) examined the circulation and tidal flushing patterns within the harbour, recording salinity, temperature, phosphate, nitrate, nitrite, chlorophyll-a, zooplankton, and secchi depth data, with calculations made on hydraulic residence time.

Rainer (1981) examined the soft-bottom benthic communities in the harbour and Blueskin Bay, to investigate the relationship between a number of environmental variables and the structure and species composition of soft-bottom macrofaunal assemblages. His study lists a total of 397 species, with many species appearing to be restricted to a limited range of environmental conditions. Lowest species diversity was found in samples from unstable fine sand and unconsolidated silt sediments, and highest species diversity in samples from stable fine sand with an admixture of shell. Species lists compiled from the study included the non-indigenous corophiid amphipods *Corophium* (*Monocorophium*) *acherusicum* and *C.* (*Monocorophium*) *sextonae* and the ascidian, *Ascidiella aspersa*, and the cryptogenic colonial ascidian *Botrylliodes leachii*.

Thrush (1988) compared macrobenthic recolonization patterns near and far away from crab burrows (*Macrophthalmus hirtipes*) on a sublittoral sand flat in the harbour. He found decreased faunal abundance nearer crab burrows, with this pattern maintained during recolonization after simulated storm disturbance.

Barnett et al (1989) Ltd conducted a detailed hydrodynamic of the harbour for the Otago Harbour Board. They established basic patterns of tidal flows and level changes in the harbour, using these to predict current patterns in relations to harbour modification, and to identify sediment transport paths in the harbour and near possible dumping grounds.

The invasive kelp *Undaria pinnatifida* was identified in Dunedin Harbour in 1990, and has spread throughout much of the hard shoreline. Dunedin harbour is deemed in the optimal temperature zone for this macroalga (Forrest et al 2000; Sinner et al 2000).

Sediment macrobenthos of the inner harbour were surveyed by Grove and Probert (1999). In this study they examined patterns of benthic community structure and their relationship to environmental variables. They observed that a combination of percent sand, macro-algal content, water depth and chromium concentration correlated best with the observed community structure. Species lists were not produced within their review.

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

Corfield and Hickey (2004a & b) examined the potential effects of fluoride discharge from the Ravensdown fertiliser plant on the surrounding benthic communities. They found evidence that fluoride, in combination with other sediment contaminants, had a significant effect on benthic community structure, particularly certain algae, sabellids, amphipods and bivalves.

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 Dunedin survey. The survey was undertaken between February 25th and March 1st 2003. Most sampling was concentrated on five main berths: Rattray Wharf, Leigh

Wharf, Victoria Wharf (Dunedin city), Container/Cruise ship Berth and Beach Street Wharf (Port Chalmers). A summary of sampling effort within the Port of Dunedin 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.

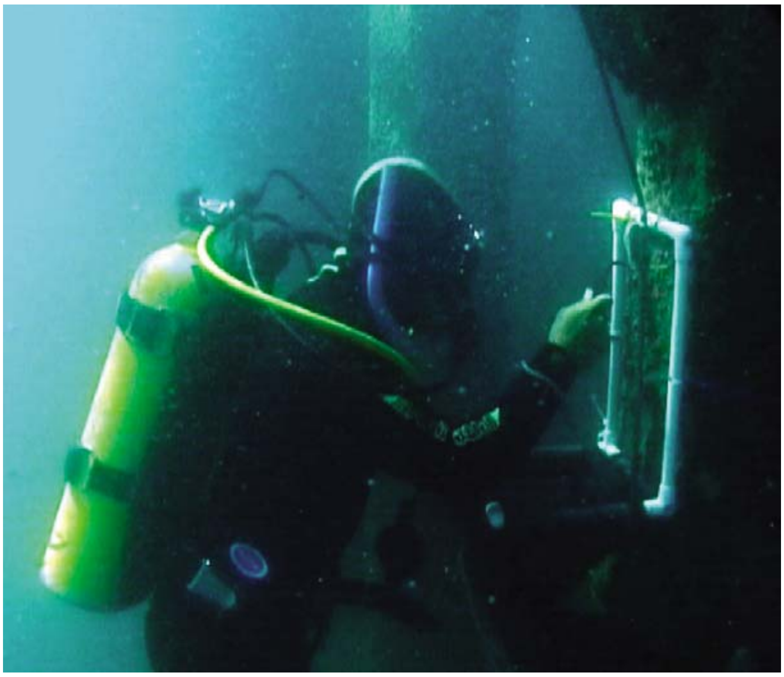

Figure 5: Diver sampling organisms on pier piles.

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 m2 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.

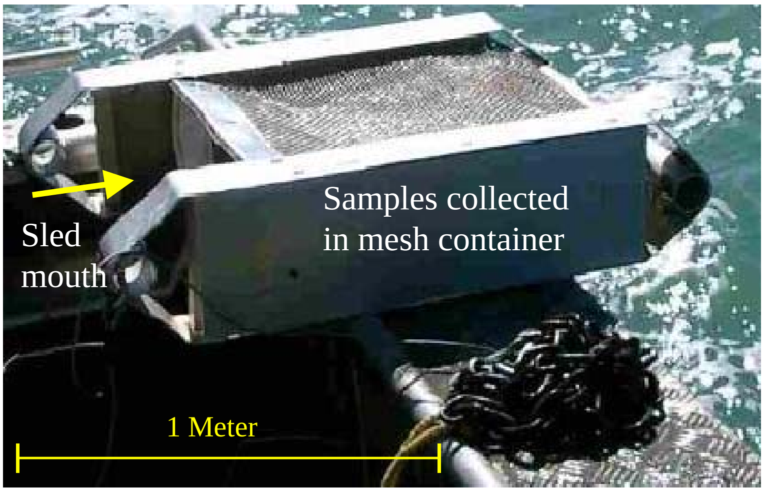

Figure 7: Benthic sled

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

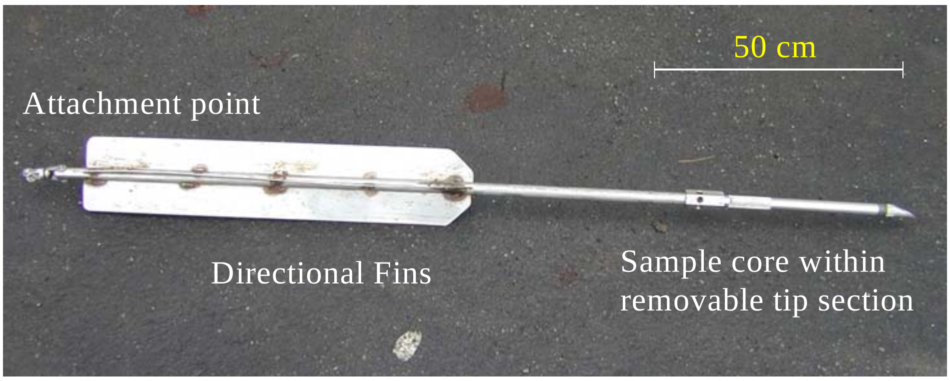

Figure 8: Javelin corer

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 1 hour at each site before retrieval. Previous studies have shown opera house traps to be more effective than other types of fish trap and that consistent catches are achieved with soak times of 20 to 50 minutes (Ferrell et al 1994; Thrush et al 2002).

Box traps

Fukui-designed box traps (63 cm x 42 cm x 20 cm) with a 1.3-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.

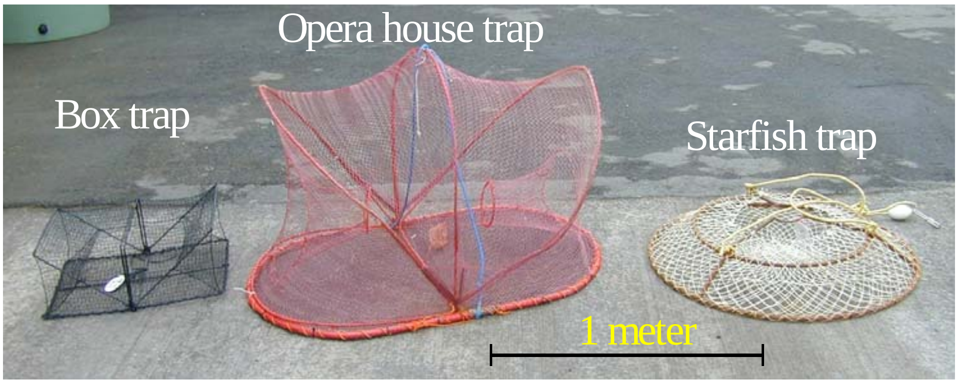

Figure 9: Trap types deployed in the port.

SAMPLING EFFORT

A summary of sampling effort within the Port of Dunedin 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 Dunedin is indicated in the following figures: diver pile scrapings and dinoflagellate cyst samples (Figs. 10 and 11), benthic sledding and sediment grab sampling (Figs. 12 and 13), box, starfish, shrimp and opera house fish trapping (Figs. 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 thirteen Ports and three marinas surveyed over two summers is summarised in Table 3c.

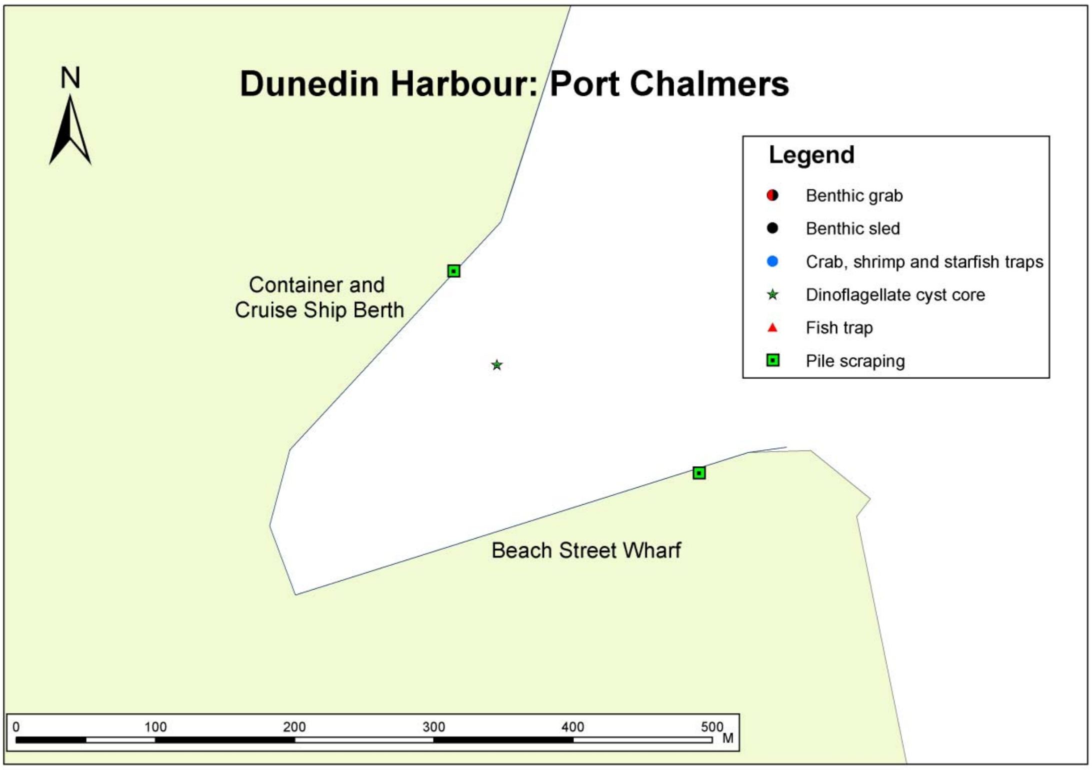

Figure 10: Port Chalmers diver pile scrape sites and javelin corer dinoflagellate sample sites

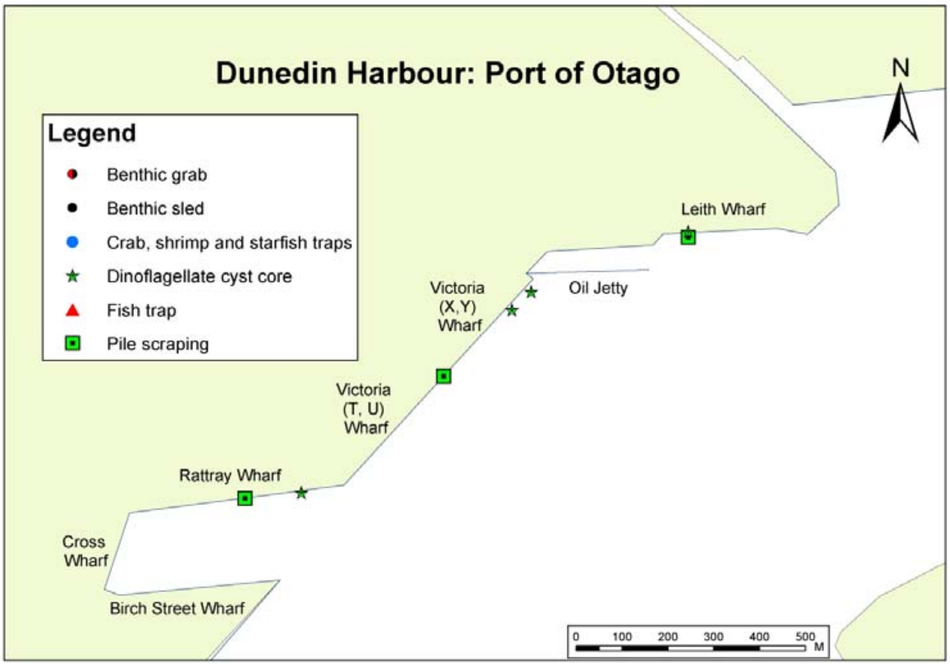

Figure 11: Port of Otago diver pile scrape sites and javelin corer dinoflagellate sample sites

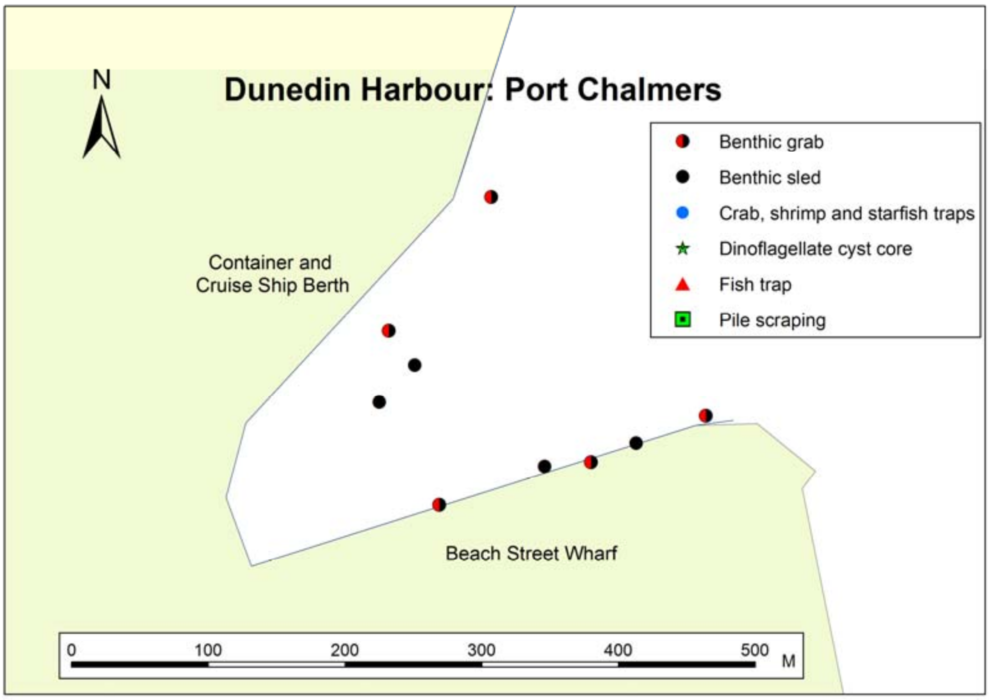

Figure 12: Port Chalmers benthic sled and benthic grab sites.

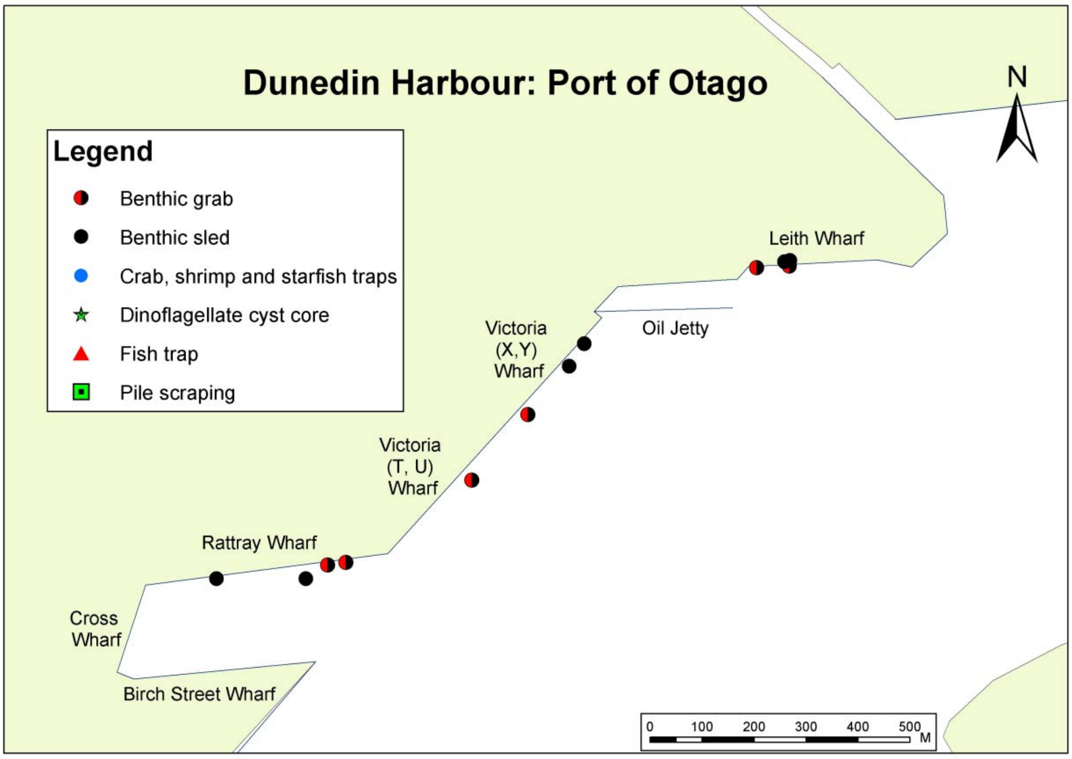

Figure 13: **Port of Otago benthic sled and benthic grab sites.**

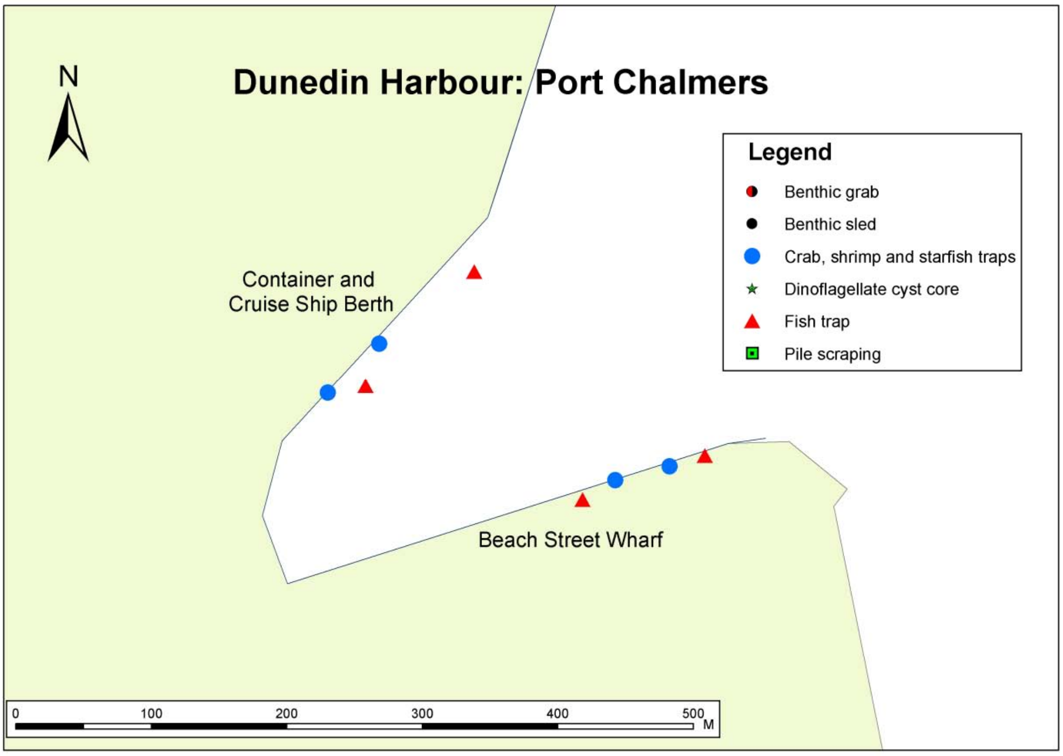

Figure 14: **Port Chalmers trapping sites using box (crab), shrimp and starfish traps and opera house fish traps**

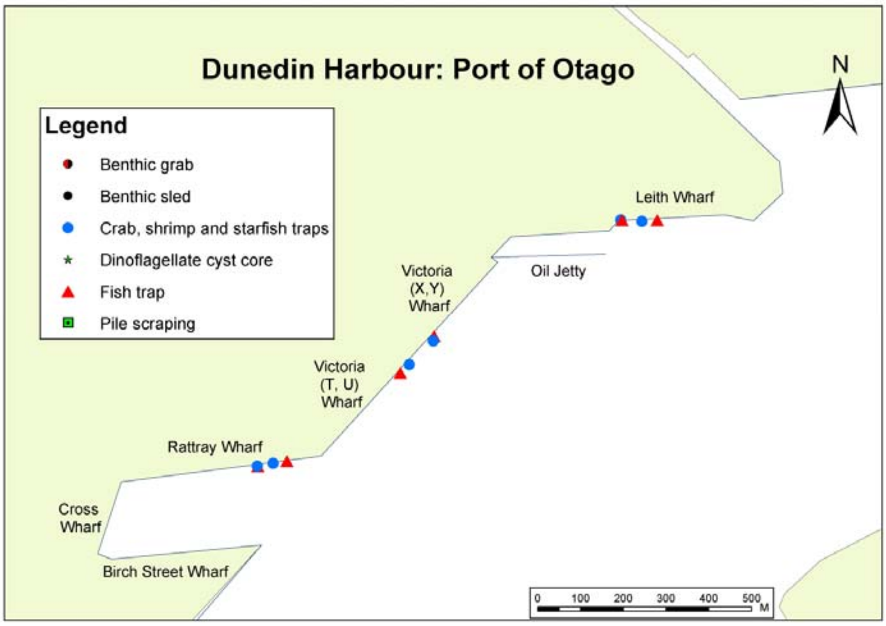

Figure 15: Port of Otago trapping sites using box (crab), shrimp and starfish traps and opera house fish traps

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 SPECIES CATEGORIES

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

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

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

Native species

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

Non-indigenous species (NIS)

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

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

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

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

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

Cryptogenic species Category 1

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

Cryptogenic species Category 2:

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

Species indeterminata

Specimens that could not be reliably identified to species level. This group includes: (1) organisms that were damaged or juvenile and lacked morphological characteristics necessary for identification, and (2) taxa for which there is not sufficient taxonomic or systematic information available to allow identification to species level.

