Port of Lyttelton

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

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Executive Summary

This report describes the results of a March 2002 survey to provide a baseline inventory of native, non-indigenous and cryptogenic marine species within the Port of Lyttelton.

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

- Sampling methods used in these surveys were based on protocols developed by the Australian Centre for Research on Introduced Marine Pests (CRIMP) for baseline surveys of non-indigenous species in ports. Modifications were made to the CRIMP protocols for use in New Zealand port conditions.

- A wide range of sampling techniques was used to collect marine organisms from a range of habitats within the Port of Lyttelton. 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 Lyttelton 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 246 species or higher taxa was identified from the Lyttelton Port survey. They consisted of 150 native species, 20 non-indigenous species, 22 cryptogenic species (those whose geographic origins are uncertain) and 54 species indeterminata (taxa for which there is insufficient taxonomic or systematic information available to allow identification to species level).

- Fourteen species of marine organisms collected from the Port of Lyttelton have not previously been described from New Zealand waters. Two of these were non-indigenous species (a crab, *Cancer gibbosulus*, and an ascidian, *Cnemidocarpa sp.*) that had not previously been recorded in New Zealand. The 12 other new species are considered cryptogenic. They include seven species of amphipod and 5 species of sponge which do not match existing species descriptions and may be new to science.

- The 20 non-indigenous organisms described from the Port of Lyttelton included representatives of six phyla. The non-indigenous species detected (ordered alphabetically by phylum, class, order, family, genus and species) were: (Bryozoa) *Bugula flabellata, Bugula neritina, Tricellaria inopinata, Cryptosula pallasiana, Conopeum seurati and Watersipora subtorquata*, (Cnidaria) *Haliplanella lineata*, (Crustacea) *Apocorophium acutum, Monocorophium acherusicum, Monocorophium sextonae, Jassa slatteryi, Stenothoe sp. aff. S. gallensis* and *Cancer gibbosulus*, (Mollusca) *Theora lubrica*, (Phycophyta) *Undaria pinnatifida, Griffithsia crassiuscula, Polysiphonia brodiaei, Polysiphonia subtilissima,* (Urochordata) *Ciona intestinalis* and *Cnemidocarpa sp.*

- The only species from the Port of Lyttelton 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 80 % (16 of 20 species) of NIS in the Port of Lyttelton are likely to have been introduced in hull fouling assemblages, 5 % (one species) via ballast water and 15 % (3 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 Lyttelton (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.

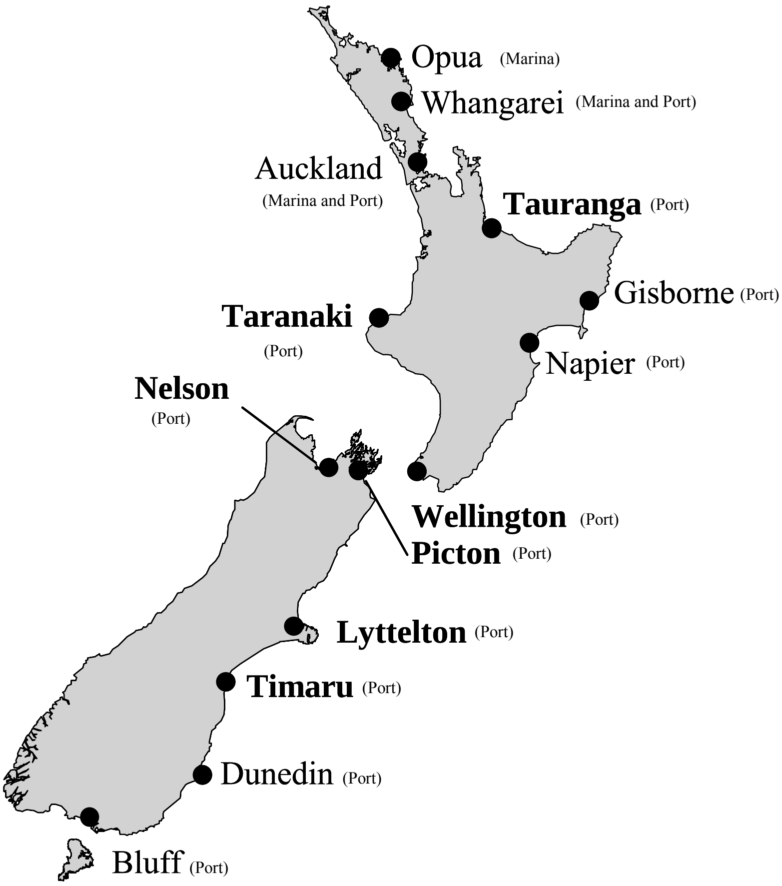

Figure 1: Commercial shipping ports in New Zealand where baseline non-indigenous species surveys have been conducted. Group 1 ports surveyed in the summer of 2001/2002 are indicated in bold and group 2 ports surveyed in the summer of 2002/2003 are indicated in plain font. Marinas were also surveyed for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

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

DESCRIPTION OF THE PORT OF LYTTELTON

The Port of Lyttelton on the east coast of the South Island is located on the northern side of Lyttelton Harbour, a narrow embayment 15 km long on the northern coast of Banks Peninsula (Fig. 2) The entrance to Lyttelton Harbour is almost 2 km wide and approximately 16 m deep, with a dredged channel (maintained to 11.6m) leading westwards to the Port (www.lpc.co.nz). Lyttelton Port is one of New Zealand's busiest shipping ports, and the major hub port in the South Island (Inglis 2001).

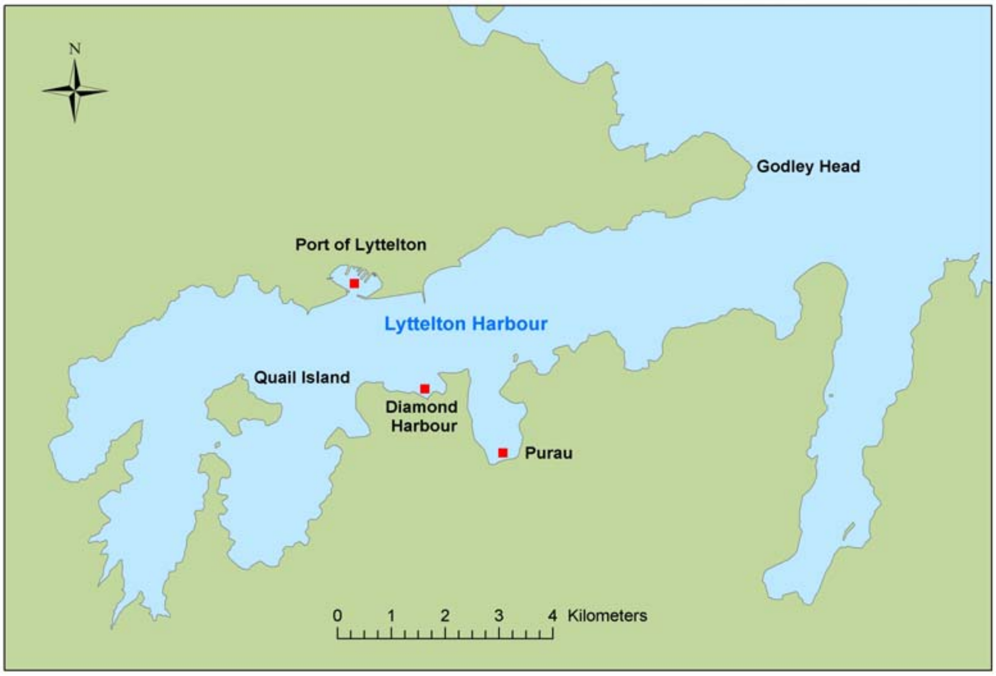

Figure 2: Lyttelton harbour

PORT OPERATION AND SHIPPING MOVEMENTS

Lyttelton Harbour was settled by Māori around 800-900 A.D. The original inhabitants called the harbour area Te-Whaka-raupo. In the early 1800's, European whalers and sealers found Ngai Tahu settlements near Lyttelton. In 1849, the town of Lyttelton was established as a recognised port and the first wharf constructed. In 1877, the Lyttelton Harbour Board was established and the port was progressively developed with a network of wharves, dry dock and stone moles for port protection (Rice 2004). In the 1960's, a nightly inter-island steamer express linked Lyttelton and Wellington (www.teara.govt.nz). The Harbour Board was disestablished in 1988 with the Port Companies Act.

The Port of Lyttelton, operated by the Lyttelton Port Company (www.lpc.co.nz), currently has the largest coal export facilities in New Zealand and handles a wide variety of cargoes, including seafood, timber, sawdust and cars. Freight, fishing and LPG vessels from all over New Zealand and a number of international ports frequent the Port of Lyttelton. In 2003/2004, container throughput was 161,200 TEU, while coal volumes increased to approximately 2.1 million tonnes. Bulk fuel volumes were 1.1 million tonnes and log volumes 109,500 tonnes. Imported vehicle volumes were 53,450 units (www.lpc.co.nz).

The port is the main conduit for Canterbury's export and import activity. In 2003, the Port of Lyttelton shipped 60 % of Canterbury's and 8 % of New Zealand's total merchandise exports and handled 67 % of Canterbury's and 6 % of New Zealand's total merchandise imports.

Containerised trade is steadily increasing and the Port of Lyttelton currently connects with over 30 international container-handling ports (www.lpc.co.nz).

The Port has a total of 15 main wharves that can accommodate ships of a wide variety of sizes (Fig. 3). Berth construction is a mixture of concrete and wood decking on predominantly Australian hardwood piles. Details of the berthing facilities available in the Port are provided in Table 1. The port has MAF inspection and quarantine, and customs clearance facilities.

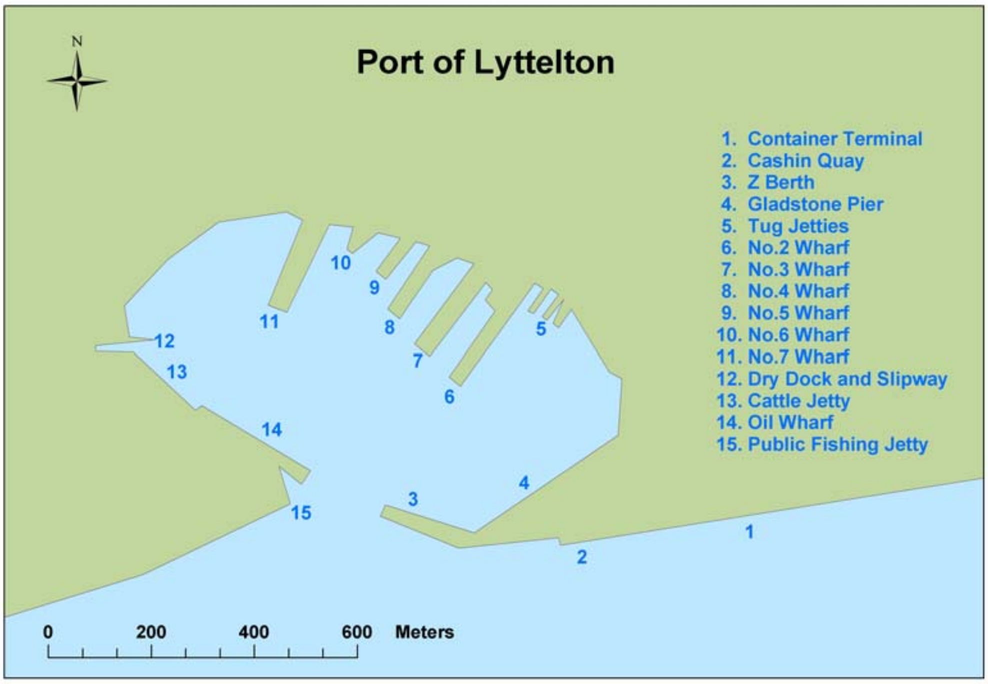

Figure 3: Lyttelton port map.

Analyses of shipping arrivals to the Port show that most commercial vessels arrive from the NW Pacific (40 %), Australia (27 %), the South Pacific (19 %), and other New Zealand ports (Inglis 2001). A recent analyses of shipping arrivals to the Port of Lyttelton show that there was a total of 105 international ship visits during 2002/2003 (100 merchant, 3 passenger, 1 fishing and 1 pleasure vessels; Campbell 2004). In 2000, there were 50 registered fishing vessels in the Port of Lyttelton (Sinner et al 2000). In the 2003/04 financial year, the Port of Lyttelton received a total of 1,293 ship visits, down on the previous year's 1,424 ships visits (www.lpc.co.nz).

Vessels unable to be berthed immediately in the Port may anchor off 1.5 nautical miles north-east of Godley Head in 16.5 m of water. Alternative anchorage for vessels of 8.5 m draught or less is available in Camp Bay in 11 m of water. Pilotage is compulsory on vessels over 500 GRT or over 40 m LOA, unless they have pilot exemption (www.lpc.co.nz). According to Inglis (2001), a total volume of 354,670 m^3 of ballast water was reported discharged in the Port of Lyttelton in 1999, with the largest country-of-origin volumes of 153,376 m^3 from Japan, 45,396 m^3 from Australia, 36,073 m^3 from Taiwan, and 77,887 m^3 unspecified.

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.

Within the Port, there is on-going annual maintenance dredging within the shipping area, with approximately 500,000 to 1 million m^3 of spoil removed. This spoil is deposited on-shore on the northern side of the Harbour from Gollans Bay up to the Heads to aid in wave refraction away from the port (Neil McLennan, Lyttleton Port Company, pers comm.).

In terms of future development, the Lyttleton Port Company is currently focusing on increasing productivity and efficiency within the port within current berth space. Coal facilities have been upgraded and four new straddle cranes have been purchased to improve service levels and reduce shipping turnaround times (www.lpc.co.nz).

PHYSICAL ENVIRONMENT OF LYTTELTON HARBOUR

The shoreline of Lyttelton Harbour includes basalt outcrops that extend below waterline to form intertidal and subtidal rocky reefs. The predominantly rocky shore is interspersed with sandy or muddy beaches in numerous embayments. Fine loess from the surrounding hills is the major source of seabed sediments in Lyttelton Harbour. An extensive area of shallow water and mudflats occupies the western end of the harbour, while coarse sand containing a large proportion of crushed shell extends through the middle of the harbour. Currents maintain coarse sand habitats in the middle of the harbour by carrying lighter sediment away (Royds Garden Ltd 1993), and mud covers the majority of other parts of the harbour, including the harbour entrance.

Lyttelton Harbour has a mean tidal range of 1.67 m (neap tides) to 1.94 m (spring tides), and a mean tidal velocity of 0.22 m per sec. The tidal circulation observed in the harbour is not completely documented, however it is known that large-scale tidal ‘gyres’ exist in the eastern half of the harbour, turning clockwise on ebb and counter-clockwise on flood tides. A clockwise eddy forms on ebb tide behind the Cashin Quay breakwater, so that velocities during flood and ebb are persistently westward along the shore and southward along the breakwater (Spigel 1993). The mean volume of water in Lyttelton Port itself has been calculated at 4,666,888 m^3 (Knox, 1983). During a mean spring tide approximately 838,272 m^3 of this water is exchanged, which equates to a mean volume exchange of 18 %. On a mean neap tide the volume exchanged is 729,122 m^3, or around 16 % (Royds Garden Ltd 1992).

EXISTING BIOLOGICAL INFORMATION

Over the last three decades a number of biological surveys have been carried out in Lyttelton Harbour and Port, although none of these surveys has specifically focused on collecting and identifying non-indigenous species. We briefly review these studies and their findings below.
Knight (1974) examined benthic communities in the inner two thirds of the harbour, with some of his sampling stations located in the small bay behind the Cashin Quay breakwater. He described four main sediment types in the harbour: sand, muddy sand, predominantly mud and dumped dredged sediments; and attributed different benthic communities to these substrata. Knight (1974) recorded a total of 110 species, dominated by polychaetes, gastropods and bivalves, from the benthic communities.

Knox (1983) surveyed the distribution of rocky intertidal organisms at nine stations from Cashin Quay breakwater into the inner harbour. Three stations were located on the breakwater itself - two on the outer side and one on the inner side. A total of 73 species was recorded from these three stations, consisting of 24 algal and 49 animal species. Knox (1983) also examined the distribution of biota on wharf piles and sampled five stations within the Port in the region of a proposed reclamation near Gladstone Pier. Fourteen species were recorded, with the number of individuals ranging from 496 to 2,088 per m^2, and a mean of 1,199 per m^2. These densities were low compared with values for similar communities elsewhere in New

Zealand, and the author suggested this was probably the result of continuous disturbance of sediments by maintenance dredging.

Knox (1993) was commissioned by Royds Garden Ltd to report on the benthic and intertidal assemblages in the vicinity of the Lyttelton sewage outfall in the bay behind Cashin Quay breakwater. The intertidal component of the study involved re-sampling three stations along Cashin Quay sampled by Knox in 1983, and examining five additional sites in the bay behind Cashin Quay breakwater. A total of 49 species was recorded – mainly algae, gastropods and bivalves. It was concluded that this area of the harbour had been greatly impacted by the discharge of sewage, with many animal species virtually eliminated and the shore now dominated by algae. Benthic sampling was undertaken by divers, who took cores at six stations in the small bay behind Cashin Quay, and at a seventh site in an adjacent bay. They described the sediments as fine mud and silt with small pebbles and shell gravel present in most areas. It was noted that the original sediments in the area probably consisted entirely of mud, but that the input of coarse sediments and wind blown sediments from the Port may have modified the composition of the seafloor. A total of 21 benthic species was recorded, and the assemblage was dominated by polychaetes.

Stevens and Forrest (1996) examined chemical contaminants in sediments around the dry dock and slipway areas in the Port. Substrate descriptions were given for each of the 42 sampling stations, along with macro faunal information relating to taxon richness and abundance at three of these sites.

Sediment contaminant levels (copper, mercury, TBT and semi-volatile organic compounds) were greatest adjacent to the dry dock discharge, the patent slip and the boat ramp. Levels were also elevated in front of the engineering workshop, probably due to this area being used as a slipway for about 50 years prior to 1990. Contaminant levels generally decreased with increasing distance from these areas.

The invasive kelp *Undaria pinnatifida* was identified in the Port of Lyttelton in 1991, and this port is deemed in the optimal temperature zone for this macroalga (Sinner et al 2000).

Handley et al (2000) undertook a biological survey of the operations area of the Port of Lyttelton. The fauna and flora of the sub-tidal soft sediment communities and intertidal rocky shores were described and species lists determined. The artificial structures of the Port were found to be well colonised by intertidal and sub-tidal species, and there was a high diversity of species considering the modified habitats present. Some of the sub-tidal benthic species were non-indigenous organisms, including the mollusc *Theora lubrica*, the algae *Undaria pinnatifida*, and the bryozoan *Bugula neritina*. Sub-tidal sediments were well-aerated, soft mud. Fenwick (2003) repeated the study in 2003 with very similar results including the same total number of taxa, although some species were found only in one of the two surveys.

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

Canterbury Regional Council (now Environment Canterbury) commissioned Woodward-Clyde to investigate the contamination of sediments on the seabed at the Port in 2001 (Woodward-Clyde 2001). The study reviewed the degree of sediment contamination and the potential for the contaminated sediment to migrate within and outside the Port. They concluded that sediment contamination levels in the inner harbour adjacent to the dry dock, generally exceeded ER-M values, i.e. the concentrations at which the United State's National

Oceanic and Atmospheric Administration (NOAA) estimated that there is a 50 % probability of toxicity to biota (Long et al 1995). The outer harbour displayed levels tending below the ER-L concentration (concentration at which NOAA determined approximately 10 % probability of toxicity. Toxicity tests confirmed that sediments at several locations within both the inner and outer harbour were toxic to benthic species. In terms of sediment movement within the Port, they conclude that while it is possible for fine particles to be dispersed throughout the outer harbour, inner harbour sediment is unlikely to be dispersed over the outer harbour area within a short time period. As the adverse effect of sediment on biota is likely to require mitigation or remediation, they suggest the most cost-effective means of cleaning up the contaminated port sediments would be removal of the sediments and dumping at sea.

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 Lyttelton survey. The survey was undertaken between March 18th and 22nd, 2002. Most sampling was concentrated on six main berths: Cashin Quay 3, Wharf 2, Wharf 4, the Oil Wharf, Gladstone Pier and the Cattle Wharf. A summary of sampling effort within the Port of Lyttelton 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. 4). 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.

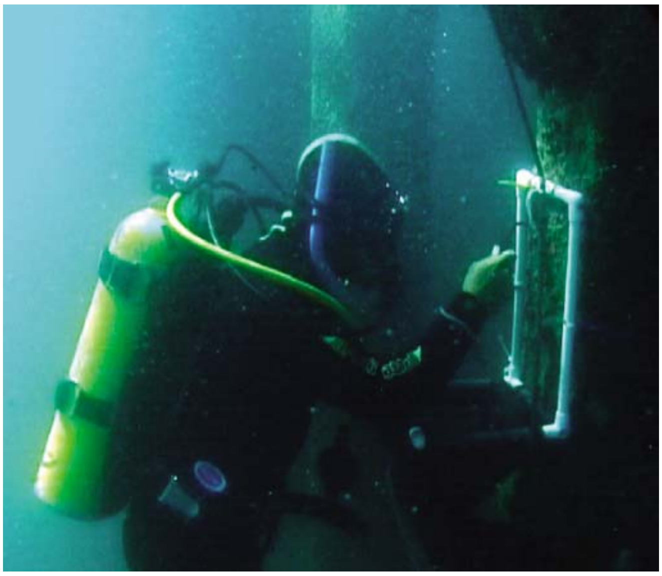

Figure 4: Diver sampling organisms on pier piles.

BENTHIC INFAUNA

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

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. 6). 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 5: **Shipek grab sampler: releasing benthic sample into bucket**

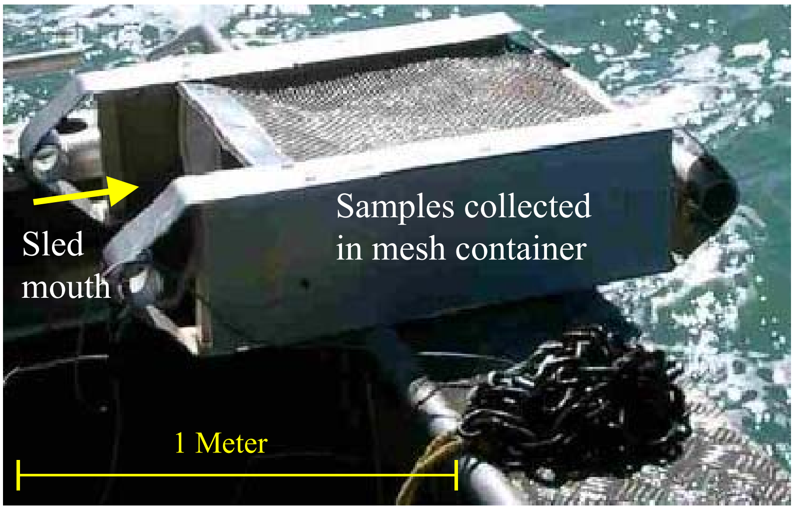

Figure 6: **Benthic sled**

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. 7). 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).

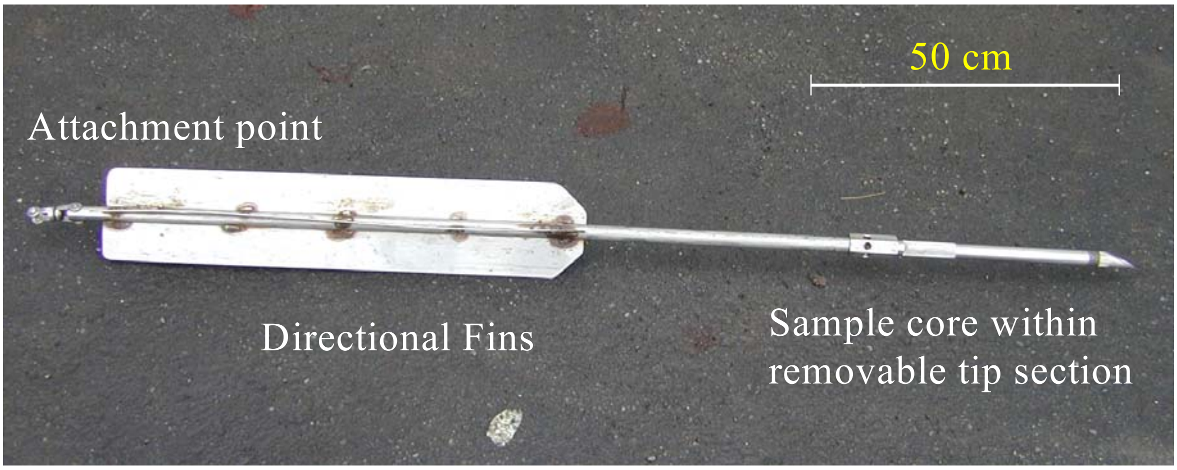

Figure 7: Javelin corer

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. 8). 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. 8). 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. 8). 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.

