Port of Nelson

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

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Executive summary

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

- 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 Nelson. 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 Nelson 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 196 species or higher taxa was identified from the Nelson Port survey.

- They consisted of 133 native species, 14 non-indigenous species, 15 cryptogenic species (those whose geographic origins are uncertain) and 34 species indeterminata (taxa for which there is insufficient taxonomic or systematic information available to allow identification to species level).

- Six species of marine organisms collected from the Port of Nelson have not previously been described from New Zealand waters; three of these are newly discovered non-indigenous species (the bryozoan *Celleporaria nodulosa,* the hydroid *Lafoeina amirantensis* and the ascidian *Cnemidocarpa* sp.) and three are cryptogenic (the sponges *Halichondria* n. sp. 5, *Haliclona* n. sp. 1, *Haliclona* n. sp. 7).

- The 14 non-indigenous organisms described from the Port of Nelson included representatives of five phyla. The non-indigenous species detected (ordered alphabetically by phylum, class, order, family, genus and species) were: (Annelida) Polydora hoplura (Bryozoa) *Bugula flabellata, Cryptosula pallasiana, Conopeum seurati, Electra angulata, Celleporaria nodulosa*, *Schizoporella errata*, *Watersipora subtorquata* and *Anguinella palmate*, (Cnidaria) *Lafoeina amirantensis*, (Mollusca) *Crassostrea gigas*, *Theora lubrica* and (Urochordata) *Ciona intestinalis* and *Cnemidocarpa* sp.

- The only species from the Port of Nelson 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.

- The bivalve *Crassostrea gigas* was also present in the Port of Nelson and this species is listed on the Australian ABWMAC schedule of non-indigenous pest species.

- 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 79 % (11 of 14 species) of NIS in the Port of Nelson are likely to have been introduced in hull fouling assemblages, 7 % via ballast water and 14 % 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 Nelson (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 Nelson 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 NELSON

Port Nelson is situated at the southern end of a naturally protected inlet, on the eastern shoreline of Tasman Bay, on the central north coast of New Zealand's South Island (41^{o} S 173^{o} 17'E) (Figs. 2 and 3). Access to the wharves of the Port is gained through a deep dredged channel between Boulder Bank and Haulashore Island, south of Nelson (Thompson 1981). The 13 km natural breakwater protects the port in all weather conditions.