Survey results

A total of 275 species or higher taxa were identified from the Dunedin Port survey. This collection consisted of 169 native (Table 6), 38 cryptogenic (Table 7), 18 non-indigenous species (Table 8) and 50 species indeterminata (Table 9, Fig. 16). The biota included a diverse array of organisms from 12 Phyla (Fig. 17). Twenty-five species from the Port of Dunedin had not previously been described from New Zealand waters. These included 23 species of sponge that are thought to be new to science (Table 7), a cryptogenic amphipod (*Leucothoe* sp.1), and two non-indigenous species that had not previously been recorded from New Zealand (the polychaete worm, *Spirobranchus polytrema*, and the sponge *Leucosolenia* cf. *discoveryi*. For general descriptions of the main groups of organisms (Phyla) encountered during this study refer to Appendix 2.

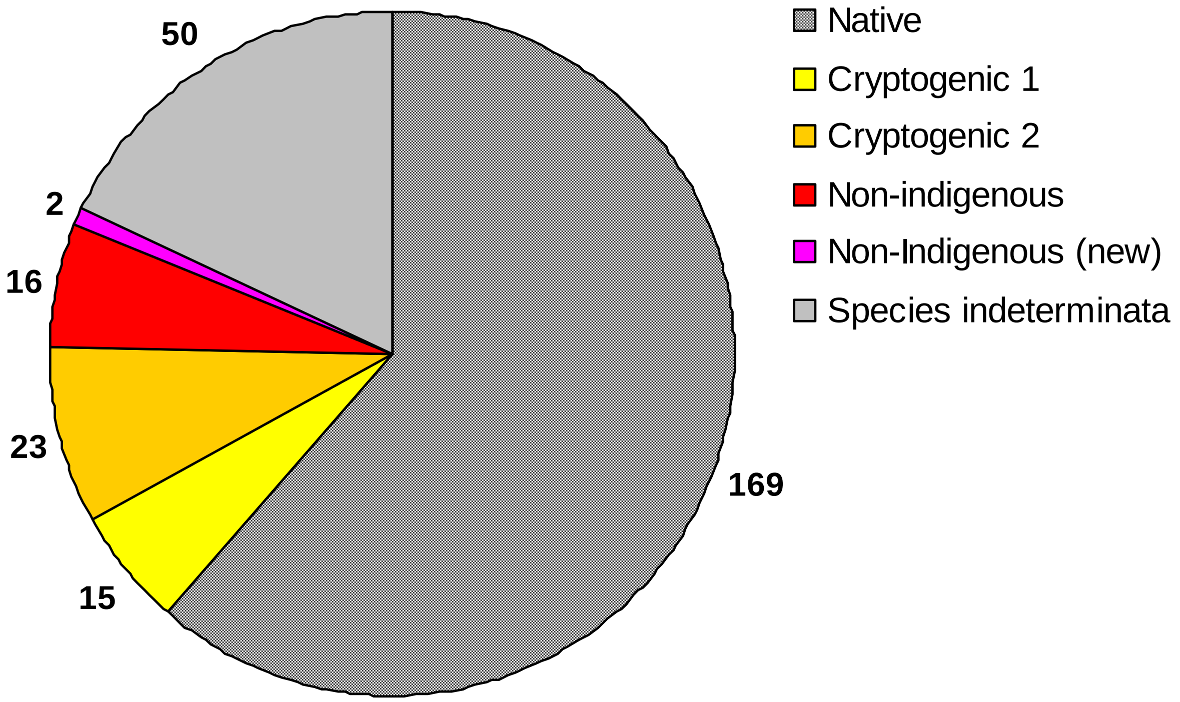

Figure 16: Diversity of marine species sampled in the Port of Dunedin. Values indicate the number of species in native, cryptogenic, non-indigenous and species indeterminata categories.

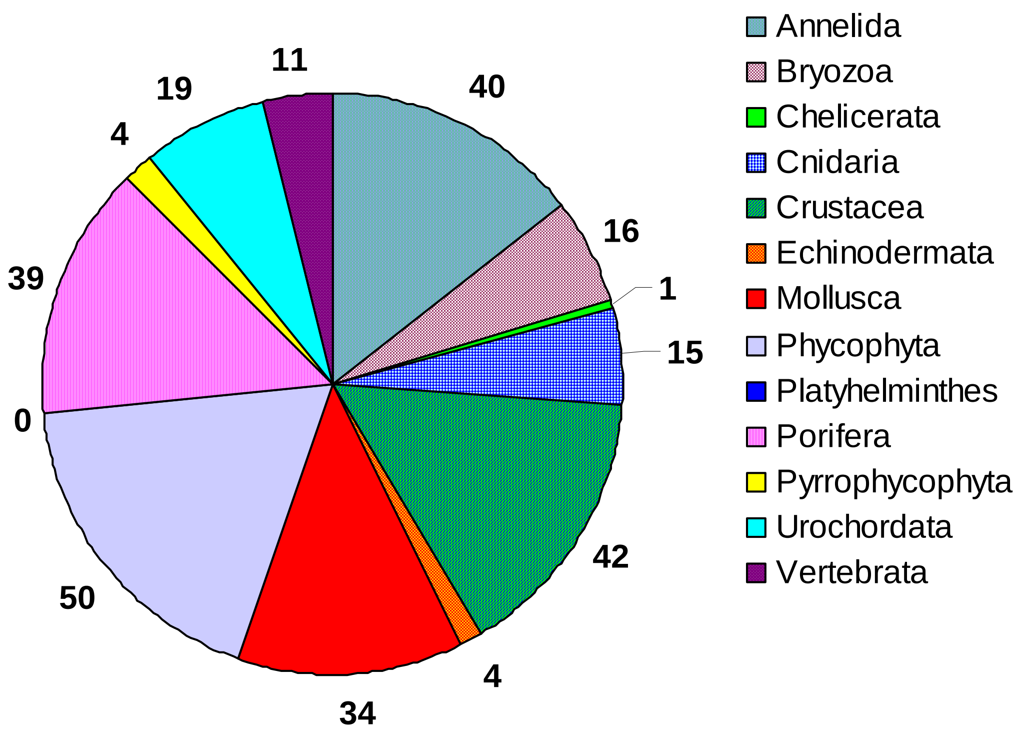

Figure 17: Marine Phyla sampled in the Port of Dunedin. Values indicate the number of species in each of the major taxonomic groups.

NATIVE SPECIES

A total of 169 native species was identified from the Port of Dunedin. Native species represented 61.5 % of all species identified from this location (Table 6) and included highly diverse assemblages of crustaceans (33 species), molluscs (29 species), annelids (28 species), phycophyta (algae, 23 species), urochordates (13 species) and porifera (10 species). A number of other less diverse phyla including bryozoans, cnidarians, vertebrates, echinoderms, pyrrophycophyta and chelicerates were also sampled from the Port (Table 6).

CRYPTOGENIC SPECIES

Thirty-eight cryptogenic species were discovered in the Port of Dunedin. Cryptogenic species represented 13.8 % of all species or higher taxa identified from the Port. The cryptogenic organisms identified included 15 Category 1 and 23 Category 2 species as defined in Section 2.9 above. These organisms included one bryozoan, four cnidarians, one crustacean, one mollusc, twenty-six sponges and five ascidians (Table 7). Many of the Category 1 cryptogenic species (e.g. the ascidians *Aplydium phortax, Astereocarpa cerea, Botrylloides leachii,* and *Corella eumyota*; and the hydroids *Amphisbetia operculata, Halecium delicatum* and *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).

NON-INDIGENOUS SPECIES

Eighteen non-indigenous species (NIS) were recorded from the Port of Dunedin (Table 8). NIS represented 6.5 % of all identified species from this location. Two of these species - the annelid worm *Spirobranchus polytrema* and the sponge *Leucosolenia* cf. *discoveryi* - were not previously known from coastal New Zealand. The remaining NIS included one annelid, four bryozoans, three crustaceans, one mollusc, five macroalgae and two sponges.

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.

***Spirobranchus polytrema* (Philippi, 1844)**

No image available.

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

S. polytrema is most commonly found along the continental shelf, intertidal, rock bottom, and sublittoral habitats, and on the underside of stones around the low water mark (www.deh.gov.au/cgi-bin/abrs/fauna/). Its impacts are unknown. During the port baseline surveys, *S. polytrema* was recorded from the ports of Wellington, Napier and Dunedin (Table 10). In Dunedin Harbour, *S. polytrema* occurred in benthic sled samples taken near the Container and Cruise Ship Berth at Port Chalmers (Fig. 18).

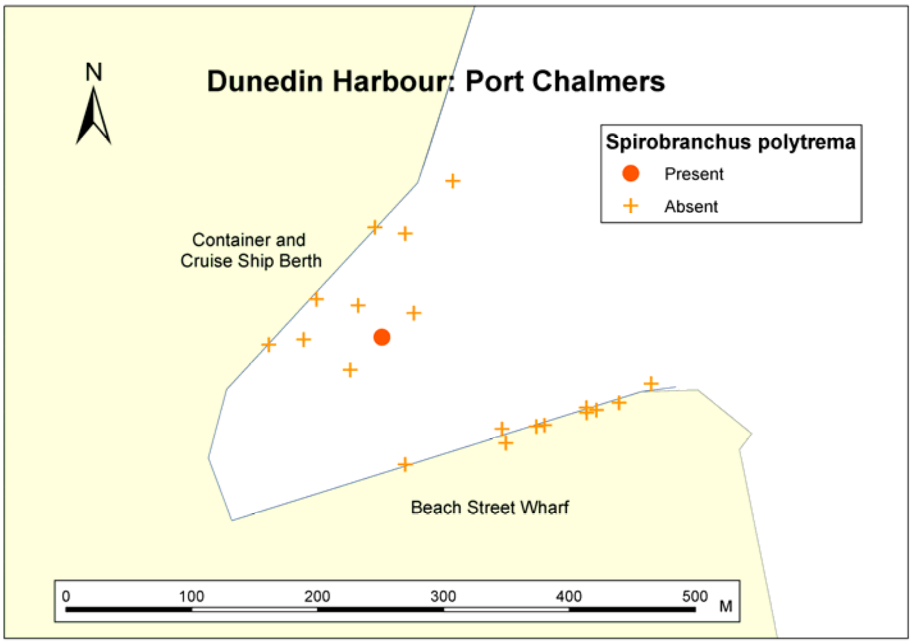

Figure 18: *Spirobranchus polytrema* distribution in Port Chalmers

***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, 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, and Dunedin during the baseline port surveys (Table 10). . *Polydora hoplura* occurred in pile scrape samples taken from Leith Wharf in the Port of Otago (Fig. 19).

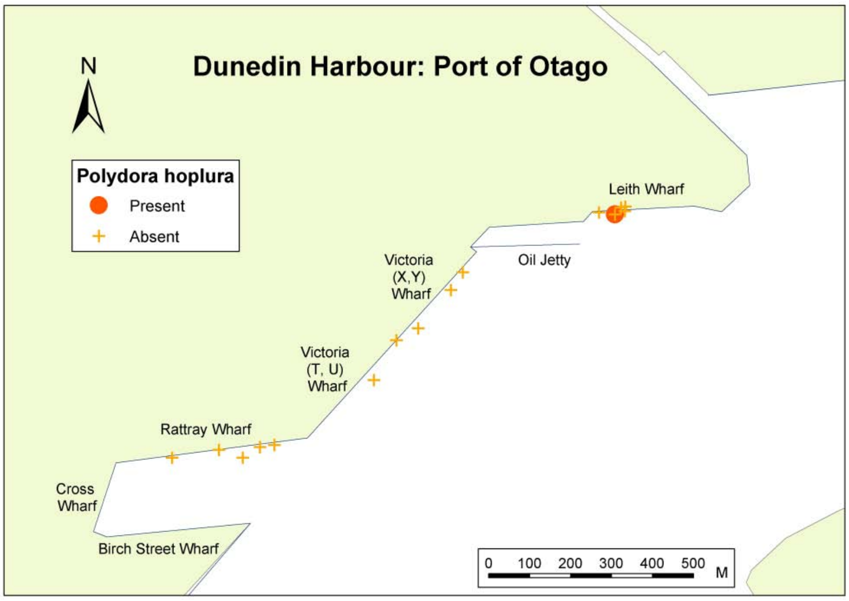

Figure 19: *Polydora hoplura* distribution in the Port of Otago.

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

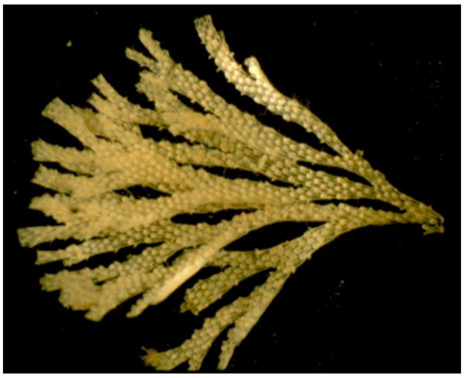

Image and information: NIMPIS (2002a)

Bugula flabellata is an erect bryozoan with broad, flat branches. It is a colonial organism and consists of numerous 'zooids' connected to one another. It is pale pink and can grow to about 4 cm high and attaches to hard surfaces such as rocks, pilings and pontoons or the shells of other marine organisms. It is often found growing with other erect bryozoan species such as *B. neritina* or growing on encrusting bryozoans. Vertical, shaded, sub-littoral rock surfaces also form substrata for this species. It has been recorded down to 35 m. *Bugula flabellata* is native to the British Isles and North Sea and has been introduced to Chile, Florida and the Caribbean and the northern east and west coasts of the USA, as well as Australia and New Zealand. It is cryptogenic on the Atlantic coasts of Spain, Portugal and France. *Bugula flabellata* has been present in New Zealand since at least 1949 and is present in most New Zealand ports. It is a dominant component of fouling assemblages in ports and harbours, particularly on vessel hulls, pilings and pontoons, and has also been reported from offshore oil platforms. There have been no recorded impacts from *B. flabellata*. During the current baseline surveys it was recorded from Opua marina, Whangarei, Auckland, Tauranga, Napier, Taranaki, Wellington, Picton, Nelson, Lyttelton, Timaru, Dunedin and Bluff. In Dunedin Harbour, *B. flabellata* occurred in pile scrape samples taken from the Container & Cruise Ship Berth and Beach St Wharf at Port Chalmers (Fig. 20), and from Leith, Rattray, and Victoria Wharves in Port Otago (Fig. 21).

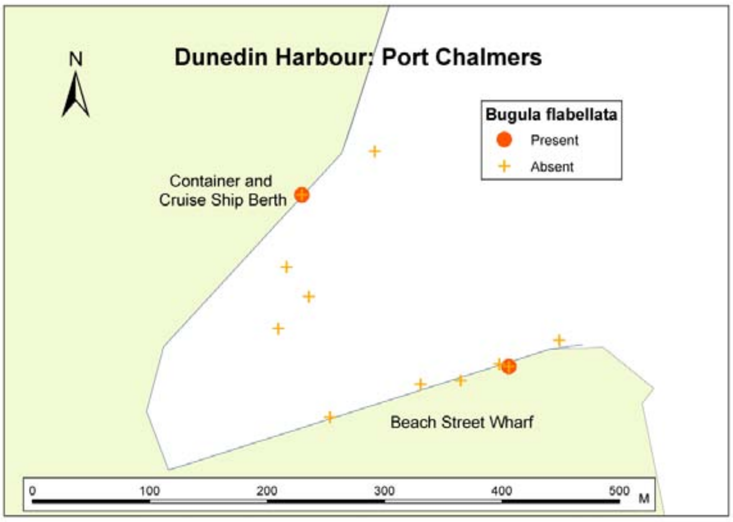

Figure 20: *Bugula flabellata* distribution in Port Chalmers.

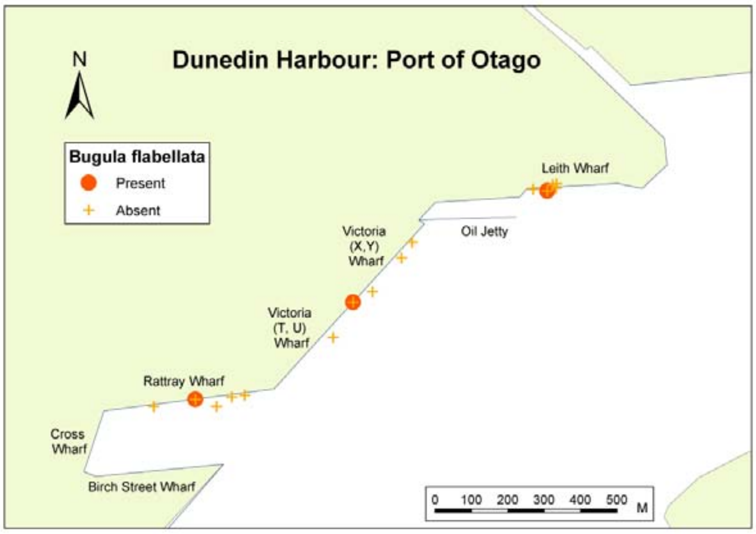

Figure 21: *Bugula flabellata* distribution in the Port of Otago.

***Bugula neritina* (Linnaeus, 1758)**

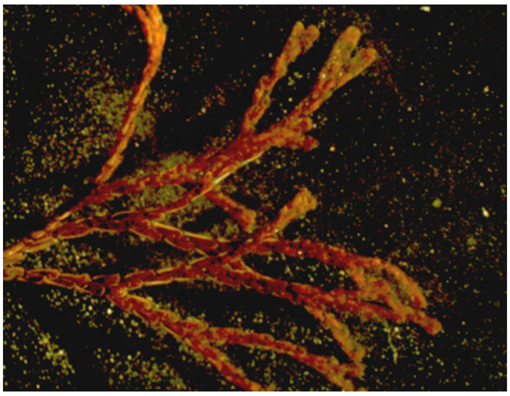

Image and information: NIMPIS (2002b)

Bugula neritina is an erect, bushy, red-purple-brown bryozoan. Branching is dichotomous (in series of two) and zooids alternate in two rows on the branches. Unlike all other species of *Bugula*, *B. neritina* has no avicularia (defensive structures) or spines, but there is a single pointed tip on the outer corner of zooids. Ovicells (reproductive structures) are large, globular and white. They often appear in such high numbers that they resemble small snails or beads. *Bugula neritina* is native to the Mediterranean Sea. It has been introduced to most of North America, Hawaii, India, the Japanese and China Seas, Australia and New Zealand. It is cryptogenic in the British Isles. *Bugula neritina* is one of the most abundant bryozoans in ports and harbours and an important member of the fouling community. The species colonises any available substratum and can form extensive monospecific growths. It grows well on pier piles, vessel hulls, buoys and similar submerged surfaces. It even grows heavily in ships' intake pipes and condenser chambers. In North America, *B. neritina* occurs on rocky reefs and seagrass leaves. In Australia, it occurs primarily on artificial substrata. *B. neritina* occurs in almost all New Zealand ports (Gordon and Matawari 1992). In the baseline survey of Dunedin Harbour, *B. neritina* occurred in pile scrape samples taken from Rattray Wharf in Port Otago (Fig. 22).

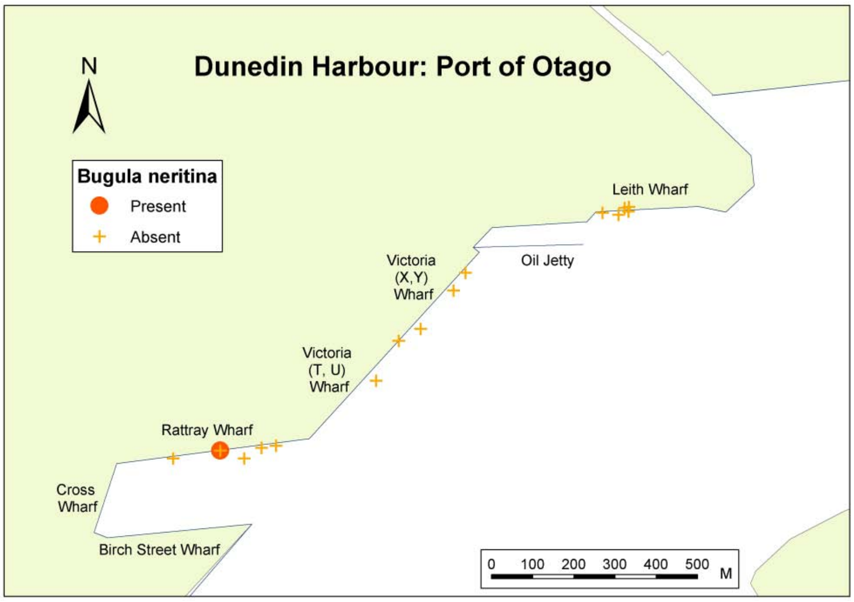

Figure 22: ***Bugula neritina* distribution in the Port of Otago.**

Cryptosula pallasiana (von Moll, 1803)

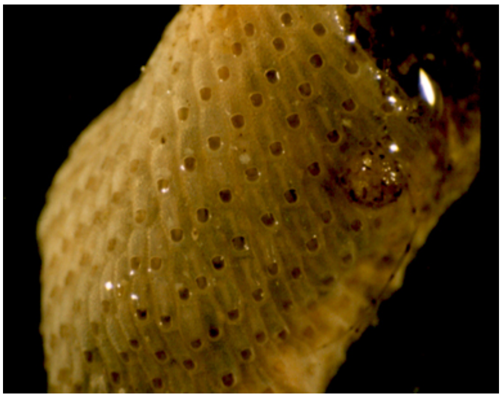

Image and information: NIMPIS (2002d)

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 Japanese Sea, 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 Port of Otago it occurred in pile scrape samples taken from Rattray Wharf (Fig. 23).

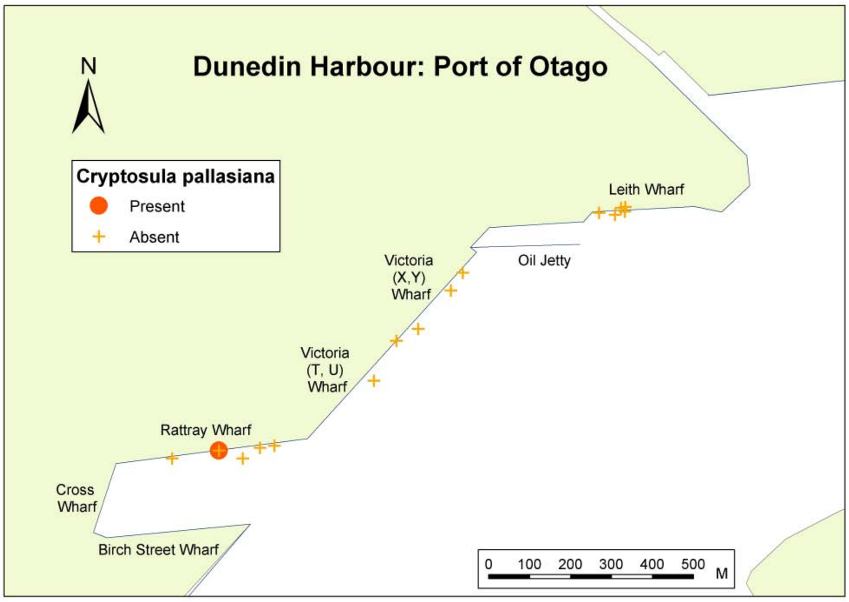

Figure 23: _Cryptosula pallasiana_ distribution in the Port of Otago.