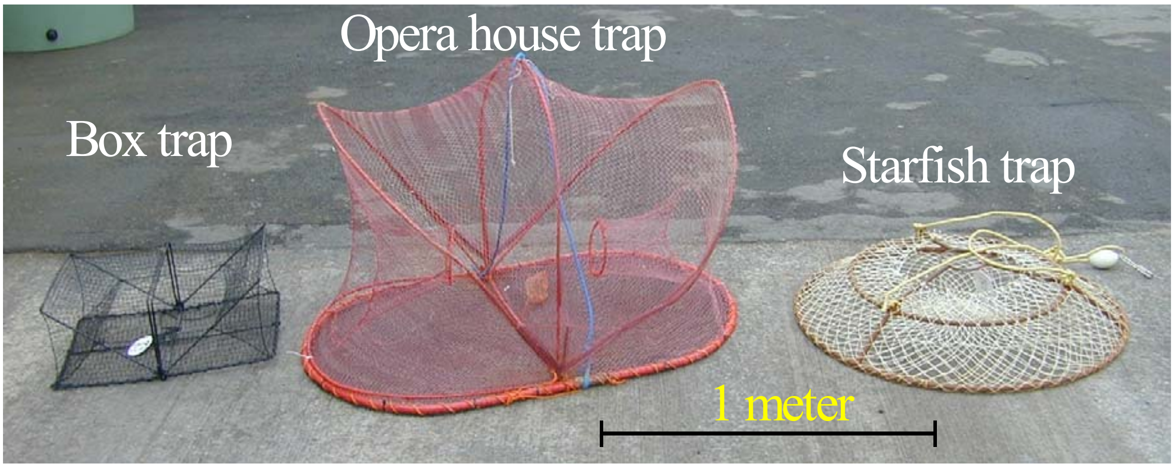

Figure 8: Trap types deployed in the port.

SAMPLING EFFORT

A summary of sampling effort within the Port of Lyttelton 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 Lyttelton is indicated in the following figures: diver pile scrapings (Fig. 9), benthic sledding (Fig. 10), box, starfish and shrimp trapping (Fig. 11), opera house fish trapping (Fig. 12), shipek grab sampling (Fig. 13) and javelin cyst coring (Fig. 14). 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.

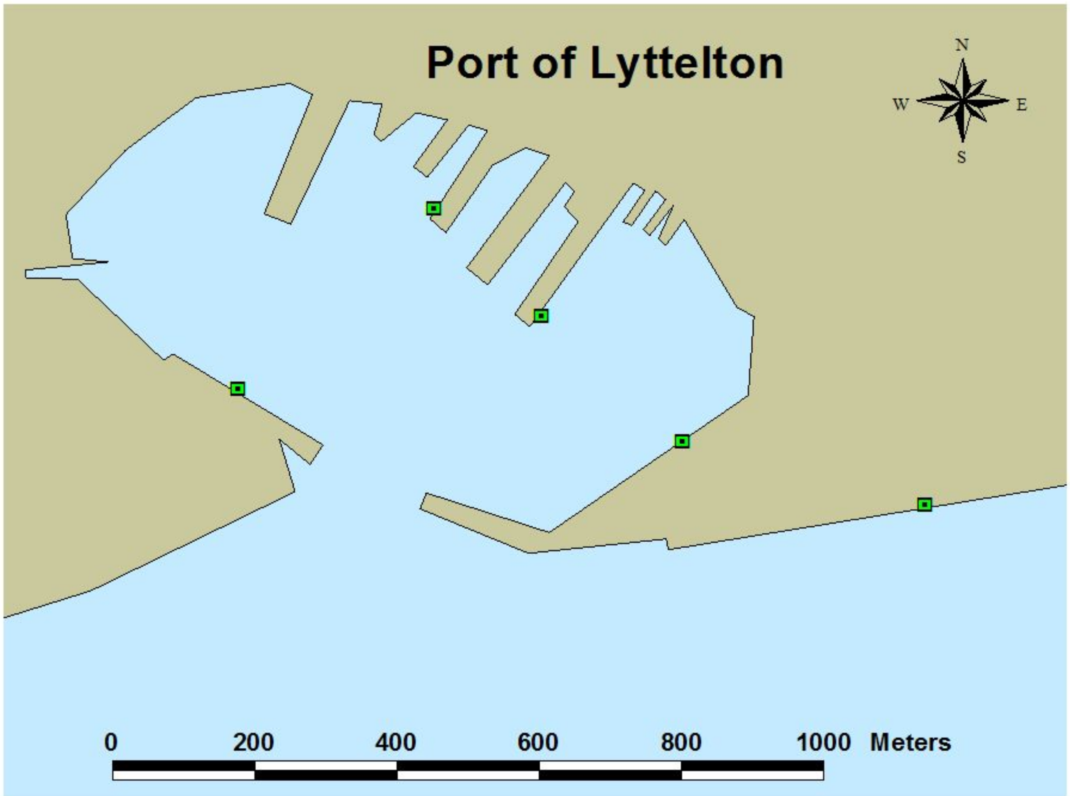

Figure 9: Diver pile scraping sites

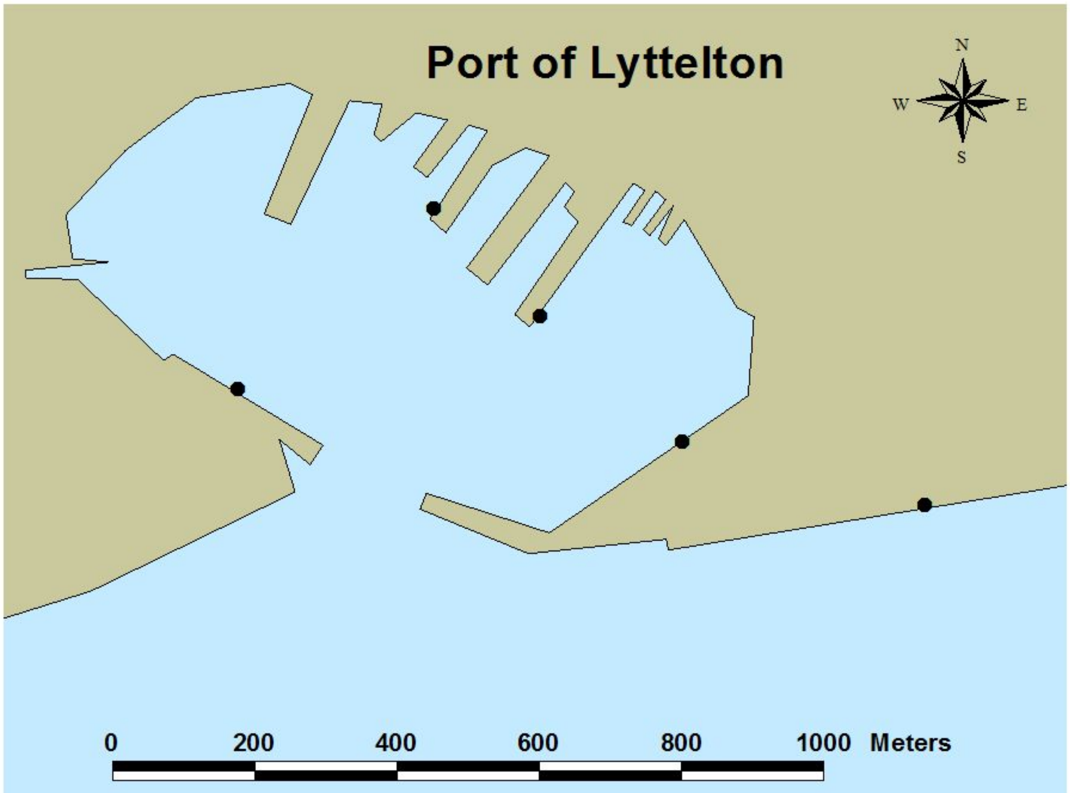

Figure 10: Benthic sledding sites.

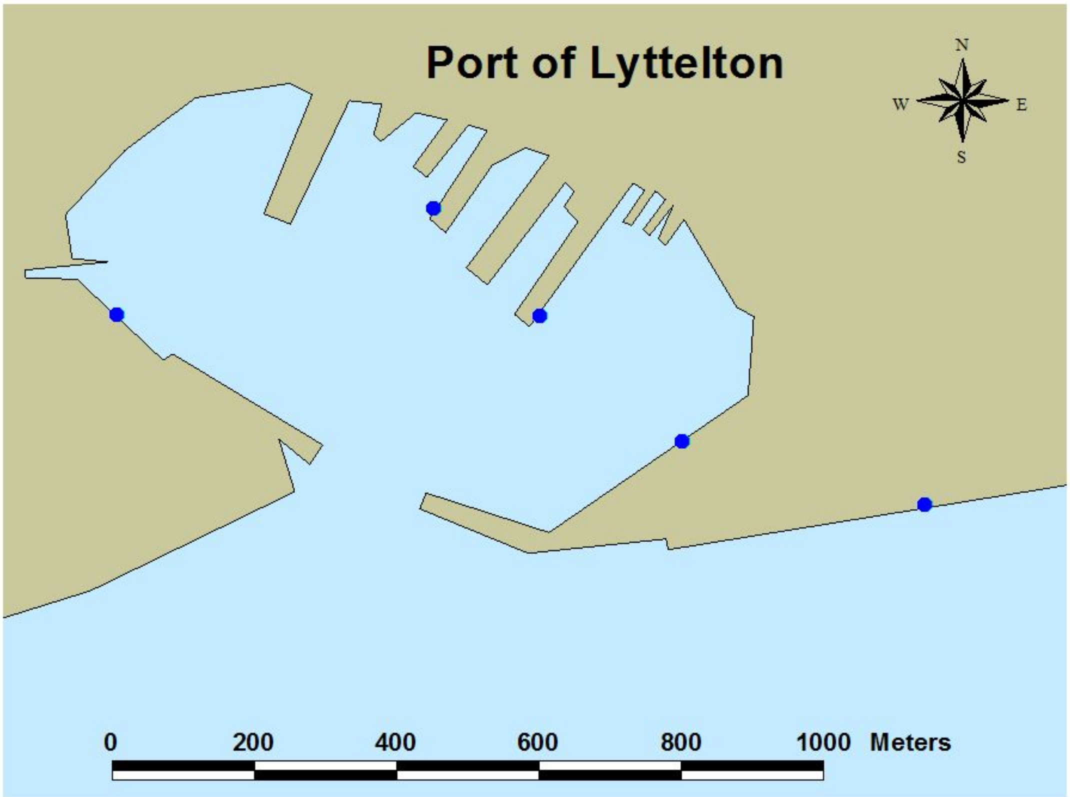

Figure 11: **Box, starfish and shrimp trapping sites.**

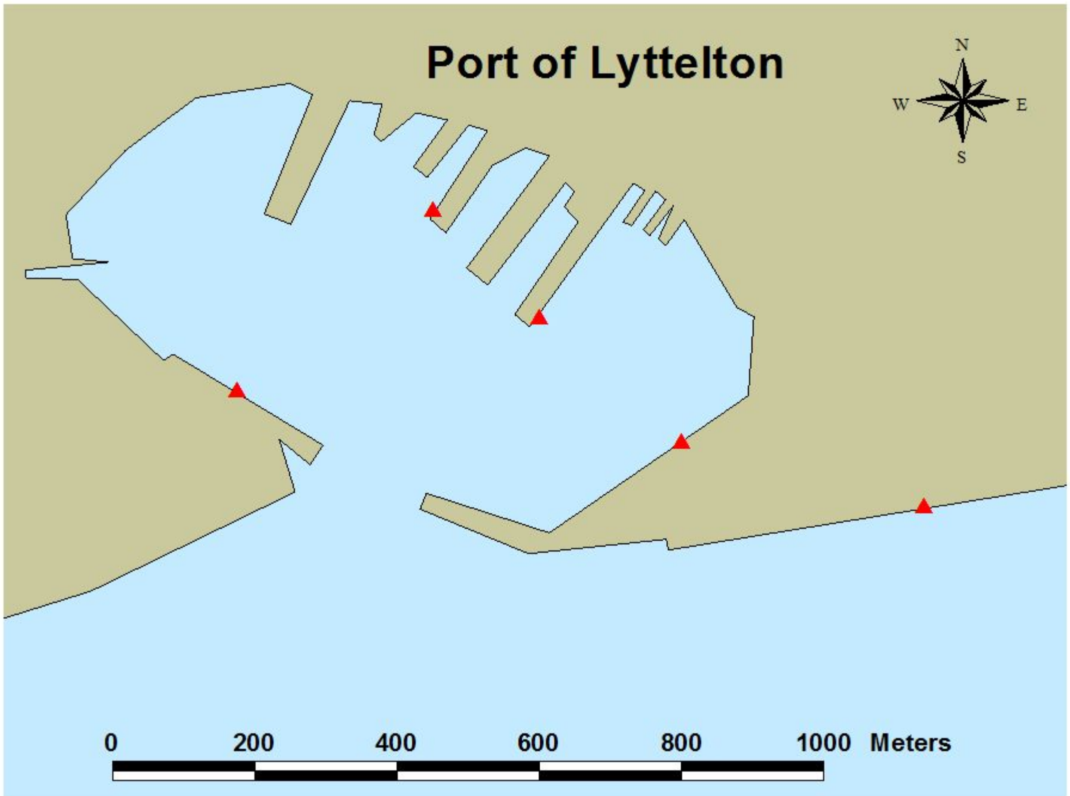

Figure 12: **Opera house trapping sites.**

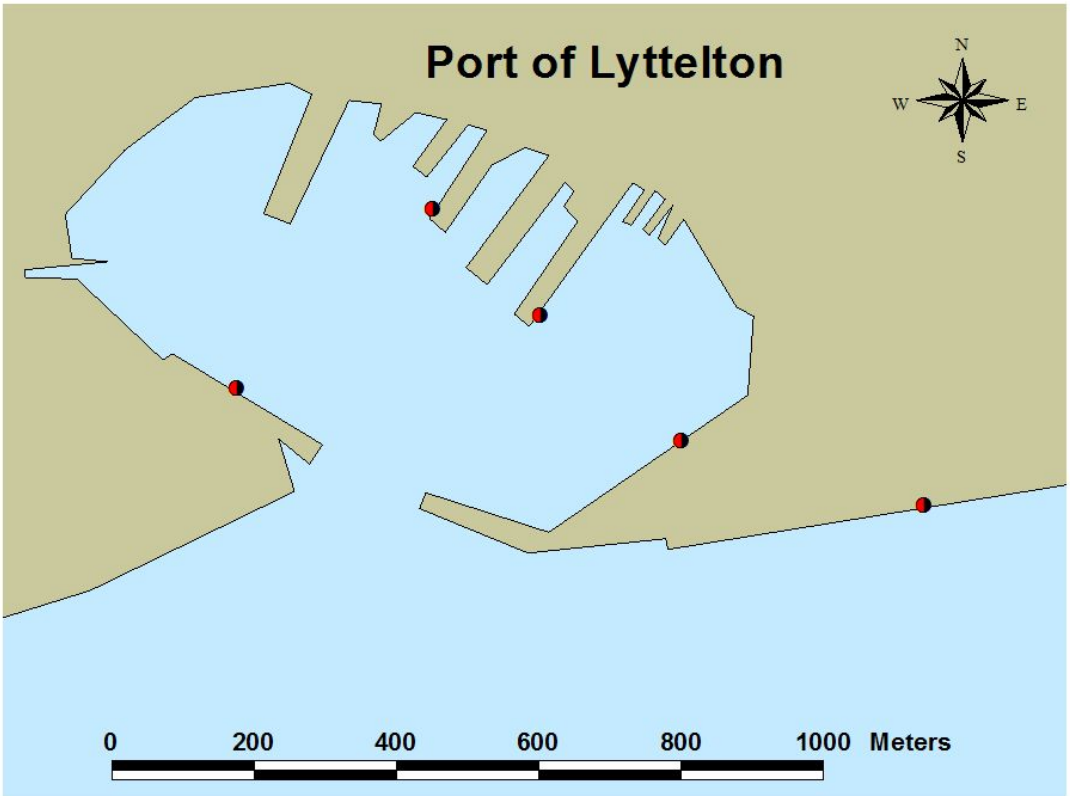

Figure 13: **Shipek grab sites.**

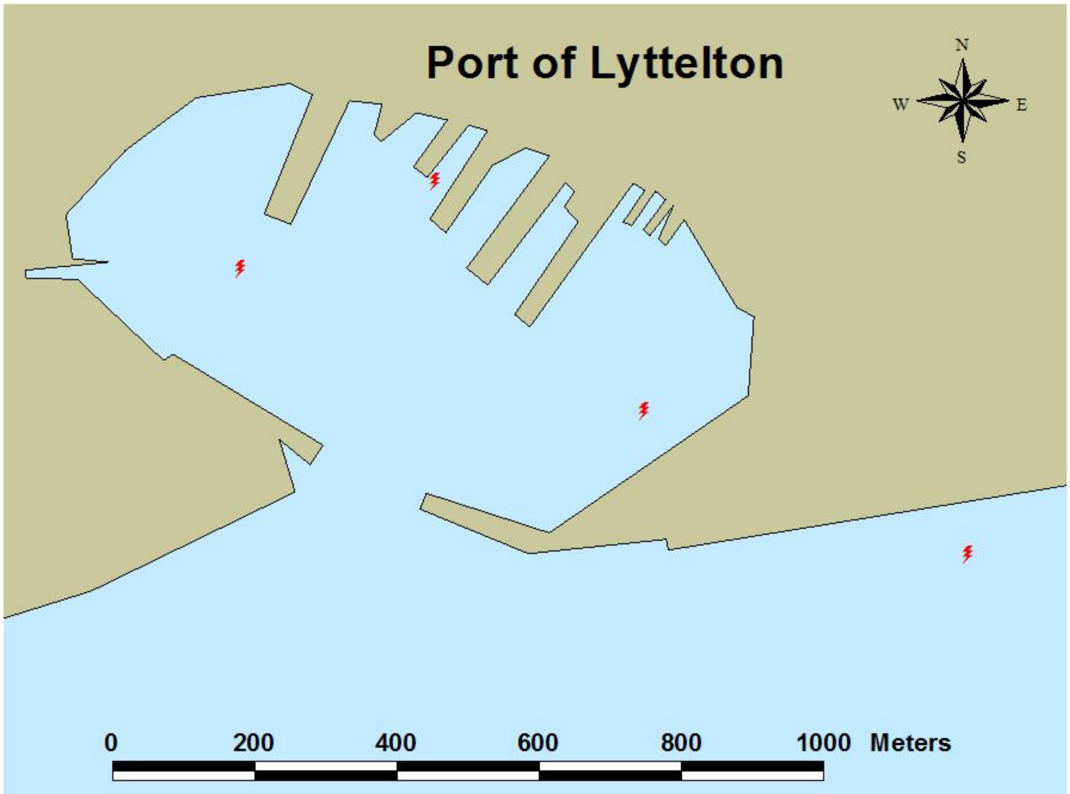

Figure 14: **Javelin core sites.**

SORTING AND IDENTIFYING 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), or because the species has 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 described 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 246 species or higher taxa were identified from the Lyttelton Port survey. This collection consisted of 150 native (Table 6), 22 cryptogenic (Table 7), 20 non-indigenous species (Table 8) and 54 species indeterminata (Table 9, Fig. 15). The biota included a diverse array of organisms from 13 Phyla (Fig. 16). Fourteen species from the Port of Lyttelton had not previously been described from New Zealand waters. For general descriptions of the main groups of organisms (Phyla) encountered during this study refer to Appendix 2.

NATIVE SPECIES

A total of 150 native species was identified from the Port of Lyttelton. Native species represents 61.0 % of all species identified from this location (Table 6) and included highly diverse assemblages of annelids (27 species), crustaceans (44 species), molluscs (18 species), phycophyta (15 species) and urochordates (11 species). A number of other less diverse phyla including bryozoans, chelicerates, cnidarians, echinoderms, porifera, pyrrophycophyta and vertebrates were also sampled from the Port (Table 6).

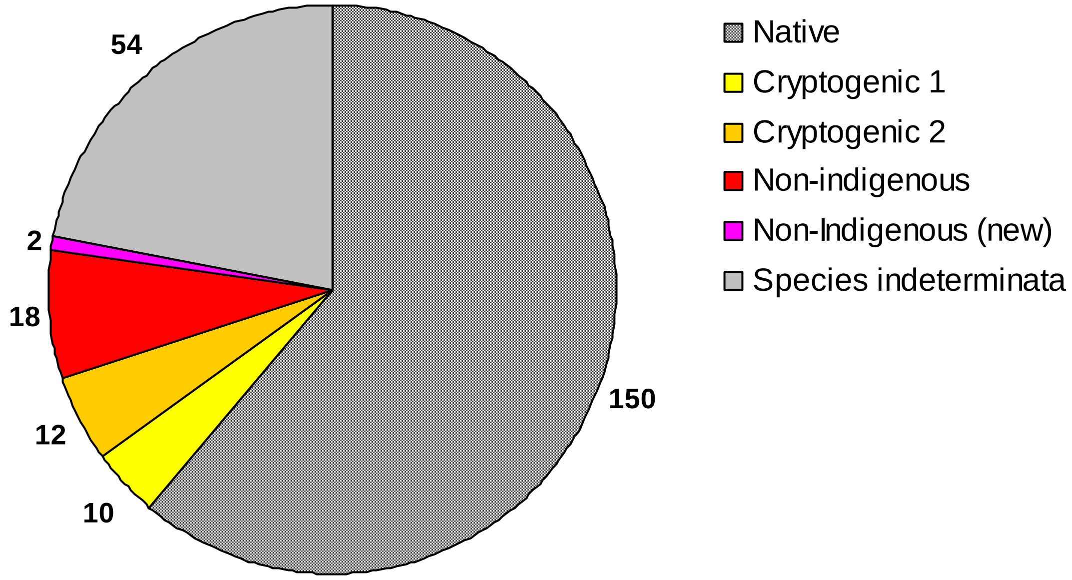

Figure 15: **Diversity of marine species sampled in the Port of Lyttelton. Values indicate the number of species in native, cryptogenic, non-indigenous and species indeterminata categories.**

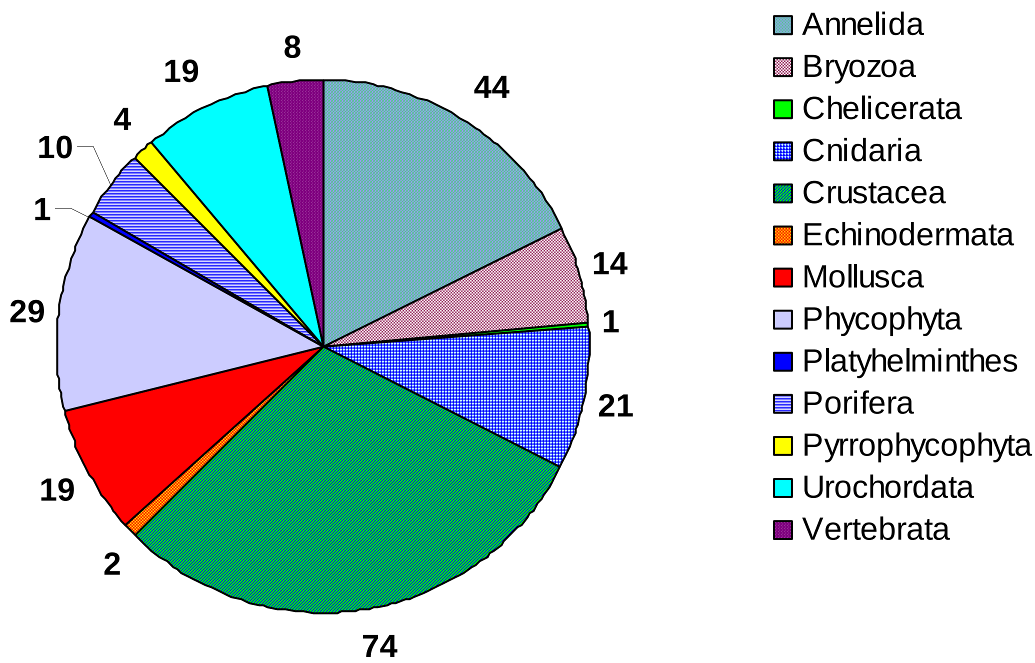

Figure 16: **Marine Phyla sampled in the Port of Lyttelton. Values indicate the number of species in each of the major taxonomic groups.**

CRYPTOGENIC SPECIES

Twenty-two cryptogenic species were discovered in the Port of Lyttelton. Cryptogenic species represent 9.0 % of all species or higher taxa identified from the Port. The cryptogenic organisms identified included 10 Category 1 and 12 Category 2 species as defined in Section 2.8 above. These organisms included three cnidarians, eight crustaceans, six sponges and five ascidian species (Table 7). Many of the Category 1 cryptogenic species (the ascidians *Aplydium phortax*, *Astereocarpa cerea*, *Botrylloides leachii*, and *Corella eumyota*; and the hydroids *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). All five of the sponges and three of the amphipods (*Leucothoe* sp. 1, *Meridiolembos* sp. aff. *Acherontis, Stomacontion* sp. aff. *S. pungpunga*) listed in the C2 category have not previously been described in New Zealand.