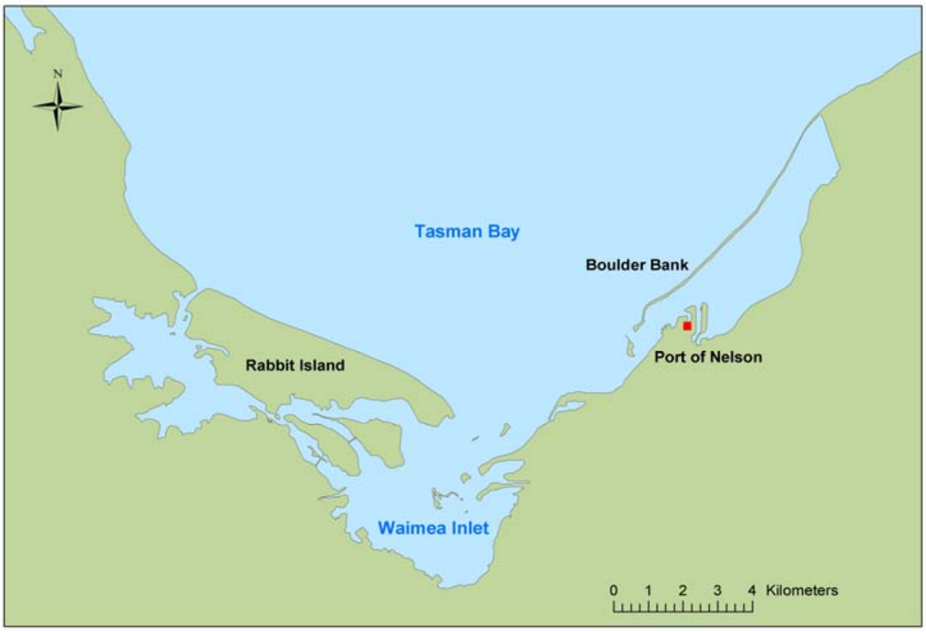

Figure 2: Tasman Bay and Port Nelson map

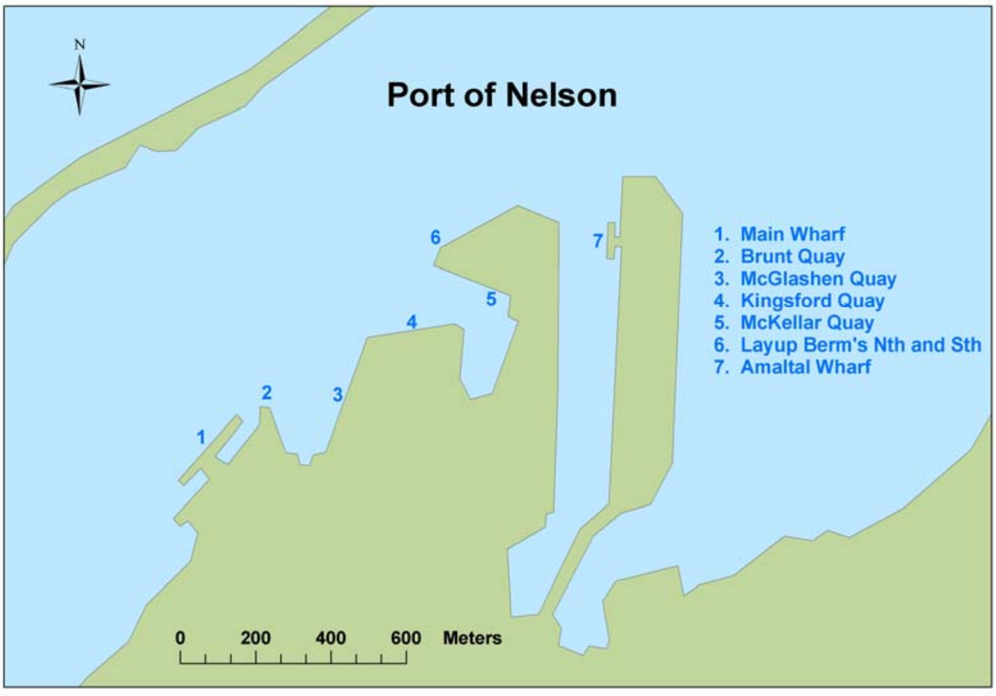

Figure 3: Port of Nelson map.

PORT OPERATION AND SHIPPING MOVEMENTS

Following early exploration by Kupe, the Nelson region was settled by a succession of different Māori tribal groups (e.g. Hāwea, Waitaha and Ngāti Māmoe). The 1820's brought an influx of sealers, whalers and associated traders to the region. The first party of European Nelson settlers, under Captain Arthur Wakefield, arrived in 1841 and Nelson Haven was found and chosen as the place for the settlement. At the time, a port of a kind, behind the long Boulder Bank, was found to be within ready communication with the small Waimea Plain, and there the next wave of new settlers landed in 1842. The port gradually developed to service the other nearby coastal settlements. By the 1880's orchard yields were sufficient to establish fruit-preserving and jam-making industries, and early in the following century an export trade in apples to Australia and the UK commenced. Haulashore Island was connected to the Boulder Bank until The Cut was made in 1906, which provided the new entrance to the port. From the early 1900's to 1922 the Union Steam Ship Company ran a passenger and service from Nelson to the West Coast and Picton. After centralisation of shipping was introduced in 1943, the port was used only by coastal vessels and tankers until 1951, when improvements made it possible for overseas ships to load and unload (Allan 1954). Goods handled in 1964 totalled 292,677 tons. At that time motor spirits were the main import, while fruit, frozen meat, and timber were the main exports (www.teara.govt.nz).

Port Nelson currently consists predominantly of linear berth face, and incorporates berthage operated by Port Nelson Ltd (www.portnelson.co.nz) and several independent fishing companies. These include two of New Zealand's largest operators, Amaltal and the Sealord Group. There are two heavy-duty wharves: the remodelled Main Wharf and Brunt Quay; and two multipurpose berths: McGlashen Quay and Kingsford Quay. There are also three designated lay-up berths for ship repair work and refitting. The main independently operated berth is McKellar Quay, with several other smaller wharves and facilities designated for use by fishing fleets. Port Nelson is Australasia's largest fishing port. Nelson interests hold over half of New Zealand's sustainable catching rights and, as such, this port is used heavily by various fishing vessels (www.portnelson.co.nz). Berth construction is a mixture of concrete and wood decking on Australian hardwood or concrete piles, with some solid concrete berths (Lay-up berths). Table 1 summarises berthage facilities at Port Nelson.

Port Nelson is a net export facility, a higher volume of cargo is loaded than unloaded (Taylor 1998). Forestry products, such as logs, sawn timber and Medium Density Fibreboard (MDF), account for much of the cargo. Seafood is also a major commodity, with aquaculture products contributing to growth in export volumes. Fruit is another large export product. In 2004, cargo volumes reached a record 2.5 million tonnes, driven by a strong performance from the fruit, forestry and fishing sectors. Container throughput was also a record 51,128 TEU in 2004, due to an increased containerisation of export apples and timber products (www.portnelson.co.nz).

As well as a high volume of national shipping traffic, Port Nelson handles vessels from a range of international destinations. Port Nelson has around 500 foreign ship visits per year and approximately 100 of these visits represent the first port of call for that vessel in New Zealand (Taylor 1998). Port Nelson Ltd provides a detailed breakdown for both vessel origin and destination in terms of number of containers and related tonnage (www.portnelson.co.nz). The port has MAF inspection and quarantine, and customs clearance facilities.