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

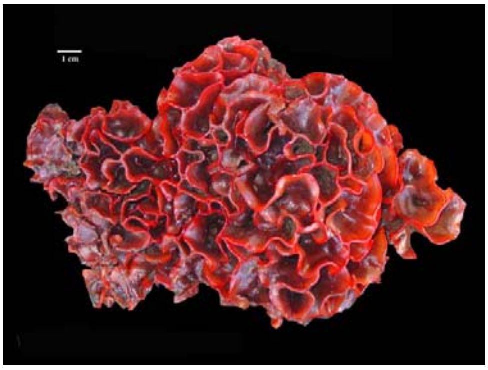

Image: California Academy of Sciences. Information: Gordon and Matawari (1992)

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). During the port baseline survey, *W. subtorquata* occurred in pile scrape samples taken from Beach St Wharf at Port Chalmers (Fig. 24) and from Leith, Rattray, and Victoria Wharves in Port Otago (Fig. 25).

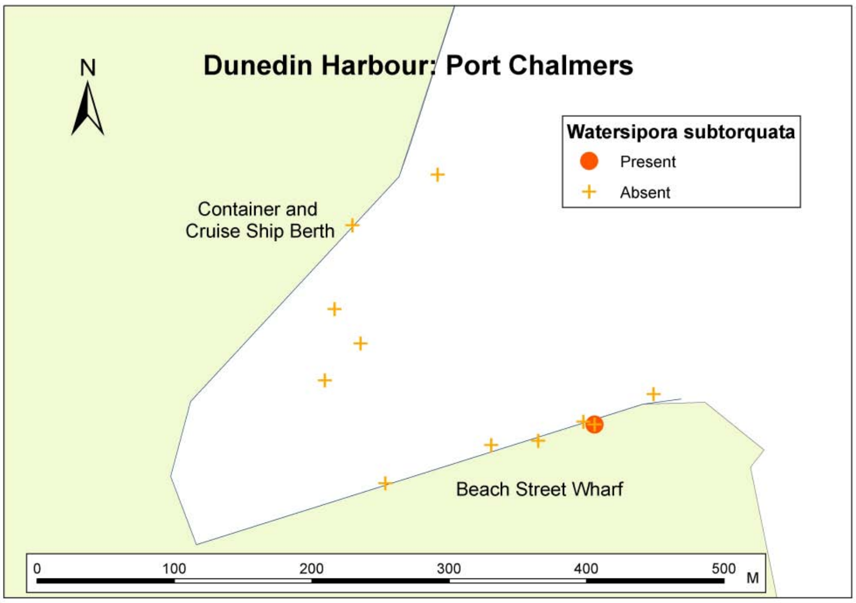

Figure 24: *Watersipora subtorquata* distribution in Port Chalmers.

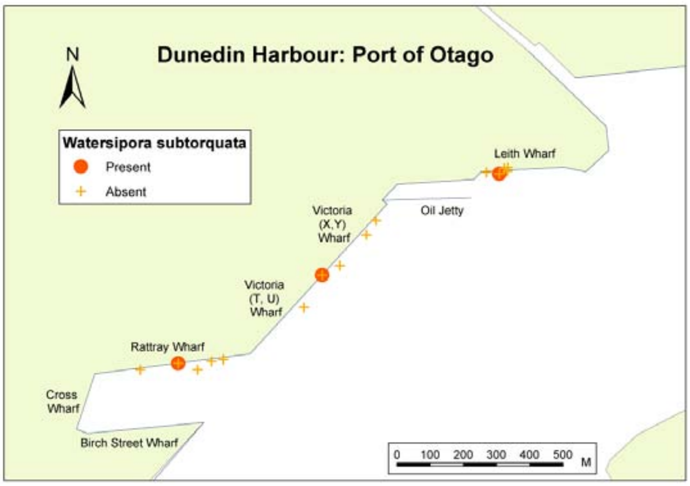

Figure 25: ***Watersipora subtorquata* distribution in the Port of Otago.**

Apocorophium acutum (Chevreux, 1908)

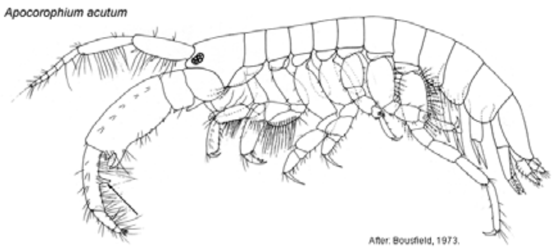

Image and information: Keys to the Northeast Atlantic and Mediterranean amphipods. [http://www.amphipoda.com/acutum.html]

Apocorophium acutum is a corophiid amphipod, known from the Atlantic Ocean (England, France, North America, Brazil, South Africa), Pacific Ocean (New Zealand) and the Mediterranean Sea. The exact native range of this species is not known, although the type specimen of this species was described from the southern Mediterranean. *A. acutum* inhabits marine sediments in estuarine mudflats and brackish water where it builds muddy tubes. It has no known documented impacts. During the baseline port surveys, *A. acutum* was recorded from the ports of Otago, Lyttelton, Tauranga and Timaru, and from the Opua and Gulf Harbour marinas. During the port baseline survey, it occurred in pile scrape samples taken from the Rattray, Leith and Victoria Wharves in Port Otago (Fig. 26).

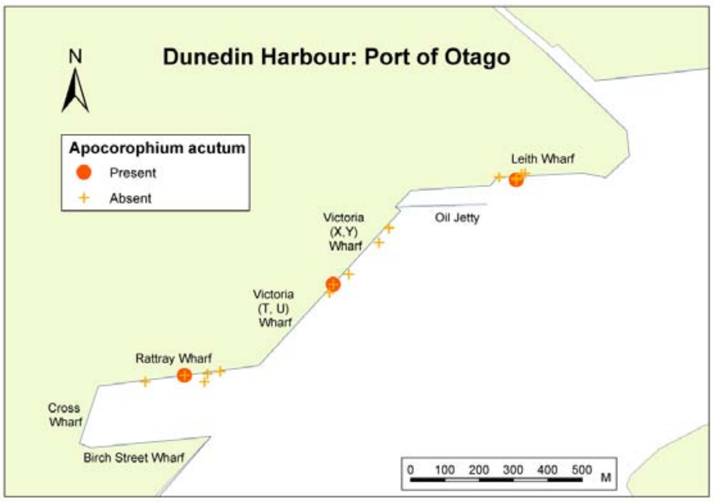

Figure 26: ***Apocorophium acutum* distribution in the Port of Otago.**

***Monocorophium acherusicum* (A. Costa, 1851)**

Image and information: NIMPIS (2002e)

Monocorophium acherusicum is a flat, yellowish-brown amphipod crustacean that lives amongst assemblages of marine invertebrates and plants or in soft-bottom habitats, and feeds by grazing on bacteria on sediment particles or on organic matter suspended in the water column. *Monocorophium acherusicum* is native to the northeast Atlantic, the Mediterranean and the northwest African coast and has been introduced to Brazil, southeast Africa, India, the Japanese and China Seas, Australia and New Zealand. It is cryptogenic in the Baltic Sea, the Caribbean and the east and northwest coasts of the USA. *Monocrophium acherusicum* occurs subtidally on sediments or where silt and detritus accumulate among fouling communities such as algae, ascidians and bryozoans, and man-made installations eg. wharf pylons, rafts and buoys. It is a tube building species constructing conspicuous, fragile U-shaped tubes of silk, mud and sand particles. It can reach high abundances and tolerate a wide range of salinities. Pilisuctorid cilates are parasites on this species in the Black Sea, but it is unknown whether these parasites could transfer to native species and cause negative impacts in New Zealand. During the baseline port surveys it was recorded from the ports of Otago, Gisborne, Lyttelton, Tauranga and Timaru and from the Whangarei Town Basin marina. During the Dunedin Harbour baseline survey, it occurred in pile scrape samples taken from the Rattray, Leith and Victoria Wharves in Port Otago (Fig. 27).

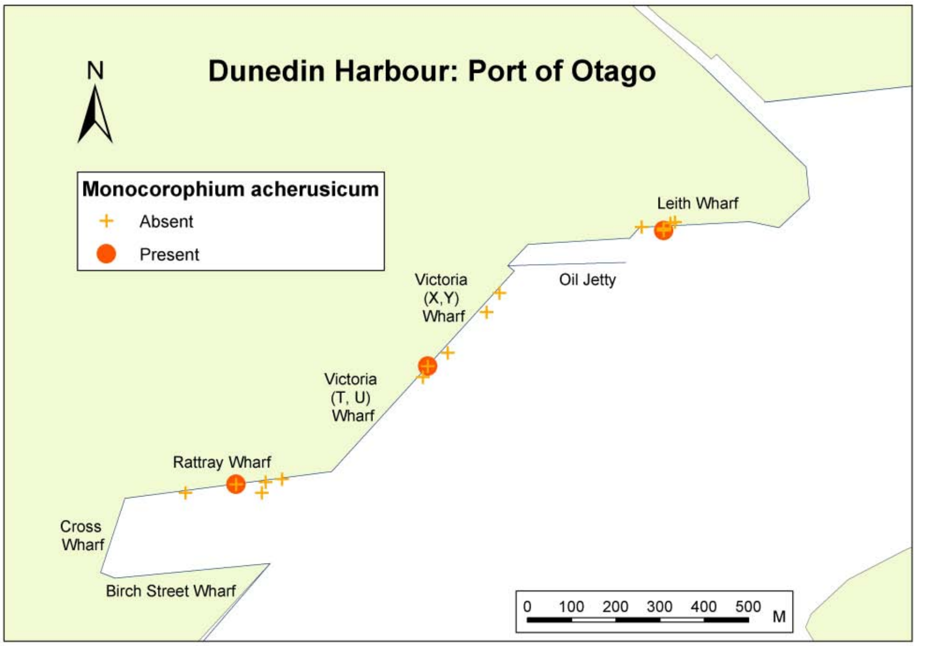

Figure 27: *Monocorophium acherusicum* distribution in the Port of Otago.

***Jassa marmorata* (Conlan, 1990)**

No image available

Jassa marmorata is an amphipod in the family Ischyroceridae that builds tubes among algae, sponges, and tunicates. The type specimen for this species was described from the northwest Atlantic. It is considered cryptogenic in the eastern Atlantic, Mediterranean Sea, and Gulf of Mexico and is thought to have been introduced to the northeast Pacific, China, Japan, USSR, Chile, the south Atlantic (Brazil, west Africa, and South Africa), the Indian Ocean (Zanzibar), southeastern Australia, and New Zealand. *J. marmorata* reaches high abundance within fouling communities on floating pontoons and pilings and in subtidal algal communities along rocky shores, from the intertidal to 30m depth. Males of this species differ in morphology as well as behaviour. This dimorphism corresponds to two contrasting reproductive strategies: small sneaker males, and large fighter males (Kurdziel and Knowles 2002). This species undergoes seasonal changes in abundance; in some cases, reaching densities as high as 8000 animals per 10 cm^2. During the baseline port survey *J. marmorata* was recorded only from the Port of Otago, where it occurred in pile scrape samples taken from the Rattray, Leith and Victoria Wharves (Fig. 28).

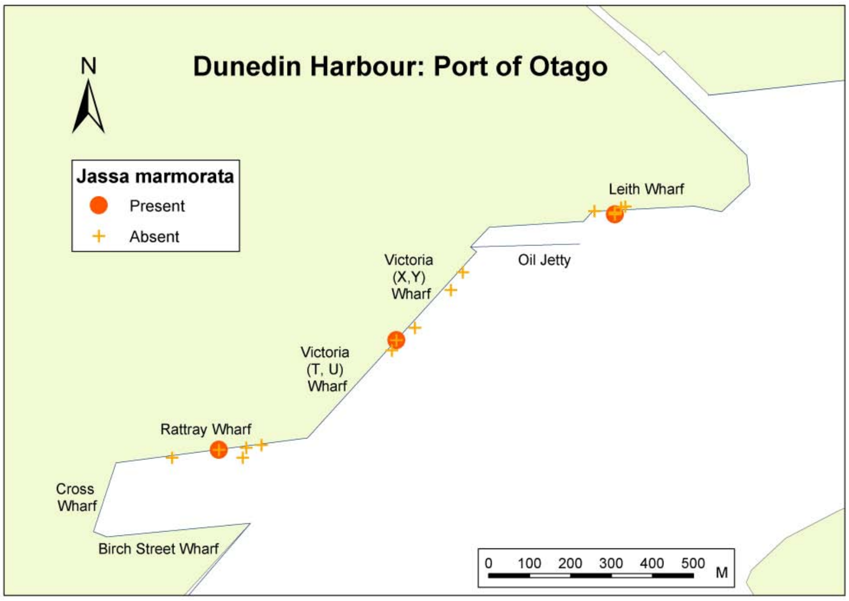

Figure 28: *Jassa marmorata* distribution in the Port of Otago.

***Crassostrea gigas* (Thunberg, 1793)**

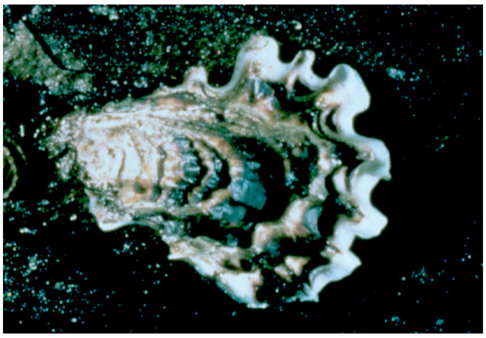

Image and information: NIMPIS (2002c)

The Pacific oyster, *Crassostrea gigas*, is an important aquaculture species throughout the world, including New Zealand. It has a white elongated shell, with an average 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 Japanese 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). However, it does not appear to have established a population within Dunedin Harbour. The specimens recovered during the port baseline survey occurred in a scrape sample taken from the hull of an abandoned Russian trawler that was laid-up at Rattray Wharf during the survey (Fig. 29). The trawler has since been sold and removed from the Harbour. No other specimens of *C. gigas* were recovered during the survey of Dunedin Harbour.

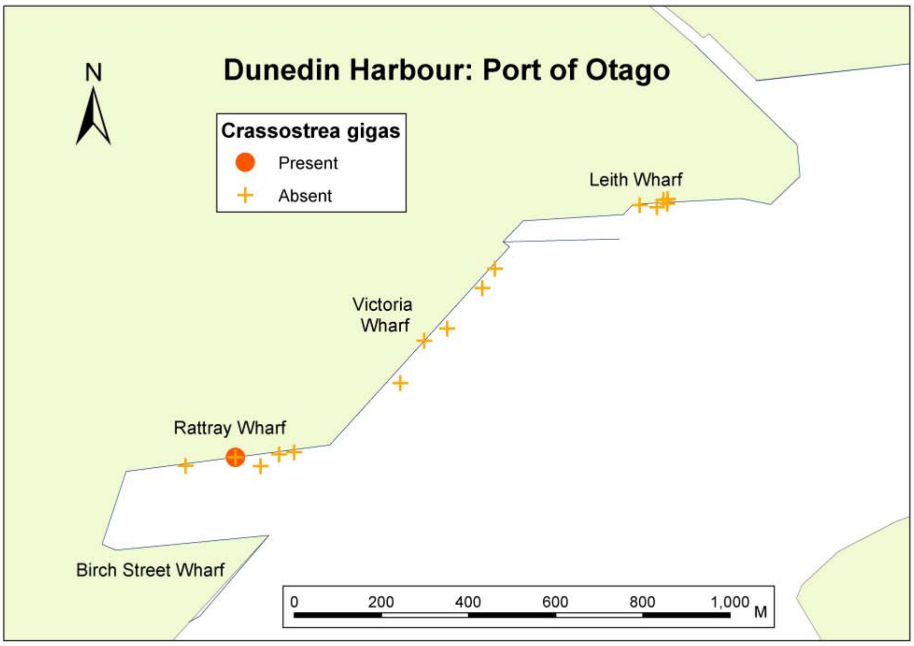

Figure 29: *Crassostrea gigas* distribution in the Port of Otago.

Cutleria multifida **(Js.Smith) Grev.**

Image: University of the Azores (available at http://www.horta.uac.pt/species/Algae/Cutleria_multifida/Cutleria_multifida.htm)

Cutleria multifida is a brown alga in the family Cutleriaceae. Its native range is thought to be the north-east Atlantic and Mediterranean Seas (Guiry et al 2005). It has been introduced to temperate west Africa, the Arabian Seas, south and south-east Pacific, northwest Pacific, Australia and New Zealand (Guiry et al 2005). Within New Zealand, *C. multifida* has been reported from Auckland, Wellington, Picton, Lyttelton, Dunedin and Stewart Island (Cranfield et al 1998). During the port baseline surveys it was recorded in Gulf Harbour Marina and the Port of Otago, where it occurred in a benthic sled sample taken near Leith Wharf (Fig. 30).

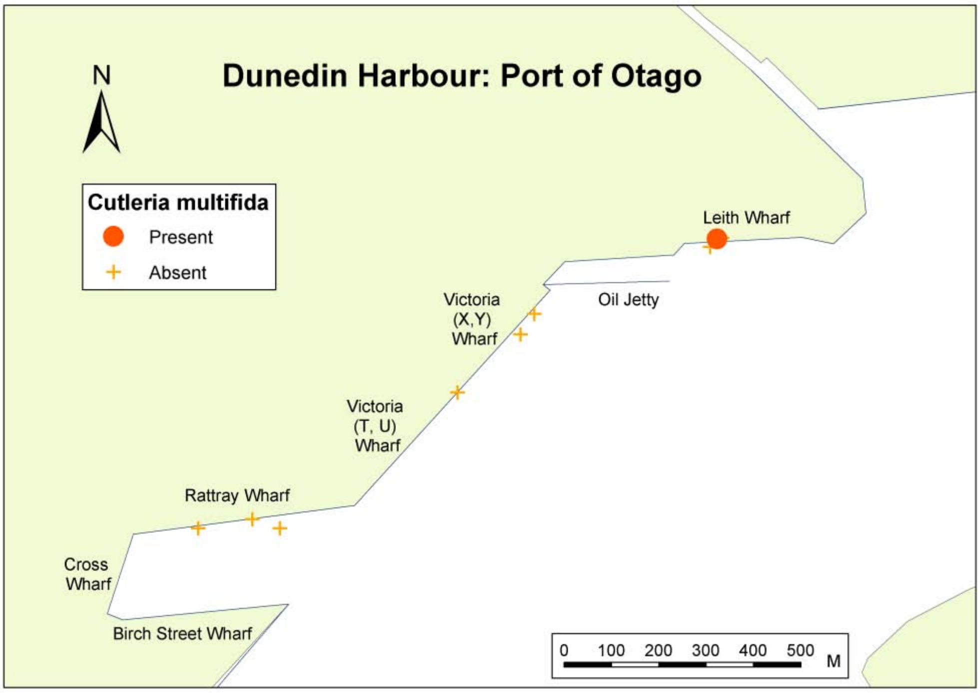

Figure 30: *Cutleria multifida* distribution in the Port of Otago.

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

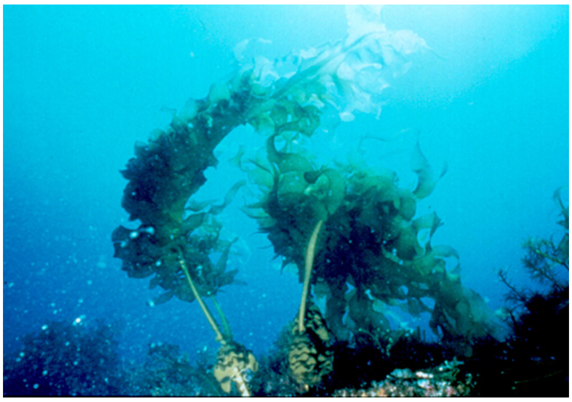

Image and information:
NIMPIS (2002g); Fletcher and Farrell (1999)

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

Undaria pinnatifida is an opportunistic alga that has the ability to rapidly colonise disturbed or new surfaces. It grows from the intertidal zone down to the subtidal zone to a depth of 15-20 metres, particularly in sheltered reef areas subject to oceanic influence. It does not tend to become established successfully in areas with high wave action, exposure and abundant local vegetation. *Undaria pinnatifida* is highly invasive, grows rapidly and has the potential to overgrow and exclude native algal species. The effects on the marine communities it invades are not yet well understood, although its presence may alter the food resources of herbivores that would normally consume native species. In areas of Tasmania (Australia) it has become very common, growing in large numbers in areas where sea urchins have depleted stocks of native algae. It can also become a problem for marine farms by increasing labour costs due to fouling problems. *U. pinnatifida* is known to occur in a range of ports and marinas throughout eastern New Zealand, from Gisborne to Stewart Island (Sinner et al 2000). During the baseline survey of Dunedin Harbour it was observed by divers and occurred in pile scrapings taken from the Container & Cruise Ship Berth and Beach St Wharf at Port Chalmers (Fig. 31) and from the Rattray, Victoria and Leith Wharves in the Port of Otago (Fig. 32).

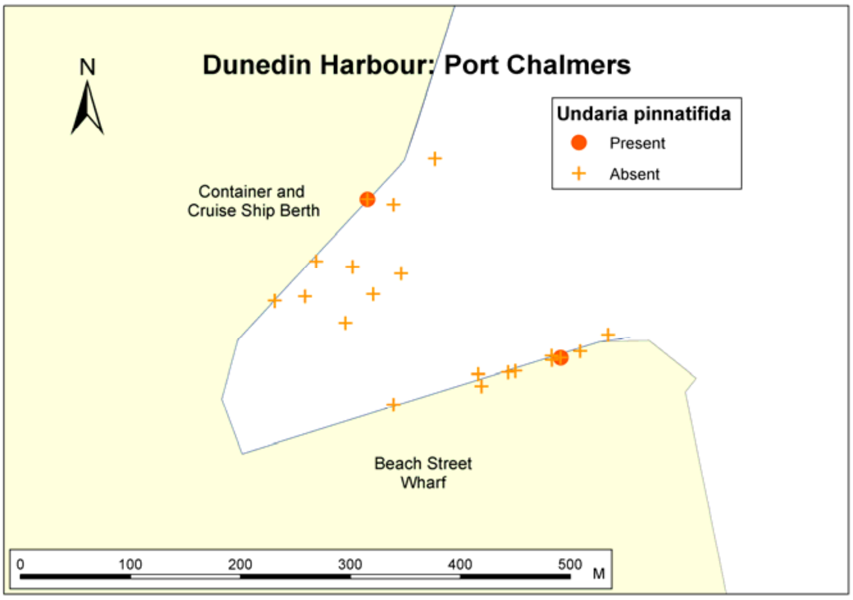

Figure 31: ***Undaria pinnatifida*** **distribution in Port Chalmers.**

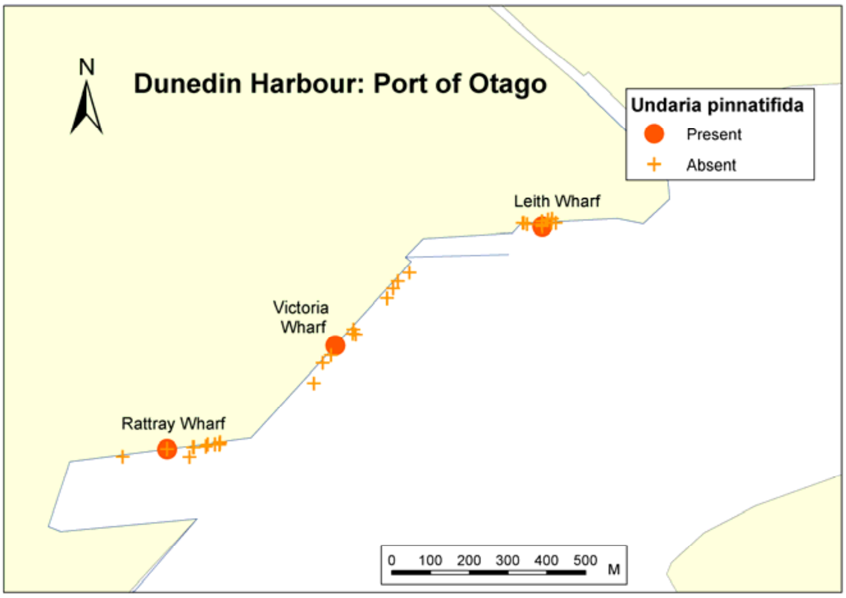

Figure 32: ***Undaria pinnatifida*** **distribution in the Port of Otago.**

Polysiphonia brodiei (Dillwyn Sprengel, 1827)

Image and information: NIMPIS (2002f)

Polysiphonia brodiei is a dark reddish brown alga, typically 4-12 cm high, but occasionally growing to 40 cm. It has many soft branches arising from one or several main stems that grow from a holdfast. *Polysiphonia brodiei* is native to the Mediterranean and northeastern Atlantic down to the equatorial coast of west Africa. It is introduced in New Zealand, southern Australia, the northeast and northwest coasts of the USA, and cryptogenic in Japan and Korea. *Polysiphonia brodiei* is found in the subtidal zone just below low tide level where it colonises wooden structures, floating structures including ropes, buoys and vessels, and other fouling species, such as mussels. *Polysiphonia brodiei* seems to prefer moderately exposed localities. In Australia, New Zealand and California, specimens have been collected mostly from port environments where the species is frequently found fouling the hulls of slow moving vessels, such as barges. It also occurs as nuisance fouling on ropes, buoys and other harbour structures such as pylons and boat ramps. Within New Zealand, *P. brodiei* is known from Wellington, Lyttelton, Timaru, Stewart Island and George Sound (Cranfield et al 1998). During the baseline port surveys, it was recorded from Lyttelton, Dunedin and Bluff. In Dunedin, it occurred in benthic sled samples taken near the Container and Cruise Ship Berth at Port Chalmers, and from pile scrape samples taken at Beach St Wharf (Port Chalmers) (Fig. 33) and Leith Wharf in Port Otago (Fig. 34).