NON-INDIGENOUS SPECIES

Twenty non-indigenous species (NIS) were recorded from the Port of Lyttelton (Table 8). NIS represents 8.1 % of all identified species from this location. Two of these species, the crab *Cancer gibbosulus* and the ascidian *Cnemidocarpa sp*., were not previously known from New Zealand. NIS included six bryozoans, one cnidarian, six crustaceans, one mollusc, four phycophyta and two urochordates. 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 overlaid 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.

Bugula flabellata (Thompson in Gray, 1847)

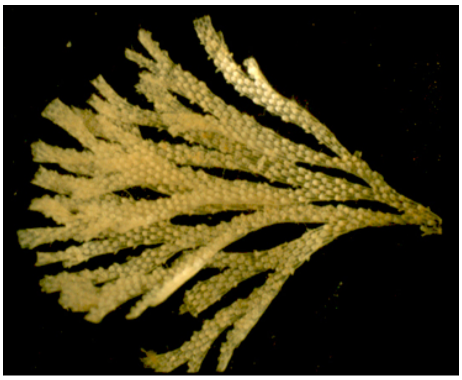

Image and information: NIMPIS (2002a)

Bugula flabellata is an erect bryozoan with broad, flat branches. It is a colonial organism and consists of numerous 'zooids' connected to one another. It is pale pink and can grow to about 4 cm high and attaches to hard surfaces such as rocks, pilings and pontoons or the shells of other marine organisms. It is often found growing with other erect bryozoan species such as *B. neritina* (see below), or growing on encrusting bryozoans. Vertical, shaded, sub-littoral rock surfaces also form substrata for this species. It has been recorded down to 35 m. *Bugula flabellata* is native to the British Isles and North Sea and has been introduced to Chile, Florida and the Caribbean and the northern east and west coasts of the USA, as well as Australia and

New Zealand. It is cryptogenic on the Atlantic coasts of Spain, Portugal and France. *Bugula flabellata* is a major fouling bryozoan in ports and harbours, particularly on vessel hulls, pilings and pontoons and has also been reported from offshore oil platforms. There have been no recorded impacts from *B. flabellata.* During the current baseline surveys it was recorded from Opua marina, Whangarei, Auckland, Tauranga, Napier, Taranaki, Wellington, Picton, Nelson, Lyttelton, Timaru, Dunedin and Bluff. In the Port of Lyttelton *B. flabellata* occurred in pile scrape samples taken from the No. 2, No. 4, and Oil Wharves, Cashin Quay and Gladstone Pier. It was also recovered in benthic sled samples taken near the Oil Wharf (Fig. 17).

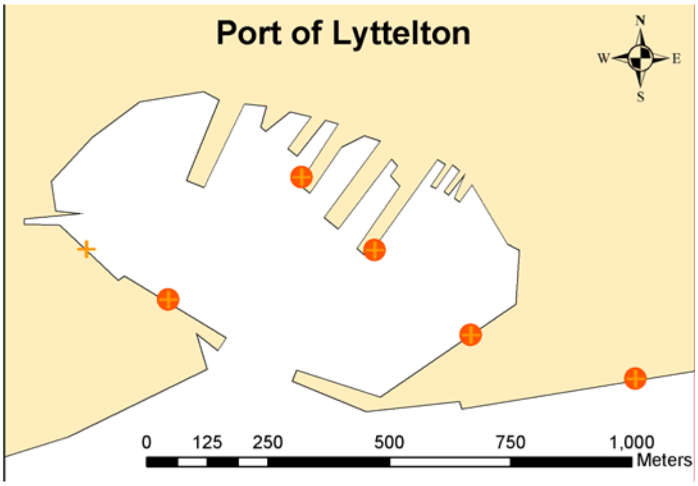

Figure 17: ***Bugula flabellata*** **presence (circle) and absence (cross) in Lyttelton**

Bugula neritina (Linnaeus, 1758)

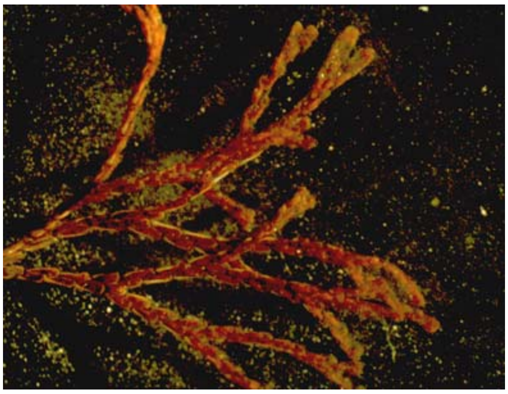

Image and information: NIMPIS (2002b)

Bugula neritina is an erect, bushy, red-purple-brown bryozoan. Branching is dichotomous (in series of two) and zooids alternate in two rows on the branches. Unlike all other species of *Bugula*, *B. neritina* has no avicularia (defensive structures) or spines, but there is a single pointed tip on the outer corner of zooids. Ovicells (reproductive structures) are large, globular and white in colour. They often appear in such high numbers that they resemble small snails or beads. *Bugula neritina* is native to the Mediterranean Sea. It has been introduced to most of North America, Hawaii, India, the Japanese and China Seas, Australia and New Zealand. It is cryptogenic in the British Isles. *Bugula neritina* is one of the most abundant bryozoans in ports and harbours and an important member of the fouling community. The species colonises any available substratum and can form extensive monospecific growths. It grows well on pier piles, vessel hulls, buoys and similar submerged surfaces. It even grows heavily in ships' intake pipes and condenser chambers. In North America, *B. neritina* occurs on rocky reefs and seagrass leaves. In Australia, it occurs primarily on artificial substrata. *B. neritina* occurs in all New Zealand ports (Gordon and Mawatari 1992). In the Port of Lyttelton *B. neritina* occurred in pile scrape samples taken from the No. 2, No. 4 and Oil Wharves, and Gladstone Pier. It also occurred in benthic sled samples taken near the No. 4 Wharf and in benthic grab samples near Gladstone Pier, and the No. 2 and No. 4 Wharves (Fig. 18).

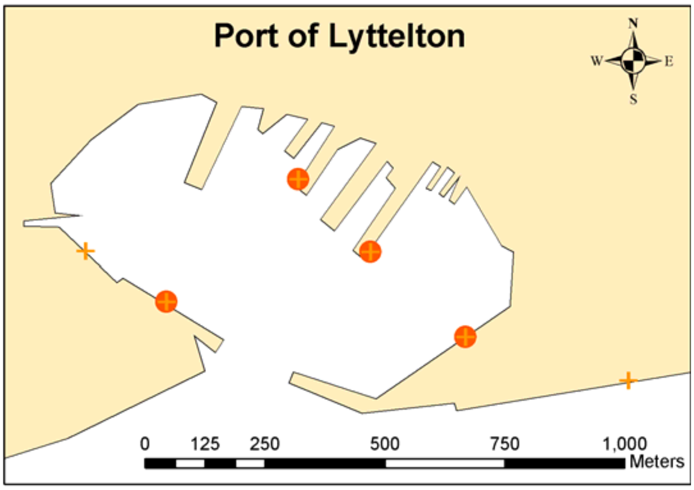

Figure 18: *Bugula neritina* presence (circle) and absence (cross) in Lyttelton

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

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

Tricellaria inopinata is an erect bryozoan. An assessment of samples and literature from various global regions suggests that Atlantic and Adriatic *T. inopinata* correspond with a morphospecies known to be invasive in New Zealand, and cryptogenic in Pacific North America, Japan and Australia. The morphospecies in question has usually been referred to as *T. occidentalis* (Trask, 1857) and, in at least one instance, as *T. porteri* (MacGillivray, 1889). *Tricellaria inopinata*'s widespread Pacific distribution and the possibility of anthropogenic dispersal there in historical times precludes the more precise identification of its source region. *Tricellaria inopinata* is a prolific fouling species with a high reproductive output. It has documented impacts on the abundance of native bryozoan species: *T. inopinata*'s invasion of the Laguna di Venezia (Italy) resulted in a sharp decline in the abundance of native bryozoans whose populations had been stable prior to *T. inopinata*'s introduction. During the port baseline surveys, *T. inopinata* was reported from the ports of Whangarei, Gisborne, Lyttelton and Taranaki. In the Port of Lyttelton it occurred in benthic grab samples taken from near the No. Wharf (Fig. 19).

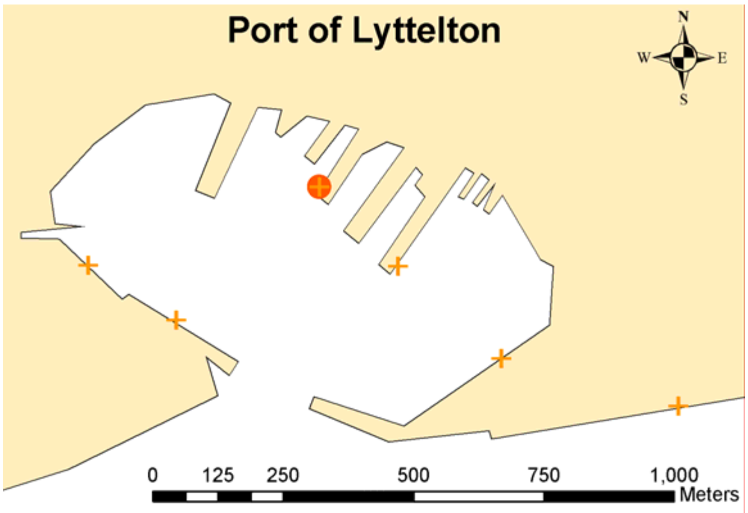

Figure 19: ***Tricellaria inopinata*** **presence (circle) and absence (cross) in Lyttelton.**

Cryptosula pallasiana **(von Moll, 1803)**

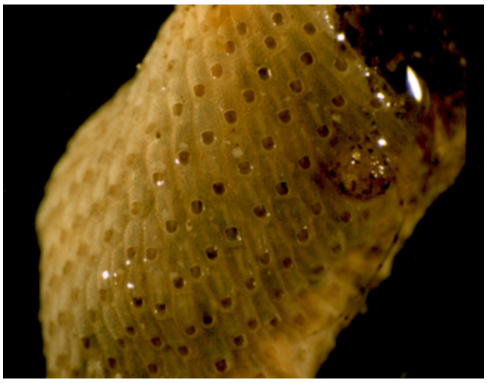

Image and information: NIMPIS (2002c)

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 the Port of Lyttelton it occurred in pile scrape samples taken from the No. 2 and No. 4 wharves, Gladstone Pier and Cashin Quay (Fig. 20).

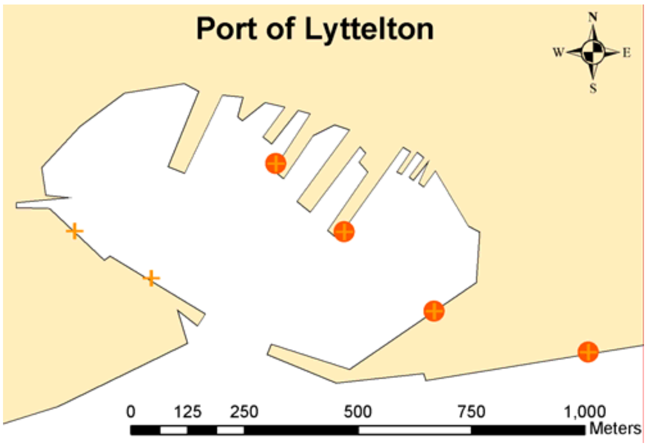

Figure 20: ***Cryptosula pallasiana*** **presence (circle) and absence (cross) in Lyttelton**

Conopeum seurati **(Canu 1908)**

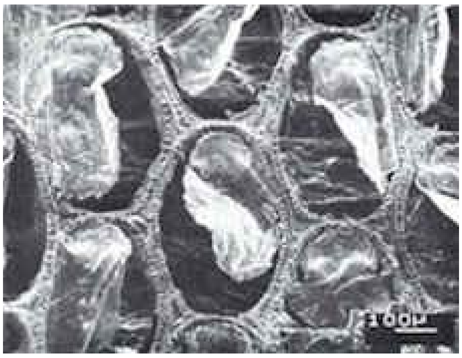

Image and information: Cranfield et al 1998; Gordon and Matawari 1992; Smithsonian Institution (available at http://www.sms.si.edu/irlspec/Conope_seurat.htm)

Conopeum seurati is an encrusting bryozoan that forms small whitish colonies on seagrasses and other substrata. The zooids are oval in shape and measure approximately 0.55 X 0.33 mm. Each zooid has a single pair of long, distal spines and the lateral spines, if present, are highly variable in number. The lophophore measures approximately 0.621 mm in diameter and bears an average of 15 tentacles. *Conopeum seurati*'s native range includes the Caspian, Azov and Mediterranean Seas. The species has been introduced to New Zealand and Florida's east coast. It has been present in New Zealand since at least 1963. *C. seurati* is a fouling organism that can be found on hard surfaces, marine animals, and plants in estuarine environments. Its impacts on native organisms are unknown.

In New Zealand, *C. seurati* has been recorded from Opua, Whangarei, Auckland, Manukau, Gisborne, Napier, Nelson and Lyttelton. In the Port of Lyttelton it occurred in pile scrape samples taken from Cashin Quay (Fig. 21).

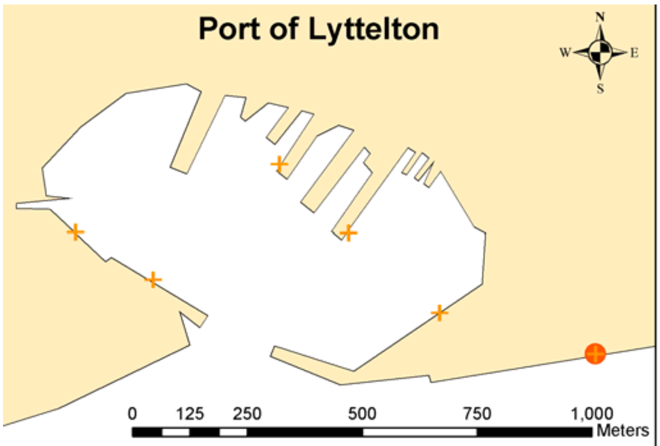

Figure 21: ***Conopeum seurati*** **presence (circle) and absence (cross) in Lyttelton**

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

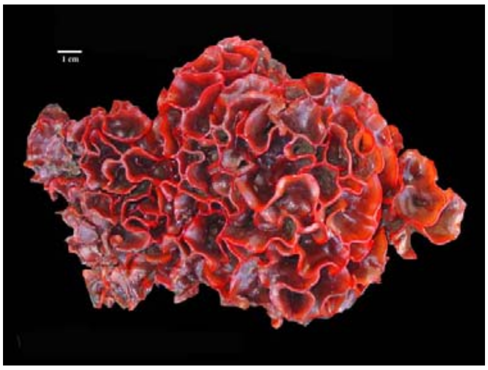

Image: California Academy of Sciences. Information: Gordon and Matawari (1992)

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

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

W. subtorquata has been present in New Zealand since at least 1982 and is now present in most ports from Opua to Bluff (Gordon and Matawari 1992). In the Port of Lyttelton it occurred in pile scrape samples taken from the No. 2, No. 4 and Oil Wharves, Gladstone Pier and Cashin Quay. It also occurred in benthic grab samples taken near the No. 2, No. 4 and Oil Wharves and Gladstone Pier (Fig. 22).

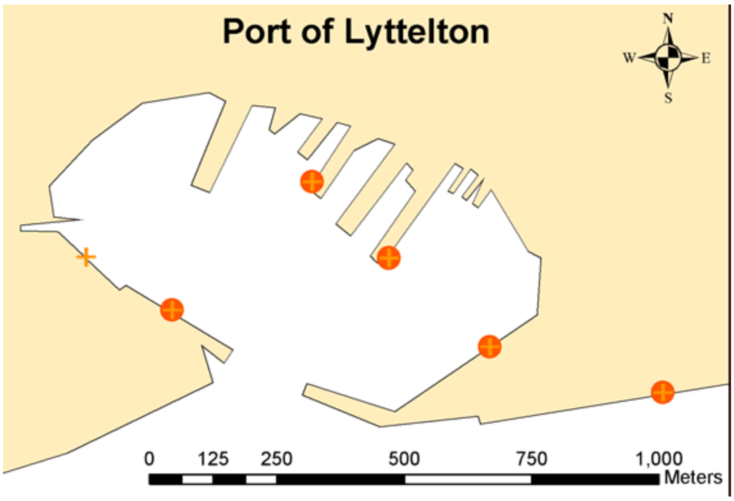

Figure 22: *Watersipora subtorquata* presence (circle) and absence (cross) in Lyttelton

***Haliplanella lineata* (Verrill, 1870)**

(Synonyms: *Diadumene lineata* (Verrill, 1873), *Haliplanella luciae* (Verrill, 1898), *Diadumene luciae*, *Aiptasiomorpha luciae*)

Image: Eldredge & Smith (2001)

Haliplanella lineata is a small (~3.5 cm diam. x 3 cm height), orange-striped green anemone that is thought to be a native of the western Pacific (Japan, China and Hong Kong). It is found on hard substrata, on the undersides of stones or shells, on pilings or floating docks, in intertidal pools or shallow-water protected areas such as harbors and embayments, and is often associated with mussels or oysters. Introduced populations have been reported from Indonesia, the Hawaiian Islands, Pacific Coast of North America, Brazil, the North Atlantic and New Zealand (Eldredge and Smith 2001). In New Zealand, *H. lineata* (*Diadumene lineata*) has previously been reported from Waitemata Harbour (Cranfield et al. 1998) and was found in Motueka in 2003 during the surveillance for unwanted marine pests (Biosecurity NZ contract ZBS2001/01). Its ecological impacts are unstudied. In the Port of Lyttelton H. lineata occurred in pile scrape samples taken from the No. 4 Wharf (Fig 23).

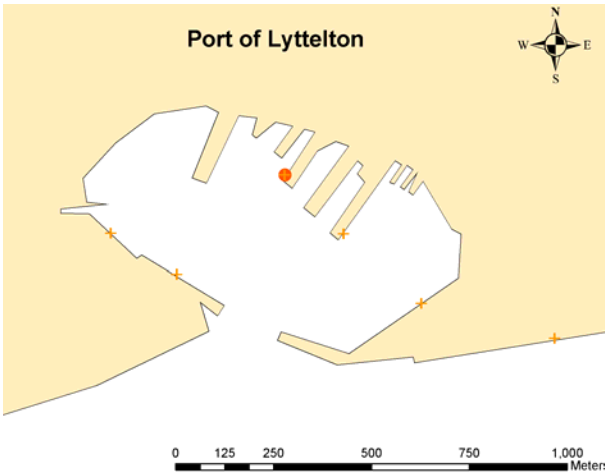

Figure 23: *Haliplanella lineata* **presence (circle) and absence (cross) in Lyttelton**

***Apocorophium acutum* (Chevreux, 1908)**

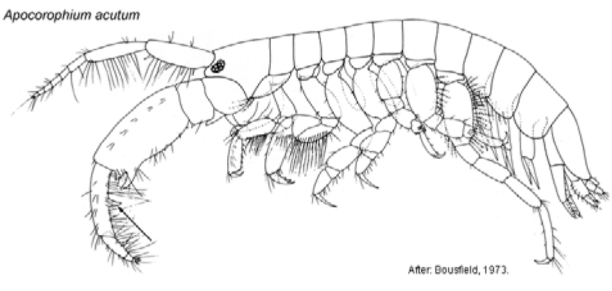

Image and information: Keys to the Northeast Atlantic and Mediterranean amphipods. [http://www.amphipoda.com/acutum.html]

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. *Apocrophium acutum* inhabits marine sediments in estuarine mudflats and brackish water and fouling assemblages where it builds muddy tubes. It has no known documented impacts. During the port baseline surveys *A. acutum* was recorded from the ports of Lyttelton, Tauranga and Timaru, and from Gulf Harbour and Opua marinas. In the Port of Lyttelton it occurred in pile scrape samples taken from the No. 2, No. 4 and Oil Wharves, and Gladstone Pier (Fig. 24).

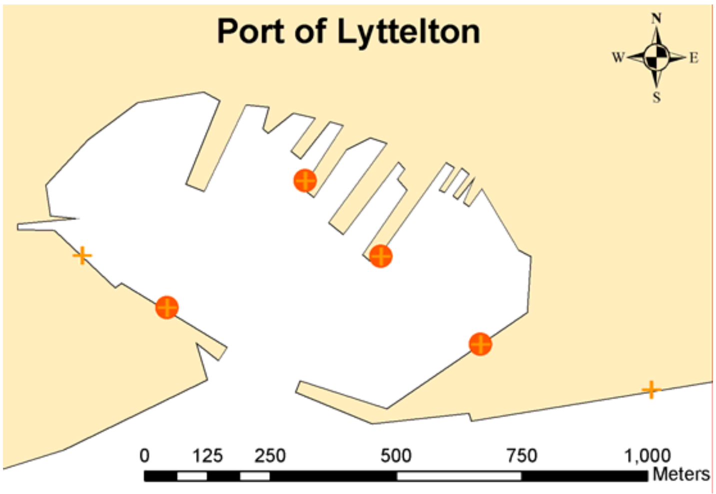

Figure 24: *Apocorophium acutum* presence (circle) and absence (cross) in Lyttelton

***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. It 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. *Monocorophium 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 can tolerate a wide range of salinities. Pilisuctorid ciliates 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 port baseline surveys, *M. acheruscium* was recorded from the ports of Tauranga, Gisborne, Lyttelton, Timaru, Dunedin and the Whangarei Town Basin Marina. In the Port of Lyttelton it occurred in pile scrape samples taken from the No. 2, No. 4 and Oil Wharves, Cashin Quay, and Gladstone Pier (Fig. 25).