There is a recreational marina nearby eastwards of the port in Dixon Basin. During the 1980's the Nelson Harbour Board dredged the area between Vickerman Street reclamation and the Matai River to create Dixon Basin. The marina currently has 485 berths (420 pontoon berths, 33 pile berths and 32 swing moorings) for vessels up to 20 m in length (www.ncc.co.nz).

Additional berths are being constructed at present. The port also contains a superyacht berth where yachts larger than 20 m are able to moor.

Analyses of shipping arrivals to the Port show that most commercial vessels arrive from the northwest Pacific (56 %), northeast Pacific (7 %), Australia (7 %) and the Arabian Seas (7 %). Exports from New Zealand also head to these locations and others, such as North America, the Middle East and Papua New Guinea (Inglis 2001). More recent analyses of shipping arrivals to the Port of Nelson (Campbell 2004) show that there was a combined total of 100 international ship visits during 2002/2003 (54 merchant, 21 fishing and 25 pleasure vessels) with essentially the same source country proportions as noted by Inglis (2001). In 2000, there were 79 registered fishing vessels in Port Nelson (Sinner et al 2000). In 2004, the number of vessel visits was 1,267; down from 1,470 in the previous year, mainly due to changes in coastal services (e.g. change in Strait Shipping using the larger 'Kent' to call once-a-week rather than the previous three weekly visits using the smaller 'Suilven'). There were also three passenger ship visits in 2004 (www.portnelson.co.nz).

Vessels unable to be berthed immediately in the port may anchor off the Boulder Bank approximately 1 nautical mile north of The Cut. Pilotage is compulsory on vessels over 100 GRT unless they have pilot exemption. Vessels under 130 m in length can move at any stage of the tide (www.portnelson.co.nz).

Vessels are expected to comply with the Voluntary Controls on the Discharge of Ballast Water in New Zealand (www.fish.govt.nz/sustainability/biosecurity); vessels are requested to exchange ballast water in mid-ocean (away from coastal influences) en route to New Zealand and discharge only the exchanged water while in port. According to Inglis (2001), a total volume of 157,000 m^3 of ballast water was discharged in Port Nelson in 1999, with the largest country-of-origin volumes of 43,099 m3 from Japan, 9,335 m^3 from Taiwan, 3,243 m^3 from Australia, and 100,238 m^3 unspecified.

Within the port, there is on-going annual maintenance dredging at the approach and entrance channels and in the harbour to clear debris that mainly comes down the Maitai river, with approximately 50,000 m^3 of spoil removed (www.ncc.govt.nz). The spoil is taken out into southern Tasman Bay where it is deposited in consented spoil grounds (www.portnelson.co.nz). These spoil grounds currently also receive the dredge spoil originating from the berth constructions at the Nelson marina.

In terms of future development, Port Nelson Ltd intends to proceed with the Main Wharf South development. Originally intended to extend the current wharf a further 130 m in length, this has now been increased to 200 m in length. This development will dramatically increase Port Nelson Ltd's container handling capabilities in view of the increasing container trade (www.portnelson.co.nz). There is also a current emphasis on increasing productivity and efficiency within Port Nelson.

PHYSICAL ENVIRONMENT OF NELSON HARBOUR

Nelson harbour is typical of most estuarine waters with relatively deep channels feeding gradually sloping intertidal banks. The strongest tidal currents are seen in areas such as the entrance channels and the channel parallel to Boulder Bank, where narrow channels constrict flow (ASR Marine Consulting and Research 2003). Near the Port, patterns of flow are such that currents flow parallel with the Port walls. The currents converge during the ebb and diverge during the flood at the northern end of the wharves. They always diverge where the estuary widens, opposite the Main Wharf. Temporary eddies occur at high tide in the main channel opposite the Port (ASR Marine Consulting and Research 2003). Tides range in the harbour from 4.10 m at mean high water to 1.52m at mean low water, giving a tidal range of 2.72 m (Ministry of Works and Development 1986). The port is dredged to a minimum of 9.8 m depth. Sediment composition in the Port is a product of the tidal current regime and ranges from muds (high silt and clay contents) in the area closest to the Port to sand further afield (Hopkins and Barter 2001).

EXISTING BIOLOGICAL INFORMATION

Several ecological studies have been undertaken within the Port environment, mainly for Port Nelson Limited. We summarise these findings below.