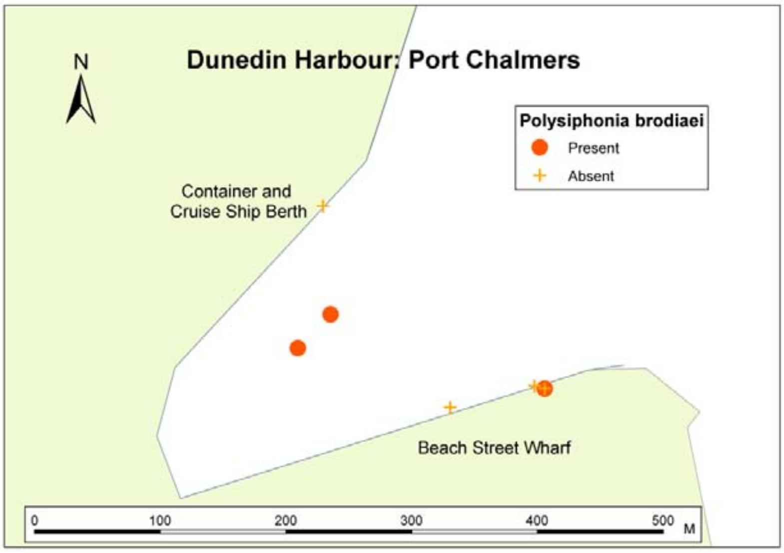

Figure 33: *Polysiphonia brodiaei* distribution in Port Chalmers.

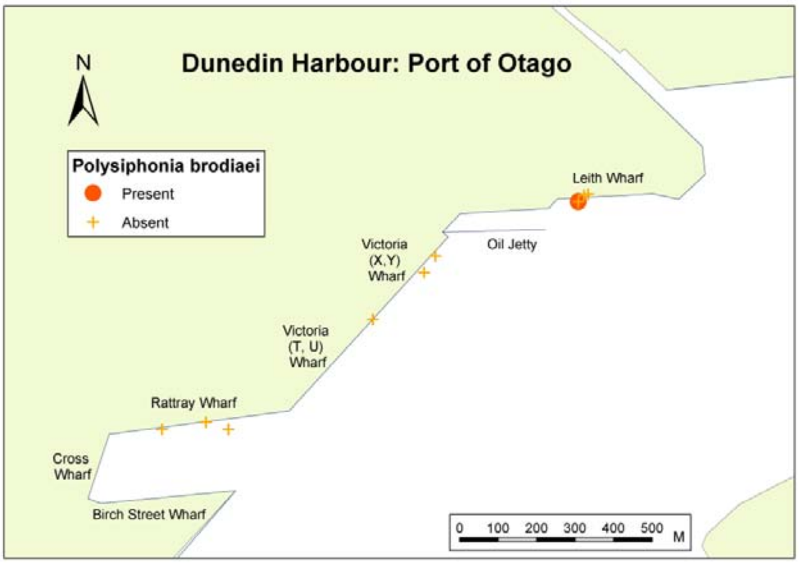

Figure 34: *Polysiphonia brodiaei* distribution in the Port of Otago.

***Polysiphonia subtilissima* (Montagne 1840)**

Image: http://www.omp.gso.uri.edu/
Information: Adams (1994)

Polysiphonia subtilissima is a red alga with delicate, tufted structures up to 4 cm high with slender and much-divided stems and a holdfast of prostrate branches. It is pink to pale crimson and has a soft and flaccid texture. *Polysiphonia subtilissima* usually occurs as an epiphyte subtidally in sheltered, warm and muddy bays. The native distribution of this species includes tropical and subtropical eastern USA, the Hawaiian Islands, and parts of Australia including South Australia, Victoria, New South Wales and Tasmania (Adams 1994). Its impacts are unknown. During the port baseline surveys, *P. subtilissima* was recorded from the ports of Lyttelton, Timaru and Dunedin. In Dunedin, it occurred in benthic sled samples taken near Beach St Wharf, Port Chalmers (Fig. 35).

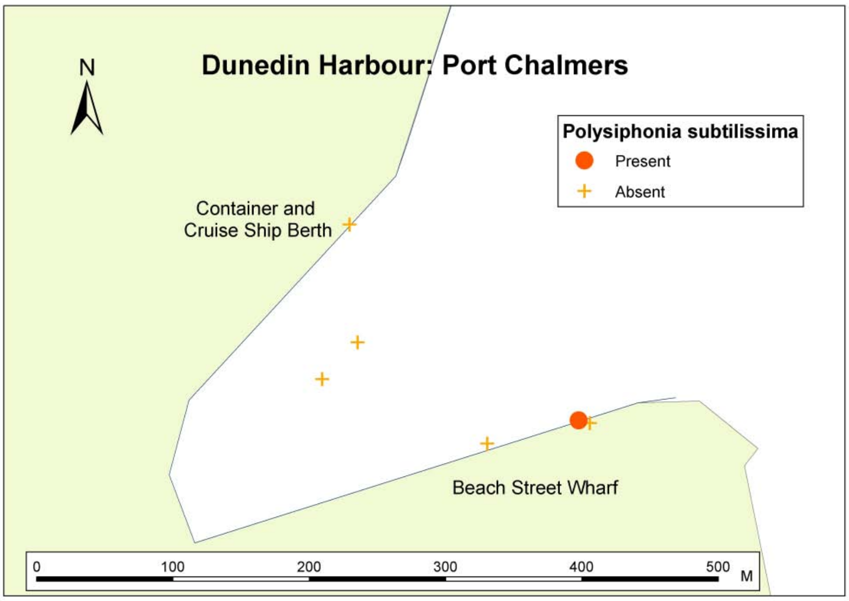

Figure 35: ***Polysiphonia subtilissima* distribution in Port Chalmers.**

***Champia affinis* (Hook f. et Harvey) J. Agardh**

No image available.

Champia affinis is a red alga up to 18 cm in height, pink in colour and of a soft and flaccid texture. It occurs on a range of hard substrata as well as detached. Its native range is thought to be southern Australia. In New Zealand it has been reported from Otago Harbour, Fiordland and Steward Island (Adams1994). No information exists on impacts in its introduced range. During the baseline survey of Dunedin, *C. affinis* occurred in benthic sled samples taken near the Container & Cruise Ship Berth at Port Chalmers (Fig. 36).

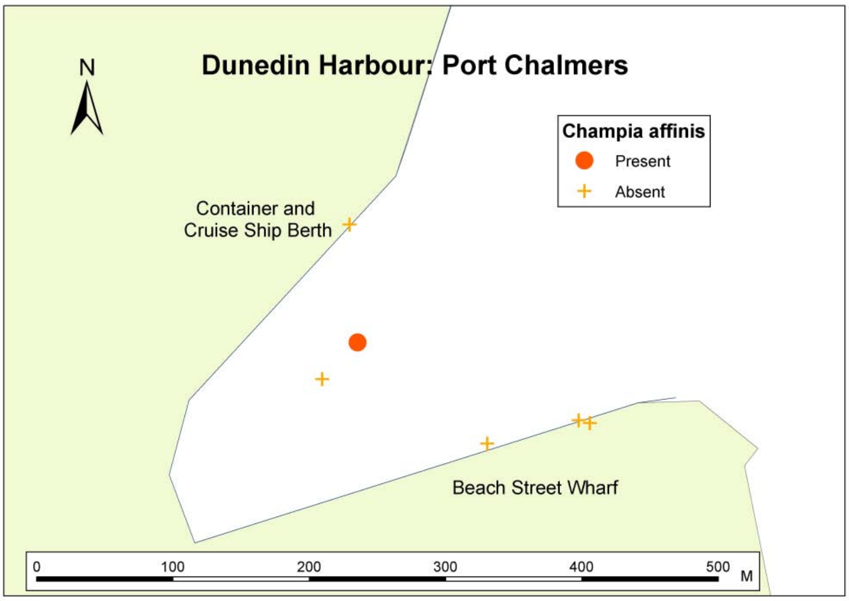

Figure 36: ***Champia affinis* distribution in Port Chalmers.**

***Grantessa intusarticulata* (Carter, 1886)**
No image available.

Grantessa intusarticulata is a sponge in the family Heteropiidae. *Grantessa intusarticulata* (Carter) was described in 1886 from Port Phillip Heads, Victoria, but was first reported in New Zealand from Island Bay, Wellington in 1926. It can be a cryptic species and rapidly invades the pipes of aquaculture systems and other dark environments (M. Kelly Shanks, pers. comm.). During the port baseline surveys *G. intusarticulata* was recorded from Dunedin and Bluff. In Dunedin, it occurred in pile scrape samples taken from the Container & Cruise Ship Berth and Beach St Wharf at Port Chalmers (Fig. 37), and from Leith, Rattray, and Victoria Wharves in Port Otago (Fig. 38).

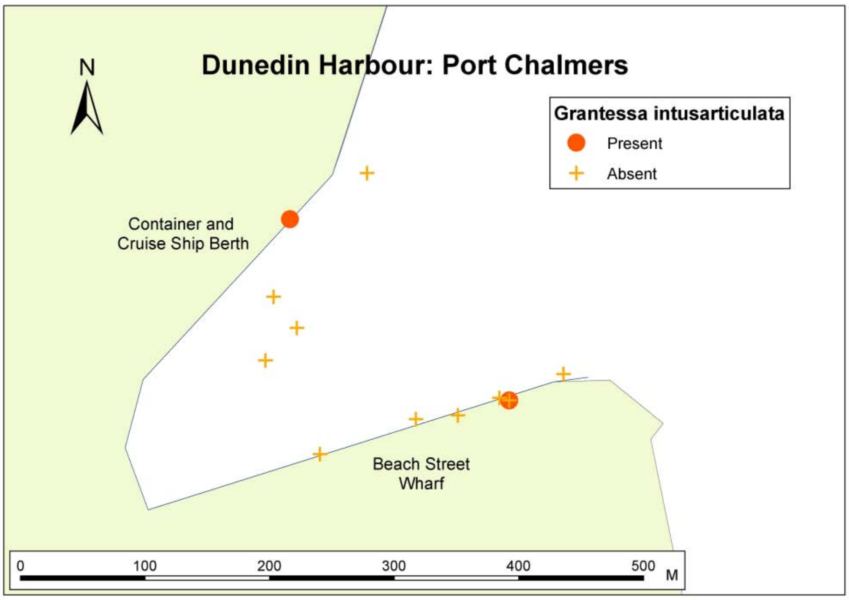

Figure 37: ***Grantessa intusarticulata* distribution in Port Chalmers.**

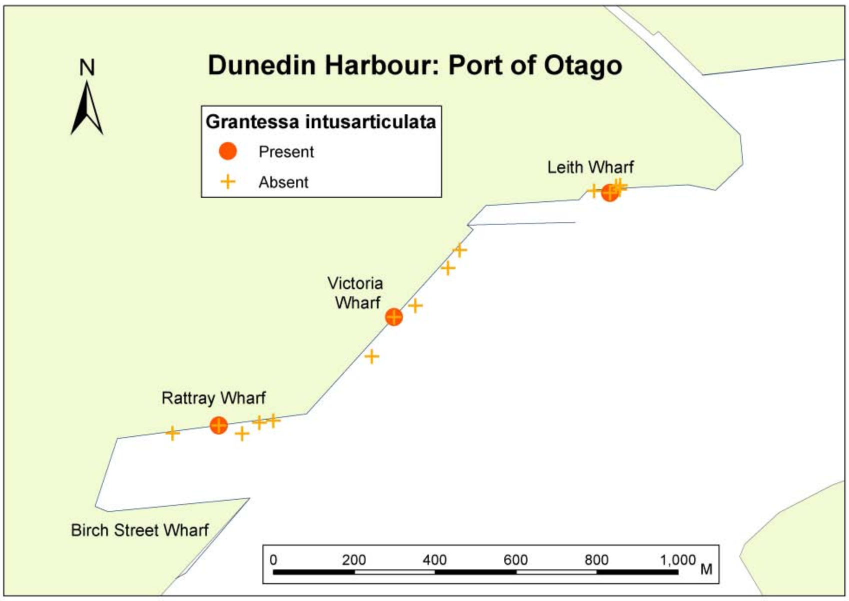

Figure 38: ***Grantessa intusarticulata*** **distribution in the Port of Otago.**

Leucosolenia cf. discoveryi **(Jenkin, 1908)**

No image available.

Leucosolenia cf. *discoveryi* is a sponge in the class Calcarea. It was first described from Discovery Bay in the Antarctic and is common in the Antarctica and Australian Sub-antarctic islands. Like *Grantessa intusarticulata*, it can be a cryptic species and rapidly invades the pipes of aquaculture systems and other dark environments (M. Kelly Shanks, pers. comm.). During the port baseline surveys *Leucosolenia* cf. *discoveryi* was recorded from Dunedin and Bluff. In Dunedin, it occurred in pile scrape samples taken from the Container & Cruise Ship Berth and Beach St Wharf at Port Chalmers (Fig. 39), and from Leith, Rattray, and Victoria Wharves in Port Otago (Fig. 40).

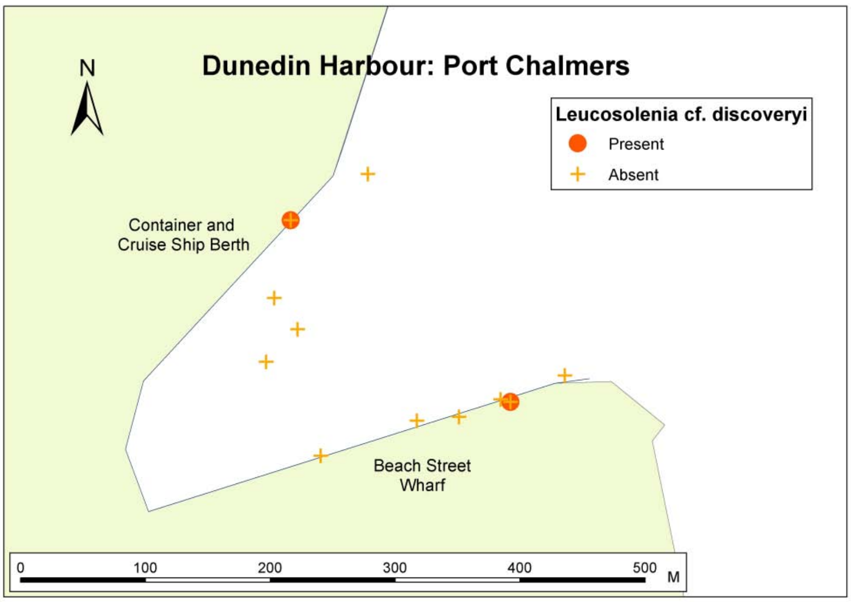

Figure 39: ***Leucosolenia*** **cf.** ***discoveryi*** **distribution in Port Chalmers.**

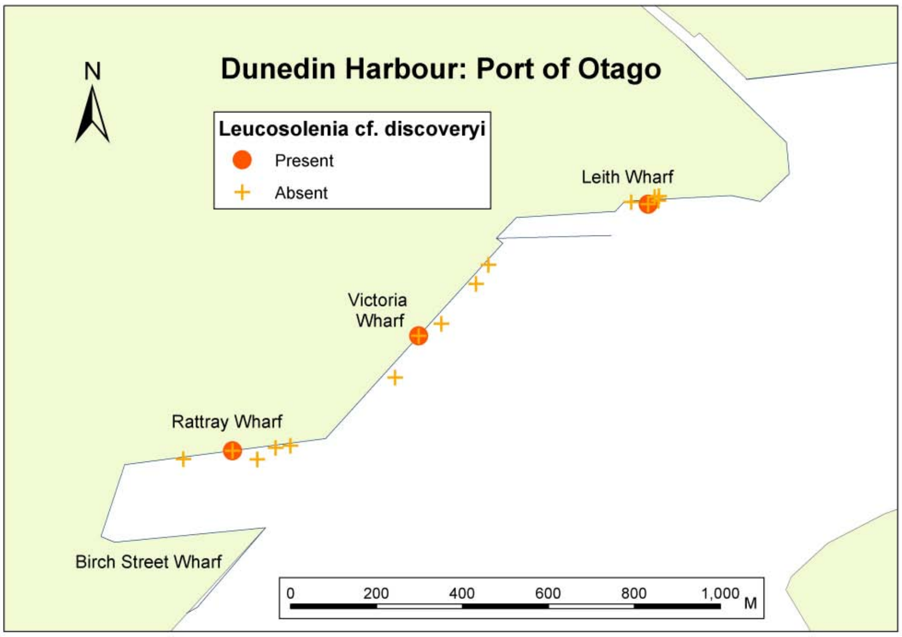

Figure 40: ***Leucosolenia*** **cf.** ***discoveryi*** **distribution in the Port of Otago.**

Halisarca dujardini **(Johnston, 1842)**

No image available.

Halisarca dujardini is an encrusting cold-water sponge. It is a cosmopolitan species with a wide distribution that includes the Arctic and Antarctic, the Subantarctic Islands, Australia, New Zealand, Chile, England, the Atlantic and the Mediterranean. It occurs from the shallow subtidal to a depth of 450 m. It has no known impacts. During the port baseline surveys *H. dujardini* was recorded from Auckland, Taranaki, Picton, Dunedin and Bluff. In Dunedin, it occurred in pile scrape samples taken from Beach St Wharf in Port Chalmers (Fig. 41).

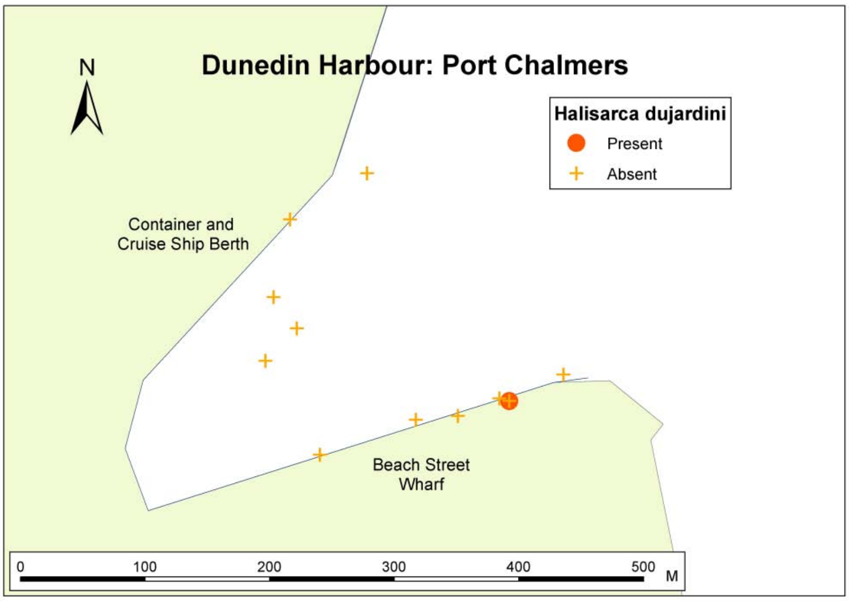

Figure 41: ***Halisarca dujardini*** **distribution in Port Chalmers.**

SPECIES INDETERMINATA

Fifty organisms from the Port of Dunedin were classified as species indeterminata. If each of these organisms is considered a species of unresolved identity, then together they represent 18.2 % of all species collected from this survey (Fig 16). Species indeterminata from the Port of Dunedin included 22 phycophyta, 10 annelids, five crustaceans, four vertebrates (fish), three molluscs, three cnidarians, two bryozoans and one urochordate species (Table 9).

NOTIFIABLE AND UNWANTED SPECIES

Of the non-indigenous species identified from the Port of Dunedin, only the Asian seaweed, *Undaria pinnatifida* is currently listed as an unwanted species on the New Zealand register of unwanted organisms (Table 5a), and the bivalve mollusc *Crassostrea gigas* is listed on the ABWMAC Australian list of pest species (Table 5b).

PREVIOUSLY UNDESCRIBED SPECIES IN NEW ZEALAND

Twenty-five species from the Port of Dunedin were previously undescribed 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). Previously undescribed cryptogenic species included 22 species of sponges and one species of amphipod (Table 7). These specimens did not match existing species descriptions and may be new to science. The two non-indigenous species not previously recorded from New Zealand waters were the annelid *Spirobranchus polytrema* (see section 3.3.1 above) and the sponge *Leucosolenia* cf. *discoveryi* (see section 3.3.17 above).

CYST-FORMING SPECIES

Four species of native dinoflagellate cysts were collected during this survey; they are indicated as members of the Pyrrophycophyta (Table 6). No cryptogenic or non-indigenous dinoflagellate species were collected from this port.

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

The non-indigenous species located in the Port are thought to have arrived in New Zealand via international shipping. Table 8 indicates the possible vectors for the introduction of each NIS into the Port. Likely vectors of introduction are largely derived from Cranfield et al (1998) and indicate that approximately 83 % (15 species) probably were introduced to New Zealand waters via hull fouling, and the remaining 17 % (three species) 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. 42a). 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 found in the different locations. However, differing sampling effort between locations did not explain differences in the numbers of NIS found ($F_{1,14} = 0.77$, $P = 0.394$, $R^2 = 0.052$). When sample effort was adjusted for, Dunedin had a slightly above-average diversity of non-indigenous, native and Cryptogenic 1 species relative to the other ports and marinas surveyed, but the greatest number of Cryptogenic 2 species (Fig 43), many of which (22 species) were newly discovered species of sponge. The largest numbers of NIS were reported from the ports of Lyttelton and Whangarei, but significantly more Cryptogenic 1 species were recorded in Whangarei Port than in other surveyed locations (Fig 43c, Studentised residual = 3.87).