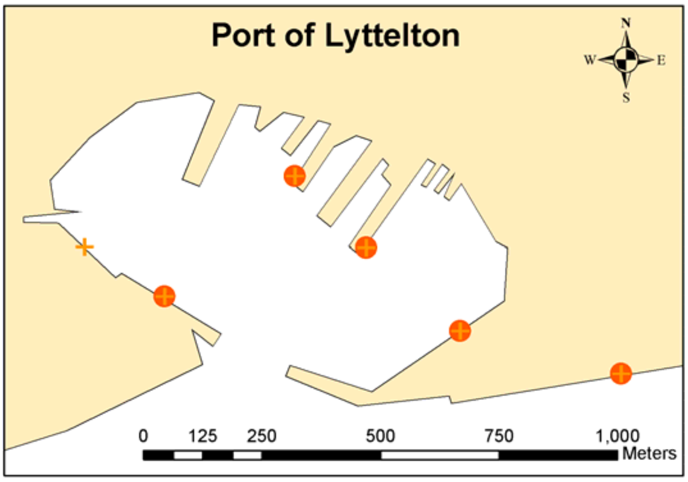

Figure 25. *Monocorophium acherusicum* presence (circle) and absence (cross) in Lyttelton

***Monocorophium sextonae* (Crawford, 1937)**

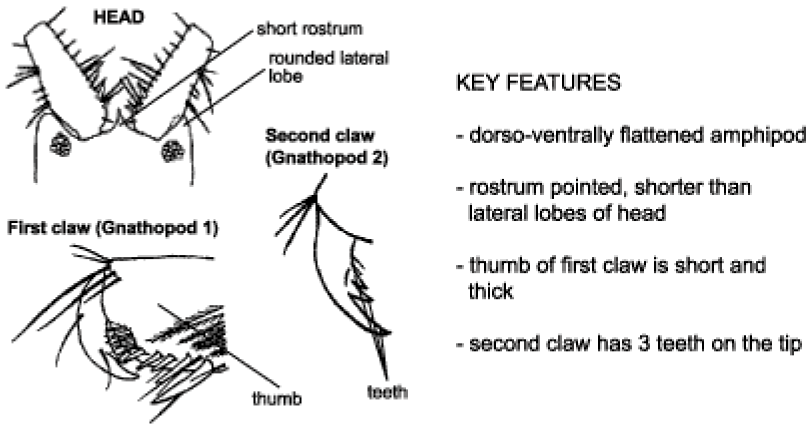

Image and information: NIMPIS (2002f)

Monocorophium sextonae is a flat-looking amphipod that is whitish grey, with two dark bars across each segment, antennae and head. It 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. The exact native range of *M. sextonae* is largely unknown, although it is cryptogenic to the north-east Atlantic and Mediterranean and has been introduced to New Zealand and Australia. It builds mud tubes on fouling species such as hydroids, sponges, algae and kelp holdfasts in the subtidal zone from just above low water mark to ~50 m depth. It is tolerant of slow flowing water and large quantities of inorganic material and fouls surfaces such as harbour pylons, rafts and buoys by building mud tubes. It can reach high abundances on sediments or where silt and detritus accumulate among fouling communities. *M. sextonae* has been present in New Zealand since at least 1921 and is known from Lyttelton and Dunedin (Cranfield et al. 1998). In the Port of Lyttelton, it occurred in pile scrape samples taken from Gladstone Pier and the Oil Wharf (Fig. 26).

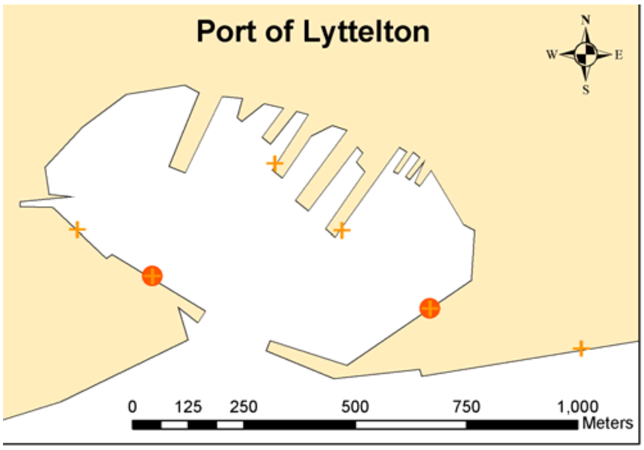

Figure 26: *Monocorophium sextonae* presence (circle) and absence (cross) in Lyttelton

***Jassa slatteryi* (Conlan, 1990)**
No image available.

Jassa slatteryi is an amphipod in the family Ischyroceridae. It is a cosmopolitan species. The type specimen was recorded from California, but it is known to be present in the Atlantic and Pacific Oceans and the Mediterranean Sea. Its habitat requirements and impacts are unknown. *J. slatteryi* also occurs in southeastern Australia and New Zealand. During the baseline port surveys it was recorded from the ports of Whangarei, Lyttelton and Timaru. In the Port of Lyttelton, *J. slatteryi* occurred in pile scrape samples taken from Cashin Quay (Fig. 27).

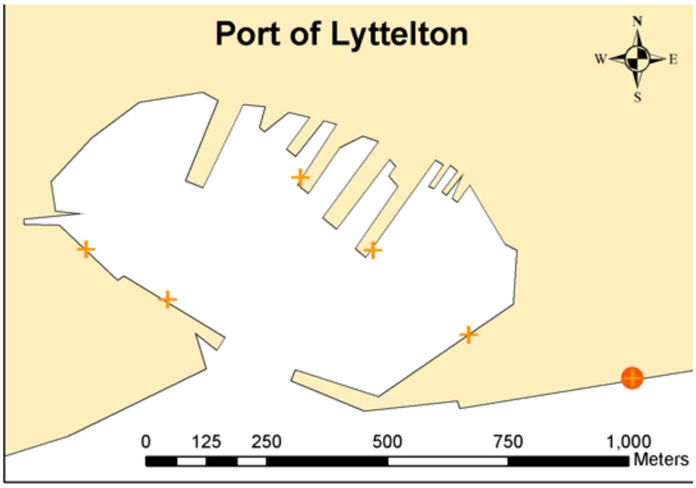

Figure 27: *Jassa slatteryi* presence (circle) and absence (cross) in Lyttelton

***Stenthoe sp. aff. S. gallensis* (Walker, 1904)**
No image available.

Stenothoe gallensis is an amphipod that is thought to have a tropical worldwide distribution (e.g. Hawaii, Florida USA) (Coles et al. 1997). Its habitat requirements and impacts are unknown. In the Port of Lyttelton, it occurred in pile scrape samples taken from Gladstone Pier (Fig. 28).

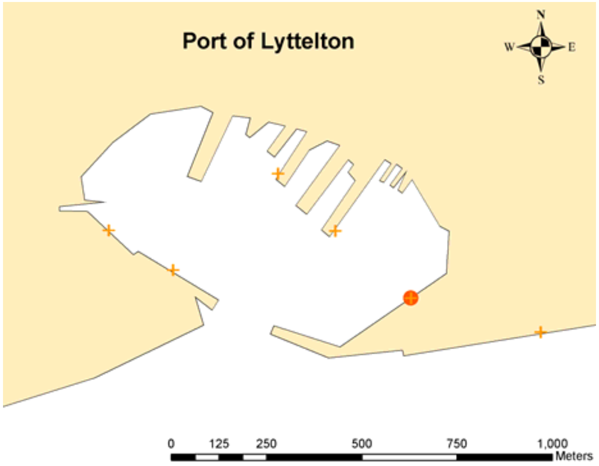

Figure 28: *Stenthoe sp. aff. S. gallensis* presence (circle) and absence (cross) in Lyttelton

***Cancer gibbosulus* (de Haan, 1835)**

Image: Colin McClay. Information: Sakai (1965)

Cancer gibbosulus is a mottled, oval shaped cancer crab with a carapace width of up to 20 mm. It is native to Japan, Korea and northern China (Liaodong Peninsular) where it is usually found on muddy sand or broken shell and sandy bottoms (Ai-Yun and Si-Liang 1991). *Cancer gibbosulus* is a new record in New Zealand waters and has no known documented impacts. During the baseline port surveys, *C. gibbosulus* was recorded from Wellington, Lyttelton and Timaru. These are the first known records of its presence in New Zealand. In the Port of Lyttelton, it occurred in pile scrape samples taken from Cashin Quay (Fig. 29).

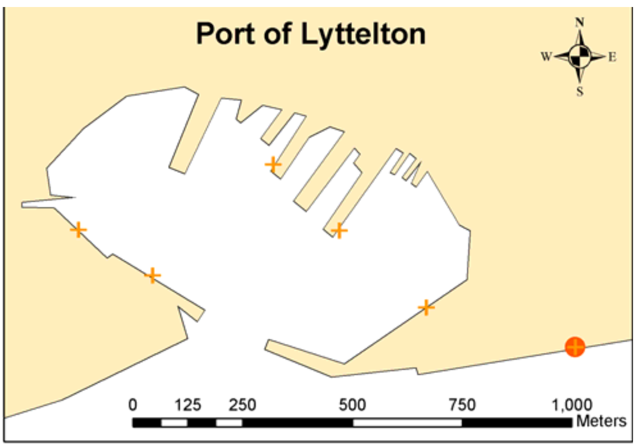

Figure 29: *Cancer gibbosulus* presence (circle) and absence (cross) in Lyttelton

Theora lubrica (Gould, 1861)

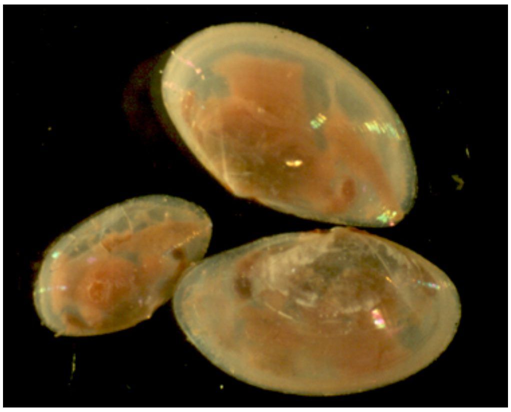

Image and information: NIMPIS (2002g)

Theora lubrica is a small bivalve with an almost transparent shell. The shell is very thin, elongated and has fine concentric ridges. *T. lubrica* grows to about 15 mm in size, and is characterised by a fine elongate rib extending obliquely across the internal surface of the shell. *Theora lubrica* is native to the Japanese and China Seas. It has been introduced to the west coast of the USA, Australia and New Zealand.

Theora lubrica typically lives in muddy sediments from the low tide mark to 50 m, however it has been found at 100 m. In many localities, *T. lubrica* is an indicator species for eutrophic and anoxic areas. *T. lubrica* has been present in New Zealand since at least 1971. It occurs in estuaries of the north-east coast of the North Island, including the Bay of Islands, Whangarei Harbour, Waitemata Harbour, Wellington and Pelorus Sound. During the port baseline surveys, it was recovered from Opua, Whangarei port and marina, Gulf Harbour marina, Auckland, Gisborne, Napier, Taranaki, Wellington, Nelson, and Lyttelton. In the survey of the Port of Lyttelton, it occurred in benthic sled samples taken near the No. 2 Wharf (Fig. 30), but it is known to be abundant throughout muddy sediments in the harbour.

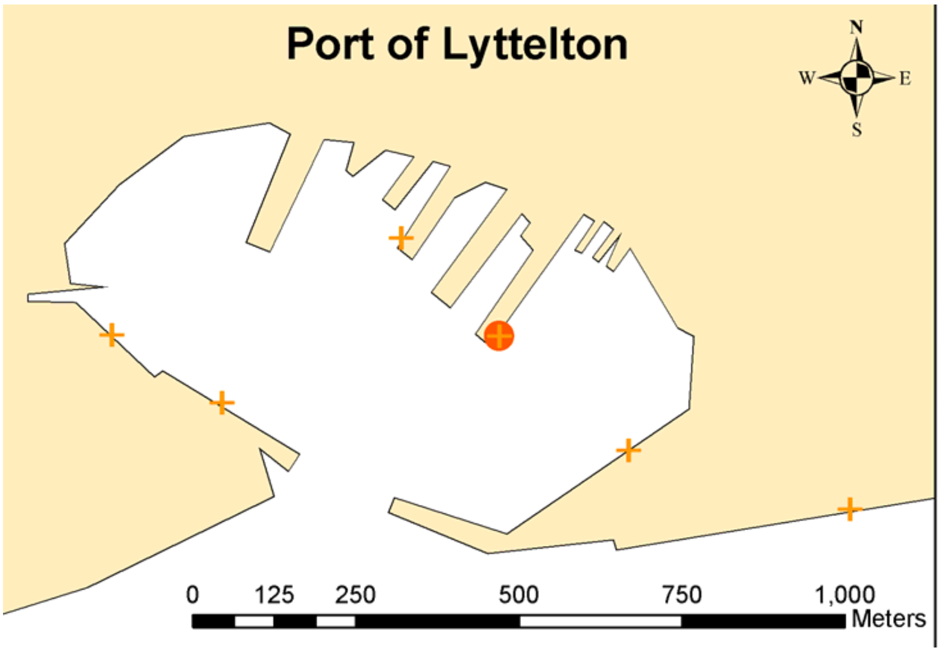

Figure 30: _Theora lubrica_ presence (circle) and absence (cross) in Lyttelton

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

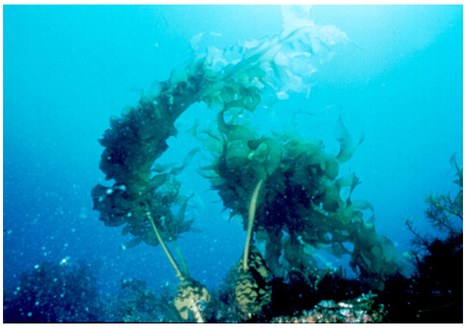

Image and information: NIMPIS (2002i); Fletcher and Farrell (1999)

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

Undaria pinnatifida is an opportunistic alga that has the ability to rapidly colonise disturbed or new surfaces. It grows from the intertidal zone down to the subtidal zone to a depth of 15-20 metres, particularly in sheltered reef areas subject to oceanic influence. It does not tend to become established successfully in areas with high wave action, exposure and abundant local vegetation. *Undaria pinnatifida* is highly invasive, grows rapidly and has the potential to overgrow and exclude native algal species. The effects on the marine communities it invades are not yet well understood, although its presence may alter the food resources of herbivores that would normally consume native species. In areas of Tasmania (Australia) it has become very common, growing in large numbers in areas where sea urchins have depleted stocks of native algae. It can also become a problem for marine farms by increasing labour costs due to fouling problems. *U. pinnatifida* is known to occur in a range of ports and marinas throughout eastern New Zealand, from Gisborne to Stewart Island. In the Port of Lyttelton, *U. pinnatifida* was observed by divers and occurred in pile scrape samples from the No. 2, No. 4 and Oil Wharves, at Gladstone Pier and Cashin Quay. Drift sporophytes were also recovered in benthic sled samples taken near the No. 4 Wharf (Fig. 31).

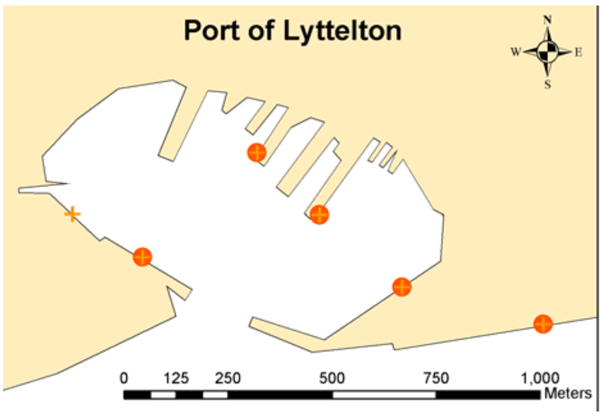

Figure 31: ***Undaria pinnatifida*** **presence (circle) and absence (cross) in Lyttelton**

***Griffithsia crassiuscula* (C.Agardh 1824)**

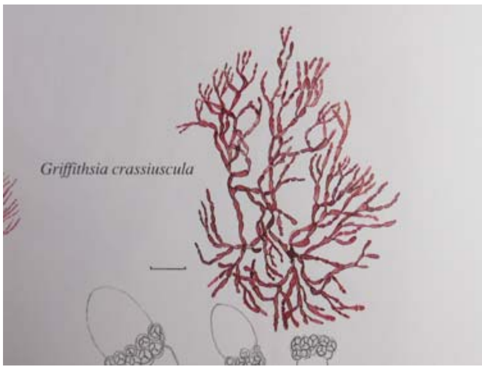

Image and information: Adams (1994)

Griffithsia crassiuscula is a small filamentous red alga. Plants are up to 10 cm high, dichotomously branched, with holdfasts of copious rhizoids. This species is bright rosy red to pink and of a turgid texture. Its native origin is thought to be southern Australia. *Griffithsia crassiuscula* is found subtidally and is mainly epiphytic on other algae and shells, but can also be found on rocks and pebbles. It has no known impacts. During the port baseline surveys, *G. crassicuscula* was recorded from Taranaki, Wellington, Picton, Lyttelton, Timaru and Bluff. In the Port of Lyttelton, it occurred in pile scrape samples taken from Gladstone Pier and the No. 4 Wharf, in benthic sled samples taken near the No. 4 Wharf and in benthic grab samples taken near the Gladstone Pier (Fig. 32).

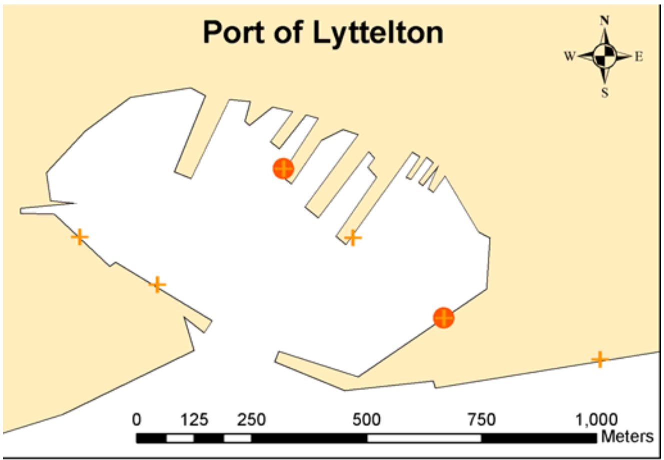

Figure 32: *Griffithsia crassiucula* presence (circle) and absence (cross) in Lyttelton

***Polysiphonia brodiei* (Dillwyn Sprengel, 1827)**

Image and information: NIMPIS (2002h)

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 north-eastern 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 the Port of Lyttelton, *P. brodiaei* occurred in pile scrape samples taken from Gladstone Pier (Fig. 33).

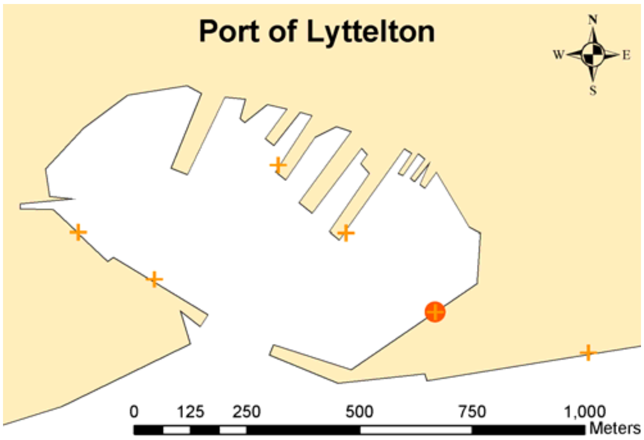

Figure 33: *Polysiphonia brodiei* presence (circle) and absence (cross) in Lyttelton

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

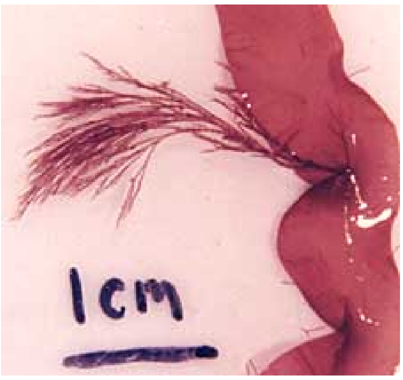

Image: http://www.omp.gso.uri.edu/
Information: Adams (1994)

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 Lyttelton it occurred in pile scrape samples taken from the No. 4 Wharf (Fig. 34).

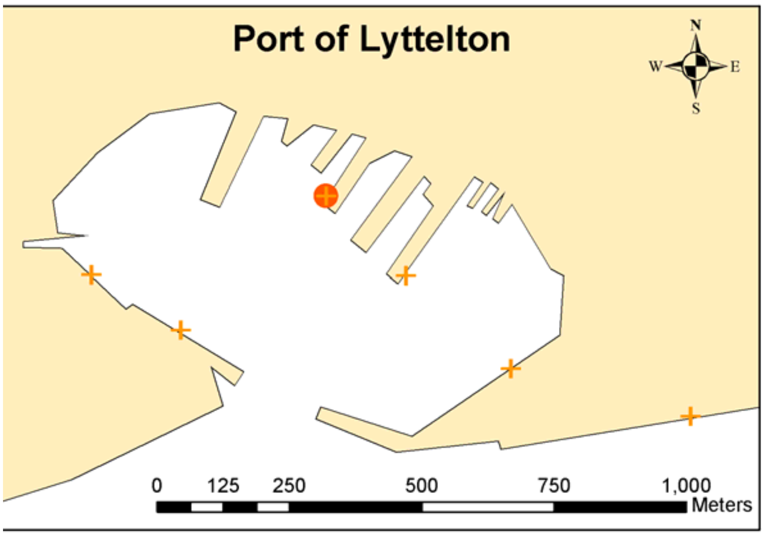

Figure 34: ***Polysiphonia subtilissima*** **presence (circle) and absence (cross) in Lyttelton**

Ciona intestinalis **(Linnaeus, 1767)**

Image and information: NIMPIS (2002j)

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

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

Africa, Korea and Chile, and recently in the Marlborough Sounds, New Zealand. During the port baseline surveys it was recorded from the ports of Napier, Nelson, Lyttelton, and Timaru. In the Port of Lyttelton, it occurred in pile scrape samples taken from Gladstone Pier and the No. 2, No. 4 and Oil Wharves. It was also present in benthic sled samples taken near the No. 2 and Oil Wharves (Fig. 35).

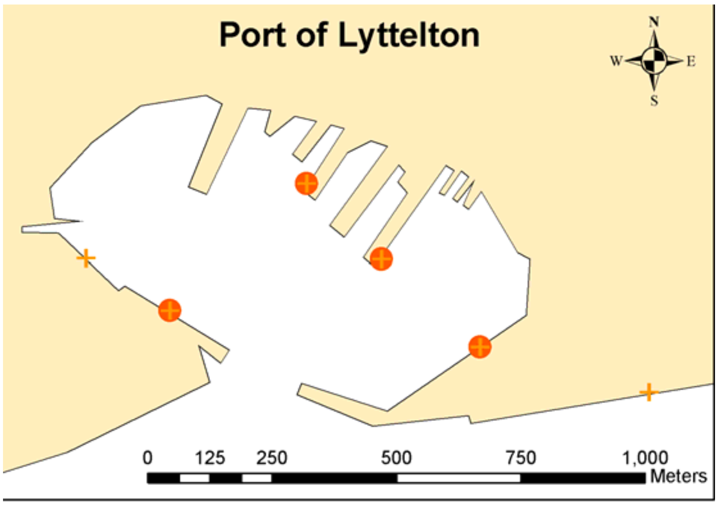

Figure 35: ***Ciona intestinalis*** **presence (circle) and absence (cross) in Lyttelton**

Cnemidocarpa sp. **(Kott, 1952)**

No image available.

This ascidian is in the family Styelidae. It appears to be a new species that is closely related to *C. nisiotus*, but varies from this species in gonad structure, the number of branchial tentacles and shape of rectal opening. It is not similar to any species described in Australia, Japan or South Africa. Its native distribution, habitat preferences and impacts are unknown. Specimens matching this description were also recovered from Gulf Harbour marina, Auckland, Tauranga, Gisborne, Taranaki, Picton, Lyttelton and Timaru during the port baseline surveys. In the Port of Lyttelton, it occurred in pile scrape samples taken from Cashin Quay and the No. 2 and Oil Wharves (Fig. 36).

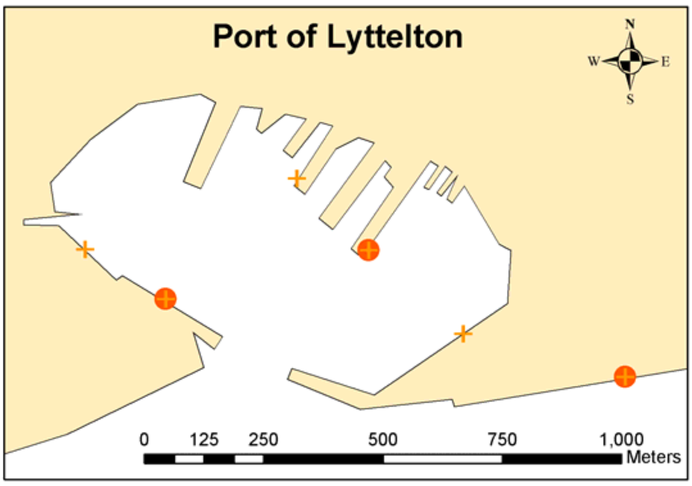

Figure 36: ***Cnemidocarpa sp.*** **presence (circle) and absence (cross) in Lyttelton**

SPECIES INDETERMINATA

Fifty-four organisms from the Port of Lyttelton were classified as species indeterminata. If each of these organisms is considered a species of unresolved identity, then together they represent 22.0 % of all species collected from this survey (Fig 15). Species indeterminata from the Port of Lyttelton included 17 Annelida, two Bryozoa, seven Cnidaria, 16 Crustacea, ten Phycophyta, one Platyhelminth and one Urochordata species (Table 9).