Roberts (1992) assessed the impact of dredging and disposal of dredge waste on the sediments and the benthic fauna in Port Nelson. The impact of long term dumping and the toxicity of Port sediments were investigated by assessing differences between the biota of Tasman Bay and the Port. Little difference was found between the two. Port sediments contained similar numbers of taxa, but more individuals than Tasman Bay. Species composition was similar, but Port sediments contained higher numbers of small worms (polychaetes and nematodes), and fewer crustaceans than Tasman Bay samples. The non-indigenous tiny window shell (*Theora lubrica*) was also noted as common in the Port and species lists were produced. The sediments in the Port contained slightly higher levels of total organic carbon, and much higher levels of ammonia than other samples during toxicity tests, indicating they contained more biodegradable organic material. Levels of trace metals (copper, lead and zinc) were higher in dredge samples from the Port than from Tasman Bay samples, but were still well below the standard international sediment quality criteria (Puget Sounds screening levels) used to indicate levels of individual contaminants that could cause biological impacts.

Forrest and Roberts (1995) examined the effects of stormwater runoff from log and woodchip stockpiles in the Port area. Sample sites were located in the direct vicinity of outfalls at berths throughout the Port. The encrusting plants and animals inhabiting concrete, wood and steel surfaces around the outfalls in these areas were noted and ranked on several levels of abundance, ranging from abundant to absent. A total of 48 species was recorded, with the dominant phylum being the molluscs. The non-indigenous mollusc *Crassostrea gigas* (Pacific oyster) was the only mollusc to be classed as abundant over all surface types and at all locations sampled. It was also one of the most abundant organisms recorded overall.

Stevens (1997) assessed the effects of reclamation and dredging options at four berths within Port Nelson – Main Wharf, Slipway, Maitai and Sealord. Macrofaunal samples were collected from each berth by dredge, their abundance ranked and species lists subsequently produced for each berth. None of the sites were thought to have special ecological value. There was little diversity in the conspicuous flora and fauna observed within the area of Main Wharf, and the macrofauna was characteristic of sandy and muddy substrates. The slipway area was the most degraded site and had an impoverished fauna. The seabed in the vicinity of Maitai consisted of flat areas of shell and sand and other areas where mega ripples had formed. The rippled areas had little conspicuous flora and fauna present. Where the bottom profile was flatter, the macrofauna consisted of a biota commonly found in sand and shell sediments. The Sealord area was dominated by horse mussels (*Atrina zelandica*) and associated biota, but the overall density of species recognised as being ecologically important was low. Macrofaunal composition reflected the mixed sandy and muddy sand substrate present across the site. Currents in the area investigated were strong.

Barter (1999) assessed sediment from the Port Nelson slipway basin for trace metals and described the diversity, abundance and composition of the associated benthic macrofaunal community. All of the sediment samples collected consisted of very fine soft mud, with varying degrees of trace metal enrichment ranging from low or undetectable at outer sites to higher in the highly enriched, black anoxic sediments close to the slipway. Most of the sediment samples collected contained sandblasting grains, tar balls and visible paint flecks. All of the macrofaunal communities sampled appeared to have been impacted by sediment quality when compared with the community structure from other less disturbed sites around the Port. This was highlighted by the presence of high numbers of nematode worms, indicating either organic enrichment or habitat disturbance, in all of the samples. Species lists were produced, and included the non-indigenous bivalve *Theora lubrica*, which was present in 90 % of all samples. Large (dead) non-indigenous Pacific oyster (*Crassostrea gigas)* shells were also noted at one site, and large increases in faunal type and numbers were thought to be associated with their presence.

Hopkins and Barter (2001) prepared a report assessing the variations to dredging disposal by Port Nelson Limited. Sampling stations were located within the port environment, along the existing shipping channel and in an area at the outer limit of dredging activity where an extension to dredging was proposed. The macrofauna in the area of the proposed extension to dredging comprised a total of 29 taxa. The dominant infaunal taxa were polychaetes, bivalves and small crustaceans. The epifauna was dominated by sea stars, nudibranchs and sea cucumbers. Species abundance varied among samples, particularly for amphipods. Sediment composition varied across the sampling stations, ranging from largely mud to mostly sand. This was attributed to strong tidal currents along the shipping channel and away from the port structures that cause scouring of muddier sediments. The ash free dry weight (AFDW) component of sediments suggested a very low level of organic enrichment, particularly in areas away from the Port.