Native organisms represented over 60 % of the species diversity sampled in each surveyed location, with a minimum contribution of 61 % in the Port of Lyttelton and a maximum of 68.5 % in Picton (Fig. 42b). 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. 42b). The port of Lyttelton's 20 NIS was the highest diversity of non-indigenous species recorded from any of the locations surveyed. Non-indigenous species represented between 3.6 % of all identified species in Bluff and 16.1 % in Whangarei Marina. NIS comprised 6.5 % of the total sampled diversity in the Port of Dunedin (Fig. 42b), ranking it ninth highest in percentage composition of NIS from the sixteen locations surveyed.

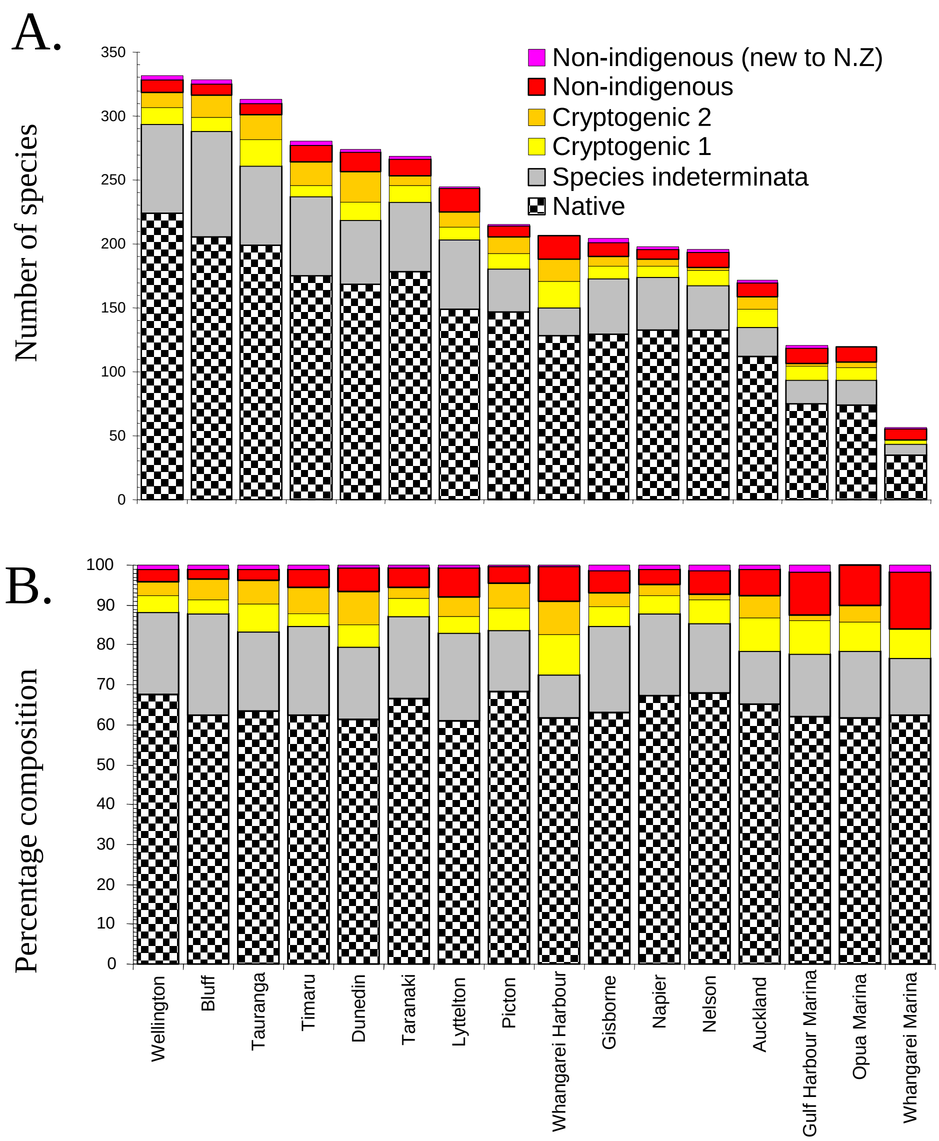

Figure 42: Differences in (a) the number of species, and (b) the relative proportions of non-indigenous, cryptogenic, species indeterminata and native categories among the sixteen locations sampled over the summers of 2001 – 2002, and 2002-2003. Locations are presented in order of decreasing species diversity sampled.

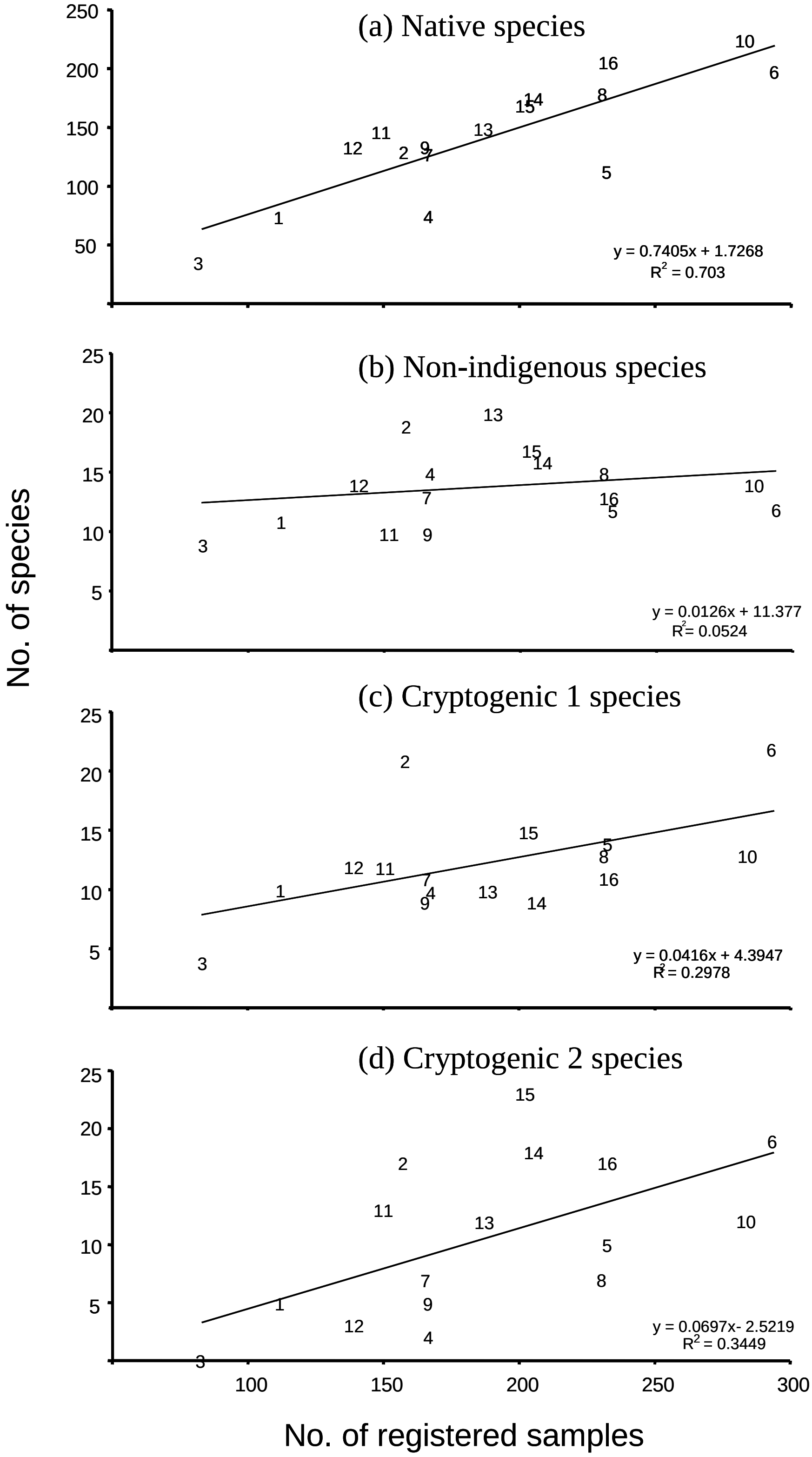

Figure 43: Linear regression equations relating numbers of species detected to sample effort at the 16 locations surveyed nation-wide. Location codes are as follows; 1 = Opua Marina, 2 = Whangarei Port, 3 = Whangarei Marina, 4 = Gulf Harbour Marina, 5 = Auckland Port, 6 = Tauranga Port, 7 = Gisborne Port, 8 = Taranaki Port, 9 = Napier Port, 10 = Wellington Port, 11 = Picton Port, 12 = Nelson Port, 13 = Lyttelton Port, 14 = Timaru Port, 15 = Dunedin Port, 16 = Bluff Port

Assessment of the risk of new introductions to the port

Many NIS introduced to New Zealand ports, through hull fouling, ships' sea chests, or ballast water, do not survive to establish self-sustaining local populations. Those that do, 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).

Compared to other New Zealand commercial ports, Dunedin Port receives only a minor amount of commercial shipping. In both 1999 and 2002/2003, Dunedin (Port Otago and Port Chalmers combined) received a total of 36 commercial vessels that came directly from overseas (Inglis 2001; New Zealand Customs Service, unpublished data). Commercial shipping arriving in the port of Dunedin from overseas comes predominantly from temperate regions of Australia (78 % of all arrivals in 2002/2003) and the north west Pacific (11 %; in particular Japan, Korea and China); environments which are broadly compatible with those in Otago Harbour. Port Chalmers has a high trade volume of bulk cargoes, in particular logs, timber and forestry products, and containers. The Port of Otago deals with a different range of cargoes, in particular fertiliser (Ravensbourne Wharf), bulk petroleum products and liquid petroleum gas (LPG). The Port of Dunedin is mainly an export facility. In both 1999 and 2000, approximately 830,000 tonnes of goods were loaded at Port Chalmers. This is reflected in the relatively high volume of ballast water (given the small number of vessel arrivals) that is discharged in Dunedin Harbour. In 1999, the Port of Dunedin received 33,364 m^3 of reported ballast discharge. On a national scale, this is not a large volume (ranking 8^{th} highest out of 15 ports). Discharged ballast water originates predominantly from Japan (56 %), Taiwan (23 %) and Australia (6 %). Shipping from these regions presents an on-going risk of introduction of new NIS to Otago Harbour.

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

Dunedin is connected directly to the ports of Bluff, Timaru, Lyttelton and Napier by regular coastal shipping and, indirectly, to most other domestic ports throughout mainland New Zealand and the Chatham Islands (Dodgshun et al 2004). Although many of the non-indigenous species found in the Dunedin survey have been recorded previously in New Zealand, there were two notable exceptions. The annelid *Spirobranchus polytrema* was first described from New Zealand waters during these port surveys, and was found to be present in Dunedin, Wellington and Napier. Little is currently known about this species; however, in the ports where it was encountered it may be competing with native fauna for space, food or other limiting resources. The sponge *Leucosolenia* cf. *discoveryi* was also unknown from New Zealand waters prior to the surveys, but has now been discovered in the ports of Bluff and Dunedin. There is no information on the risks posed by this species to New Zealand's native ecosystems and species. However, it is common in Antarctica and Australian Sub-antarctic Islands, and Bluff and Dunedin represent the northernmost locations where the species has so far been encountered.

The highly invasive alga, *Undaria pinnatifida*, has been present in Dunedin for more than a decade. It has been spread through shipping and other vectors to 11 of the 16 ports and marinas surveyed during the baseline surveys (the exceptions being Opua, Whangarei Port and Marina, Gulf Harbour Marina, Tauranga Port), although a control programme in Bluff Harbour has subsequently removed populations established there. Nevertheless, vessels departing from Dunedin after having spent time at berth within the port may pose a significant risk of spreading this species to ports within New Zealand that remain uninfested. The risk of translocation of *U. pinnatifida* and other fouling species is highest for slow-moving vessels, such as yachts and barges, and vessels that have long residence times in port. In Port Otago and Port Chalmers, dredge vessels, barges, recreational craft, and seasonal fishing vessels that are laid up for significant periods of time pose a particular risk for the spread of these species. Cruise liners and fishing vessels depart regularly from Dunedin Harbour for Fiordland, the Chatham and Sub-antarctic Islands. These environments are valued for their unique natural values and marine biodiversity. *U. pinnatifida* and many of the other NIS recorded in this survey are not known to be present in these areas and there is a real threat that they may be spread to them through shipping and other vectors.

Management of existing non-indigenous species in the port

The NIS detected during this survey were generally more prevalent in Port Otago than in Port Chalmers. Out of 18 NIS encountered, nine occurred exclusively in Port Otago, six were found in both parts of the harbour, and only three were encountered exclusively in Port Chalmers. In some instances, this may be caused by the environmental differences between the two locations, or may reflect the greater sampling effort with Port Otago (i.e. three berths were sampled compared with two at Port Chalmers). The amphipod *Apocorophium acutum*, for example, prefers estuarine and brackish water conditions (refer to section 3.3.7), and was encountered only in Port Otago sites (estuarine and brackish water) and not around Port Chalmers (clear, more oceanic water). Ten of the 18 NIS detected in this survey were encountered in more than one sampling location. Eight species - *S. polytrema, P. hoplura, C. pallasiana, C. gigas, C. multifida, P. subtilissima, C. affinis* and *H. dujardini* – were encountered in only a single sampling location. Six of these were only encountered in one single sample, while the sponge *H. dujardini* and the bryozoan *C. pallasiana* occurred in five and two samples, respectively. It is therefore unclear whether viable populations of the eight species mentioned above have established in Dunedin. 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. Many of the species recorded in Dunedin are widespread and local population controls are unlikely to be effective. Management should be directed toward preventing spread of species established in Otago Harbour to locations where they do not presently occur. This may be particularly relevant to species found only in the Port of Dunedin such as the alga *Champia affinis*, which was not detected in any other port or marina surveyed nationwide, and to species such as *Undaria pinnatifida*, which are known to be invasive and have impacts on native flora and fauna. Such management will require better understanding of the frequency of movements by vessels of different types from Dunedin to other domestic and international locations and improved procedures for hull maintenance and domestic ballast transfer by vessels leaving this port.

Prevention of new introductions

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

2016 all merchant vessels will be required to meet discharge standards for ballast water that are stipulated within the agreement.

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

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

Conclusions and recommendations

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

The predominance of hull fouling as a likely introduction vector for NIS encountered in the Port of Dunedin (probably responsible for 83 % of the NIS introductions) is consistent with previous findings from a range of overseas locations. For instance, Hewitt et al (1999) attributed the introduction of 77 % of the 99 NIS encountered in Port Phillip Bay (Australia) to hull fouling, and only 20 % to ballast water. Similarly, 61 % of the 348 marine and brackish water NIS established in the Hawaiian Islands are thought to have arrived on ships' hulls, but only 5 % in ballast water (Eldredge and Carlton 2002). However, ballast water is thought to be responsible for the introduction of 30 % of the 212 marine NIS established in San Fransisco Bay (USA), compared to 34 % for hull fouling (Cohen and Carlton 1995). The high percentages of NIS thought to have been introduced by hull fouling in Australasia may reflect the fact that hull fouling has a far longer history (~200 years) as an introduction vector than ballast water (~40 years) (Hewitt et al 1999). However, the fact that some of New Zealand and Australia's most recent marine NIS introductions (e.g. *Undaria pinnatifida*, *Codium fragile sp. tomentosoides*) have been facilitated by hull fouling suggests that it has remained an important transport mechanism (Cranfield et al 1998; Hewitt et al 1999).

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

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Tables

Table 1a: Berthage facilities in Port Chalmers.

Berth	Berth No.	Purpose	Construction	Length of Berth (m)	Depth (m below chart datum)
George Street Berth	Inner	Container facilities	Concrete deck/steel piles	304	12.5
George Street Berth	Outer	Container facilities	Concrete deck/steel piles	296	12.5
Beach Street Forestry Berth		Logs, timber and forestry products, container vessels	Concrete deck/concrete casings	412	12.5

Table 1b: Berthage facilities in Port of Otago.

Berth	Berth No.	Purpose	Construction	Length of Berth (m)	Depth (m below chart datum)
Ravensbourne Fertiliser Pier		Fertiliser discharge	Wood + concrete deck/wood piles Berthing concrete beam/steel piles	149	8
Oil jetty		Bulk petroleum products	Concrete deck/wood piles	219	8
LPG Berth		LPG discharge facility	Concrete deck/wood piles	150	5.5
Leith Wharf		Conventional and roll on-roll off vessels	Wood + concrete deck/wood piles Berthing concrete beam/steel piles	152	7.7
Victoria Wharf	T & U	Conventional vessels	Concrete deck/steel sheet piling + concrete	183	8
Victoria Wharf	X & Y	Fishing vessels and lay-up	Wood + concrete deck/wood piles	250	8
Rattray Wharf		Fishing vessels and lay-up	Wood deck/wood piles	426	5
Birch Street Wharf		Fishing vessels and lay-up	Wood + concrete deck/wood piles	310	6

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	

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

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

Sample method	Number of shipping berths sampled	Number of replicate samples taken
Benthic Sled Tows	5	10
Benthic Grab (Shipek)	5	15
Box traps	5	20
Diver quadrat scraping	5	75
Boat Hull inspection	1 vessel	2
Opera house fish traps	5	20
Starfish traps	5	20
Shrimp traps	5	18
Javelin cores	N/A	9

[a] indicates shipping berths and additional locations within the Port

Table 3b: Pile scraping sampling effort in the Port of Dunedin. 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	6 concrete, 4 wood	4 concrete, 6 wood
1.5	6 concrete, 4 wood	4 concrete, 6 wood
3.5	6 concrete, 4 wood	4 concrete, 5 wood
7	6 concrete, 1 wood	2 concrete
Miscellaneous	4 concrete, 2 wood	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 grabs	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 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 Dunedin survey.

Phylum, Class	Order	Family	Genus and species
Annelida			
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea australiensis*
Polychaeta	Eunicida	Eunicidae	*Eunice australis*
Polychaeta	Eunicida	Eunicidae	*Marphysa capensis*
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris sphaerocephala*
Polychaeta	Phyllodocida	Glyceridae	*Glycera lamelliformis*
Polychaeta	Phyllodocida	Goniadidae	*Glycinde dorsalis*
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus angustifrons*
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus macroura*
Polychaeta	Phyllodocida	Nereididae	*Nereis falcaria*
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia microphylla*
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe macrolepidota*
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus jacksoni*
Polychaeta	Phyllodocida	Syllidae	*Haplosyllis spongicola*
Polychaeta	Sabellida	Sabellidae	*Branchiomma curta*
Polychaeta	Sabellida	Sabellidae	*Megalomma suspiciens*
Polychaeta	Sabellida	Serpulidae	*Galeolaria hystrix*
Polychaeta	Sabellida	Serpulidae	*Neovermilia sphaeropomatus*
Polychaeta	Scolecida	Capitellidae	*Heteromastus filiformis*
Polychaeta	Scolecida	Orbiniidae	*Scoloplos simplex*
Polychaeta	Spionida	Spionidae	*Boccardia lamellata*
Polychaeta	Spionida	Spionidae	*Boccardia syrtis*
Polychaeta	Spionida	Spionidae	*Prionospio aucklandica*
Polychaeta	Spionida	Spionidae	*Scolecolepides benhami*
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris nuchalis*
Polychaeta	Terebellida	Cirratulidae	*Timarete anchylochaetus*
Polychaeta	Terebellida	Pectinariidae	*Pectinaria australis*
Polychaeta	Terebellida	Terebellidae	*Nicolea maxima*
Polychaeta	Terebellida	Terebellidae	*Streblosoma toddae*
Bryozoa			
Gymnolaemata	Cheilostomata	Candidae	*Caberea rostrata*
Gymnolaemata	Cheilostomata	Candidae	*Caberea zelandica*
Gymnolaemata	Cheilostomata	Candidae	*Scrupocellaria ornithorhyncus*
Gymnolaemata	Cheilostomata	Celleporidae	*Celleporina proximalis*
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella delta*
Gymnolaemata	Cheilostomata	Microporellidae	*Calloporina angustipora*
Gymnolaemata	Cheilostomata	Microporellidae	*Fenestrulina disjuncta*
Gymnolaemata	Cheilostomata	Microporellidae	*Fenestrulina thyreophora*

Phylum, Class	Order	Family	Genus and species
Gymnolaemata	Cheilostomata	Romancheinidae	*Exochella armata*
Chelicerata			
Pycnogonida	Pantopoda	Ammotheidae	*Callipallene novaezealandiae*
Cnidaria			
Hydrozoa	Hydroida	Haleciidae	*Halecium corrugatissimum*
Hydrozoa	Hydroida	Plumulariidae	*Monotheca flexuosa*
Hydrozoa	Hydroida	Plumulariidae	*Plumularia spirocladia*
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia bispinosa*
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia fasciculata*
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia minima*
Hydrozoa	Hydroida	Sertulariidae	*Sertularella robusta*
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus johnstoni*
Crustacea			
Cirripedia	Thoracica	Balanidae	*Austrominius modestus*
Cirripedia	Thoracica	Balanidae	*Notomegabalanus decorus*
Cirripedia	Thoracica	Pachylasmidae	*Epopella plicata*
Malacostraca	Amphipoda	Amaryllidae	*Amaryllis macrophthalma*
Malacostraca	Amphipoda	Aoridae	*Aora typica*
Malacostraca	Amphipoda	Aoridae	*Haplocheira barbimana*
Malacostraca	Amphipoda	Colomastigidae	*Colomastix subcastellata*
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine pacifica*
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa frequens*
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe trailli*
Malacostraca	Amphipoda	Lysianassidae	*Acontiostoma tuberculata*
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia dabita*
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia vesca*
Malacostraca	Amphipoda	Melitidae	*Mallacoota subcarinata*
Malacostraca	Amphipoda	Phoxocephalidae	*Torridoharpinia hurleyi*
Malacostraca	Amphipoda	Phtisicidae	*Caprellina longicollis*
Malacostraca	Amphipoda	Podoceridae	*Podocerus cristatus*
Malacostraca	Anomura	Paguidae	*Pagurus traversi*
Malacostraca	Anomura	Porcellanidae	*Petrolisthes novaezelandiae*
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus cookii*
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus varius*
Malacostraca	Brachyura	Majidae	*Notomithrax minor*
Malacostraca	Brachyura	Majidae	*Notomithrax peronii*
Malacostraca	Brachyura	Majidae	*Notomithrax ursus*