NOTIFIABLE AND UNWANTED SPECIES

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

PREVIOUSLY UNDESCRIBED SPECIES IN NEW ZEALAND

Fourteen species from the Port of Lyttelton 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 seven amphipod crustaceans and five species of sponges (Table 7). These species do not match existing taxonomic descriptions and may be new to science. Two non-indigenous species in the Port of Lyttelton had not previously been recorded from New Zealand waters. These were the crab *Cancer gibbosulus* (see section 3.3.13 above) and the ascidian *Cnemidocarpa* sp. (see section 3.3.20 above).

CYST-FORMING SPECIES

Cysts of four species of dinoflagellate were collected during this survey; they are indicated as members of the Pyrrophycophyta in Table 6. No cryptogenic, non-indigenous or potentially harmful 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 80 % probably were introduced to New Zealand waters via hull fouling, 5% by ballast water discharge and 15 % could have arrived via either mechanism.

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 332 in the Port of Wellington to 56 in Whangarei Town Basin Marina (Fig. 35a). Native organisms represented over 60 % of the species diversity sampled in each surveyed location, with a minimum contribution of 61.0 % in Lyttelton, and a maximum of 68.4 % in Picton (Fig. 35b). Species indeterminata organisms represented between 13.4 % and 25.3 % 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. 35b). Lyttelton's 20 NIS was the highest diversity of non-indigenous species recorded from any of the locations surveyed. Non-indigenous species represented between 3.7 % of all identified species in Bluff and 16.1 % in Whangarei Marina. NIS comprised 8.1 % of the total sampled diversity in Lyttelton (Fig. 35b), ranking it fifth highest in percentage composition of NIS from the sixteen locations surveyed.

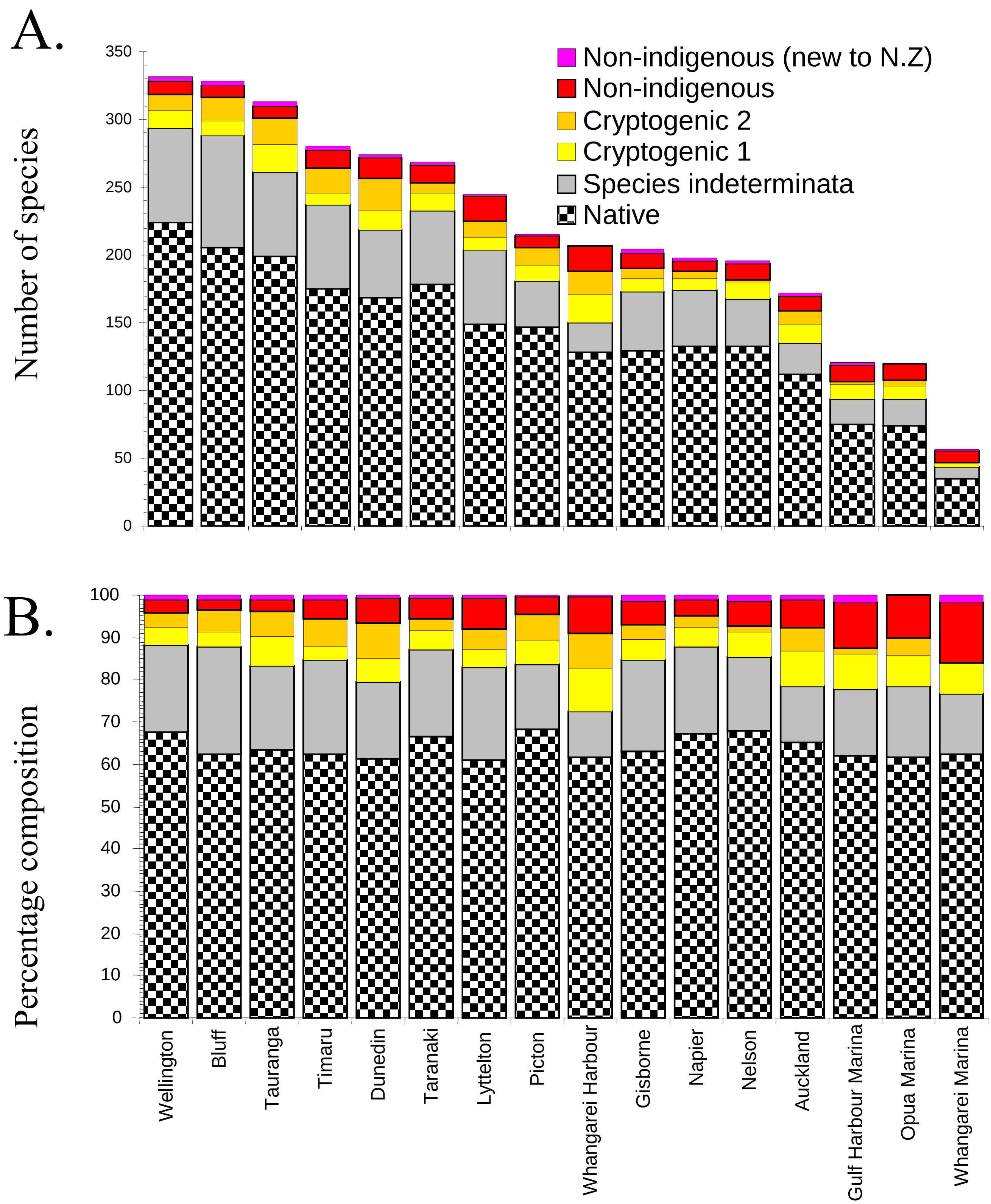

Figure 35: **Differences in (a) the number of species, and (b) the relative proportions of non-indigenous, cryptogenic, species indeterminata and native categories among the sixteen locations sampled over the summers of 2001 – 2002, and 2002-2003. Locations are presented in order of decreasing species diversity sampled.**

The number of species recorded in each location reflects sampling effort (Table 3c) and local patterns of marine biodiversity within the ports and marinas. Sampling effort alone (expressed as the total number of registered samples in each port), accounted for significant proportions of variation in the numbers of native (linear regression; $F_{1,14} = 33.14$, $P < 0.001$, $R^2 = 0.703$), Cryptogenic 1 ($F_{1,14} = 5.94$, $P = 0.029$, $R^2 = 0.298$) and Cryptogenic 2 ($F_{1,14} = 7.37$, $P = 0.017$, $R^2 = 0.345$) species recorded in the different locations. However differing sampling effort between locations did not explain differences in the numbers of NIS found there ($F_{1,14} = 0.77$, $P = 0.394$, $R^2 = 0.052$). Relative to the other ports and marinas surveyed, Lyttelton had a large number of NIS, and moderate diversity of native, Cryptogenic 1 and Cryptogenic 2 species (Fig 36a, c, d). 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 36c, Studentised residual = 3.87).

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 discharge, do not survive to establish self-sustaining local populations. Those that do, often come from coastlines that have similar marine environments to New Zealand. For example, approximately 80% of the marine NIS known to be present within New Zealand are native to temperate coastlines of Europe, the North West Pacific, and southern Australia (Cranfield et al. 1998).

Commercial shipping arriving in the port of Lyttelton from overseas comes predominantly from temperate regions of the North West Pacific (40%; in particular Japan, Korea and China) and southern Australia (29%); environments which are broadly compatible with those in Lyttelton Harbour. In addition, relative to other ports in New Zealand, Lyttelton has a high trade volume of bulk cargoes, including exports of coal, wool, dairy products and timber, and imports of minerals and mineral fuels (Statistics NZ 2004). This is reflected in the relatively high volume of ballast that is discharged in Lyttelton Harbour. According to Inglis (2001), Lyttelton received the second highest (after Port Taranaki) volume of reported ballast discharge (354,670 m^3) of New Zealand ports, which came predominantly from Japan (44%), Australia (13%), Taiwan (10%) and South Korea (7%). Shipping from these regions presents an on-going risk of introduction of new NIS to Lyttelton Harbour.

Assessment of translocation risk for introduced species found in the port

As a major hub port, Lyttelton is connected directly to the ports of Wellington, Tauranga, Onehunga, Timaru, and Dunedin by regular coastal shipping and, indirectly, to most other domestic ports throughout mainland New Zealand (Dodgshun et al. 2004). Although many of the non-indigenous species found in the Lyttelton survey have been recorded previously in New Zealand, there were two notable exceptions. The ascidian *Cnemidocarpa sp.* was first described from New Zealand waters during these port surveys, and was found to be present in Auckland, Gisborne, Gulf Harbour Marina, Nelson, Picton, Tauranga, Taranaki, Timaru and Wellington. Little is currently known about this species, however it appears to now be widely spread through New Zealand's shipping ports where it may be competing with native fauna for space in fouling assemblages. The Asian crab, *Cancer gibbosulus* was also unknown from New Zealand waters prior to the surveys, but has now been discovered in Wellington, and Timaru ports in addition to the record from Lyttelton port. There is no information on the risks posed by this species to New Zealand's native ecosystems and species. New Zealand has an indigenous (but much larger) species of cancer crab, *Cancer novaezelandiae*, which is common in Lyttelton Harbour and throughout southern New Zealand.

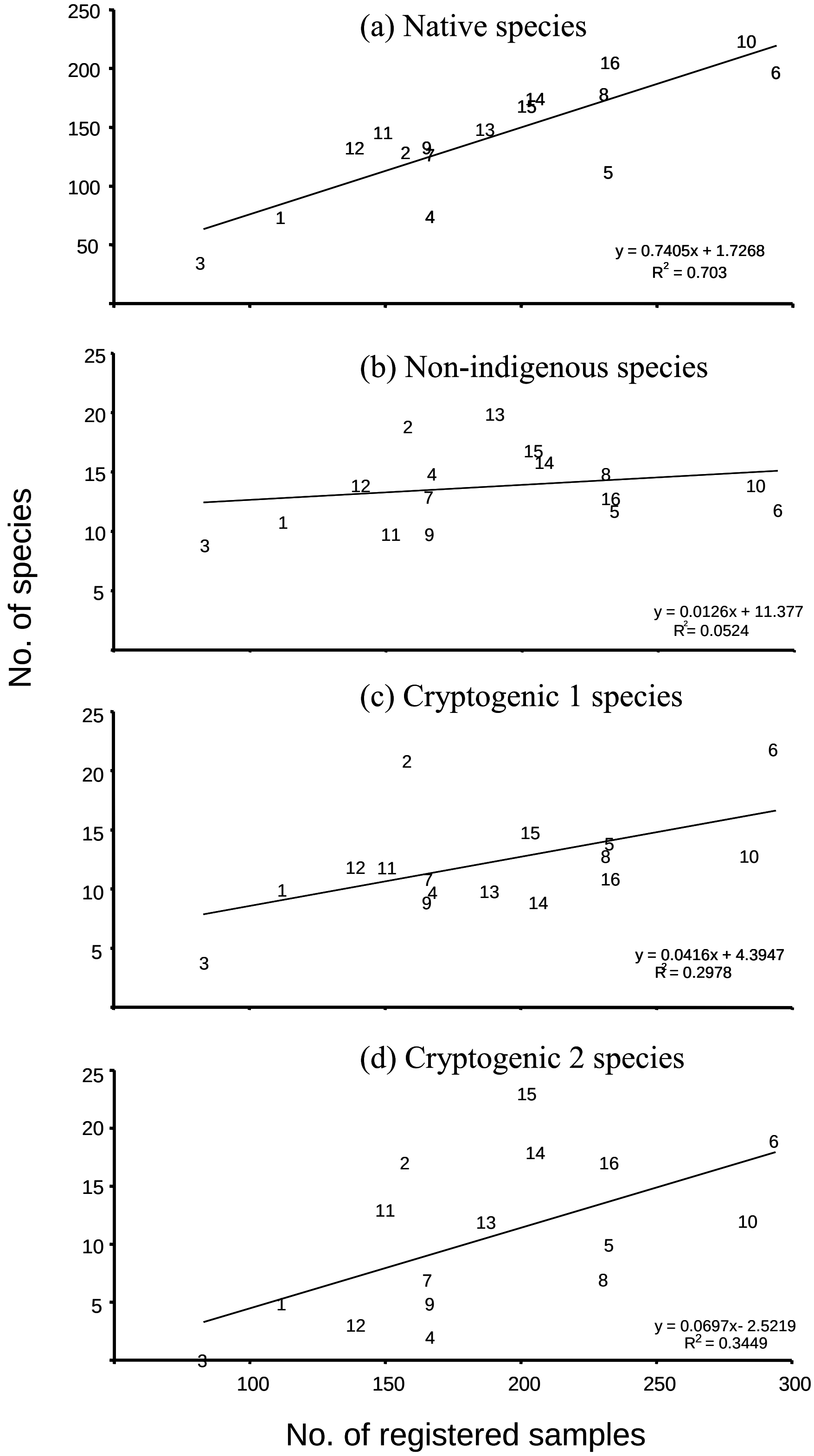

Figure 36: **Linear regression equations relating numbers of species detected to sample effort at the 16 locations surveyed nation-wide. Location codes are as follows; 1 = Opua, 2 = Whangarei port, 3 = Whangarei marina, 4 = Gulf Harbour marina, 5 = Auckland port, 6 = Tauranga port, 7 = Gisborne port, 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**

The highly invasive alga, *Undaria pinnatifida*, has been present in Lyttelton since 1991. 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 and Tauranga Port), although a control programme in Bluff Harbour has subsequently removed populations established there. Nevertheless, vessels departing from Lyttelton 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 Lyttelton, coal 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.

Lyttelton has also had a long history as a staging post for vessels visiting subantartic and Antarctic coastlines. It is a major point of departure for fishing vessels, cruise liners and expedition vessels heading for these regions. Recent studies have shown that vessels travelling to the southern ocean do transport NIS as hull fouling and ballast (Lewis et al. 2004), although there is limited information about their ability to establish there. Given the presence of relatively large numbers of NIS and cryptogenic species (in comparison to other New Zealand ports) from cool-termperate origins in Lyttelton and the port's shipping connection to Antarctica, it presents a high risk of translocation of NIS to these sensitive environments.

Management of existing non-indigenous species in the port

Most of the NIS detected in this survey, with the exception of the crab *Cancer gibbosulus*, appear to be well established in the port. It is unclear whether a viable population of *C. gibbosulus* has established in Lyttelton, since only one specimen was found during the survey. Similarly, relatively few specimens of this species were recorded in the other ports in which it was found (Wellington, n = 1; Timaru, n = 3). Further surveys, targeting this species, are necessary to determine the true extent of its 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 Lyttelton are widespread and local population controls are unlikely to be effective. Management should be directed toward preventing spread of species established in Lyttelton Harbour to locations where they do not presently occur. This may be particularly relevant to species found only in the Port of Lyttelton such as the cnidarian *Haliplanella lineata* and the amphipods *Monocorophium sextonae* and *Stenothoe sp. aff. S. gallensis*, which were not detected in any other port or marina surveyed nationwide. Such management will require better understanding of the frequency of movements by vessels of different types from Lyttelton 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 Lyttelton 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 Lyttelton (probably responsible for 80% of the NIS introductions) is consistent with previous findings from a range of overseas locations. For instance, Hewitt et al (1999) attributed the introduction of 77 % of the 99 NIS encountered in Port Phillip Bay (Australia) to hull fouling, and only 20 % to ballast water. Similarly, 61 % of the 348 marine and brackish water NIS established in the Hawaiian Islands are thought to have arrived on ships’ hulls, but only 5 % in ballast water (Eldredge and Carlton 2002). However, ballast water is thought to be responsible for the introduction of 30 % of the 212 marine NIS established in San Fransisco Bay (USA), compared to 34 % for hull fouling (Cohen and Carlton 1995). The high percentages of NIS thought to have been introduced by hull fouling in Australasia may reflect the fact that hull fouling has a far longer history (~200 years) as an introduction vector than ballast water (~40 years). However, the fact that some of New Zealand and Australia's most recent marine NIS introductions (e.g. *Undaria pinnatifida*, *Codium fragile sp. tomentosoides*) have been facilitated by hull fouling suggests that it has remained an important transport mechanism (Cranfield et al 1998; Hewitt et al 1999).

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

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Tables

Table 1: Berthage facilities in the Port of Lyttelton.

Berth	Berth No.	Purpose	Construction	Length of Berth (m)	Depth (m below chart datum)
Cashin Quay	1	Multipurpose	Concrete deck/wood piles	230	13.0
	2	Multipurpose	Concrete deck/wood piles	215	13.0
	3, 4	Container Terminal berths	Concrete deck/concrete-filled steel tubular or concrete piles	410	13.0
Z Berth		General cargo, fishing operations	Concrete deck/wood piles	160	10.0
Gladstone Pier		Container cargo	Wood deck/wood piles	275	10.0
No. 1 Breastwork		General cargo, discharge of bulk cement	Wood deck/wood piles	159	9.5
No. 2 Wharf	East	Dry bulk import, general cargoes, export of logs	Concrete deck/wood piles	270	11.7
	West	Dry bulk import, general cargoes, export of logs	Concrete deck/wood piles	169	10.5
No. 3 Wharf	East	Dry bulk import, general cargoes, export of logs, lay-up	Wood deck/wood piles	195	10.0
	West	Dry bulk import, general cargoes, export of logs, lay-up	Wood deck/wood piles	223	10.8
No. 4 Wharf	East	Lay-up	Wood deck/wood piles	148	9.0
	West	Lay-up	Wood deck/wood piles	170	9.0
No. 7 Wharf	East	Quarter ramp and roll-on/roll-off vessels	Concrete deck/wood piles	217	10.5
	West	Quarter ramp and roll-on/roll-off vessels	Concrete deck/wood piles	187	10.7
Oil Wharf		Liquid bulk cargoes, bunkering	Wood deck/wood piles	202	12.5
Cattle Wharf		Bunkering of fishing vessels	Wood deck/wood piles	60	10.0

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

	CRIMP Protocol		NIWA Method		
Taxa sampled	Survey method	Sample procedure	Survey method	Sample procedure	Notes
Dinoflagellate cysts	Small hand core	Cores taken by divers from locations where sediment deposition occurs	TFO Gravity core ("javelin" core)	Cores taken from locations where sediment deposition occurs	Use of the javelin core eliminated the need to expose divers to unnecessary hazards (poor visibility, snags, boat movements, repetitive dives > 10 m). It is a method recommended by the WESTPAC/IOC Harmful Algal Bloom project for dinoflagellate cyst collection (Matsuoka and Fukuyo 2000)
Benthic infauna	Large core	3 cores close to (0 m) and 3 cores away (50 m) from each berth	Shipek benthic grab	3 cores within 10 m of each sampled berth and at sites in the port basin	Use of the benthic grab eliminated need to expose divers to unnecessary hazards (poor visibility, snags, boat movements, repetitive dives > 10 m).
Dinoflagellates	20um plankton net	Horizontal and vertical net tows	Not sampled	Not sampled	Plankton assemblages spatially and temporally variable, time-consuming and difficult to identify to species. Workshop recommended using resources to sample other taxa more comprehensively
Zooplankton and/ phytoplankton	100 um plankton net	Vertical net tow	Not sampled	Not sampled	Plankton assemblages spatially and temporally variable, time-consuming and difficult to identify to species. Workshop recommended using resources to sample other taxa more comprehensively
Crab/shrimp	Baited traps	3 traps of each kind left overnight at each site	Baited traps	4 traps (2 line x 2 traps) of each kind left overnight at each site	
Macrobiota	Qualitative visual survey	Visual searches of wharves & breakwaters for target species	Qualitative visual survey	Visual searches of wharves & breakwaters for target species	
Sedentary / encrusting biota	Quadrat scraping	0.10 m2 quadrats sampled at -0.5 m, -3.0 m and -7.0 m on 3 outer piles 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

Taxa sampled	CRIMP Protocol Survey method	CRIMP Protocol Sample procedure	NIWA Method Survey method	NIWA Method Sample procedure	Notes
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 Lyttelton 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	6[a]	20
Diver quadrat scraping	5	77
Opera house fish traps	5	20
Starfish traps	6[a]	20
Shrimp traps	6[a]	19
Javelin cores	N/A	8

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

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

Sample Depth (M)	Outer Piles	Inner Piles
0.5	2 concrete, 8 wood	10 wood
1.5	2 concrete, 8 wood	10 wood
3.5	2 concrete, 8 wood	10 wood
7	2 concrete, 8 wood	Nil
Miscellaneous	1 concrete, 6 wood	Nil

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

Survey Location	Benthic sled tows	Benthic grab	Box traps	Diver quadrat scraping	Opera house traps	Starfish traps	Shrimp traps	Javel in 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	N/A (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	N/A (10)	4 (12)	4 (12)	4 (46)	4 (8)	4 (8)	4 (8)	(8)
Whangarei Marina	3 (6)	2 (6)	2 (8)	4 (33)	2 (8)	2 (8)	2 (8)	(6)
Whangarei Harbour	4 (9)	4 (12)	4 (16)	4 (65)	4 (16)	4 (16)	4 (16)	(7)

* Shipek grab malfunctioned in the Ports of Nelson and Picton

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

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

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

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

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

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

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

Phylum, Class	Order	Family	Genus and species
Annelida			
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea australiensis*
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos loveni*
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris sphaerocephala*
Polychaeta	Phyllodocida	Glyceridae	*Glycera lamelliformis*
Polychaeta	Phyllodocida	Goniadidae	*Glycinde dorsalis*
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus verrilli*
Polychaeta	Phyllodocida	Nereididae	*Neanthes kerguelensis*
Polychaeta	Phyllodocida	Nereididae	*Nereis falcaria*
Polychaeta	Phyllodocida	Nereididae	*Perinereis amblyodonta*
Polychaeta	Phyllodocida	Nereididae	*Perinereis camiguinoides*
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe macrolepidota*
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus polychromus*
Polychaeta	Phyllodocida	Polynoidae	*Ophiodromus angustifrons*
Polychaeta	Phyllodocida	Sigalionidae	*Labiosthenolepis laevis*
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis zebra*
Polychaeta	Sabellida	Sabellidae	*Branchiomma curta*
Polychaeta	Sabellida	Sabellidae	*Demonax aberrans*
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla laciniosa*
Polychaeta	Sabellida	Serpulidae	*Spirobranchus cariniferus*
Polychaeta	Scolecida	Opheliidae	*Armandia maculata*
Polychaeta	Spionida	Spionidae	*Scolecolepides benhami*
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris nuchalis*
Polychaeta	Terebellida	Cirratulidae	*Timarete anchylochaetus*
Polychaeta	Terebellida	Terebellidae	*Nicolea armilla*
Polychaeta	Terebellida	Terebellidae	*Nicolea maxima*
Polychaeta	Terebellida	Terebellidae	*Streblosoma toddae*
Polychaeta	Terebellida	Trichobranchidae	*Terebellides narribri*
Bryozoa			
Gymnolaemata	Cheilostomata	Candidae	*Caberea zelandica*
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria immersa*
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria tenuirostris*
Gymnolaemata	Cheilostomata	Celleporidae	*Celleporina proximalis*
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides angela*
Gymnolaemata	Cheilostomata	Schizoporellidae	*Chiastosella watersi*
Chelicerata			
Pycnogonida	Pantopoda	Ammotheidae	*Callipallene novaezealandiae*
Cnidaria			
Anthozoa	Actiniaria	Aiptasiomorphidae	*Aiptasiomorpha minima*