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

The invasive kelp *Undaria pinnatifida* was identified in Port Nelson in 1997, and this port is deemed in the optimal temperature zone for this macroalga (Sinner et al 2000). Nelson City Council (2003) assessed the extent of the Asian kelp *Undaria pinnatifida* in Nelson harbour as part of the Nelson State of the Environment Report for coastal areas. The report details the distribution and density of *Undaria* in the harbour environment from 1999 to 2003, with maps detailing infestation locations. Comparatively heavy infestations of *Undaria* were found in the Nelson marina, on Haulashore Island and through the Cut during the 1999 survey. In addition, *Undaria* was found on the hull of a moored vessel. A cleanup of the area followed, but not all plants could be removed due to the high level of infestation. By 2000, the infestation had spread, and 35 vessels were infested. Again, a cleanup of the area was initiated. In spite of these efforts, *Undaria* had spread even further by 2001 - there were now dense beds of *Undaria* where intermittent plants had been in 2000. New areas of infestation were noted on harbour piles and shoals. Infested vessels had increased in number from 35 in 2000 to 45 in 2001 (Nelson City Council 2003). Regular removal of plants had some impact on the abundance and total biomass of *Undaria,* but it failed to prevent or limit vessel infestation. Results of annual monitoring since 2001 suggest that efforts to clear the *Undaria* from Nelson Harbour have been ineffective and the overall infestation has remained constant. Some areas have escaped infestation, but this is largely due to wave exposure, mobile sediments and these areas being regularly exposed at high tide. Considering the vigorous pattern of spread displayed by *Undaria* since its discovery in 1997, the vitality of native seaweeds appears surprisingly unaffected.

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 Nelson survey. The survey was undertaken between January 22nd and 25th, 2002. Most sampling was concentrated on four main berths: Kingsford Quay, Main Wharf, McGlashen Quay, and the lay-up and repair wharf (Fig 3). Additional trapping and opportunistic sampling was conducted at four other locations. A summary of sampling effort within the Port is provided in Tables 3a,b.

DIVER OBSERVATIONS AND COLLECTIONS ON WHARF PILES

Fouling assemblages were sampled on four pilings at each berth. Selected pilings were separated by 10 – 15 m and comprised two pilings on the outer face of the berth and, where possible, two inner pilings beneath the berth (Gust et al 2001). On each piling, four quadrats (40 cm x 25 cm) were fixed to the outer surface of the pile at water depths of approximately -0.5 m, -1.5 m, -3.0 m and -7 m. A diver descended slowly down the outer surface of each pile and filmed a vertical transect from approximately high water to the base of the pile, using a digital video camera in an underwater housing. On reaching the sea floor, the diver then ascended slowly and captured high-resolution still images of each quadrat using the photo capture mechanism on the video camera. Because of limited visibility, four overlapping still images, each covering approximately ¼ of the area of the quadrat were taken for each quadrat. A second diver then removed fouling organisms from the piling by scraping the organisms inside each quadrat into a 1-mm mesh collection bag, attached to the base of the quadrat (Fig 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.

BENTHIC INFAUNA

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

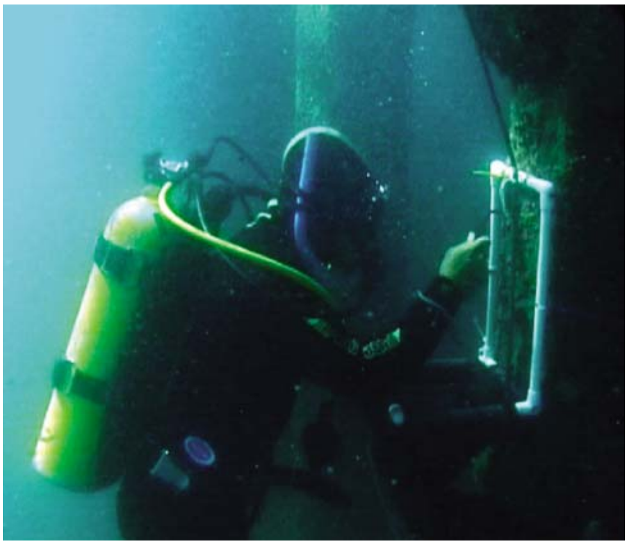

Figure 4: Diver sampling organisms on pier piles.

Figure 5: Shipek grab sampler: releasing benthic sample into bucket

EPIBENTHOS

Larger benthic organisms were sampled using an Ocklemann sled (hereafter referred to as a "sled"). The sled is approximately one meter long with an entrance width of ~0.7 m x 0.2 m. A short yoke of heavy chain connects the sled to a tow line (Fig 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 four 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.

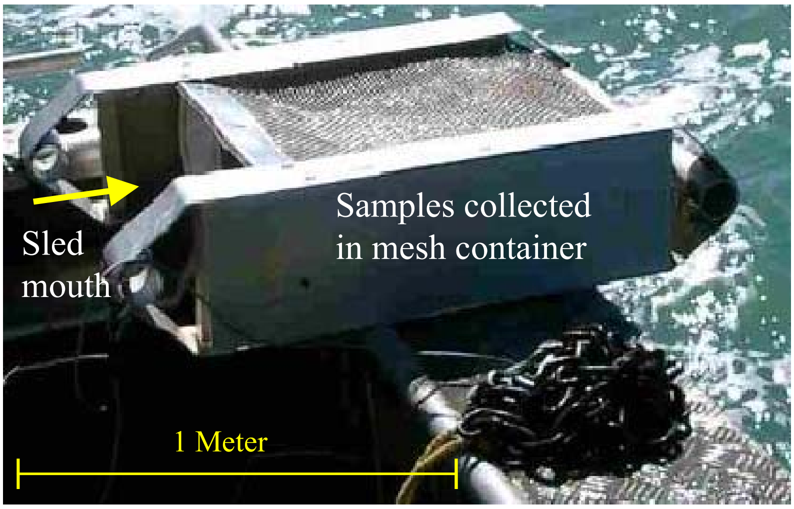

Figure 6: Benthic sled

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).