Phylum, Class	Order	Family	Genus and species
Malacostraca	Brachyura	Ocypodidae	*Macrophthalmus hirtipes*
Malacostraca	Brachyura	Portunidae	*Nectocarcinus antarcticus*
Malacostraca	Brachyura	Portunidae	*Nectocarcinus integrifrons*
Malacostraca	Caridea	Crangonidae	*Nauticaris marionis*
Malacostraca	Caridea	Crangonidae	*Pontophilus australis*
Malacostraca	Caridea	Palemonidae	*Periclimenes yaldwyni*
Malacostraca	Isopoda	Cirolanidae	*Natatolana rossi*
Malacostraca	Isopoda	Sphaeromatidae	*Cilicaea canaliculata*
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma campbellensis*
Echinodermata			
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias muricata*
Asteroidea	Valvatida	Asterinidae	*Patiriella regularis*
Ophiuroidea	Ophiurida	Ophionereididae	*Ophionereis fasciata*
Ophiuroidea	Phrynophiurida	Ophiomyxidae	*Ophiomyxa brevirima*
Mollusca			
Bivalvia	Myoida	Hiatellidae	*Hiatella arctica*
Bivalvia	Mytiloida	Mytilidae	*Aulacomya maoriana*
Bivalvia	Mytiloida	Mytilidae	*Modiolarca impacta*
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus pulex*
Bivalvia	Ostreoida	Ostreidae	*Ostrea chilensis*
Bivalvia	Pterioida	Pectinidae	*Talochlamys zelandiae*
Bivalvia	Veneroida	Cardiidae	*Pratulum pulchellum*
Bivalvia	Veneroida	Kelliidae	*Kellia cycladiformis*
Bivalvia	Veneroida	Lasaeidae	*Lasaea hinemoa*
Bivalvia	Veneroida	Semelidae	*Leptomya retiaria*
Bivalvia	Veneroida	Tellinidae	*Pseudarcopagia disculus*
Bivalvia	Veneroida	Veneridae	*Austrovenus stutchburyi*
Bivalvia	Veneroida	Veneridae	*Tawera spissa*
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria australis*
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella novaezelandiae*
Gastropoda	Littorinimorpha	Littorinidae	*Risellopsis varia*
Gastropoda	Neogastropoda	Muricidae	*Xymene plebeius*
Gastropoda	Neotaenioglossa	Velutinidae	*Lamellaria cerebroides*
Gastropoda	Notaspidea	Pleurobranchidae	*Berthella medietas*
Gastropoda	Nudibranchia	Chromodorididae	*Chromodoris aureomarginata*
Gastropoda	Nudibranchia	Dorididae	*Archidoris wellingtonensis*
Gastropoda	Nudibranchia	Dorididae	*Atagema carinata*
Gastropoda	Patellogastropoda	Nacellidae	*Cellana ornata*

Phylum, Class	Order	Family	Genus and species
Gastropoda	Systellomatophora	Onchidiidae	*Onchidella nigricans*
Gastropoda	Vetigastropoda	Trochidae	*Micrelenchus huttonii*
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona violacea*
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona zelandica*
Polyplacophora	Ischnochitonina	Chitonidae	*Onithochiton neglectus*
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton pelliserpentis*
Phycophyta			
Bryopsidophyceae	Bryopsidales	Codiaceae	*Codium dichotomum*
Bryopsidophyceae	Bryopsidales	Codiaceae	*Codium fragile ssp. novae-zelandiae*
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora crinalis*
Rhodophyceae	Ceramiales	Ceramiaceae	*Anotrichium crinitum*
Rhodophyceae	Ceramiales	Ceramiaceae	*Lophothamnion hirtum*
Rhodophyceae	Ceramiales	Ceramiaceae	*Mediothamnion lyallii*
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme denticulata*
Rhodophyceae	Ceramiales	Deleseriaceae	*Phycodrys quercifolia*
Rhodophyceae	Ceramiales	Deleseriaceae	*Schizoseris griffithsia*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Adamsiella chauvinii*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia harveyi*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Brongniartella australis*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia decipiens*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia strictissima*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Stictosiphonia vaga*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Streblocladia glomerulata*
Rhodophyceae	Gelidiales	Gelidiaceae	*Capreolia implexa*
Rhodophyceae	Gigartinales	Gigartinaceae	*Sarcothalia circumcincta*
Rhodophyceae	Gigartinales	Gigartinaceae	*Sarcothalia livida*
Rhodophyceae	Gracilariales	Gracilariceae	*Gracilaria truncata*
Rhodophyceae	Plocamiales	Plocamiaceae	*Plocamium leptophyllum*
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia obtusa*
Ulvophyceae	Ulvales	Ulvaceae	*Ulva spathulata*
Porifera			
Demospongiae	Dictyoceratida	Irciniidae	*Ircinia akaroa*
Demospongiae	Hadromerida	Suberitidae	*Suberites cf. affinis*
Demospongiae	Halichondrida	Axinellidae	*Pseudaxinella australis*
Demospongiae	Halichondrida	Halichondriidae	*Halichondria punctata*
Demospongiae	Halichondrida	Halichondriidae	*Vosmaeria torquata*
Demospongiae	Poecilosclerida	Crellidae	*Crella (Pytheas) affinis*
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas cf. anchorata*

Phylum, Class	Order	Family	Genus and species
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas fulva*
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia) hentscheli*
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia) tasmani*
Pyrrophycophyta			
Dinophyceae	Gymnodiniales	Gymnodiniacea	*Cochlodinium sp.*
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium conicum cf. conicoides*
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium sp.*
Dinophyceae	Peridiniales	Peridiniaceae	*Scrippsiella trochoidea*
Urochordata			
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum notti*
Ascidiacea	Aplousobranchia	Holozoidae	*Hypsistozoa fasmeriana*
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium adamsi*
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium knoxi*
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula mortenseni*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura cancellata*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura lutea*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura pachydermatina*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura picta*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura pulla*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura rugata*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura spinosissima*
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa bicornuta*
Vertebrata			
Actinopterygii	Gadiformes	Moridae	*Lotella rhacinus*
Actinopterygii	Mugiliformes	Mugilidae	*Aldrichetta forsteri*
Actinopterygii	Mugiliformes	Mugilidae	*Parapercis colias*
Actinopterygii	Perciformes	Cheilodactylidae	*Nemadactylus macropterus*
Actinopterygii	Perciformes	Labridae	*Notolabrus celidotus*
Actinopterygii	Perciformes	Labridae	*Notolabrus miles*
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina capito*

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

Phylum, Class	Order	Family	Genus and species	
Bryozoa				
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia ambigua*	C1
Cnidaria				
Hydrozoa	Hydroida	Bougainvilliidae	*Bougainvillia muscus*	C1
Hydrozoa	Hydroida	Haleciidae	*Halecium delicatulum*	C1
Hydrozoa	Hydroida	Plumulariidae	*Plumularia setacea*	C1
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia operculata*	C1
Crustacea				
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe sp. 1*	C2
Mollusca				
Bivalvia	Mytiloida	Mytilidae	*Mytilus galloprovincialis*	C1
Porifera				
Demospongiae	Dendroceratida	Darwinellidae	*Darwinella cf. gardineri*	C1
Demospongiae	Dictyoceratida	Dysideidae	*Dysidea n. sp. 1*	C2
Demospongiae	Dictyoceratida	Dysideidae	*Dysidea n. sp. 4*	C2
Demospongiae	Dictyoceratida	Dysideidae	*Dysidea n. sp. 5*	C2
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia n. sp. 4*	C2
Demospongiae	Halichondrida	Halichondriidae	*Halichondria n. sp. 2*	C2
Demospongiae	Halichondrida	Halichondriidae	*Halichondria n. sp. 7*	C2
Demospongiae	Halichondrida	Halichondriidae	*Halichondria n. sp. 8*	C2
Demospongiae	Halichondrida	Halichondriidae	*Halichondria panicea*	C1

Phylum, Class	Order	Family	Genus and species	
Demospongiae	Halichondrida	Halichondriidae	*Hymeniacidon n. sp. 1*	C2
Demospongiae	Halisarcida	Halisarcidae	*Halisarca n. sp. 1*	C2
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia diffusa*	C1
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia n. sp. 4*	C2
Demospongiae	Haplosclerida	Chalinidae	*Haliclona n. sp. 2*	C2
Demospongiae	Haplosclerida	Chalinidae	*Haliclona n. sp. 3*	C2
Demospongiae	Haplosclerida	Chalinidae	*Haliclona n. sp. 11*	C2
Demospongiae	Haplosclerida	Chalinidae	*Haliclona n. sp. 12*	C2
Demospongiae	Haplosclerida	Chalinidae	*Haliclona n. sp. 13*	C2
Demospongiae	Haplosclerida	Chalinidae	*Haliclona n. sp. 14*	C2
Demospongiae	Haplosclerida	Chalinidae	*Haliclona n. sp. 15*	C2
Demospongiae	Poecilosclerida	Ancinoiidae	*Crella (Pytheas) incrustans*	C1
Demospongiae	Poecilosclerida	Chondropsiidae	*Chondropsis n. sp. 1*	C2
Demospongiae	Poecilosclerida	Microcionidae	*Dictyociona cf. atoxa*	C2
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia) n. sp. 1*	C2
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia) n. sp. 2*	C2
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella n. sp. 1*	C2
Urochordata				
Ascidiacea	Aplousobranchia	Didemnidae	*Diplosoma listerianum*	C1
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium phortax*	C1
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella eumyota*	C1
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes leachii*	C1
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa cerea*	C1

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

Phylum, Class	Order	Family	Genus and species	Probable means of introduction	Date of introduction or detection (d)
Annelida					
Polychaeta	Sabellida	Serpulidae	*Spirobranchus polytrema* **(NR)**	H	Nov. 2001 [d]
Polychaeta	Spionida	Spionidae	*Polydora hoplura*	H	Unknown [1]
Bryozoa					
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula flabellata*	H	Pre-1949
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula neritina*	H	1949
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula pallasiana*	H	1890s
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora subtorquata*	H or B	Pre-1982
Crustacea					
Malacostraca	Amphipoda	Corophiidae	*Apocorophium acutum*	H	Pre-1921
Malacostraca	Amphipoda	Corophiidae	*Monocorophium acherusicum*	H	Pre-1921
Malacostraca	Amphipoda	Ischyroceridae	*Jassa marmorata*	H	Unknown [1]
Mollusca					
Bivalvia	Ostreoida	Ostreidae	*Crassostrea gigas*	H	1961
Phycophyta					
Phaeophyceae	Cutleriales	Cutleriaceae	*Cutleria multifida*	H	Pre-1870
Phaeophyceae	Laminariales	Alariaceae	*Undaria pinnatifida*	H or B	Pre-1987
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia brodiaei*	H	Pre-1940
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia subtilissima*	H	Pre-1974
Rhodophyceae	Rhodymeniales	Champiaceae	*Champia affinis*	H	Pre-1855
Porifera					
Calcarea	Leucosolenida	Heteropiidae	*Grantessa intusarticulata*	H	Unknown [1]
Calcarea	Leucosolenida	Leucosoleniidae	*Leucosolenia* cf. *discoveryi* **(NR)**	H	Feb. 2003 [d]
Demospongiae	Halisarcida	Halisarcidae	*Halisarca dujardini*	H or B	Pre-1973

[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 Dunedin survey. This group includes: (1) organisms that were damaged or juvenile and lacked cruical 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	Phyllodocida	Nereididae	*Perinereis Perinereis-A*
Polychaeta	Phyllodocida	Nereididae	*Platynereis Platynereis_australis_group*
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia Eulalia-NIWA-2*
Polychaeta	Phyllodocida	Syllidae	*Syllidae Indet*
Polychaeta	Phyllodocida	Syllidae	*Typosyllis Typosyllis-B*
Polychaeta	Sabellida	Serpulidae	*Serpula Serpula-C*
Polychaeta	Spionida	Spionidae	*Boccardia Indet*
Polychaeta	Terebellida	Cirratulidae	*Chaetozone Indet*
Polychaeta	Terebellida	Terebellidae	*Terebella Terebella-B*
Polychaeta	Terebellida	Terebellidae	*Terebellidae Indet*
Bryozoa			
Gymnolaemata	Cheilostomata	Bitectiporidae	*Schizosmittina sp.*
Stenolaemata	Cyclostomata	Tubuliporidae	*Tubulipora sp.*
Cnidaria			
Anthozoa	Actiniaria	Acontiophoridae	*Mimetridium sp.*
Hydrozoa	Hydroida	Campanulariidae	*Obelia sp. 1*
Hydrozoa	Hydroida	Plumulariidae	*Plumularia sp.*
Crustacea			
Malacostraca	Amphipoda	Aoridae	*Aoridae sp.*
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis sp. 1*
Malacostraca	Brachyura	Majidae	*Notomithrax sp.*
Malacostraca	Caridea	Palemonidae	*?Palaemon affinis*
Malacostraca	Tanaidacea	Nototanaidae	*Teleotanais sp.*
Mollusca			
Bivalvia	Nuculoida	Nuculidae	*Nucula sp.*
Gastropoda	Neogastropoda	Turridae	*Neoguraleus sp.*
Gastropoda	Nudibranchia	Dorididae	*Aphelodoris sp.*

Phylum, Class	Order	Family	Genus and species
Phycophyta			
Alismatidae	Najadales	Zosteraceae	*Zostera sp.*
Bryopsidophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis sp.*
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora sp.*
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora congesta?*
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora sp.*
Rhodophyceae	Ceramiales	Ceramiaceae	*Antithamnion sp.*
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium sp.*
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia sp.*
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia? sp.*
Rhodophyceae	Ceramiales	Deleseriaceae	*Hymenena sp.*
Rhodophyceae	Ceramiales	Deleseriaceae	*Hymenena? sp.*
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesseriaceae sp.*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia sp.*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Echinothamnion? sp.*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia sp.*
Rhodophyceae	Gigartinales	Gigartinaceae	*Gigartina/Sarcothalia? sp.*
Rhodophyceae	Halymeniales	Halymeniaceae	*Cryptonemia sp.*
Rhodophyceae	Plocamiales	Plocamiaceae	*Plocamium sp.*
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia linearis?*
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia sp.*
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha sp.*
Ulvophyceae	Ulvales	Ulvaceae	*Ulva sp.*
Urochordata			
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum sp.*
Vertebrata			
Actinopterygii	Perciformes	Labridae	*Labridae sp.*
Actinopterygii	Perciformes	Tripterygiidae	*Ruanoho sp.*
Actinopterygii	Perciformes	Tripterygiidae	*Tripterygiidae sp.*
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina sp.*

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

Non-indigenous species	Capture technique	Locations detected in Dunedin Harbour	Detected in other locations surveyed in ZBS2000_04
Spirobranchus polytrema	Benthic sled	Container & Cruise Ship Berth Port Chalmers, Fig 18	Napier, Wellington
Polydora hoplura	Pile scrape	Leith Wharf Port Otago, Fig 19	Nelson, Picton, Tauranga, Whangarei Harbour, Wellington
Bugula flabellata	Pile scrape	Container & Cruise Ship Berth; Beach St Wharf Port Chalmers, Fig 20 Leith Wharf; Rattray Wharf; Victoria Wharf Port Otago, Fig 21	Auckland, Bluff, Lyttleton, Napier, Nelson, Opua Marina, Picton, Taranaki, Tauranga, Timaru, Whangarei Harbour, Wellington
Bugula neritina	Pile scrape	Rattray Wharf Port Otago, Fig 22	Auckland, Gisborne, Gulf Harbour Marina, Lyttleton, Napier, Opua Marina, Taranaki, Tauranga, Timaru, Whangarei Harbour, Whangarei Marina
Cryptosula pallasiana	Pile scrape	Rattray Wharf Port Otago, Fig 23	Gisborne, Lyttleton, Nelson, Taranaki, Timaru, Whangarei Harbour, Wellington
Watersipora subtorquata	Pile scrape	Beach St Wharf Port Chalmers, Fig 24 Leith Wharf; Rattray Wharf; Victoria Wharf Port Otago, Fig 25	Bluff, Gisborne, Gulf Harbour Marina, Lyttleton, Napier, Nelson, Opua Marina, Picton, Taranaki, Tauranga, Timaru, Whangarei Harbour, Wellington
Apocorophium acutum	Pile scrape	Leith Wharf; Rattray Wharf; Victoria Wharf Port Otago, Fig 26	Gulf Harbour Marina, Lyttleton, Opua Marina, Tauranga, Timaru
Monocorophium acherusicum	Pile scrape	Leith Wharf; Rattray Wharf; Victoria Wharf Port Otago, Fig 27	Gisborne, Lyttleton, Tauranga, Timaru, Whangarei Marina
Jassa marmorata	Pile scrape	Leith Wharf; Rattray Wharf; Victoria Wharf Port Otago, Fig 28	None
Crassostrea gigas	Ship hull scrape	Rattray Wharf Port Otago, Fig 29	Auckland, Gulf Harbour Marina, Nelson, Opua Marina, Taranaki, Whangarei Harbour

Non-indigenous species	Capture technique	Locations detected in Dunedin Harbour	Detected in other locations surveyed in ZBS2000_04
Cutleria multifida	Benthic sled	Leith Wharf Port Otago, Fig 30	Gulf Harbour Marina
Undaria pinnatifida	Pile scrape	Container & Cruise Ship Berth; Beach St Wharf Port Chalmers, Fig 31 Leith Wharf; Rattray Wharf; Victoria Wharf Port Otago, Fig 32	Gisborne, Lyttleton, Napier, Picton, Timaru, Wellington
Polysiphonia brodiaei	Pile scrape, Benthic sled	Container & Cruise Ship Berth; Beach St Wharf Port Chalmers, Fig 33 Leith Wharf; Rattray Wharf; Victoria Wharf Port Otago, Fig 34	Bluff, Lyttleton
Polysiphonia subtilissima	Benthic sled	Beach St Wharf Port Chalmers, Fig 35	Lyttleton, Timaru
Champia affinis	Benthic sled	Container & Cruise Ship Berth Port Chalmers, Fig 36	None
Grantessa intusarticulata	Pile scrape	Container & Cruise Ship Berth; Beach St Wharf Port Chalmers, Fig 37 Leith Wharf; Rattray Wharf; Victoria Wharf Port Otago, Fig 38	Bluff
Leucosolenia cf. discoveryi	Pile scrape	Container & Cruise Ship Berth; Beach St Wharf Port Chalmers, Fig 39 Leith Wharf; Rattray Wharf; Victoria Wharf Port Otago, Fig 40	Bluff
Halisarca dujardini	Pile scrape	Beach St Wharf Port Chalmers, Fig 41	Auckland, Bluff, Picton, Taranaki, Wellington

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 mainmarine 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 (phylum Ulvophyceae), red algae (phylum Rhodophyceae) and brown algae (phylum Phaeophyceae). 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: Criteria for assigning non-indigenous status to species sampled from the Port of Dunedin.

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

Phylum and species	C1	C2	C3	C4	C5	C6	C7	C8	C9
Annelida									
Spirobranchus polytrema	+		+		+				+
Polydora hoplura			+		+	+	+	+	+
Bryozoa									
Bugula flabellate	+	+	+		+	+	+	+	+
Bugula neritina	+				+	+	+	+	+
Cryptosula pallasiana	+	+	+		+	+	+	+	+
Watersipora subtorquata	+	+	+		+	+	+	+	+
Crustacea									
Apocorophium acutum			+			+		+	+
Monocorophium acherusicum			+		+	+		+	+
Jassa marmorata	+		+					+	+
Mollusca									
Crassostrea gigas	+	+	+			+	+	+	+
Phycophyta									
Cutleria multifida	+	+			+	+	+	+	+
Undaria pinnatifida	+	+	+		+	+	+	+	+
Polysiphonia brodiaei	+	+	+		+	+	+	+	+
Polysiphonia subtilissima	+	+			+	+	+	+	+
Champia affinis						+	+	+	+
Porifera									
Grantessa intusarticulata	+		+		+		+	+	+
Leucosolenia cf. discoveryi	+		+		+	+		+	+
Halisarca dujardini	+		+	+		+	+	+	+

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 Dunedin

Terminal	Site	Eastings	Northings	NZ Latitude	NZ Longitude	Survey Method	No. of sample units
Port_Chalmers	BEACH	2325540	5485534	-45.81547	170.62818	BGRB	1
Port_Chalmers	BEACH	2325345	5485469	-45.81601	170.62565	BGRB	1
Port_Chalmers	BEACH	2325456	5485500	-45.81576	170.62708	BGRB	1
Port_Chalmers	BEACH	2325489	5485514	-45.81564	170.62751	BSLD	1
Port_Chalmers	BEACH	2325422	5485497	-45.81577	170.62665	BSLD	1
Port_Chalmers	BEACH	2325489	5485510	-45.81567	170.62751	CRBTP	2
Port_Chalmers	BEACH	2325449	5485500	-45.81576	170.62700	CRBTP	2
Port_Chalmers	BEACH	2325352	5485590	-45.81492	170.62578	CYST	1
Port_Chalmers	BEACH	2325515	5485518	-45.81561	170.62785	FSHTP	2
Port_Chalmers	BEACH	2325425	5485486	-45.81587	170.62668	FSHTP	2
Port_Chalmers	BEACH	2325497	5485512	-45.81566	170.62761	PSC	18
Port_Chalmers	BEACH	2325345	5485469	-45.81601	170.62565	SEDIMENT	3
Port_Chalmers	BEACH	2325489	5485510	-45.81567	170.62751	SHRTP	2
Port_Chalmers	BEACH	2325449	5485500	-45.81576	170.62700	SHRTP	2
Port_Chalmers	BEACH	2325489	5485510	-45.81567	170.62751	STFTP	2
Port_Chalmers	BEACH	2325449	5485500	-45.81576	170.62700	STFTP	2
Port_Chalmers	CONTAINER	2325383	5485694	-45.81399	170.62621	BGRB	1
Port_Chalmers	CONTAINER	2325308	5485596	-45.81486	170.62521	BGRB	1
Port_Chalmers	CONTAINER	2325247	5485566	-45.81511	170.62443	BGRB	1
Port_Chalmers	CONTAINER	2325327	5485571	-45.81509	170.62545	BSLD	1
Port_Chalmers	CONTAINER	2325301	5485544	-45.81532	170.62511	BSLD	1
Port_Chalmers	CONTAINER	2325275	5485600	-45.81481	170.62479	CRBTP	2
Port_Chalmers	CONTAINER	2325237	5485564	-45.81513	170.62429	CRBTP	2
Port_Chalmers	CONTAINER	2325352	5485590	-45.81492	170.62578	CYST	2
Port_Chalmers	CONTAINER	2325345	5485653	-45.81436	170.62571	FSHTP	2
Port_Chalmers	CONTAINER	2325265	5485569	-45.81509	170.62465	FSHTP	2
Port_Chalmers	CONTAINER	2325321	5485657	-45.81431	170.62541	PSC	16
Port_Chalmers	CONTAINER	2325383	5485694	-45.81399	170.62621	SEDIMENT	3
Port_Chalmers	CONTAINER	2325275	5485600	-45.81481	170.62479	SHRTP	2
Port_Chalmers	CONTAINER	2325237	5485564	-45.81513	170.62429	SHRTP	2
Port_Chalmers	CONTAINER	2325275	5485600	-45.81481	170.62479	STFTP	2
Port_Chalmers	CONTAINER	2325237	5485564	-45.81513	170.62429	STFTP	2
Port_Otago	LEITH	2317571	5478594	-45.87581	170.52306	BGRB	1
Port_Otago	LEITH	2317508	5478591	-45.87582	170.52225	BGRB	1
Port_Otago	LEITH	2317571	5478594	-45.87581	170.52306	BGRB	1
Port_Otago	LEITH	2317572	5478605	-45.87570	170.52308	BSLD	1
Port_Otago	LEITH	2317562	5478603	-45.87572	170.52295	BSLD	1
Port_Otago	LEITH	2317546	5478594	-45.87580	170.52274	CRBTP	2
Port_Otago	LEITH	2317497	5478591	-45.87581	170.52211	CRBTP	2
Port_Otago	LEITH	2317547	5478599	-45.87575	170.52275	CYST	1
Port_Otago	LEITH	2317205	5478467	-45.87685	170.51830	CYST	1
Port_Otago	LEITH	2317582	5478594	-45.87581	170.52321	FSHTP	2
Port_Otago	LEITH	2317500	5478594	-45.87579	170.52214	FSHTP	2
Port_Otago	LEITH	2317547	5478586	-45.87587	170.52275	PSC	14
Port_Otago	LEITH	2317571	5478594	-45.87581	170.52306	SEDIMENT	3
Port_Otago	LEITH	2317546	5478594	-45.87580	170.52274	SHRTP	2
Port_Otago	LEITH	2317497	5478591	-45.87581	170.52211	SHRTP	2
Port_Otago	LEITH	2317546	5478594	-45.87580	170.52274	STFTP	2