Phylum, Class	Order	Family	Genus and species
Anthozoa	Actiniaria	Bathyphelliidae	*Acraspedanthus elongatus*
Anthozoa	Actiniaria	Diadumenidae	*Diadumene neozelandica*
Anthozoa	Actiniaria	Sagartiidae	*Anthothoe vagrans*
Hydrozoa	Hydroida	Phialellidae	*Opercularella humilis*
Hydrozoa	Hydroida	Plumulariidae	*Monotheca flexuosa*
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia bispinosa*
Hydrozoa	Hydroida	Sertulariidae	*Sertularia unguiculata*
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus johnstoni*
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus subarticulatus*
Crustacea			
Cirripedia	Thoracica	Balanidae	*Austrominius modestus*
Cirripedia	Thoracica	Balanidae	*Notomegabalanus decorus*
Malacostraca	Amphipoda	Amaryllidae	*Amaryllis macrophthalma*
Malacostraca	Amphipoda	Amphilochidae	*Amphilochus filidactylus*
Malacostraca	Amphipoda	Aoridae	*Aora maculata*
Malacostraca	Amphipoda	Aoridae	*Aora typica*
Malacostraca	Amphipoda	Aoridae	*Haplocheira barbimana*
Malacostraca	Amphipoda	Colomastigidae	*Colomastix magnirama*
Malacostraca	Amphipoda	Cyproideidae	*Peltopes peninsulae*
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine pacifica*
Malacostraca	Amphipoda	Iphimediidae	*Anisoiphimedia haurakiensis*
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis haswelli*
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis longimana*
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis typica*
Malacostraca	Amphipoda	Ischyroceridae	*Ischyrocerus longimanus*
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa frequens*
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe trailli*
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia akaroica*
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia angusta*
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia stephenseni*
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia vesca*
Malacostraca	Amphipoda	Melitidae	*Mallacoota subcarinata*
Malacostraca	Amphipoda	Phoxocephalidae	*Torridoharpinia hurleyi*
Malacostraca	Amphipoda	Podoceridae	*Podocerus cristatus*
Malacostraca	Amphipoda	Podoceridae	*Podocerus karu*
Malacostraca	Amphipoda	Podoceridae	*Podocerus manawatu*
Malacostraca	Amphipoda	Podoceridae	*Podocerus wanganui*
Malacostraca	Amphipoda	Sebidae	*Seba typica*
Malacostraca	Anomura	Paguridae	*Lophopagurus (L.) lacertosus*
Malacostraca	Anomura	Porcellanidae	*Petrolisthes elongatus*
Malacostraca	Anomura	Porcellanidae	*Petrolisthes novaezelandiae*
Malacostraca	Brachyura	Cancridae	*Cancer novaezelandiae*
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus varius*

Phylum, Class	Order	Family	Genus and species
Malacostraca	Brachyura	Majidae	*Notomithrax minor*
Malacostraca	Brachyura	Ocypodidae	*Macrophthalmus hirtipes*
Malacostraca	Brachyura	Pinnotheridae	*Pinnotheres novaezelandiae*
Malacostraca	Brachyura	Portunidae	*Nectocarcinus antarcticus*
Malacostraca	Caridea	Crangonidae	*Pontophilus australis*
Malacostraca	Caridea	Palemonidae	*Palaemon affinis*
Malacostraca	Isopoda	Cirolanidae	*Natatolana rossi*
Malacostraca	Isopoda	Paranthuridae	*Paranthura cf. flagellata*
Malacostraca	Isopoda	Sphaeromatidae	*Cilicaea canaliculata*
Malacostraca	Isopoda	Sphaeromatidae	*Ischyromene cordiforaminalis*
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma campbellense*
Echinodermata			
Asteroidea	Valvatida	Asterinidae	*Patiriella regularis*
Ophiuroidea	Ophiurida	Amphiuridae	*Amphipholis squamata*
Mollusca			
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus pulex*
Bivalvia	Ostreoida	Ostreidae	*Ostrea chilensis*
Bivalvia	Veneroida	Lasaeidae	*Lasaea hinemoa*
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria australis*
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella novaezelandiae*
Gastropoda	Littorinimorpha	Littorinidae	*Risellopsis varia*
Gastropoda	Neogastropoda	Muricidae	*Xymene plebeius*
Gastropoda	Nudibranchia	Chromodorididae	*Cadlina willani*
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris lanuginata*
Gastropoda	Nudibranchia	Dorididae	*Archidoris nanula*
Gastropoda	Nudibranchia	Dorididae	*Paradoris leuca*
Gastropoda	Patellogastropoda	Lottiidae	*Notoacmea helmsi*
Gastropoda	Sacoglossa	Limapontiidae	*Ercolania felina*
Gastropoda	Systellomatophora	Onchidiidae	*Onchidella nigricans*
Gastropoda	Vetigastropoda	Trochidae	*Micrelenchus huttonii*
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona zelandica*
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus porosus*
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton pelliserpentis*
Phycophyta			
Rhodophyceae	Ceramiales	Ceramiaceae	*Anotrichium crinitum*
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium rubrum*
Rhodophyceae	Ceramiales	Deleseriaceae	*Acrosorium venulosum*
Rhodophyceae	Ceramiales	Delesseriaceae	*Myriogramme denticulata*
Rhodophyceae	Ceramiales	Delesseriaceae	*Phycodrys quercifolia*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia harveyi*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia moritziana*

Phylum, Class	Order	Family	Genus and species
Rhodophyceae	Ceramiales	Rhodomelaceae	*Stictosiphonia hookeri*
Rhodophyceae	Gigartinales	Phyllophoraceae	*Stenogramme interrupta*
Rhodophyceae	Gigartinales	Sarcodiaceae	*Trematocarpus aciculare*
Rhodophyceae	Plocamiales	Plocamiaceae	*Plocamium angustum*
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria caespitosa*
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia foliifera*
Ulvophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis vestita*
Ulvophyceae	Cladophorales	Cladophoraceae	*Cladophora crinalis*
Porifera			
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia cf. arenaria*
Demospongiae	Haplosclerida	Chalinidae	*Haliclona cf. punctata*
Demospongiae	Haplosclerida	Chalinidae	*Haliclona glabra*
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas fulva*
Pyrrophycophyta			
Dinophyceae	Gymnodiniales	Gymnodiniaceae	*Cochlodinium sp.*
Dinophyceae	Gymnodiniales	Polykrikaceae	*Pheoploykrikos sp.*
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium conicum*
Dinophyceae	Peridiniales	Peridiniaceae	*Scrippsiella trochoidea*
Urochordata			
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium adamsi*
Ascidiacea	Stolidobranchia	Botryllinae	*Botryllus stewartensis*
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula amokurae*
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula mortenseni*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura cancellata*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura carnea*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura lutea*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura pachydermatina*
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa bicornuta*
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa nisiotus*
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa regalis*
Vertebrata			
Actinopterygii	Gadiformes	Moridae	*Pseudophycis bachus*
Actinopterygii	Perciformes	Cheilodactylidae	*Nemadactylus macropterus*
Actinopterygii	Perciformes	Labridae	*Notolabrus celidotus*
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina capito*
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina gymnota*
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina sp.*
Actinopterygii	Pleuronectiformes	Pleuronectidae	*Peltorhamphus latus*
Chondrichthyes	Squaliformes	Squalidae	*Squalus acanthias*

Table 7: Cryptogenic marine species recorded from the Port of Lyttelton 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	
Cnidaria				
Hydrozoa	Hydroida	Campanulariidae	*Obelia dichotoma*	C1
Hydrozoa	Hydroida	Haleciidae	*Halecium delicatulum*	C1
Hydrozoa	Hydroida	Plumulariidae	*Plumularia setacea*	C1
Crustacea				
Malacostraca	Amphipoda	Aoridae	*Aora sp. aff. A. typica*	C2
Malacostraca	Amphipoda	Corophiidae	*Meridiolembos sp. aff. acherontis*	C2
Malacostraca	Amphipoda	Corophiidae	*Monocorophium sp. aff. M. insidiosum*	C2
Malacostraca	Amphipoda	Dexaminidae	*Polycheria sp. aff. P. obtusa*	C2
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe sp. 1*	C2
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia sp. aff. akaroica*	C1
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia sp. aff. angusta*	C2
Malacostraca	Amphipoda	Lysianassidae	*Stomacontion sp. aff. S. pungpunga*	C2
Porifera				
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia n. sp. 1*	C2
Demospongiae	Hadromerida	Suberitidae	*Suberitidae n. g. n. sp. 1*	C2
Demospongiae	Halichondrida	Halichondriidae	*Halichondria panicea*	C1
Demospongiae	Haplosclerida	Chalinidae	*Adocia n. sp. 3*	C2
Demospongiae	Haplosclerida	Chalinidae	*Haliclona n. sp. 8*	C2
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella n. sp. 1*	C2
Urochordata				
Ascidiacea	Aplousobrancia	Polyclinidae	*Aplidium phortax*	C1
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella eumyota*	C1
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes leachii*	C1
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa cerea*	C1
Ascidiacea	Stolidobranchia	Styelidae	*Styela plicata*	C1

Table 8: Non-indigenous marine species recorded from the Port of Lyttelton 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)
Bryozoa					
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula flabellata*	H	Pre-1949
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula neritina*	H	1949
Gymnolaemata	Cheilostomata	Candidae	*Tricellaria inopinata*	H	Pre-1964
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula pallasiana*	H	1890s
Gymnolaemata	Cheilostomata	Electridae	*Conopeum seurati*	H	Pre-1963
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora subtorquata*	H or B	Pre-1982
Cnidaria					
Anthozoa	Actiniaria	Haliplanellidae	*Haliplanella lineata*	H	Mar. 2002 [d]
Crustacea					
Malacostraca	Amphipoda	Corophiidae	*Apocorophium acutum*	H	Pre-1921
Malacostraca	Amphipoda	Corophiidae	*Monocorophium acherusicum*	H	Pre-1921
Malacostraca	Amphipoda	Corophiidae	*Monocorophium sextonae*	H	Pre-1921
Malacostraca	Amphipoda	Ischyroceridae	*Jassa slatteryi*	H	Unknown [1]
Malacostraca	Amphipoda	Stenothoidae	*Stenothoe sp. aff. S. gallensis*	H	Unknown [1]
Malacostraca	Brachyura	Cancridae	*Cancer gibbosulus* **(NR)**	H or B	Nov. 2001 [d]
Mollusca					
Bivalvia	Veneroida	Semelidae	*Theora lubrica*	B	1971
Phycophyta					
Phaeophyceae	Laminariales	Alariaceae	*Undaria pinnatifida*	H or B	Pre-1987
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia crassiuscula*	H	Pre-1954
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia brodiaei*	H	Pre-1940
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia subtilissima*	H	Pre-1974
Urochordata					
Ascidiacea	Aplousobranchia	Cionidae	*Ciona intestinalis*	H	Pre-1950
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa sp.* **(NR)**	H	Dec. 2001 [d]

[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 Lyttleon 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	*Nereididae indet*
Polychaeta	Phyllodocida	Nereididae	*Platynereis Platynereis australis group*
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia Eulalia-NIWA-2*
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides Mystides-B*
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodocidae Indet*
Polychaeta	Phyllodocida	Polynoidae	*Polynoidae indet*
Polychaeta	Phyllodocida	Syllidae	*Eusyllis Eusyllis-B*
Polychaeta	Phyllodocida	Syllidae	*Eusyllis Eusyllis-C*
Polychaeta	Phyllodocida	Syllidae	*Eusyllin-unknown Eusyllin-unknown-A*
Polychaeta	Phyllodocida	Syllidae	*Syllidae Indet*
Polychaeta	Sabellida	Sabellidae	*Branchiomma Branchiomma-A*
Polychaeta	Sabellida	Sabellidae	*Potamilla Potamilla-A*
Polychaeta	Sabellida	Sabellidae	*Sabellidae Indet*
Polychaeta	Sabellida	Serpulidae	*Serpula Indet*
Polychaeta	Terebellida	Cirratulidae	*Cirratulus Cirratulus-A*
Polychaeta	Terebellida	Terebellidae	*Terebella Terebella-B*
Polychaeta	Terebellida	Terebellidae	*Terebellidae Indet*
Bryozoa			
Gymnolaemata	Cheilostomata	Electridae	*Electra sp.*
Stenolaemata	Cyclostomata	Hastingsiidae	*Hastingsia sp.*
Cnidaria			
Anthozoa	Actiniaria	Acontiophoridae	*Mimetridium sp.*
Anthozoa	Actiniaria	Diadumenidae	*Diadumenidae sp.*
Anthozoa	Actiniaria	Diadumenidae/Haliplanellidae	*Diadumenidae/Haliplanellidae sp.*
Anthozoa	Actiniaria		*Acontiaria sp.*
Anthozoa	Actiniaria		*Actiniaria sp.*
Hydrozoa	Hydroida	Haleciidae	*Halecium ?beanii*
Hydrozoa	Hydroida	Plumulariidae	*Plumularia ?setacea*

Phylum, Class	Order	Family	Genus and species
Crustacea			
Malacostraca	Amphipoda	Corophiidae	*Meridiolembos sp.*
Malacostraca	Amphipoda	Hyalidae	*Hyale sp.*
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis sp. 1*
Malacostraca	Amphipoda	Ischyroceridae	*Ischyrocerus sp.*
Malacostraca	Amphipoda	Ischyroceridae	*Jassa sp.*
Malacostraca	Amphipoda	Lysianassidae	*?Lysianopsis sp.*
Malacostraca	Amphipoda	Lysianassidae	*?Phoxostoma sp.*
Malacostraca	Amphipoda	Ischyroceridae	*?Ventojassa sp.*
Malacostraca	Amphipoda	Lysianassidae	*?Waldeckia sp.*
Malacostraca	Amphipoda	Podoceridae	*Podocerus sp.*
Malacostraca	Brachyura	Xanthidae	*?Xanthidae sexlobata*
Malacostraca	Isopoda	Anthuridae	*Mesanthura ?affinis*
Malacostraca	Isopoda	Pseudojaniridae	*Schottea sp*
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma sp*
Malacostraca	Tanaidacea	Tanaidae	*Zeuxoides sp.*
Malacostraca	Tanaidacea	Tanaidae	*Zeuxoides sp. 2*
Phycophyta			
Rhodophyceae	Acrochaetiales	Acrochaetiaceae	*Audouinella sp.*
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesseriaceae sp.*
Rhodophyceae	Ceramiales	Delesseriaceae	*Erythroglossum sp.*
Rhodophyceae	Ceramiales	Delesseriaceae	*Hymenena sp.*
Rhodophyceae	Ceramiales	Delesseriaceae	*Schizoseris sp.*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia sp.*
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia sp.*
Ulvophyceae	Cladophorales	Cladophoraceae	*Cladophora sp.*
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha sp.*
Ulvophyceae	Ulvales	Ulvaceae	*Ulva sp.*
Platyhelminthes			
Turbellaria	Polycladida		*Indet genus indet sp.*
Urochordata			
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum sp.*

Table 10: Non-indigenous marine organisms recorded from the Port of Lyttelton 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.

Genus and species	Capture techniques in the Port of Lyttelton	Locations detected in the Port	Detected in other locations surveyed in ZBS2000_04
Bugula flabellata	Pile scrape, Benthic sled	No. 2 Wharf; No. 4 Wharf; Cashin Quay; Gladstone Pier; Oil Wharf (See Fig 17)	Auckland, Bluff, Dunedin, Nelson, Napier, Opua Marina, Picton, Tauranga, Taranaki, Timaru, Whangarei Harbour, Wellington
Bugula neritina	Pile scrape, Benthic sled, Benthic grab	No. 2 Wharf; No. 4 Wharf; Gladstone Pier; Oil Wharf (See Fig 18)	Auckland, Dunedin, Gisborne, Gulf Harbour Marina, Napier, Opua Marina, Tauranga, Taranaki, Timaru, Whangarei Harbour, Whangarei Marina
Tricellaria inopinata	Benthic grab	No. 4 Wharf (See Fig 19)	Gisborne, Taranaki, Whangarei Harbour
Cryptosula pallasiana	Pile scrape	No. 2 Wharf; No. 4 Wharf; Cashin Quay; Gladstone Pier (See Fig 20)	Dunedin, Gisborne, Nelson, Taranaki, Timaru, Whangarei Harbour, Wellington
Conopeum seurati	Pile scrape	Cashin Quay (See Fig 21)	Nelson, Whangarei Marina
Watersipora subtorquata	Pile scrape, Benthic grab	No. 2 Wharf; No. 4 Wharf; Cashin Quay; Gladstone Pier; Oil Wharf (See Fig 22)	Bluff, Dunedin, Gisborne, Gulf Harbour Marina, Napier, Nelson, Opua Marina, Picton Tauranga, Taranaki, Timaru, Whangarei Harbour, Wellington
Haliplanella lineata	Pile scrape	No. 4 Wharf (See Fig 23)	None
Apocorophium acutum	Pile scrape	No. 2 Wharf; No. 4 Wharf; Gladstone Pier; Oil Wharf (See Fig 24)	Dunedin, Gulf Harbour Marina, Opua Marina, Tauranga, Timaru
Monocorophium acherusicum	Pile scrape	No. 2 Wharf; No. 4 Wharf; Cashin Quay; Gladstone Pier; Oil Wharf (See Fig 25)	Dunedin, Gisborne, Tauranga, Timaru, Whangarei Marina
Monocorophium sextonae	Pile scrape	Gladstone Pier; Oil Wharf (See Fig 26)	None
Jassa slatteryi	Pile scrape	Cashin Quay (See Fig 27)	Timaru, Whangarei Harbour

Genus and species	Capture techniques in the Port of Lyttelton	Locations detected in the Port	Detected in other locations surveyed in ZBS2000_04
Stenothoe sp. aff. S. gallensis	Pile scrape	Gladstone Pier (See Fig 28)	None
Cancer gibbosulus	Pile scrape	Cashin Quay (See Fig 29)	Timaru, Wellington
Theora lubrica	Benthic sled	No. 2 Wharf (See Fig 30)	Auckland, Gisborne, Gulf Harbour Marina, Nelson, Napier, Opua, Taranaki, Whangarei Harbour, Whangarei Marina, Wellington
Undaria pinnatifida	Pile scrape, Benthic sled	No. 2 Wharf; No. 4 Wharf; Cashin Quay; Gladstone Pier; Oil Wharf (See Fig 31)	Dunedin, Gisborne, Napier, Picton, Timaru, Wellington
Griffithsia crassiuscula	Pile scrape, Benthic sled, Benthic grab	No. 4 Wharf; Gladstone Pier (See Fig 32)	Bluff, Picton, Taranaki, Timaru, Wellington
Polysiphonia brodiaei	Pile scrape	Gladstone Pier (See Fig 33)	Bluff, Dunedin
Polysiphonia subtilissima	Pile scrape	No. 4 Wharf (See Fig 34)	Dunedin, Timaru
Ciona intestinalis	Pile scrape, Benthic sled	No. 2 Wharf; No. 4 Wharf; Gladstone Pier; Oil Wharf (See Fig 35)	Nelson, Napier, Timaru
Cnemidocarpa sp.	Pile scrape	No. 2 Wharf; Cashin Quay; Oil Wharf (See Fig 36)	Auckland, Gisborne, Gulf Harbour Marina, Nelson, Picton, Tauranga, Taranaki, Timaru, 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 Rottman	NIWA Greta Point
Echiura	Echiuroidea	Geoff Read	NIWA Greta Point
Mollusca	Bivalvia. Cephalopoda, Gastropoda, Polyplacophora	Bruce Marshall	Museum of NZ Te Papa Tongarewa
Nemertea	Anopla, Enopla	Geoff Read	NIWA Greta Point
Phycophyta	Phaeophyceae, Rhodophyceae, Ulvophyceae	Wendy Nelson, Kate Neill	NIWA Greta Point
Platyhelminthes	Turbellaria	Sean Handley	NIWA Nelson
Porifera	Demospongiae, Calcarea	Michelle Kelly-Shanks	NIWA Auckland
Priapula	Priapulidae	Geoff Read	NIWA Greta Point
Pyrrophycophyta	Dinophyceae	Hoe Chang, Rob Stewart	NIWA Greta Point
Urochordata	Ascidiacea	Mike Page, Anna Bradley Patricia Kott[1]	NIWA Nelson and [1]Queensland Museum
Vertebrata	Osteichthyes	Clive Roberts, Andrew Stewart	Museum of NZ Te Papa Tongarewa

Appendix 2: Generic descriptions of representative groups of the main marine phyla collected during sampling.

Phylum Annelida

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

Phylum Bryozoa

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

Phylum Chelicerata

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

Phylum Cnidaria

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

Phylum Crustacea

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

Phylum Echinodermata

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

Phylum Mollusca

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

Phylum Phycophyta

Algae: These are the marine plants. Several types were encountered during our survey. Large *macroalgae* were sampled that live attached to submerged natural and artificial surfaces including rocks, pilings, ropes and the shells or carapaces of other species. These include the green algae (Chlorophyta), red algae (Rhodophyta) and brown algae (Phaeophyta). We also encountered microscopic algal species called *dinoflagellates* (phylum Pyrrophyta), 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 Lyttelton. 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
Bryozoa									
Bugula flabellata	+	+	+		+	+	+	+	+
Bugula neritina	+				+	+	+	+	+
Tricellaria inopinata	+	+	+		+	+		+	+
Cryptosula pallasiana	+	+	+		+	+	+	+	+
Conopeum seurati	+		+	+	+	+	+	+	+
Watersipora subtorquata	+	+	+		+	+	+	+	+
Cnidaria									
Haliplanella lineata	+		+		+			+	
Crustacea									
Apocorophium acutum	+			+		+	+		
Monocorophium acherusicum			+		+	+		+	+
Monocorophium sextonae			+		+	+	+	+	+
Jassa slatteryi	+		+			+		+	+
Stenothoe sp. aff. S. gallensis	+		+				+	+	+
Cancer gibbosulus	+		+				+	+	+
Mollusca									
Theora lubrica	+	+			+	+	+	+	+
Phycophyta									
Undaria pinnatifida	+	+	+		+	+	+	+	+
Griffithsia crassiuscula	+	+				+		+	+
Polysiphonia brodiaei	+	+	+		+	+	+	+	+
Polysiphonia subtilissima	+	+			+	+	+	+	+
Urochordata									
Ciona intestinalis	+		+		+	+	+	+	+
Cnemidocarpa sp.	+		+		+			+	

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 Lyttelton

Site	Eastings	Northings	NZ Latitude	NZ Longitude	Survey Method	No. of sample units
1	2487552	5733221	-43.60979	172.72167	CYST	2
2	2488001	5733097	-43.61093	172.72722	CYST	2
3	2487246	5733544	-43.60688	172.71789	CYST	2
4	2486985	5733421	-43.60798	172.71466	CYST	2
CAT JET	2486960	5733262	-43.60941	172.71434	CRBTP	4
CAT JET	2486960	5733262	-43.60941	172.71434	SHRTP	4
CAT JET	2486960	5733262	-43.60941	172.71434	STFTP	4
CQ3	2487946	5733089	-43.61099	172.72654	BGRB	3
CQ3	2487946	5733089	-43.61099	172.72654	BSLD	2
CQ3	2487946	5733089	-43.61099	172.72654	CRBTP	4
CQ3	2487946	5733089	-43.61099	172.72654	FSHTP	4
CQ3	2487946	5733089	-43.61099	172.72654	PSC	15
CQ3	2487946	5733089	-43.61099	172.72654	SHRTP	4
CQ3	2487946	5733089	-43.61099	172.72654	STFTP	4
GLADSTONE	2487605	5733179	-43.61018	172.72232	BGRB	3
GLADSTONE	2487605	5733179	-43.61018	172.72232	BSLD	2
GLADSTONE	2487605	5733179	-43.61018	172.72232	CRBTP	4
GLADSTONE	2487605	5733179	-43.61018	172.72232	FSHTP	4
GLADSTONE	2487605	5733179	-43.61018	172.72232	PSC	15
GLADSTONE	2487605	5733179	-43.61018	172.72232	SHRTP	4
GLADSTONE	2487605	5733179	-43.61018	172.72232	STFTP	4
OIL	2486982	5733258	-43.60944	172.71461	BGRB	3
OIL	2486982	5733258	-43.60944	172.71461	BSLD	2
OIL	2486960	5733262	-43.60941	172.71434	FSHTP	4
OIL	2486982	5733258	-43.60944	172.71461	PSC	16
W2	2487400	5733355	-43.60859	172.71979	BGRB	3
W2	2487400	5733355	-43.60859	172.71979	BSLD	2
W2	2487400	5733355	-43.60859	172.71979	CRBTP	4
W2	2487400	5733355	-43.60859	172.71979	FSHTP	4
W2	2487400	5733355	-43.60859	172.71979	PSC	15
W2	2487400	5733355	-43.60859	172.71979	SHRTP	3
W2	2487400	5733355	-43.60859	172.71979	STFTP	4
W4	2487292	5733555	-43.60678	172.71846	BGRB	3
W4	2487292	5733555	-43.60678	172.71846	BSLD	2
W4	2487292	5733555	-43.60678	172.71846	CRBTP	4
W4	2487292	5733555	-43.60678	172.71846	FSHTP	4
W4	2487292	5733555	-43.60678	172.71846	PSC	16
W4	2487292	5733555	-43.60678	172.71846	SHRTP	4
W4	2487292	5733555	-43.60678	172.71846	STFTP	4