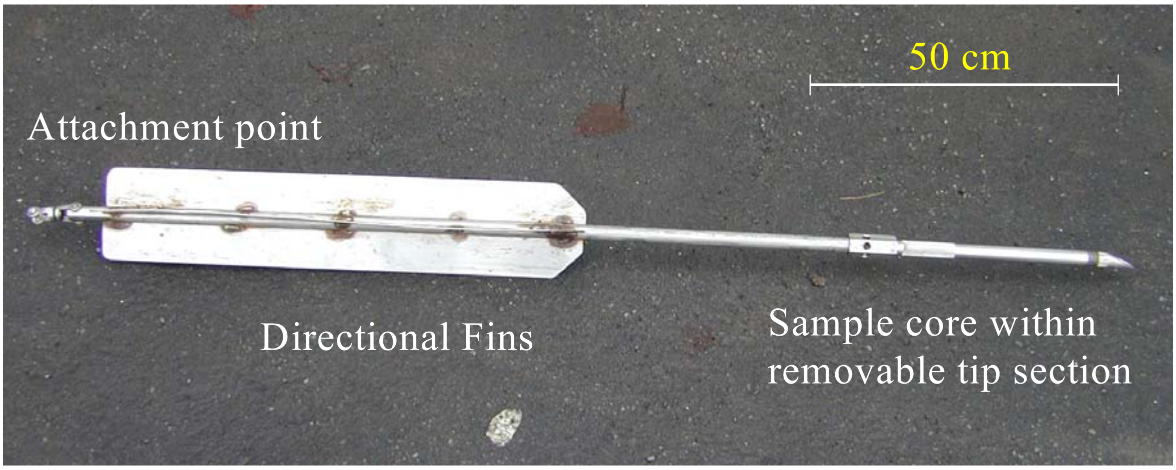

Figure 7: Javelin corer

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.

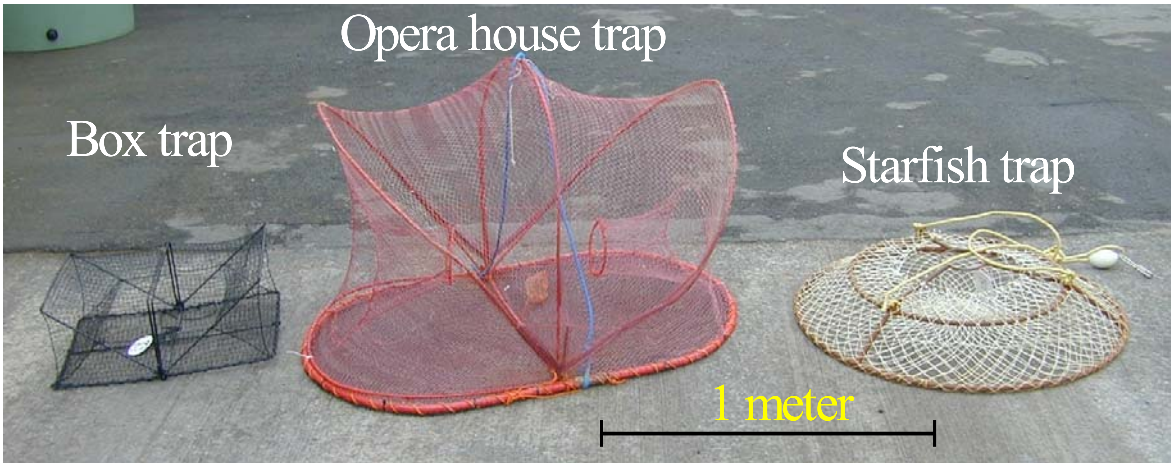

Figure 8: Trap types deployed in the port.

SAMPLING EFFORT

A summary of sampling effort within the Port of Nelson 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 Nelson 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 and javelin cyst coring (Fig 13). Sampling effort was varied between ports and marinas on the basis of risk assessments (Inglis 2001) to maximise the search efficiency for NIS nationwide. A comparison of total sampling effort in each of the thirteen ports and three marinas surveyed in the national baseline survey programme is provided in Table 3c.

The benthic grab sampler was damaged during the field survey of Nelson and, as a result, only one site could be sampled using this technique (Fig. 13).

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 identifying 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).