Terminal	Site	Eastings	Northings	NZ Latitude	NZ Longitude	Survey Method	No. of sample units
Port_Otago	LEITH	2317497	5478591	-45.87581	170.52211	STFTP	2
Port_Otago	RATTRAY	2316716	5478025	-45.88070	170.51183	BGRB	1
Port_Otago	RATTRAY	2316681	5478020	-45.88073	170.51138	BGRB	1
Port_Otago	RATTRAY	2316681	5478020	-45.88073	170.51138	BGRB	1
Port_Otago	RATTRAY	2316639	5477994	-45.88095	170.51083	BSLD	1
Port_Otago	RATTRAY	2316467	5477994	-45.88091	170.50861	BSLD	1
Port_Otago	RATTRAY	2316685	5478025	-45.88069	170.51144	CRBTP	2
Port_Otago	RATTRAY	2316648	5478018	-45.88074	170.51096	CRBTP	2
Port_Otago	RATTRAY	2316704	5478026	-45.88069	170.51168	CYST	2
Port_Otago	RATTRAY	2316717	5478030	-45.88065	170.51185	FSHTP	2
Port_Otago	RATTRAY	2316649	5478018	-45.88074	170.51098	FSHTP	2
Port_Otago	RATTRAY	2316581	5478013	-45.88077	170.51009	HULL SC	2
Port_Otago	RATTRAY	2316581	5478013	-45.88077	170.51009	PSC	14
Port_Otago	RATTRAY	2316681	5478020	-45.88073	170.51138	SEDIMENT	3
Port_Otago	RATTRAY	2316685	5478025	-45.88069	170.51144	SHRTP	2
Port_Otago	RATTRAY	2316648	5478018	-45.88074	170.51096	SHRTP	2
Port_Otago	RATTRAY	2316685	5478025	-45.88069	170.51144	STFTP	2
Port_Otago	RATTRAY	2316648	5478018	-45.88074	170.51096	STFTP	2
Port_Otago	VIC XY	2316959	5478183	-45.87934	170.51502	BGRB	1
Port_Otago	VIC XY	2317067	5478309	-45.87824	170.51646	BGRB	1
Port_Otago	VIC XY	2317067	5478309	-45.87824	170.51646	BGRB	1
Port_Otago	VIC XY	2317176	5478445	-45.87704	170.51791	BSLD	1
Port_Otago	VIC XY	2317147	5478402	-45.87742	170.51753	BSLD	1
Port_Otago	VIC XY	2317059	5478310	-45.87822	170.51636	CRBTP	2
Port_Otago	VIC XY	2317003	5478255	-45.87870	170.51562	CRBTP	2
Port_Otago	VIC XY	2317205	5478467	-45.87685	170.51830	CYST	1
Port_Otago	VIC XY	2317163	5478427	-45.87720	170.51775	CYST	1
Port_Otago	VIC XY	2317061	5478322	-45.87812	170.51639	FSHTP	2
Port_Otago	VIC XY	2316982	5478236	-45.87887	170.51534	FSHTP	2
Port_Otago	VIC XY	2317014	5478280	-45.87848	170.51577	PSC	13
Port_Otago	VIC XY	2317067	5478309	-45.87824	170.51646	SEDIMENT	3
Port_Otago	VIC XY	2317059	5478310	-45.87822	170.51636	SHRTP	2
Port_Otago	VIC XY	2317003	5478255	-45.87870	170.51562	SHRTP	2
Port_Otago	VIC XY	2317059	5478310	-45.87822	170.51636	STFTP	2
Port_Otago	VIC XY	2317003	5478255	-45.87870	170.51562	STFTP	2

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

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

					Terminal	Port_Chalmers																
					Berth code	BEACH																
					Pile replicate	1								2								
					Pile position	IN				OUT				IN					OUT			
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	4	1	2	3	4	MISC	1	2	3	4	MISC
Actinopterygii	Perciformes	Tripterygiidae	*Tripterygiidae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Tripterygiidae	*Ruanoho*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*sp.*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alismatidae	Najadales	Zosteraceae	*Zostera*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Acontiophoridae	*Mimetridium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum*	*notti*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Diplosoma*	*listerianum*	C1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Holozoidae	*Hypsistozoa*	*fasmeriana*	N	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	0	1	1	1	0	0	1	1	0	1	0	1	0	0	1	0	1	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	1	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*knoxi*	N	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pachydermatina*	N	0	0	0	0	0	1	1	1	0	0	1	0	0	0	1	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pulla*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*lutea*	N	0	0	1	1	0	0	0	0	0	1	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
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*rugata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*spinosissima*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*picta*	N	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	1	0	1	1	1	0	1	1	1	0	0	0	1	1	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
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Modiolarca*	*impacta*	N	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0
Bivalvia	Mytiloida	Mytilidae	*Aulacomya*	*maoriana*	N	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Mytilus*	*galloprovincialis*	C1	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	0	0	0	0	0	0
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	1	1	0	0	0	0	1	0	1	0	1	0	0	1	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	1	0
Bivalvia	Veneroida	Kelliidae	*Kellia*	*cycladiformis*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Lasaeidae	*Lasaea*	*hinemoa*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Bryopsidophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calcarea	Leucosolenida	Heteropiidae	*Grantessa*	*intusarticulata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Calcarea	Leucosolenida	Leucosoleniidae	*Leucosolenia*	*cf. discoveryi*	A	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*novaezelandiae*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	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	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	1	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*peronii*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*ursus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Crangonidae	*Nauticaris*	*marionis*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	1	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1	0	0
Crustacea	Thoracica	Balanidae	*Notomegabalanus*	*decorus*	N	0	1	1	0	0	1	1	1	0	0	0	1	0	0	1	1	1	1
Crustacea	Thoracica	Pachylasmidae	*Epopella*	*plicata*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Demospongiae	Dendroceratida	Darwinellidae	*Darwinella*	*cf. gardineri (rust red with spongin triacts)*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Dysidea*	*n. sp. 1 (erect cactus)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Irciniidae	*Ircinia*	*akaroa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Hadromerida	Suberitidae	*Suberites*	*cf. affinis*	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	Port_Chalmers																	
				Berth code	BEACH																	
				Pile replicate		1										2						
				Pile position	IN					OUT				IN					OUT			
Demospongiae	Halichondrida	Axinellidae	*Pseudaxinella*	*australis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*n. sp. 8 (fingery turrets)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*n. sp. 7 (fingery Dunedin)*	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	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*punctata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Vosmaeria*	*torquata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halisarcida	Halisarcidae	*Halisarca*	*dujardini*	A	0	0	1	0	0	0	0	1	0	1	1	1	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
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*n. sp. 4 (plump smooth big oscules)*	C2	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*diffusa*	C1	0	0	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Crellidae	*Crella (Pytheas)*	*affinis*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas*	*cf. anchorata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas*	*fulva*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Demospongiae	Poecilosclerida	Microcionidae	*Dictyociona*	*cf. atoxa*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia)*	*hentscheli*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia)*	*tasmani*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria*	*australis*	N	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
Gastropoda	Littorinimorpha	Littorinidae	*Risellopsis*	*varia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Gastropoda	Neotaenioglossa	Velutinidae	*Lamellaria*	*cerebroides*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Gastropoda	Notaspidea	Pleurobranchidae	*Berthella*	*medietas*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Chromodoris*	*aureomarginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Aphelodoris*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Archidoris*	*wellingtonensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Atagema*	*carinata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Patellogastropoda	Nacellidae	*Cellana*	*ornata*	N	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
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	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	*Scrupocellaria*	*ornithorhyncus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*zelandica*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Celleporidae	*Celleporina*	*proximalis*	N	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella*	*delta*	N	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	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*sp.*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Haleciidae	*Halecium*	*delicatulum*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Haleciidae	*Halecium*	*corrrugatissimum*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*spirocladia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Monotheca*	*flexuosa*	N	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
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*fasciculata*	N	0	1	0	0	0	1	1	0	0	0	0	0	0	0	1	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
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*bispinosa*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*minima*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*johnstoni*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Amaryllidae	*Amaryllis*	*macrophthalma*	N	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	0	1	1	1	0	1	0	1	0	1	0	1	0	0	1	1	1	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*typica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Malacostraca	Amphipoda	Aoridae	*Aoridae*	*sp.*	SI	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	Port_Chalmers																	
				Berth code	BEACH																	
				Pile replicate		1								2								
				Pile position	IN					OUT				IN					OUT			
Malacostraca	Amphipoda	Colomastigidae	*Colomastix*	*subcastellata*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Apocorophium*	*acutum*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*acherusicum*	A	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
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*sp. 1*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*marmorata*	A	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*trailli*	N	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*sp. 1*	C2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*vesca*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Acontiostoma*	*tuberculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Melitidae	*Mallacoota*	*subcarinata*	N	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0
Malacostraca	Amphipoda	Phtisicidae	*Caprellina*	*longicollis*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*cristatus*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Cilicaea*	*canaliculata*	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	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Malacostraca	Tanaidacea	Tanaidae	*Zeuxoides*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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*	*capensis*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*sphaerocephala*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	1	1	1	0	0	1	0	0	1	0	1	0	0	0	0	1	0
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*Perinereis-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*Eulalia-NIWA-2*	SI	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*microphylla*	N	0	0	0	0	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	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*jacksoni*	N	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis*	*Typosyllis-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Polychaeta	Phyllodocida	Syllidae	*Syllidae*	*Indet*	SI	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Haplosyllis*	*spongicola*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*curta*	N	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
Polychaeta	Sabellida	Serpulidae	*Galeolaria*	*hystrix*	N	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0
Polychaeta	Sabellida	Serpulidae	*Neovermilia*	*sphaeropomatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*lamellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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
Polychaeta	Terebellida	Cirratulidae	*Chaetozone*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	1	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	1	0	0	0
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*maxima*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebella*	*Terebella-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebellidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona*	*zelandica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona*	*violacea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton*	*pelliserpentis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Ischnochitonina	Chitonidae	*Onithochiton*	*neglectus*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Pycnogonida	Pantopoda	Callipallenidae	*Callipallene*	*novaezealandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Mediothamnion*	*lyallii*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Antithamnion*	*sp.*	SI	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	Port_Chalmers																	
					Berth code	BEACH																	
					Pile replicate	1								2									
					Pile position	IN				OUT				IN					OUT				
Rhodophyceae	Ceramiales	Ceramiaceae	*Lophothamnion*	*hirtum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Phycodrys*	*quercifolia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*denticulata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Schizoseris*	*griffithsia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Hymenena*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesseriaceae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*harveyi*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*brodiaei*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Adamsiella*	*chauvinii*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Echinothamnion*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Stictosiphonia*	*vaga*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gelidiales	Gelidiaceae	*Capreolia*	*implexa*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gigartinales	Gigartinaceae	*Gigartina*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Rhodophyceae	Gigartinales	Gigartinaceae	*Sarcothalia*	*circumcincta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Halymeniales	Halymeniaceae	*Cryptonemia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia*	*linearis*	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	0	1	0
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia*	*obtusa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*spathulata*	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																	Port_Otago
					Berth code	CONTAINER																LEITH
					Pile replicate	1								2								1
					Pile position	IN			OUT					IN			OUT					IN
Class	Orders	Family	Genus	Species	*Status	1	2	3	1	2	3	4	MISC	1	2	3	1	2	3	4	MISC	1
Actinopterygii	Perciformes	Tripterygiidae	*Tripterygiidae*	*sp.*	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Tripterygiidae	*Ruanoho*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*sp.*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alismatidae	Najadales	Zosteraceae	*Zostera*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Anthozoa	Actiniaria	Acontiophoridae	*Mimetridium*	*sp.*	SI	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum*	*notti*	N	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Diplosoma*	*listerianum*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Holozoidae	*Hypsistozoa*	*fasmeriana*	N	0	1	0	0	1	1	1	0	0	0	0	0	1	0	0	1	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*knoxi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	1	1	0	1	0	1	0	0	0	0	0	1	1	0	1	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pachydermatina*	N	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pulla*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*lutea*	N	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*rugata*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*spinosissima*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*picta*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	1	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	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	1	0	0	0	0	0	0	0	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	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
Bivalvia	Mytiloida	Mytilidae	*Modiolarca*	*impacta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Aulacomya*	*maoriana*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Mytilus*	*galloprovincialis*	C1	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	1	0	0	0	0	0	0	0	1
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	1	1	1	1	1	1	0	0	1	1	0	1	1	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
Bivalvia	Veneroida	Kelliidae	*Kellia*	*cycladiformis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Lasaeidae	*Lasaea*	*hinemoa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bryopsidophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calcarea	Leucosolenida	Heteropiidae	*Grantessa*	*intusarticulata*	A	0	1	1	0	1	0	0	1	0	1	0	0	1	0	0	0	0
Calcarea	Leucosolenida	Leucosoleniidae	*Leucosolenia*	*cf. discoveryi*	A	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	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
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	1	0	0	0	1	0	0	0	0	0	0	0	1	1	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
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	1	0	0	0	0	0	1	0	1	1	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*peronii*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*ursus*	N	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Crangonidae	*Nauticaris*	*marionis*	N	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	1	0	0	1	1	0	0	0	1	0	0	1	1	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
Crustacea	Thoracica	Pachylasmidae	*Epopella*	*plicata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dendroceratida	Darwinellidae	*Darwinella*	*cf. gardineri (rust red with spongin triacts)*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Dysidea*	*n. sp. 1 (erect cactus)*	C2	0	0	1	0	1	0	0	0	0	1	1	0	1	1	0	1	0
Demospongiae	Dictyoceratida	Irciniidae	*Ircinia*	*akaroa*	N	0	1	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0
Demospongiae	Hadromerida	Suberitidae	*Suberites*	*cf. affinis*	N	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																Port_Otago	
					Berth code	CONTAINER															LEITH	
					Pile replicate	1							2									1
					Pile position	IN			OUT				IN				OUT				IN	
Demospongiae	Halichondrida	Axinellidae	*Pseudaxinella*	*australis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*n. sp. 8 (fingery turrets)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*n. sp. 7 (fingery Dunedin)*	C2	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
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*punctata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Vosmaeria*	*torquata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halisarcida	Halisarcidae	*Halisarca*	*dujardini*	A	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	1	0	0	0	0	0	0	0	0	0	1	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	1	0
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia*	*diffusa*	C1	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
Demospongiae	Poecilosclerida	Crellidae	*Crella (Pytheas)*	*affinis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas*	*cf. anchorata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas*	*fulva*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Microcionidae	*Dictyociona*	*cf. atoxa*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia)*	*hentscheli*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia)*	*tasmani*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria*	*australis*	N	0	0	0	1	0	0	0	0	1	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
Gastropoda	Littorinimorpha	Littorinidae	*Risellopsis*	*varia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Neotaenioglossa	Velutinidae	*Lamellaria*	*cerebroides*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Notaspidea	Pleurobranchidae	*Berthella*	*medietas*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Chromodoris*	*aureomarginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Gastropoda	Nudibranchia	Dorididae	*Aphelodoris*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Gastropoda	Nudibranchia	Dorididae	*Archidoris*	*wellingtonensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Gastropoda	Nudibranchia	Dorididae	*Atagema*	*carinata*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Gastropoda	Patellogastropoda	Nacellidae	*Cellana*	*ornata*	N	0	0	0	0	0	0	0	0	0	0	0	1	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
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*rostrata*	N	0	1	1	0	1	0	1	0	0	1	1	0	1	1	0	1	0
Gymnolaemata	Cheilostomata	Candidae	*Scrupocellaria*	*ornithorhyncus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*zelandica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Celleporidae	*Celleporina*	*proximalis*	N	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
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella*	*delta*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia*	*ambigua*	C1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Haleciidae	*Halecium*	*delicatulum*	C1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Hydrozoa	Hydroida	Haleciidae	*Halecium*	*corrrugatissimum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*spirocladia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Monotheca*	*flexuosa*	N	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
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*fasciculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Sertularella*	*robusta*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*bispinosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*minima*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*johnstoni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Amaryllidae	*Amaryllis*	*macrophthalma*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	0	1	1	0	1	1	1	0	0	1	1	0	1	1	0	1	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*typica*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aoridae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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