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

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

					Berth code	CQ3																GLADSTONE	
					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	1	2	3
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*gymnota*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Acontiophoridae	*Mimetridium*	*sp.*	SI	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Aiptasiomorphidae	*Aiptasiomorpha*	*minima*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Bathyphelliidae	*Acraspedanthus*	*elongatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Diadumenidae	*Diadumene*	*neozelandica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Diadumenidae	*Diadumenidae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Haliplanellidae	*Haliplanella*	*lineata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Sagartiidae	*Anthothoe*	*vagrans*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria		*Acontiaria*	*sp.*	SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1
Anthozoa	Actiniaria		*Actiniaria*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Cionidae	*Ciona*	*intestinalis*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	0	1	1	1	0	0	1	1	0	0	1	1	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	1	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	1	0	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botryllus*	*stewartensis*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	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	1
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*amokurae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pachydermatina*	N	0	0	0	0	1	0	0	0	0	1	0	0	1	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	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*carnea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*nisiotus*	N	1	1	0	0	0	1	0	0	1	1	1	0	0	1	0	0	0	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	0	1	0	0	0	1	0	1	1	0	0	1	1	1	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*regalis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*sp.*	A	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Styela*	*plicata*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	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	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	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*crinalis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*elongatus*	N	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*novaezelandiae*	N	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Cancridae	*Cancer*	*gibbosulus*	A	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Cancridae	*Cancer*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0
Crustacea	Brachyura	Pinnotheridae	*Pinnotheres*	*novaezelandiae*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*?Xanthidae*	*sexlobata*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	1	0	0	1	1	0	0	1	0	0	0	1	1	1	0	1	1	0
Crustacea	Thoracica	Balanidae	*Notomegabalanus*	*decorus*	N	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 1 (soft spikey tan cushion)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*cf. arenaria*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Hadromerida	Suberitidae	*Suberitidae n. g.*	*n. sp. 1 (oxeas & tylostyles)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
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	Haplosclerida	Chalinidae	*Haliclona*	*cf. punctata*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Chalinidae	*Adocia*	*n. sp. 3 (crumbly smooth fat oxeas 130)*	C2	0	0	0	0	0	1	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	0

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

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

					Berth code	CQ3															GLADSTONE		
					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	1	2	3
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	1	1	0	1	1	1	0	0	1	1	0	1	1	1	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
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	0	0	1	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Cadlina*	*willani*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Archidoris*	*nanula*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris*	*lanuginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Paradoris*	*leuca*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Patellogastropoda	Lottiidae	*Notoacmea*	*helmsi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Sacoglossa	Limapontiidae	*Ercolania*	*felina*	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*	*neritina*	A	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	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*zelandica*	N	0	1	1	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria*	*tenuirostris*	N	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria*	*immersa*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Celleporidae	*Celleporina*	*proximalis*	N	0	1	0	0	1	0	1	0	0	0	1	0	1	1	0	0	0	0
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula*	*pallasiana*	A	1	0	1	1	0	0	0	0	1	0	0	1	1	0	0	0	1	0
Gymnolaemata	Cheilostomata	Electridae	*Conopeum*	*seurati*	A	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Electridae	*Electra*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides*	*angela*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Schizoporellidae	*Chiastosella*	*watersi*	N	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	1	1	1	1	0	0	0	1	1	1	1	1	1	0	0	1	1	1
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*dichotoma*	C1	0	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0
Hydrozoa	Hydroida	Haleciidae	*Halecium*	*delicatulum*	C1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Phialellidae	*Opercularella*	*humilis*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*setacea*	C1	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Monotheca*	*flexuosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*johnstoni*	N	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*subarticulatus*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Amaryllidae	*Amaryllis*	*macrophthalma*	N	0	1	1	0	0	0	1	0	0	1	1	0	1	0	0	0	0	0
Malacostraca	Amphipoda	Amphilochidae	*Amphilochus*	*filidactylus*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*sp. aff. A. typica*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Malacostraca	Amphipoda	Aoridae	*Aora*	*maculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Colomastigidae	*Colomastix*	*magnirama*	N	0	0	1	0	1	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	1
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*acherusicum*	A	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	1
Malacostraca	Amphipoda	Corophiidae	*Meridiolembos*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*sp. aff. M. insidiosum*	C2	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*sextonae*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Cyproideidae	*Peltopes*	*peninsulae*	N	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	1	0	0	0
Malacostraca	Amphipoda	Dexaminidae	*Polycheria*	*sp. aff. P. obtusa*	C2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Hyalidae	*Hyale*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Iphimediidae	*Anisoiphimedia*	*haurakiensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*typica*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*haswelli*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*longimana*	N	0	0	1	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
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa*	*frequens*	N	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Ischyrocerus*	*longimanus*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Ischyrocerus*	*sp.*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

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

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

					Berth code	CQ3																	GLADSTONE
					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	1	2	3
Malacostraca	Amphipoda	Ischyroceridae	*?Ventojassa*	*sp.*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*slatteryi*	A	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*sp.*	SI	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	1	1	0	1	1	1	0	0	1	0	0	1	1	0	0	0	1
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
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*akaroica*	N	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*sp.*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Stomacontion*	*sp. aff. S. pungpunga*	C2	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*stephenseni*	N	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*sp. aff. angusta*	C2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*?Waldeckia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*angusta*	N	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	1	0	0	0	0	0	1	0	0	0	0	1
Malacostraca	Amphipoda	Lysianassidae	*?Lysianopsis*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*?Phoxostoma*	*sp.*	SI	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	1	0	1	0	1	1	1	0	1	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*manawatu*	N	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*karu*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*cristatus*	N	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*sp.*	SI	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*wanganui*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Sebidae	*Seba*	*typica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Stenothoidae	*Stenothoe*	*sp. aff. S. gallensis*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Anthuridae	*Mesanthura*	*?affinis*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Paranthuridae	*Paranthura*	*cf. flagellata*	N	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Malacostraca	Isopoda	Pseudojaniridae	*Schottea*	*sp*	SI	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*sp*	SI	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Malacostraca	Isopoda	Sphaeromatidae	*Cilicaea*	*canaliculata*	N	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*campbellense*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Ischyromene*	*cordiforaminalis*	N	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Tanaidacea	Tanaidae	*Zeuxoides*	*sp.*	SI	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ophiuroidea	Ophiurida	Amphiuridae	*Amphipholis*	*squamata*	N	1	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	1	0	0	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos*	*loveni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea*	*australiensis*	N	0	0	0	0	0	0	1	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	1	0	1	0	0	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*camiguinoides*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*kerguelensis*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereididae*	*indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*amblyodonta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*Eulalia-NIWA-2*	SI	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides*	*Mystides-B*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodocidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	1
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*polychromus*	N	0	0	1	0	1	0	0	0	0	0	1	0	1	1	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Polynoidae*	*indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllin-unknown*	*Eusyllin-unknown-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-B*	SI	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-C*	SI	0	0	0	0	0	0	0	0	1	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
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis*	*zebra*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

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

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

					Berth code	CQ3																GLADSTONE	
					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	1	2	3
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*curta*	N	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	1	1
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*Branchiomma-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Demonax*	*aberrans*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Potamilla*	*Potamilla-A*	SI	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla*	*laciniosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Sabellidae*	*Indet*	SI	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Spirobranchus*	*cariniferus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Serpula*	*Indet*	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Opheliidae	*Armandia*	*maculata*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Timarete*	*anchylochaetus*	N	0	0	0	0	0	0	0	0	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
Polychaeta	Terebellida	Cirratulidae	*Cirratulus*	*Cirratulus-A*	SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebella*	*Terebella-B*	SI	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*armilla*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	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
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*maxima*	N	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	*Cryptoconchus*	*porosus*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton*	*pelliserpentis*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Pycnogonida	Pantopoda	Callipallenidae	*Callipallene*	*novaezealandiae*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*rubrum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*crassiuscula*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Rhodophyceae	Ceramiales	Ceramiaceae	*Anotrichium*	*crinitum*	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	1	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Schizoseris*	*sp*	SI	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	Deleseriaceae	*Phycodrys*	*quercifolia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Erythroglossum*	*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	0	0	0	0	0	0	0	0	0	0	0	1	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
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*moritziana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*subtilissima*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Stictosiphonia*	*hookeri*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gigartinales	Sarcodiaceae	*Trematocarpus*	*aciculare*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria*	*caespitosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia*	*sp.*	SI	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia*	*foliifera*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stenolaemata	Cyclostomata	Hastingsiidae	*Hastingsia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Turbellaria	Polycladida		*Indet genus*	*indet sp.*	SI	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Ulvophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis*	*vestita*	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	1	0	0	0	1	0	0	0	1	0	0	0	0	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
			Land plants	*-*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Too small to ID	*-*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Too small to ID	*red*	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

					Berth code													OIL										
					Pile replicate					2								1								2		
					Pile position	OUT				IN			OUT					IN			OUT					IN		
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	1	2	3	4	MISC	1	2	3	1	2	3	4	MISC	1	2	3
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*gymnota*	N	0	0	0	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	1	0	1	0	0	0	0	0	0
Anthozoa	Actiniaria	Aiptasiomorphidae	*Aiptasiomorpha*	*minima*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Bathyphelliidae	*Acraspedanthus*	*elongatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Diadumenidae	*Diadumene*	*neozelandica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Diadumenidae	*Diadumenidae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Anthozoa	Actiniaria	Haliplanellidae	*Haliplanella*	*lineata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Sagartiidae	*Anthothoe*	*vagrans*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria		*Acontiaria*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0
Anthozoa	Actiniaria		*Actiniaria*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Cionidae	*Ciona*	*intestinalis*	A	0	0	0	0	0	0	1	0	0	1	1	1	0	0	1	1	0	1	1	1	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1	1	1	1	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	0	1	0	0	1
Ascidiacea	Stolidobranchia	Botryllinae	*Botryllus*	*stewartensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*amokurae*	N	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pachydermatina*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*lutea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*carnea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	0	1	0	0	0	1	0	0	1	1	0	0	1	1	1	1	1	1	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*nisiotus*	N	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	1	1	1	0	0	0	0	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*regalis*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*sp.*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Styela*	*plicata*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus*	*pulex*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	0	0	0	0	0	0	0	0	0	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	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*crinalis*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*elongatus*	N	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Cancridae	*Cancer*	*gibbosulus*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Cancridae	*Cancer*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Crustacea	Brachyura	Pinnotheridae	*Pinnotheres*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*?Xanthidae*	*sexlobata*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	1	1	0	0	1	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	1	0	0
Crustacea	Thoracica	Balanidae	*Notomegabalanus*	*decorus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 1 (soft spikey tan cushion)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*cf. arenaria*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Hadromerida	Suberitidae	*Suberitidae n. g.*	*n. sp. 1 (oxeas & tylostyles)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*panicea*	C1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Chalinidae	*Haliclona*	*cf. punctata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Chalinidae	*Adocia*	*n. sp. 3 (crumbly smooth fat oxeas 130)*	C2	0	0	0	0	0	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	0	0	0	0	0	1	0

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

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

					Berth code												OIL											
					Pile replicate					2							1								2			
					Pile position	OUT				IN			OUT					IN			OUT					IN		
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	1	2	3	4	MISC	1	2	3	1	2	3	4	MISC	1	2	3
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria*	*australis*	N	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella*	*novaezelandiae*	N	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Littorinimorpha	Littorinidae	*Risellopsis*	*varia*	N	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Cadlina*	*willani*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Archidoris*	*nanula*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris*	*lanuginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Paradoris*	*leuca*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Patellogastropoda	Lottiidae	*Notoacmea*	*helmsi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Sacoglossa	Limapontiidae	*Ercolania*	*felina*	N	0	0	0	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	0	1	0	1	0	0	0	0	0	1	0	0	1	1	1	1	0	1	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1	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	0	0	0
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria*	*tenuirostris*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria*	*immersa*	N	0	0	0	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	1	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	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Electridae	*Conopeum*	*seurati*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Electridae	*Electra*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides*	*angela*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gymnolaemata	Cheilostomata	Schizoporellidae	*Chiastosella*	*watersi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	1	1	0	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*dichotoma*	C1	0	0	0	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	0	0	0
Hydrozoa	Hydroida	Phialellidae	*Opercularella*	*humilis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*setacea*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*johnstoni*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*subarticulatus*	N	0	0	0	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	0	0	0
Malacostraca	Amphipoda	Amphilochidae	*Amphilochus*	*filidactylus*	N	0	0	1	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	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*sp. aff. A. typica*	C2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*maculata*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Colomastigidae	*Colomastix*	*magnirama*	N	0	0	0	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	1	1	0	0	0	0	1	0	1	0	1	0	1	1	1	1	0	0	0	0	1	1
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*acherusicum*	A	0	0	1	0	0	1	1	0	1	1	0	0	0	1	0	1	1	1	1	0	0	0	1
Malacostraca	Amphipoda	Corophiidae	*Meridiolembos*	*sp.*	SI	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*sp. aff. M. insidiosum*	C2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*sextonae*	A	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0
Malacostraca	Amphipoda	Cyproideidae	*Peltopes*	*peninsulae*	N	0	0	1	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	1	0
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine*	*pacifica*	N	1	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Dexaminidae	*Polycheria*	*sp. aff. P. obtusa*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Hyalidae	*Hyale*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Malacostraca	Amphipoda	Iphimediidae	*Anisoiphimedia*	*haurakiensis*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*typica*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*haswelli*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*longimana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*sp. 1*	SI	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa*	*frequens*	N	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Ischyrocerus*	*longimanus*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Ischyrocerus*	*sp.*	SI	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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

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

					Berth code													OIL										
					Pile replicate					2								1								2		
					Pile position	OUT				IN			OUT					IN			OUT					IN		
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	1	2	3	1	2	3	4	MISC	1	2	3	1	2	3	4	MISC	1	2	3
Malacostraca	Amphipoda	Ischyroceridae	*?Ventojassa*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*slatteryi*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*sp.*	SI	0	0	0	0	0	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	0	1	0	0	1	0	0	1	1	0	0	1	1	0	1	1	0	0	0	1	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	0	0	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*akaroica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Stomacontion*	*sp. aff. S. pungpunga*	C2	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*stephenseni*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*sp. aff. angusta*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*?Waldeckia*	*sp.*	SI	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*angusta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*vesca*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*?Lysianopsis*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*?Phoxostoma*	*sp.*	SI	0	0	0	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	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*manawatu*	N	1	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*karu*	N	1	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*cristatus*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*wanganui*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Sebidae	*Seba*	*typica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Stenothoidae	*Stenothoe*	*sp. aff. S. gallensis*	A	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Anthuridae	*Mesanthura*	*?affinis*	SI	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Paranthuridae	*Paranthura*	*cf. flagellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Pseudojaniridae	*Schottea*	*sp*	SI	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*sp*	SI	1	0	0	0	1	0	0	1	1	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	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*campbellense*	N	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Ischyromene*	*cordiforaminalis*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Tanaidacea	Tanaidae	*Zeuxoides*	*sp.*	SI	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ophiuroidea	Ophiurida	Amphiuridae	*Amphipholis*	*squamata*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos*	*loveni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea*	*australiensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	1	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*camiguinoides*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*kerguelensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereididae*	*indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*amblyodonta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*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	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides*	*Mystides-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodocidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*polychromus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Polychaeta	Phyllodocida	Polynoidae	*Polynoidae*	*indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllin-unknown*	*Eusyllin-unknown-A*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-C*	SI	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Syllidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis*	*zebra*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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																								
					Berth code													OIL										
					Pile replicate					2									1								2	
					Pile position	OUT				IN			OUT					IN			OUT					IN		
					*Status	1	2	3	4	1	2	3	1	2	3	4	MISC	1	2	3	1	2	3	4	MISC	1	2	3
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*curta*	N	0	1	1	1	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	0	1	1
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*Branchiomma-A*	SI	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	0
Polychaeta	Sabellida	Sabellidae	*Demonax*	*aberrans*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Potamilla*	*Potamilla-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla*	*laciniosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Sabellidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Spirobranchus*	*cariniferus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Serpula*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Opheliidae	*Armandia*	*maculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Timarete*	*anchylochaetus*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris*	*nuchalis*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Cirratulus*	*Cirratulus-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*armilla*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebellidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona*	*zelandica*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus*	*porosus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*rubrum*	N	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*crassiuscula*	A	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Anotrichium*	*crinitum*	N	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*denticulata*	N	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Schizoseris*	*sp*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Hymenena*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Phycodrys*	*quercifolia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Erythroglossum*	*sp.*	SI	0	1	0	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	0	0	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	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*brodiaei*	A	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*moritziana*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*subtilissima*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Stictosiphonia*	*hookeri*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gigartinales	Sarcodiaceae	*Trematocarpus*	*aciculare*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria*	*caespitosa*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia*	*foliifera*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stenolaemata	Cyclostomata	Hastingsiidae	*Hastingsia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Turbellaria	Polycladida		*Indet genus*	*indet sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis*	*vestita*	N	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*sp.*	SI	0	1	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Land plants	-	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Too small to ID	-	SI	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Too small to ID	*red*	SI	0	0	0	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

					Berth code	W2																W4						
					Pile replicate	1								2								1						
					Pile position	OUT					IN			OUT				IN				OUT					IN		
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	MISC	1	2	3	1	2	3	4	1	2	3		1	2	3	4	MISC	1	2	3
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*gymnota*	N	0	0	0	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	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Aiptasiomorphidae	*Aiptasiomorpha*	*minima*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Bathyphelliidae	*Acraspedanthus*	*elongatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Diadumenidae	*Diadumene*	*neozelandica*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Anthozoa	Actiniaria	Diadumenidae	*Diadumenidae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Haliplanellidae	*Haliplanella*	*lineata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Sagartiidae	*Anthothoe*	*vagrans*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria		*Acontiaria*	*sp.*	SI	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0
Anthozoa	Actiniaria		*Actiniaria*	*sp.*	SI	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Cionidae	*Ciona*	*intestinalis*	A	0	0	1	0	0	0	1	1	0	0	1	1	0	0	1	0	0	0	1	1	0	1	1
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	1	1	1	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	1	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	1	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	1	0	0	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	0	0	1	0	0	0	0	1	0	1	1	0	1	0	0	1	0	0	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botryllus*	*stewartensis*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*amokurae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1	1	0	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pachydermatina*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*lutea*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*carnea*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	1	1	1	1	1	0	0	1	0	1	1	1	0	0	1	0	0	1	0	0	0	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*nisiotus*	N	0	0	0	0	0	0	1	1	0	1	1	0	0	0	1	0	1	1	0	0	0	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	1	0	1	1	0	0	1	0	0	1	0	1	0	1	0	0	0	1	1	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*regalis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*sp.*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Styela*	*plicata*	C1	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	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	0	0	0
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	0	0	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	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*crinalis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*elongatus*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Cancridae	*Cancer*	*gibbosulus*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Cancridae	*Cancer*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Crustacea	Brachyura	Pinnotheridae	*Pinnotheres*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*?Xanthidae*	*sexlobata*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	0	0	0	0	0	0	1	1	1	0	0	0	1	0	1	1	0	0	0	0	1	0	0
Crustacea	Thoracica	Balanidae	*Notomegabalanus*	*decorus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 1 (soft spikey tan cushion)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*cf. arenaria*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Hadromerida	Suberitidae	*Suberitidae n. g.*	*n. sp. 1 (oxeas & tylostyles)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*panicea*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Chalinidae	*Haliclona*	*cf. punctata*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Haplosclerida	Chalinidae	*Adocia*	*n. sp. 3 (crumbly smooth fat oxeas 130)*	C2	0	0	0	1	0	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	0	0	0	0	0	0	0

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

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

					Berth code	W2															W4							
					Pile replicate	1								2							1							
					Pile position	OUT					IN			OUT				IN			OUT					IN		
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	MISC	1	2	3	1	2	3	4	1	2	3	1	2	3	4	MISC	1	2	3
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	1	0	1	1	0	1	0	0	0	0	1	0	0	1	0	0	1	1	1	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	0	0	0	0	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella*	*novaezelandiae*	N	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0
Gastropoda	Littorinimorpha	Littorinidae	*Risellopsis*	*varia*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Cadlina*	*willani*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Archidoris*	*nanula*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris*	*lanuginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Paradoris*	*leuca*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Patellogastropoda	Lottiidae	*Notoacmea*	*helmsi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Sacoglossa	Limapontiidae	*Ercolania*	*felina*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Systellomatophora	Onchidiidae	*Onchidella*	*nigricans*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	0	0	1	1	0	1	0	1	1	0	0	1	1	0	1	0	0	0	0	0	1
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*zelandica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria*	*tenuirostris*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria*	*immersa*	N	0	0	0	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	0	0	0
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula*	*pallasiana*	A	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Electridae	*Conopeum*	*seurati*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Electridae	*Electra*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides*	*angela*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Schizoporellidae	*Chiastosella*	*watersi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	0	0
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*dichotoma*	C1	0	0	0	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	0	0	0
Hydrozoa	Hydroida	Phialellidae	*Opercularella*	*humilis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*setacea*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*subarticulatus*	N	0	0	0	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	0	0	0
Malacostraca	Amphipoda	Amphilochidae	*Amphilochus*	*filidactylus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*sp. aff. A. typica*	C2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*maculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Colomastigidae	*Colomastix*	*magnirama*	N	0	0	0	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	1	1	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	1	1	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*acherusicum*	A	1	1	0	0	0	0	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	1	0
Malacostraca	Amphipoda	Corophiidae	*Meridiolembos*	*sp.*	SI	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*sp. aff. M. insidiosum*	C2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*sextonae*	A	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Cyproideidae	*Peltopes*	*peninsulae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine*	*pacifica*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Dexaminidae	*Polycheria*	*sp. aff. P. obtusa*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Hyalidae	*Hyale*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Iphimediidae	*Anisoiphimedia*	*haurakiensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*typica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*haswelli*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*longimana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*sp. 1*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa*	*frequens*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Ischyrocerus*	*longimanus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Ischyrocerus*	*sp.*	SI	0	0	0	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

					Berth code	W2																				W4		
					Pile replicate	1								2								1						
					Pile position	OUT					IN			OUT				IN			OUT					IN		
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	MISC	1	2	3	1	2	3	4	1	2	3	1	2	3	4	MISC	1	2	3
Malacostraca	Amphipoda	Ischyroceridae	*?Ventojassa*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*slatteryi*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*trailli*	N	0	1	1	1	0	0	1	1	0	0	1	1	0	0	0	0	0	1	1	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	0	1	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*akaroica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Stomacontion*	*sp. aff. S. pungpunga*	C2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*stephenseni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*sp. aff. angusta*	C2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*?Waldeckia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*angusta*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	1	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	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*?Lysianopsis*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*?Phoxostoma*	*sp.*	SI	0	0	0	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	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*manawatu*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*karu*	N	0	0	0	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	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*wanganui*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Sebidae	*Seba*	*typica*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Stenothoidae	*Stenothoe*	*sp. aff. S. gallensis*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Anthuridae	*Mesanthura*	*?affinis*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Paranthuridae	*Paranthura*	*cf. flagellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Pseudojaniridae	*Schottea*	*sp*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*sp*	SI	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	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	0	0	0	1	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*campbellense*	N	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*Ischyromene*	*cordiforaminalis*	N	0	0	0	0	0	0	0	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	0	0	0	0	0	0
Ophiuroidea	Ophiurida	Amphiuridae	*Amphipholis*	*squamata*	N	0	0	0	0	0	0	1	1	0	1	0	0	0	1	1	0	0	0	0	0	0	1	0
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos*	*loveni*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea*	*australiensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*sphaerocephala*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	1	0	1	1	1	0	0	0	0	0	0	1	0	1	1	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*camiguinoides*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*kerguelensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereididae*	*indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*amblyodonta*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*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	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides*	*Mystides-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodocidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*polychromus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Polychaeta	Phyllodocida	Polynoidae	*Polynoidae*	*indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllin-unknown*	*Eusyllin-unknown-A*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-C*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Syllidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis*	*zebra*	N	0	0	0	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