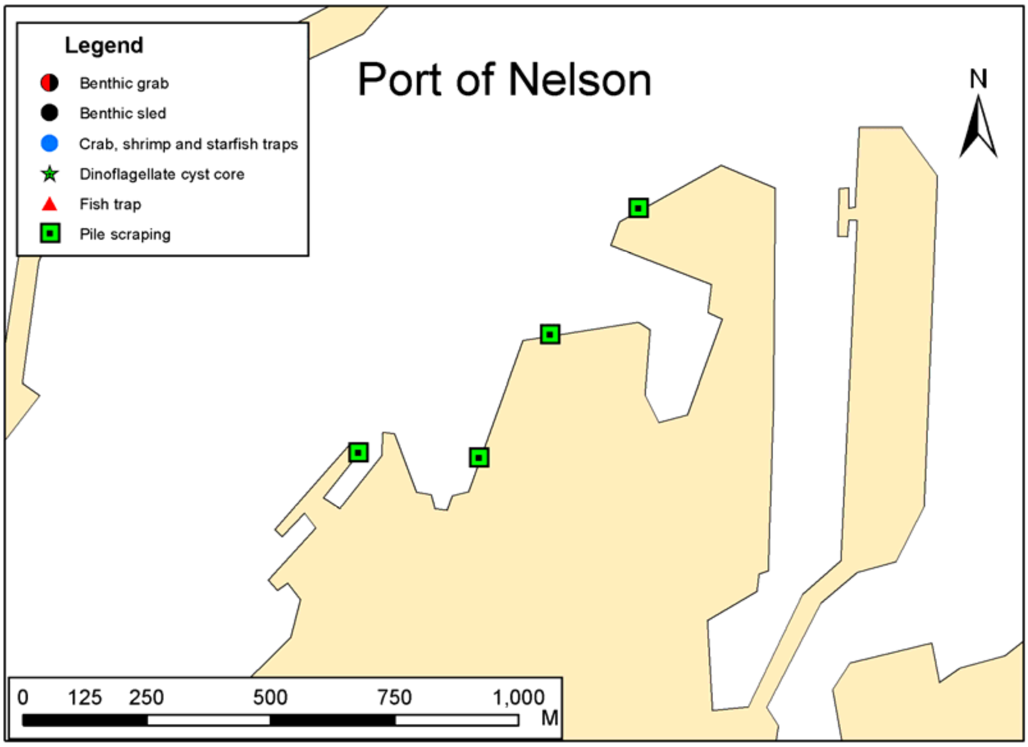

Figure 9: Diver pile scraping sites

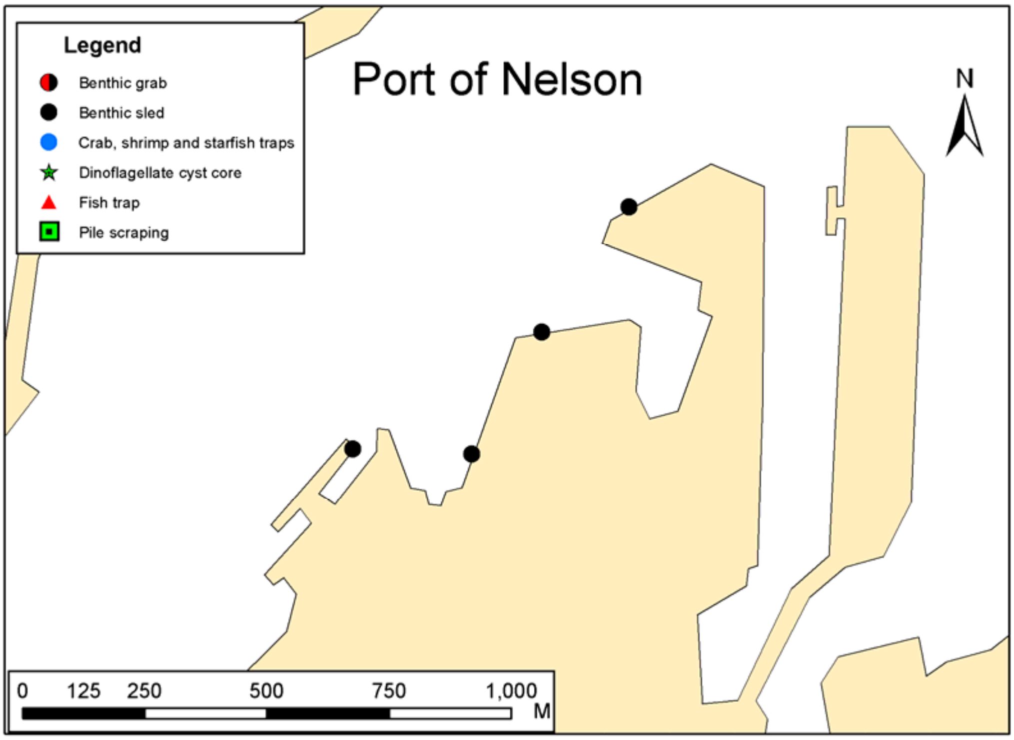

Figure 10: Benthic sledding sites.