					Terminal															Port_Otago	
					Berth code	CONTAINER														LEITH	
					Pile replicate	1							2								1
					Pile position	IN			OUT				IN				OUT				IN
Malacostraca	Amphipoda	Colomastigidae	*Colomastix*	*subcastellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Apocorophium*	*acutum*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*acherusicum*	A	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
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*sp. 1*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*marmorata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa*	*frequens*	N	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
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*sp. 1*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*vesca*	N	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Acontiostoma*	*tuberculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Malacostraca	Amphipoda	Melitidae	*Mallacoota*	*subcarinata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Phtisicidae	*Caprellina*	*longicollis*	N	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
Malacostraca	Isopoda	Sphaeromatidae	*Cilicaea*	*canaliculata*	N	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*campbellensis*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Tanaidacea	Tanaidae	*Zeuxoides*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Eunicida	Eunicidae	*Eunice*	*australis*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Eunicidae	*Marphysa*	*capensis*	N	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	1	0	0	1	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	1	1	0	1	1	1	0	0	1	1	0	1	1	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*Perinereis-A*	SI	0	0	0	0	0	0	0	0	1	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
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*microphylla*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*jacksoni*	N	0	1	0	0	1	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	1	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
Polychaeta	Phyllodocida	Syllidae	*Haplosyllis*	*spongicola*	N	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*curta*	N	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	1	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Galeolaria*	*hystrix*	N	0	1	1	0	1	0	1	0	0	1	1	0	1	1	0	0	0
Polychaeta	Sabellida	Serpulidae	*Neovermilia*	*sphaeropomatus*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*lamellata*	N	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
Polychaeta	Terebellida	Cirratulidae	*Chaetozone*	*Indet*	SI	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
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*maxima*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebella*	*Terebella-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebellidae*	*Indet*	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona*	*zelandica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona*	*violacea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton*	*pelliserpentis*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Polyplacophora	Ischnochitonina	Chitonidae	*Onithochiton*	*neglectus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pycnogonida	Pantopoda	Callipallenidae	*Callipallene*	*novaezealandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Mediothamnion*	*lyallii*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Antithamnion*	*sp.*	SI	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																Port_Otago	
					Berth code	CONTAINER															LEITH	
					Pile replicate	1							2									1
					Pile position	IN			OUT				IN				OUT				IN	
Rhodophyceae	Ceramiales	Ceramiaceae	*Lophothamnion*	*hirtum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Phycodrys*	*quercifolia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*denticulata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Schizoseris*	*griffithsia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Hymenena*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesseriaceae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*harveyi*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*brodiaei*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Adamsiella*	*chauvinii*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Echinothamnion*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Stictosiphonia*	*vaga*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gelidiales	Gelidiaceae	*Capreolia*	*implexa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gigartinales	Gigartinaceae	*Gigartina*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gigartinales	Gigartinaceae	*Sarcothalia*	*circumcincta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Halymeniales	Halymeniaceae	*Cryptonemia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia*	*linearis*	N	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	1	1	1	0	0	0	0	0	1	1	0	0	0
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia*	*obtusa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*spathulata*	N	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														RATTRAY						
					Pile replicate						12	2							1						
					Pile position	OUT						IN			OUT				IN			OUT			
Class	Orders	Family	Genus	Species	*Status	2	1	2	3	4	MISC	1	2	3	1	2	3	4	1	2	3	1	2	3	MISC
Actinopterygii	Perciformes	Tripterygiidae	*Tripterygiidae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Tripterygiidae	*Ruanoho*	*sp.*	SI	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*sp.*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alismatidae	Najadales	Zosteraceae	*Zostera*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Acontiophoridae	*Mimetridium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum*	*notti*	N	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
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	*Hypsistozoa*	*fasmeriana*	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*	*adamsi*	N	1	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*knoxi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pachydermatina*	N	0	0	0	0	0	1	0	1	0	0	1	1	0	0	1	0	0	1	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pulla*	N	0	0	1	0	1	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*lutea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*rugata*	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*	*spinosissima*	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*	*picta*	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	1	0	1	1	1	0	0	1	0	0	1	1	0	0	1	1	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	0	0	0	1	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
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	0	0	0	0	1	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	1	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	Mytiloida	Mytilidae	*Aulacomya*	*maoriana*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Mytilus*	*galloprovincialis*	C1	0	1	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	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	0	1	1	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
Bivalvia	Pterioida	Pectinidae	*Talochlamys*	*zelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Lasaeidae	*Lasaea*	*hinemoa*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Bryopsidophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calcarea	Leucosolenida	Heteropiidae	*Grantessa*	*intusarticulata*	A	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1
Calcarea	Leucosolenida	Leucosoleniidae	*Leucosolenia*	*cf. discoveryi*	A	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	1	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	Hymenosomatidae	*Halicarcinus*	*cookii*	N	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	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	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*peronii*	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*	*ursus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Crangonidae	*Nauticaris*	*marionis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	0	1	1	0	0	0	0	0	0	1	1	1	0	0	0	1	1	1	0	0
Crustacea	Thoracica	Balanidae	*Notomegabalanus*	*decorus*	N	0	0	1	0	0	0	0	0	0	0	1	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	*Darwinella*	*cf. gardineri (rust red with spongin triacts)*	C1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Dysidea*	*n. sp. 1 (erect cactus)*	C2	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Irciniidae	*Ircinia*	*akaroa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Hadromerida	Suberitidae	*Suberites*	*cf. affinis*	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																				
					Berth code														RATTRAY						
					Pile replicate						12	2							1						
					Pile position		OUT					IN			OUT			IN				OUT			
Demospongiae	Halichondrida	Axinellidae	*Pseudaxinella*	*australis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*n. sp. 8 (fingery turrets)*	C2	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*n. sp. 7 (fingery Dunedin)*	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	*Halichondria*	*punctata*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Vosmaeria*	*torquata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halisarcida	Halisarcidae	*Halisarca*	*dujardini*	A	0	0	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	*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	Haplosclerida	Callyspongiidae	*Callyspongia*	*diffusa*	C1	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	Crellidae	*Crella (Pytheas)*	*affinis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas*	*cf. anchorata*	N	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas*	*fulva*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Microcionidae	*Dictyociona*	*cf. atoxa*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia)*	*hentscheli*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia)*	*tasmani*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria*	*australis*	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Littorinimorpha	Littorinidae	*Risellopsis*	*varia*	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*	*cerebroides*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Notaspidea	Pleurobranchidae	*Berthella*	*medietas*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Chromodoris*	*aureomarginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Aphelodoris*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Archidoris*	*wellingtonensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Atagema*	*carinata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Patellogastropoda	Nacellidae	*Cellana*	*ornata*	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	1	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0
Gymnolaemata	Cheilostomata	Candidae	*Scrupocellaria*	*ornithorhyncus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*zelandica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Celleporidae	*Celleporina*	*proximalis*	N	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	1	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella*	*delta*	N	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	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	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	Haleciidae	*Halecium*	*delicatulum*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Haleciidae	*Halecium*	*corrrugatissimum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*spirocladia*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0
Hydrozoa	Hydroida	Plumulariidae	*Monotheca*	*flexuosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	*Amphisbetia*	*fasciculata*	N	0	0	0	0	0	1	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	1	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*bispinosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*minima*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*johnstoni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Amaryllidae	*Amaryllis*	*macrophthalma*	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	1	1	1	0	0	1	1	0	1	1	1	0	0	1	0	1	1	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*typica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aoridae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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														RATTRAY						
					Pile replicate						12	2							1						
					Pile position		OUT					IN			OUT			IN				OUT			
Malacostraca	Amphipoda	Colomastigidae	*Colomastix*	*subcastellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Apocorophium*	*acutum*	A	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*acherusicum*	A	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	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	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*sp. 1*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*marmorata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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
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	Leucothoidae	*Leucothoe*	*sp. 1*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*vesca*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Acontiostoma*	*tuberculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Melitidae	*Mallacoota*	*subcarinata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Phtisicidae	*Caprellina*	*longicollis*	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	*Cilicaea*	*canaliculata*	N	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	0	0	1	1	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*campbellensis*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Malacostraca	Tanaidacea	Tanaidae	*Zeuxoides*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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*	*capensis*	N	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	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*Perinereis-A*	SI	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	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	*Eulalia*	*microphylla*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	1	0	1	1	1	0	0	0	1	0	1	1	1	0	1	1	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*jacksoni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis*	*Typosyllis-B*	SI	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	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	*Haplosyllis*	*spongicola*	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*	*curta*	N	1	0	0	1	0	0	0	0	1	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	*Galeolaria*	*hystrix*	N	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Neovermilia*	*sphaeropomatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*Indet*	SI	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*lamellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*hoplura*	A	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Chaetozone*	*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	*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	Terebellidae	*Streblosoma*	*toddae*	N	1	0	1	1	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*maxima*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebella*	*Terebella-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebellidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona*	*zelandica*	N	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona*	*violacea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton*	*pelliserpentis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Ischnochitonina	Chitonidae	*Onithochiton*	*neglectus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pycnogonida	Pantopoda	Callipallenidae	*Callipallene*	*novaezealandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Mediothamnion*	*lyallii*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Antithamnion*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), 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													RATTRAY							
					Pile replicate						12	2							1						
					Pile position	OUT						IN			OUT			IN				OUT			
Rhodophyceae	Ceramiales	Ceramiaceae	*Lophothamnion*	*hirtum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Phycodrys*	*quercifolia*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*denticulata*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Schizoseris*	*griffithsia*	N	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Hymenena*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesseriaceae*	*sp.*	SI	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*harveyi*	N	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*brodiaei*	A	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Adamsiella*	*chauvinii*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Echinothamnion*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Stictosiphonia*	*vaga*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gelidiales	Gelidiaceae	*Capreolia*	*implexa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gigartinales	Gigartinaceae	*Gigartina*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gigartinales	Gigartinaceae	*Sarcothalia*	*circumcincta*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Halymeniales	Halymeniaceae	*Cryptonemia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia*	*linearis*	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	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia*	*obtusa*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*sp.*	SI	1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*spathulata*	N	0	0	1	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								VIC XY												
					Pile replicate	2							1						2						
					Pile position	IN			OUT				IN			OUT			IN			OUT			
Class	Orders	Family	Genus	Species	*Status	1	2	3	1	2	3	MISC	1	2	3	1	2	3	1	2	3	1	2	3	4
Actinopterygii	Perciformes	Tripterygiidae	*Tripterygiidae*	*sp.*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Tripterygiidae	*Ruanoho*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*sp.*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alismatidae	Najadales	Zosteraceae	*Zostera*	*sp.*	SI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Acontiophoridae	*Mimetridium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum*	*notti*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	*Hypsistozoa*	*fasmeriana*	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*	*adamsi*	N	0	0	1	0	0	1	0	1	1	1	0	0	1	0	0	0	1	1	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*knoxi*	N	0	0	0	0	0	0	0	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	0	1	0	0	0	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pachydermatina*	N	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pulla*	N	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*lutea*	N	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1	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*	*rugata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*spinosissima*	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*	*picta*	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	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	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
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	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	*Modiolarca*	*impacta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Aulacomya*	*maoriana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Mytilus*	*galloprovincialis*	C1	0	0	0	1	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	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	0	0	0	1	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	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	Lasaeidae	*Lasaea*	*hinemoa*	N	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bryopsidophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Calcarea	Leucosolenida	Heteropiidae	*Grantessa*	*intusarticulata*	A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
Calcarea	Leucosolenida	Leucosoleniidae	*Leucosolenia*	*cf. discoveryi*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	1	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	Hymenosomatidae	*Halicarcinus*	*cookii*	N	0	0	1	1	1	1	0	1	1	0	0	0	0	1	0	1	0	1	1	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*peronii*	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*	*ursus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Crangonidae	*Nauticaris*	*marionis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Notomegabalanus*	*decorus*	N	0	0	0	0	1	0	0	1	0	0	1	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	*Darwinella*	*cf. gardineri (rust red with spongin triacts)*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Dysidea*	*n. sp. 1 (erect cactus)*	C2	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	1
Demospongiae	Dictyoceratida	Irciniidae	*Ircinia*	*akaroa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Hadromerida	Suberitidae	*Suberites*	*cf. affinis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), 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							VIC XY													
					Pile replicate	2							1						2						
					Pile position	IN			OUT			IN				OUT			IN			OUT			
Demospongiae	Halichondrida	Axinellidae	*Pseudaxinella*	*australis*	N	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*n. sp. 8 (fingery turrets)*	C2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*n. sp. 7 (fingery Dunedin)*	C2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*panicea*	C1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*punctata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Vosmaeria*	*torquata*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halisarcida	Halisarcidae	*Halisarca*	*dujardini*	A	0	0	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	*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	Haplosclerida	Callyspongiidae	*Callyspongia*	*diffusa*	C1	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	Crellidae	*Crella (Pytheas)*	*affinis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas*	*cf. anchorata*	N	0	0	0	0	0	0	0	0	1	1	0	0	1	0	1	1	0	0	0	1
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas*	*fulva*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Microcionidae	*Dictyociona*	*cf. atoxa*	C2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia)*	*hentscheli*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia)*	*tasmani*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria*	*australis*	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	*Risellopsis*	*varia*	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*	*cerebroides*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Notaspidea	Pleurobranchidae	*Berthella*	*medietas*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Chromodoris*	*aureomarginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Aphelodoris*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Archidoris*	*wellingtonensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Atagema*	*carinata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Patellogastropoda	Nacellidae	*Cellana*	*ornata*	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	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	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	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Scrupocellaria*	*ornithorhyncus*	N	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*zelandica*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Celleporidae	*Celleporina*	*proximalis*	N	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella*	*delta*	N	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	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	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	Haleciidae	*Halecium*	*delicatulum*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Haleciidae	*Halecium*	*corrrugatissimum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*spirocladia*	N	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Monotheca*	*flexuosa*	N	0	0	1	0	0	0	0	0	1	0	1	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	1	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*fasciculata*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Sertularella*	*robusta*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*bispinosa*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*minima*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*johnstoni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Amaryllidae	*Amaryllis*	*macrophthalma*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	0	1	0	1	1	1	0	0	1	1	0	0	1	1	1	1	0	1	1	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*typica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Malacostraca	Amphipoda	Aoridae	*Aoridae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), 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							VIC XY													
					Pile replicate	2							1						2						
					Pile position	IN			OUT			IN				OUT			IN			OUT			
Malacostraca	Amphipoda	Colomastigidae	*Colomastix*	*subcastellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Apocorophium*	*acutum*	A	1	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*acherusicum*	A	0	0	0	0	0	0	0	1	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	1	0	0	0	1	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*sp. 1*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*marmorata*	A	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	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
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	Leucothoidae	*Leucothoe*	*sp. 1*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*vesca*	N	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Acontiostoma*	*tuberculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Melitidae	*Mallacoota*	*subcarinata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Malacostraca	Amphipoda	Phtisicidae	*Caprellina*	*longicollis*	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	*Cilicaea*	*canaliculata*	N	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*campbellensis*	N	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Tanaidacea	Tanaidae	*Zeuxoides*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	1	1	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*	*capensis*	N	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	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	0	0	0	1	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	1	0	0	1	1	0	0	1	0	1	0	0	0	0	1
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*Perinereis-A*	SI	0	0	1	1	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	*Eulalia*	*microphylla*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	0	1	0	1	1	0	1	1	1	0	0	0	1	1	1	0	1	1	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*jacksoni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis*	*Typosyllis-B*	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	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	*Haplosyllis*	*spongicola*	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*	*curta*	N	0	0	0	0	1	1	0	0	1	1	1	0	0	0	0	0	0	1	0	0
Polychaeta	Sabellida	Sabellidae	*Megalomma*	*suspiciens*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Sabellida	Serpulidae	*Neovermilia*	*sphaeropomatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*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	*Boccardia*	*lamellata*	N	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	Terebellida	Cirratulidae	*Chaetozone*	*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	*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	Terebellidae	*Streblosoma*	*toddae*	N	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*maxima*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebella*	*Terebella-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebellidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona*	*zelandica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona*	*violacea*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton*	*pelliserpentis*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Ischnochitonina	Chitonidae	*Onithochiton*	*neglectus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pycnogonida	Pantopoda	Callipallenidae	*Callipallene*	*novaezealandiae*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Mediothamnion*	*lyallii*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Rhodophyceae	Ceramiales	Ceramiaceae	*Antithamnion*	*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							VIC XY													
					Pile replicate	2							1						2						
					Pile position	IN			OUT			IN				OUT			IN			OUT			
Rhodophyceae	Ceramiales	Ceramiaceae	*Lophothamnion*	*hirtum*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Phycodrys*	*quercifolia*	N	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*denticulata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Schizoseris*	*griffithsia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Hymenena*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesseriaceae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*harveyi*	N	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*sp.*	SI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*brodiaei*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Adamsiella*	*chauvinii*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Rhodophyceae	Ceramiales	Rhodomelaceae	*Echinothamnion*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Rhodophyceae	Ceramiales	Rhodomelaceae	*Stictosiphonia*	*vaga*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gelidiales	Gelidiaceae	*Capreolia*	*implexa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gigartinales	Gigartinaceae	*Gigartina*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gigartinales	Gigartinaceae	*Sarcothalia*	*circumcincta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Halymeniales	Halymeniaceae	*Cryptonemia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia*	*linearis*	N	0	0	0	0	0	1	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	1	0	0	0	0	0	0	1	0	0
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia*	*obtusa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*sp.*	SI	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	0	1	1	1	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*sp.*	SI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*spathulata*	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	*Status	RATTRAY Fishing boat in lay-up	
Actinopterygii	Perciformes	Tripterygiidae	*Tripterygiidae*	*sp.*	SI	1	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	1	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	1
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pachydermatina*	N	1	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	1	0
Bivalvia	Ostreoida	Ostreidae	*Crassostrea*	*gigas*	A	0	1
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	1	0
Crustacea	Thoracica	Balanidae	*Notomegabalanus*	*decorus*	N	0	1
Demospongiae	Dictyoceratida	Dysideidae	*Dysidea*	*n. sp. 1 (erect cactus)*	C2	0	1
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*n. sp. 7 (fingery Dunedin)*	C2	1	1
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	1	1
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	1	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	1	1
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*setacea*	C1	0	1
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*spirocladia*	N	1	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	0	1
Malacostraca	Isopoda	Sphaeromatidae	*Cilicaea*	*canaliculata*	N	1	1
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	1	0
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea*	*australiensis*	N	0	1
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	1	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	1	1
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	1	1
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	1	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Schizoseris*	*griffithsia*	N	1	1
Rhodophyceae	Ceramiales	Deleseriaceae	*Phycodrys*	*quercifolia*	N	1	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*sp.*	SI	0	1

*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	Port_Chalmers						Port_Otago								
					Berth code	BEACH			CONTAINER			LEITH			RATTRAY			VIC XY		
Class	Order	Family	Genus	Species	*Status	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Bivalvia	Nuculoida	Nuculidae	*Nucula*	*sp.*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Semelidae	*Leptomya*	*retiaria*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Tellinidae	*Pseudarcopagia*	*disculus*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Dysidea*	*n. sp. 1 (erect cactus)*	C2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Vetigastropoda	Trochidae	*Micrelenchus*	*huttonii*	N	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0
Gymnolaemata	Cheilostomata	Bitectiporidae	*Schizosmittina*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*rostrata*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella*	*delta*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Gymnolaemata	Cheilostomata	Microporellidae	*Calloporina*	*angustipora*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Gymnolaemata	Cheilostomata	Microporellidae	*Fenestrulina*	*disjuncta*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Gymnolaemata	Cheilostomata	Romancheinidae	*Exochella*	*armata*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*sp.*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*operculata*	C1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*johnstoni*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*dabita*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Phoxocephalidae	*Torridoharpinia*	*hurleyi*	N	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1
Polychaeta	Phyllodocida	Glyceridae	*Glycera*	*lamelliformis*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Goniadidae	*Glycinde*	*dorsalis*	N	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus*	*macroura*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Capitellidae	*Heteromastus*	*filiformis*	N	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Scolecida	Orbiniidae	*Scoloplos*	*simplex*	N	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Prionospio*	*aucklandica*	N	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*syrtis*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Spionida	Spionidae	*Scolecolepides*	*benhami*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Timarete*	*anchylochaetus*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Terebellida	Pectinariidae	*Pectinaria*	*australis*	N	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona*	*zelandica*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*sp.*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Adamsiella*	*chauvinii*	N	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Echinothamnion*	*sp.*	SI	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*decipiens*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*sp.*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*strictissima*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyceae	Plocamiales	Plocamiaceae	*Plocamium*	*leptophyllum*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyceae	Plocamiales	Plocamiaceae	*Plocamium*	*sp.*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Stenolaemata	Cyclostomata	Tubuliporidae	*Tubulipora*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	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 5c. Results from the benthic sled samples.

					Terminal	Port_Chalmers				Port_Otago					
					Berth code	BEACH		CONTAINER		LEITH		RATTRAY		VIC XY	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2	1	2
Actinopterygii	Perciformes	Tripterygiidae	*Tripterygiidae*	*sp.*	SI	1	0	1	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*sp.*	N	1	1	1	0	1	0	1	0	0	1
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	1	0	0	1	0	0	1	0
Alismatidae	Najadales	Zosteraceae	*Zostera*	*sp.*	SI	1	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	1	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	1	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	1	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*lutea*	N	0	0	1	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pachydermatina*	N	0	0	0	0	0	0	0	1	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	0	1	1	0	0	0	0	0	0
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	1	1	0	0	0	0	0	0	0
Bivalvia	Veneroida	Cardiidae	*Pratulum*	*pulchellum*	N	0	0	1	0	0	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Tawera*	*spissa*	N	1	0	1	0	0	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Austrovenus*	*stutchburyi*	N	0	0	0	0	0	0	1	0	0	0
Bryopsidophyceae	Bryopsidales	Codiaceae	*Codium*	*fragile ssp. novae-zelandiae*	N	0	0	1	0	1	0	0	0	1	0
Bryopsidophyceae	Bryopsidales	Codiaceae	*Codium*	*dichotomum*	N	0	0	0	0	0	1	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*crinalis*	N	0	0	0	0	1	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	0	0	0	0	0	0	1	0	0	0
Crustacea	Anomura	Paguidae	*Pagurus*	*traversi*	N	0	0	1	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*cookii*	N	0	0	1	0	0	1	0	0	1	1
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	0	0	1	0
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	0	0	1	0	1	0	0	0	1	1
Crustacea	Brachyura	Portunidae	*Nectocarcinus*	*antarcticus*	N	0	0	1	0	0	0	0	0	0	0
Crustacea	Caridea	Crangonidae	*Pontophilus*	*australis*	N	1	0	1	0	0	0	0	1	0	0
Crustacea	Caridea	Palemonidae	*?Palaemon*	*affinis*	SI	0	0	0	0	0	0	1	0	0	0
Crustacea	Caridea	Palemonidae	*Periclimenes*	*yaldwyni*	N	0	0	0	0	0	1	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	0	1	0	0	0	0	0	0	0
Gastropoda	Neogastropoda	Muricidae	*Xymene*	*plebeius*	N	0	0	0	0	0	0	0	1	0	0
Gastropoda	Neogastropoda	Turridae	*Neoguraleus*	*sp.*	SI	1	0	1	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Chromodoris*	*aureomarginata*	N	1	0	0	0	0	0	0	0	0	0
Gastropoda	Vetigastropoda	Trochidae	*Micrelenchus*	*huttonii*	N	0	0	1	0	1	1	0	1	1	1
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella*	*delta*	N	0	0	1	0	1	0	0	0	1	0
Gymnolaemata	Cheilostomata	Microporellidae	*Calloporina*	*angustipora*	N	0	0	0	0	1	1	0	0	1	1
Gymnolaemata	Cheilostomata	Microporellidae	*Fenestrulina*	*disjuncta*	N	0	0	1	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Microporellidae	*Fenestrulina*	*thyreophora*	N	0	0	1	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Romancheinidae	*Exochella*	*armata*	N	0	0	0	0	1	0	0	0	0	0
Hydrozoa	Hydroida	Bougainvilliidae	*Bougainvillia*	*muscus*	C1	0	0	0	0	0	0	1	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*fasciculata*	N	0	0	1	0	1	1	0	0	1	0
Hydrozoa	Hydroida	Sertulariidae	*Sertularella*	*robusta*	N	0	0	0	0	0	0	1	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*johnstoni*	N	1	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	0	0	0	0	0	0	1	0	0	1
Malacostraca	Amphipoda	Aoridae	*Aoridae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	1
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine*	*pacifica*	N	0	0	0	0	0	1	0	0	0	0
Malacostraca	Amphipoda	Phoxocephalidae	*Torridoharpinia*	*hurleyi*	N	0	0	0	0	0	0	0	1	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Cilicaea*	*canaliculata*	N	0	0	0	0	0	1	0	1	0	0
Ophiuroidea	Ophiurida	Ophionereididae	*Ophionereis*	*fasciata*	N	0	0	0	0	0	0	0	0	0	1
Ophiuroidea	Phrynophiurida	Ophiomyxidae	*Ophiomyxa*	*brevirima*	N	0	0	0	0	1	0	0	0	0	0
Phaeophyceae	Cutleriales	Cutleriaceae	*Cutleria*	*multifida*	A	0	0	0	0	0	1	0	0	0	0
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora*	*congesta?*	SI	0	0	1	0	0	0	0	0	0	0
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora*	*sp.*	SI	0	0	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Goniadidae	*Glycinde*	*dorsalis*	N	1	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	0	0	0	0	1	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Serpula*	*Serpula-C*	SI	0	0	1	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Spirobranchus*	*polytrema*	A	0	0	1	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	1	1	1	1	1	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 5c. Results from the benthic sled samples.

					Terminal	Port_Chalmers				Port_Otago					
					Berth code	BEACH		CONTAINER		LEITH		RATTRAY		VIC XY	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2	1	2
Rhodophyceae	Ceramiales	Ceramiaceae	*Anotrichium*	*crinitum*	N	0	0	0	0	1	1	1	1	1	1
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*sp.*	SI	0	0	1	0	0	0	0	1	0	1
Rhodophyceae	Ceramiales	Ceramiaceae	*Mediothamnion*	*lyallii*	N	1	0	0	0	0	0	1	0	1	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Hymenena*	*sp.*	SI	0	0	0	0	0	0	0	1	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Phycodrys*	*quercifolia*	N	0	0	0	0	0	0	0	1	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Adamsiella*	*chauvinii*	N	0	1	1	0	1	1	0	1	1	1
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*decipiens*	N	0	1	1	1	1	1	0	0	1	1
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*brodiaei*	A	0	0	1	1	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Brongniartella*	*australis*	N	0	0	0	0	0	0	0	0	0	1
Rhodophyceae	Ceramiales	Rhodomelaceae	*Echinothamnion*	*sp.*	SI	0	0	0	0	0	0	0	0	1	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*subtilissima*	A	1	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Streblocladia*	*glomerulata*	N	0	0	0	0	1	0	0	0	0	0
Rhodophyceae	Gigartinales	Gigartinaceae	*Sarcothalia*	*livida*	N	0	0	0	0	1	0	0	0	0	0
Rhodophyceae	Gracilariales	Gracilariaceae	*Gracilaria*	*truncata*	N	0	0	1	0	0	0	0	0	0	0
Rhodophyceae	Plocamiales	Plocamiaceae	*Plocamium*	*leptophyllum*	N	0	0	0	0	1	0	0	1	1	0
Rhodophyceae	Plocamiales	Plocamiaceae	*Plocamium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	1
Rhodophyceae	Rhodymeniales	Champiaceae	*Champia*	*affinis*	A	0	0	1	0	0	0	0	0	0	0
Stenolaemata	Cyclostomata	Tubuliporidae	*Tubulipora*	*sp.*	SI	0	0	1	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*sp.*	SI	0	0	0	0	1	1	0	0	0	0

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

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

					Terminal	Port_Chalmers					Port_Otago			
					Berth code	BEACH	CONTAINER		LEITH		RATTRAY		VIC XY	
Class	Order	Family	Genus	Species	*Status	1	1	2	1	2	1	2	1	2
Dinophyceae	Gymnodiniales	Gymnodiniacea	*Cochlodinium*	*sp.*	N	0	0	1	0	0	0	1	0	1
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium*	*sp.*	N	1	1	1	1	0	0	1	1	1
Dinophyceae	Peridiniales	Peridiniaceae	*Scrippsiella*	*trochoidea*	N	1	0	1	1	0	0	0	0	0
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium conicum*	*cf. conicoides*	N	0	0	0	0	1	0	0	0	0

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

Appendix 5e. Results from the fish trap samples.

					Terminal	Port_Chalmers								Port_Otago												
					Berth code	BEACH				CONTAINER				LEITH				RATTRAY				VIC XY				
					Line No.	1		2		1		2		1		2		1		2		1		2		
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	Total
Actinopterygii	Gadiformes	Moridae	*Lotella*	*rhacinus*	N	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	1	5
Actinopterygii	Mugiliformes	Mugilidae	*Parapercis*	*colias*	N	0	0	1	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	5
Actinopterygii	Mugiliformes	Mugilidae	*Aldrichetta*	*forsteri*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Actinopterygii	Perciformes	Cheilodactylidae	*Nemadactylus*	*macropterus*	N	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	18
Actinopterygii	Perciformes	Labridae	*Labridae*	*sp.*	SI	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	4
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*miles*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	3

*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	Port_Chalmers								Port_Otago											
					Berth code	BEACH				CONTAINER				LEITH				RATTRAY				VIC XY			
					Line no.	1		2		1		2		1		2		1		2		1		2	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Actinopterygii	Gadiformes	Moridae	*Lotella*	*rhacinus*	N	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	1	1	0	1	0	1	1	0	1	0	0	0	1	1	0	1	0	1	1	1
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*miles*	N	0	0	1	1	0	1	1	0	1	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	1	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*ursus*	N	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	1	1
Crustacea	Brachyura	Portunidae	*Nectocarcinus*	*integrifrons*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Syllidae*	*Indet*	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*Status: A = non-indigenous (highlighted by shading), 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.

					Terminal	Port_Chalmers								Port_Otago											
					Berth code	BEACH				CONTAINER				LEITH				RATTRAY				VIC XY			
					Line No.	1		2		1		2		1		2		1		2		1		2	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*peronii*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*sp.*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Portunidae	*Nectocarcinus*	*integrifrons*	N	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Portunidae	*Nectocarcinus*	*antarcticus*	N	1	0	0	0	0	0	1	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 5h. Results from the shrimp trap samples.

					Terminal	Port_Chalmers								Port_Otago									
					Berth code	BEACH				CONTAINER				LEITH				RATTRAY				VIC XY	
					Line No.	1		2		1		2		1		2		1		2		1	2
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Malacostraca	Isopoda	Cirolanidae	*Natatolana*	*rossi*	N	1	1	1	0	1	0	0	0	1	1	1	1	1	0	1	0	1	1

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

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).