					Berth code	W2															W4							
					Pile replicate	1								2							1							
					Pile position	OUT					IN			OUT				IN			OUT					IN		
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	MISC	1	2	3	1	2	3	4	1	2	3	1	2	3	4	MISC	1	2	3
Polychaeta	Sabellida	Sabellidae	Branchiomma	curta	N	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0	1	1
Polychaeta	Sabellida	Sabellidae	Branchiomma	Branchiomma-A	SI	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0
Polychaeta	Sabellida	Sabellidae	Demonax	aberrans	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	Potamilla	Potamilla-A	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	Pseudopotamilla	laciniosa	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	Sabellidae	Indet	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	Spirobranchus	cariniferus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Polychaeta	Sabellida	Serpulidae	Serpula	Indet	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Opheliidae	Armandia	maculata	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	Timarete	anchylochaetus	N	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1
Polychaeta	Terebellida	Cirratulidae	Protocirrineris	nuchalis	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	Cirratulus	Cirratulus-A	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	Terebella	Terebella-B	SI	0	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1
Polychaeta	Terebellida	Terebellidae	Streblosoma	toddae	N	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	Nicolea	armilla	N	0	0	0	0	1	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	1	0	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	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	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	Cryptoconchus	porosus	N	0	0	0	0	0	0	1	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	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	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	Ceramium	rubrum	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	Griffithsia	crassiuscula	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	Anotrichium	crinitum	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	Myriogramme	denticulata	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1
Rhodophyceae	Ceramiales	Deleseriaceae	Schizoseris	sp	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	Hymenena	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	Erythroglossum	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	Bostrychia	harveyi	N	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	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	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	Bostrychia	moritziana	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	Polysiphonia	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	Polysiphonia	subtilissima	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	Stictosiphonia	hookeri	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Rhodophyceae	Gigartinales	Sarcodiaceae	Trematocarpus	aciculare	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Lomentariaceae	Lomentaria	caespitosa	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	Rhodymenia	sp.	SI	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	Rhodymenia	foliifera	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Stenolaemata	Cyclostomata	Hastingsiidae	Hastingsia	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Turbellaria	Polycladida		Indet genus	indet sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Bryopsidales	Bryopsidaceae	Bryopsis	vestita	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	Ulva	sp.	SI	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	Enteromorpha	sp.	SI	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Land plants	-	SI	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Too small to ID	-	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			Too small to ID	red	SI	0	0	0	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

					Berth code													
					Pile replicate						2							
					Pile position	OUT					IN			OUT				
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	MISC	1	2	3	1	2	3	4	MISC
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	1	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*gymnota*	N	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
Anthozoa	Actiniaria	Aiptasiomorphidae	*Aiptasiomorpha*	*minima*	N	0	0	0	0	0	0	0	0	0	0	0	1	0
Anthozoa	Actiniaria	Bathyphelliidae	*Acraspedanthus*	*elongatus*	N	0	1	1	0	0	0	1	0	0	0	0	0	0
Anthozoa	Actiniaria	Diadumenidae	*Diadumene*	*neozelandica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Diadumenidae	*Diadumenidae*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria	Haliplanellidae	*Haliplanella*	*lineata*	A	0	0	0	0	0	0	0	0	1	0	0	0	0
Anthozoa	Actiniaria	Sagartiidae	*Anthothoe*	*vagrans*	N	0	0	0	0	0	0	0	0	0	1	0	0	0
Anthozoa	Actiniaria		*Acontiaria*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Anthozoa	Actiniaria		*Actiniaria*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Cionidae	*Ciona*	*intestinalis*	A	0	1	1	1	0	0	1	1	0	1	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	1	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*adamsi*	N	0	1	0	0	0	0	1	1	0	0	1	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	1	1	0	0	0	0	0	1	1	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	1	0	0	0	0	0	0	1	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botryllus*	*stewartensis*	N	0	0	1	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	1	1	0	1	0	1	1	0	1	1	1	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*amokurae*	N	0	0	0	1	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	1	1	0	0	0	1	1	0	1	1	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*pachydermatina*	N	0	1	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	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*carnea*	N	0	0	1	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	1	1	1	1	0	1	1	0	1	1	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*nisiotus*	N	0	1	1	0	0	0	0	1	0	0	1	1	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	0	1	0	0	0	0	1	0	0	0	1	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*regalis*	N	0	0	0	0	0	0	0	0	0	1	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*sp.*	A	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Styela*	*plicata*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	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
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Lasaeidae	*Lasaea*	*hinemoa*	N	0	0	0	0	0	1	0	0	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*crinalis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	0	0	0	0	0	0	0	0	0	1	0	0	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*elongatus*	N	0	1	0	0	0	1	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
Crustacea	Brachyura	Cancridae	*Cancer*	*gibbosulus*	A	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Cancridae	*Cancer*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	0	1	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	0	0	0	0	0	1	0
Crustacea	Brachyura	Pinnotheridae	*Pinnotheres*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*?Xanthidae*	*sexlobata*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	1	0	0	0	0	0	0	0	0	1	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	0	1	0	1	0	1	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
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*n. sp. 1 (soft spikey tan cushion)*	C2	0	0	0	0	0	0	0	1	0	0	0	0	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia*	*cf. arenaria*	N	0	0	0	1	0	0	0	0	0	0	0	1	0
Demospongiae	Hadromerida	Suberitidae	*Suberitidae n. g.*	*n. sp. 1 (oxeas & tylostyles)*	C2	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
Demospongiae	Haplosclerida	Chalinidae	*Haliclona*	*cf. punctata*	N	0	0	0	0	0	0	0	1	0	0	0	1	0
Demospongiae	Haplosclerida	Chalinidae	*Adocia*	*n. sp. 3 (crumbly smooth fat oxeas 130)*	C2	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

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

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

				Berth code														
				Pile replicate							2							
				Pile position	OUT					IN			OUT					
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	MISC	1	2	3	1	2	3	4	MISC
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	0	1	0	0	0	1	0	0	0	1	0	0
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria*	*australis*	N	1	0	0	0	0	0	0	0	1	0	0	0	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella*	*novaezelandiae*	N	0	1	1	1	1	0	0	1	0	0	0	0	0
Gastropoda	Littorinimorpha	Littorinidae	*Risellopsis*	*varia*	N	1	0	0	0	0	1	0	0	1	0	0	0	0
Gastropoda	Nudibranchia	Chromodorididae	*Cadlina*	*willani*	N	0	0	0	1	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Archidoris*	*nanula*	N	0	0	0	1	0	0	0	0	0	1	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris*	*lanuginata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Paradoris*	*leuca*	N	0	0	0	0	1	0	0	0	0	0	0	0	0
Gastropoda	Patellogastropoda	Lottiidae	*Notoacmea*	*helmsi*	N	1	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Sacoglossa	Limapontiidae	*Ercolania*	*felina*	N	0	0	0	0	0	0	0	0	0	0	0	0	1
Gastropoda	Systellomatophora	Onchidiidae	*Onchidella*	*nigricans*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	0	0	0	0	1	1	0	1	1	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	0	0	0	0	0	0	1	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Caberea*	*zelandica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria*	*tenuirostris*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria*	*immersa*	N	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
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula*	*pallasiana*	A	1	0	0	0	0	1	0	0	1	0	0	0	0
Gymnolaemata	Cheilostomata	Electridae	*Conopeum*	*seurati*	A	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Electridae	*Electra*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides*	*angela*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Schizoporellidae	*Chiastosella*	*watersi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	1	0	1	1	1	1	1	1	1	0	1	1	0
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*dichotoma*	C1	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
Hydrozoa	Hydroida	Phialellidae	*Opercularella*	*humilis*	N	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
Hydrozoa	Hydroida	Plumulariidae	*Monotheca*	*flexuosa*	N	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
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*subarticulatus*	N	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
Malacostraca	Amphipoda	Amphilochidae	*Amphilochus*	*filidactylus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*sp. aff. A. typica*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*typica*	N	0	0	0	1	0	0	0	0	0	1	0	0	0
Malacostraca	Amphipoda	Aoridae	*Aora*	*maculata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Colomastigidae	*Colomastix*	*magnirama*	N	0	0	0	0	0	0	0	0	0	0	1	0	0
Malacostraca	Amphipoda	Corophiidae	*Apocorophium*	*acutum*	A	0	1	1	0	0	1	1	1	0	1	1	0	1
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*acherusicum*	A	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Meridiolembos*	*sp.*	SI	0	1	0	0	1	0	0	0	0	0	1	0	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*sp. aff. M. insidiosum*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Corophiidae	*Monocorophium*	*sextonae*	A	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Cyproideidae	*Peltopes*	*peninsulae*	N	0	0	0	0	0	0	0	0	0	0	1	0	0
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine*	*pacifica*	N	0	0	0	0	1	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Dexaminidae	*Polycheria*	*sp. aff. P. obtusa*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Hyalidae	*Hyale*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Iphimediidae	*Anisoiphimedia*	*haurakiensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*typica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*haswelli*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis*	*longimana*	N	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
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa*	*frequens*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Ischyrocerus*	*longimanus*	N	0	0	0	0	1	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Ischyrocerus*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0

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

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

					Berth code														
					Pile replicate						2								
					Pile position	OUT					IN			OUT					
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	MISC	1	2	3	1	2	3	4	MISC	
Malacostraca	Amphipoda	Ischyroceridae	*?Ventojassa*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*slatteryi*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*trailli*	N	0	1	1	1	1	0	1	1	0	1	1	1	1	
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*sp. 1*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*akaroica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Lysianassidae	*Stomacontion*	*sp. aff. S. pungpunga*	C2	0	0	0	0	0	0	0	0	0	0	1	0	0	
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*stephenseni*	N	0	0	1	0	0	0	1	0	0	0	0	0	0	
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*sp. aff. angusta*	C2	0	1	0	0	0	0	0	0	0	1	1	0	0	
Malacostraca	Amphipoda	Lysianassidae	*?Waldeckia*	*sp.*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*angusta*	N	0	0	0	1	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	
Malacostraca	Amphipoda	Lysianassidae	*?Lysianopsis*	*sp.*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Lysianassidae	*?Phoxostoma*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	1	0	0	
Malacostraca	Amphipoda	Melitidae	*Mallacoota*	*subcarinata*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*manawatu*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*karu*	N	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	
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Podoceridae	*Podocerus*	*wanganui*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Sebidae	*Seba*	*typica*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Amphipoda	Stenothoidae	*Stenothoe*	*sp. aff. S. gallensis*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Isopoda	Anthuridae	*Mesanthura*	*?affinis*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Isopoda	Paranthuridae	*Paranthura*	*cf. flagellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Isopoda	Pseudojaniridae	*Schottea*	*sp*	SI	0	0	1	0	0	1	0	0	0	0	0	0	0	
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*sp*	SI	1	0	0	0	0	1	0	0	1	0	0	0	0	
Malacostraca	Isopoda	Sphaeromatidae	*Cilicaea*	*canaliculata*	N	0	1	0	0	0	0	1	0	0	0	0	0	0	
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma*	*campbellense*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	
Malacostraca	Isopoda	Sphaeromatidae	*Ischyromene*	*cordiforaminalis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Malacostraca	Tanaidacea	Tanaidae	*Zeuxoides*	*sp.*	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	
Ophiuroidea	Ophiurida	Amphiuridae	*Amphipholis*	*squamata*	N	0	1	0	0	1	0	0	0	0	1	1	0	0	
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	0	1	0	0	1	0	0	0	0	1	1	0	0	
Polychaeta	Eunicida	Dorvilleidae	*Schistomeringos*	*loveni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea*	*australiensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris*	*sphaerocephala*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	1	1	0	0	0	1	0	0	0	1	0	
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*camiguinoides*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*kerguelensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Nereididae	*Nereididae*	*indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*amblyodonta*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	
Polychaeta	Phyllodocida	Nereididae	*Platynereis*	*Platynereis_australis_group*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*Eulalia-NIWA-2*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides*	*Mystides-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodocidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	1	1	1	1	0	1	1	0	1	0	1	1	
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*polychromus*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Polynoidae	*Polynoidae*	*indet*	SI	0	0	0	0	0	0	0	0	0	0	1	0	0	
Polychaeta	Phyllodocida	Syllidae	*Eusyllin-unknown*	*Eusyllin-unknown-A*	SI	1	0	0	0	0	1	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-B*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Syllidae	*Eusyllis*	*Eusyllis-C*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Syllidae	*Syllidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis*	*zebra*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	

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

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

					Berth code													
					Pile replicate							2						
					Pile position	OUT					IN			OUT				
Class	Orders	Family	Genus	Species	*Status	1	2	3	4	MISC	1	2	3	1	2	3	4	MISC
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*curta*	N	0	1	1	1	1	0	1	1	0	1	1	1	1
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*Branchiomma-A*	SI	0	0	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Demonax*	*aberrans*	N	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Potamilla*	*Potamilla-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla*	*laciniosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Sabellidae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Spirobranchus*	*cariniferus*	N	1	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Serpula*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Scolecida	Opheliidae	*Armandia*	*maculata*	N	0	1	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Timarete*	*anchylochaetus*	N	0	0	1	0	0	0	1	0	0	1	1	0	0
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris*	*nuchalis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Cirratulus*	*Cirratulus-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebella*	*Terebella-B*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	0	0	0	0	0	0	0	1	0	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*armilla*	N	0	1	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Terebellidae*	*Indet*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Nicolea*	*maxima*	N	0	0	0	0	1	0	0	0	0	0	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona*	*zelandica*	N	0	1	0	0	0	0	0	0	0	1	0	0	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus*	*porosus*	N	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
Pycnogonida	Pantopoda	Callipallenidae	*Callipallene*	*novaezealandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*rubrum*	N	0	0	1	0	1	0	0	0	0	1	0	0	1
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*crassiuscula*	A	0	0	0	0	0	0	0	0	0	0	1	0	1
Rhodophyceae	Ceramiales	Ceramiaceae	*Anotrichium*	*crinitum*	N	0	0	1	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*denticulata*	N	0	1	1	0	0	0	0	0	0	1	1	0	1
Rhodophyceae	Ceramiales	Deleseriaceae	*Schizoseris*	*sp*	SI	0	0	1	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
Rhodophyceae	Ceramiales	Deleseriaceae	*Phycodrys*	*quercifolia*	N	0	0	1	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Delesseriaceae	*Erythroglossum*	*sp.*	SI	0	1	1	0	0	0	0	0	0	1	0	0	1
Rhodophyceae	Ceramiales	Delesseriaceae	*Delesseriaceae*	*sp.*	SI	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	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*brodiaei*	A	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*moritziana*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*sp.*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia*	*subtilissima*	A	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Stictosiphonia*	*hookeri*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Gigartinales	Sarcodiaceae	*Trematocarpus*	*aciculare*	N	1	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria*	*caespitosa*	N	0	1	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia*	*sp.*	SI	0	1	1	0	0	0	0	0	0	1	1	0	1
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia*	*foliifera*	N	0	0	0	0	0	0	0	0	0	0	0	0	0
Stenolaemata	Cyclostomata	Hastingsiidae	*Hastingsia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Turbellaria	Polycladida		*Indet genus*	*indet sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
Ulvophyceae	Bryopsidales	Bryopsidaceae	*Bryopsis*	*vestita*	N	0	1	0	0	0	0	0	0	0	1	1	0	1
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*sp.*	SI	1	0	0	1	0	0	0	0	1	1	0	0	1
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
			Land plants	*-*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
			Too small to ID	*-*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0
			Too small to ID	*red*	SI	0	0	0	0	0	0	0	0	1	0	0	0	0

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

Appendix 5b. Results from the benthic grab samples.

					Berth code	CQ3			GLADSTONE			OIL			W2			W4		
Class	Order	Family	Genus	Species	*Status	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	1	1	1	1	0	1	1	1	1	1	1	1	0	1	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	0	0	0	1	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	1	0	0	0	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella*	*novaezelandiae*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Gastropoda	Neogastropoda	Muricidae	*Xymene*	*plebeius*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0
Gymnolaemata	Cheilostomata	Candidae	*Tricellaria*	*inopinata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	0	0	0	1	1	1	1	1	0	0	1	0	0	1	1
Hydrozoa	Hydroida	Haleciidae	*Halecium*	*?beanii*	SI	0	1	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	1	1
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*?setacea*	SI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*johnstoni*	N	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*bispinosa*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Sertularia*	*unguiculata*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*subarticulatus*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*?Waldeckia*	*sp.*	SI	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Phoxocephalidae	*Torridoharpinia*	*hurleyi*	N	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus*	*verrilli*	N	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Sigalionidae	*Labiosthenolepis*	*laevis*	N	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1
Polychaeta	Spionida	Spionidae	*Scolecolepides*	*benhami*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris*	*nuchalis*	N	0	0	0	1	0	1	0	0	0	1	1	0	1	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*crassiuscula*	A	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
			Land plants	-	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
			Too small to ID	-	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
			Too small to ID	red	SI	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 5c. Results from the benthic sled samples.

					Berth code	CQ3		GLADSTONE		OIL		W2		W4	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2	1	2
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	0	0	1	0	0	0
Actinopterygii	Pleuronectiformes	Pleuronectidae	*Peltorhamphus*	*latus*	N	0	0	0	0	0	0	0	0	0	1
Anthozoa	Actiniaria	Diadumenidae	*Diadumenidae*	*sp.*	SI	0	0	0	0	0	0	1	1	0	0
Ascidiacea	Aplousobranchia	Cionidae	*Ciona*	*intestinalis*	A	0	0	0	0	1	0	1	1	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	0	0	0	0	0	1	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	0	0	0	0	0	0	1	0	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	0	0	0	0	1	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	0	0	0	0	1	0	0	1	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*nisiotus*	N	1	0	0	0	0	0	1	1	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	0	0	0	0	0	1	0	0	1
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	0	0	0	0	0	0	0	1	0
Bivalvia	Veneroida	Semelidae	*Theora*	*lubrica*	A	0	0	0	0	0	0	0	1	0	0
Crustacea	Anomura	Paguridae	*Lophopagurus (L.)*	*lacertosus*	N	1	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	0	0	0	1	1	0	1	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	0	1	0	1
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	1	1	1	1	1	1	1	1	1	1
Crustacea	Brachyura	Portunidae	*Nectocarcinus*	*antarcticus*	N	0	0	0	0	1	1	0	0	0	0
Crustacea	Caridea	Crangonidae	*Pontophilus*	*australis*	N	1	0	1	1	1	1	1	1	0	1
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	0	0	1	0	0	0
Demospongiae	Haplosclerida	Chalinidae	*Haliclona*	*glabra*	N	0	0	0	1	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella*	*n. sp. 1 (macrosigma)*	C2	0	0	0	0	0	1	1	1	0	1
Gastropoda	Neogastropoda	Muricidae	*Xymene*	*plebeius*	N	1	0	1	1	0	1	0	0	1	0
Gastropoda	Vetigastropoda	Trochidae	*Micrelenchus*	*huttonii*	N	0	0	0	0	0	0	1	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*flabellata*	A	0	0	0	0	0	1	0	0	0	0
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula*	*neritina*	A	0	0	0	0	0	0	0	0	1	0
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria*	*immersa*	N	0	1	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Campanulariidae	*Obelia*	*dichotoma*	C1	0	1	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Plumulariidae	*Plumularia*	*setacea*	C1	1	0	1	0	0	0	1	0	1	1
Hydrozoa	Hydroida	Sertulariidae	*Sertularia*	*unguiculata*	N	1	1	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus*	*johnstoni*	N	1	1	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia*	*bispinosa*	N	0	1	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ischyroceridae	*Jassa*	*sp.*	SI	0	0	0	0	0	0	0	1	0	0
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*trailli*	N	0	0	0	0	0	0	0	1	0	0
Malacostraca	Amphipoda	Lysianassidae	*?Phoxostoma*	*sp.*	SI	0	0	0	0	0	0	1	0	0	0
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia*	*vesca*	N	0	0	0	0	0	0	1	0	0	0
Phaeophyceae	Laminariales	Alariaceae	*Undaria*	*pinnatifida*	A	0	0	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Glyceridae	*Glycera*	*lamelliformis*	N	0	0	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Goniadidae	*Glycinde*	*dorsalis*	N	0	0	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Hesionidae	*Ophiodromus*	*angustifrons*	N	0	0	0	0	0	0	0	1	0	0
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus*	*verrilli*	N	0	0	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides*	*Mystides-B*	SI	0	0	0	0	0	0	0	1	0	0
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe*	*macrolepidota*	N	0	0	0	0	0	0	1	1	0	0
Polychaeta	Phyllodocida	Sigalionidae	*Labiosthenolepis*	*laevis*	N	1	1	1	1	0	1	1	1	1	1
Polychaeta	Sabellida	Sabellidae	*Branchiomma*	*curta*	N	0	0	0	0	1	0	1	1	0	0
Polychaeta	Terebellida	Trichobranchidae	*Terebellides*	*narribri*	N	1	1	1	1	1	1	0	0	0	1
Rhodophyceae	Acrochaetiales	Acrochaetiaceae	*Audouinella*	*sp.*	SI	0	0	0	1	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Anotrichium*	*crinitum*	N	0	0	1	1	0	0	1	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*rubrum*	N	0	0	0	0	0	0	0	1	1	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*crassiuscula*	A	0	0	0	0	0	0	0	0	0	1
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*denticulata*	N	0	0	0	0	0	0	0	1	0	1
Rhodophyceae	Ceramiales	Deleseriaceae	*Acrosorium*	*venulosum*	N	0	0	0	0	0	0	1	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Phycodrys*	*quercifolia*	N	0	0	0	0	0	0	1	0	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Bostrychia*	*harveyi*	N	0	0	0	0	0	1	0	0	0	0
Rhodophyceae	Gigartinales	Phyllophoraceae	*Stenogramme*	*interrupta*	N	0	0	0	0	0	0	0	0	1	0
Rhodophyceae	Plocamiales	Plocamiaceae	*Plocamium*	*angustum*	N	0	0	0	0	1	0	0	0	0	0
			Too small to ID	-	SI	0	0	0	0	0	0	1	0	0	1

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

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

					Berth code	1		2		3		4	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2
Dinophyceae	Gymnodiniales	Gymnodiniacea	*Cochlodinium*	*sp.*	N	0	0	0	0	0	0	0	1
Dinophyceae	Gymnodiniales	Polykrikaceae	*Pheopolykrikos*	*sp.*	N	1	0	0	0	0	0	0	0
Dinophyceae	Peridiniales	Peridiniaceae	*Scrippsiella*	*trochoidea*	N	0	0	0	1	1	0	0	1
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium*	*conicum*	N	0	0	0	0	1	0	0	0

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

Appendix 5e. Results from the fish trap samples.

					Berth code	CQ3				GLADSTONE				OIL				W2				W4			
					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	*Pseudophycis*	*bachus*	N	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Cheilodactylidae	*Nemadactylus*	*macropterus*	N	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	0	0	0	0
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	0	1	1	1	0	1	1	1	1	1	0	1	0	0	1	1	0	1	1	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*gymnota*	N	0	1	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	1	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chondrichthyes	Squaliformes	Squalidae	*Squalus*	*acanthias*	N	1	1	1	1	1	1	1	1	0	0	0	1	1	1	1	1	0	1	1	0
Crustacea	Brachyura	Cancridae	*Cancer*	*novaezelandiae*	N	1	1	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0

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

Appendix 5f. Results from the crab trap samples.

				Berth code	CAT JET				CQ3				GLADSTONE				W2				W4				
				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

Class	Order	Family	Genus	Species	*Status	CAT JET 1-1	CAT JET 1-2	CAT JET 2-1	CAT JET 2-2	CQ3 1-1	CQ3 1-2	CQ3 2-1	CQ3 2-2	GLADSTONE 1-1	GLADSTONE 1-2	GLADSTONE 2-1	GLADSTONE 2-2	W2 1-1	W2 1-2	W2 2-1	W2 2-2	W4 1-1	W4 1-2	W4 2-1	W4 2-2	Total
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	0	0	0	0	0	0	1	0	1	1	1	1	0	0	1	1	0	0	1	1	9
Chondrichthyes	Squaliformes	Squalidae	*Squalus*	*acanthias*	N	0	1	0	0	1	1	1	1	0	0	0	1	1	0	1	0	1	1	0	0	10
Crustacea	Brachyura	Cancridae	*Cancer*	*novaezelandiae*	N	0	1	0	1	1	1	1	1	0	1	0	1	0	0	1	0	1	1	1	1	13
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1

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

Appendix 5g. Results from the starfish trap samples.

					Site code	CAT JET				CQ3				GLADSTONE				W2				W4			
					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
Crustacea	Brachyura	Cancridae	*Cancer*	*novaezelandiae*	N	1	1	1	1	1	1	1	1	0	1	0	0	0	1	1	0	0	0	0	1
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

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

Appendix 5h. Results from the shrimp trap samples.

					Berth code	CAT JET				CQ3				GLADSTONE				W2			W4			
					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
Malacostraca	Isopoda	Cirolanidae	*Natatolana*	*rossi*	N	1	0	0	0	1	1	1	1	0	0	1	0	1	0	0	0	1	1	0

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

Addendum

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