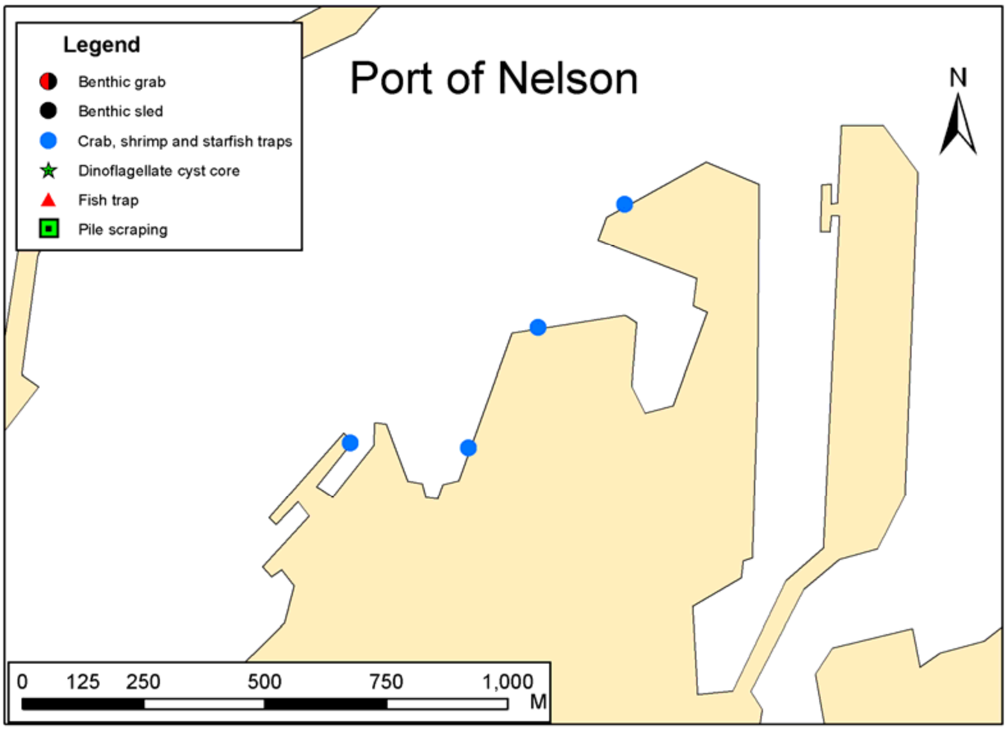

Figure 11: Box, starfish and shrimp trapping sites.

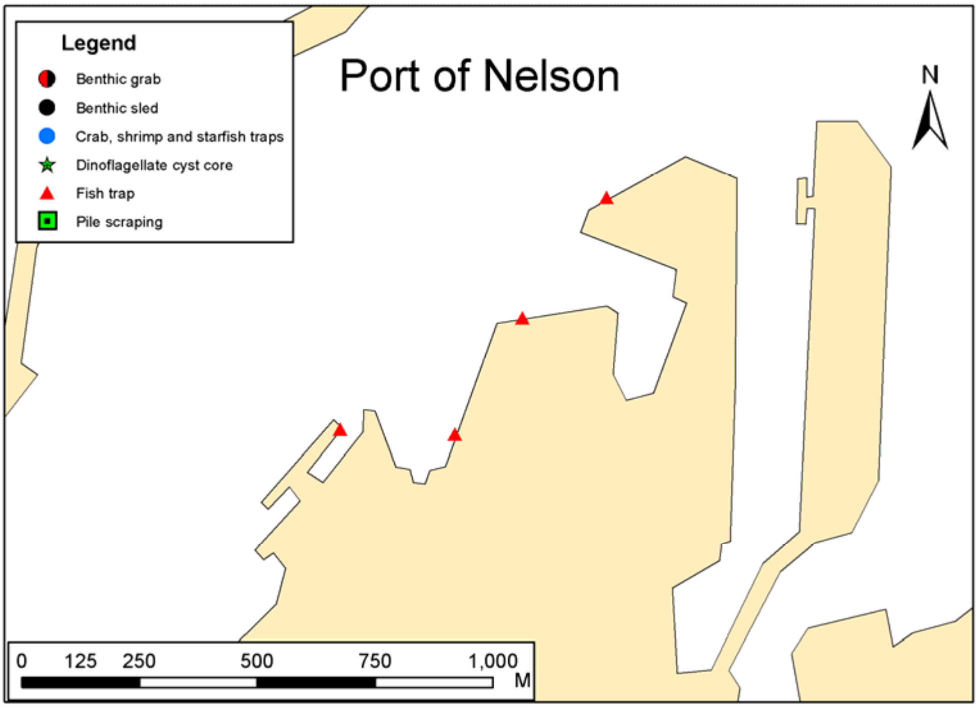

Figure 12: Opera house trapping sites.

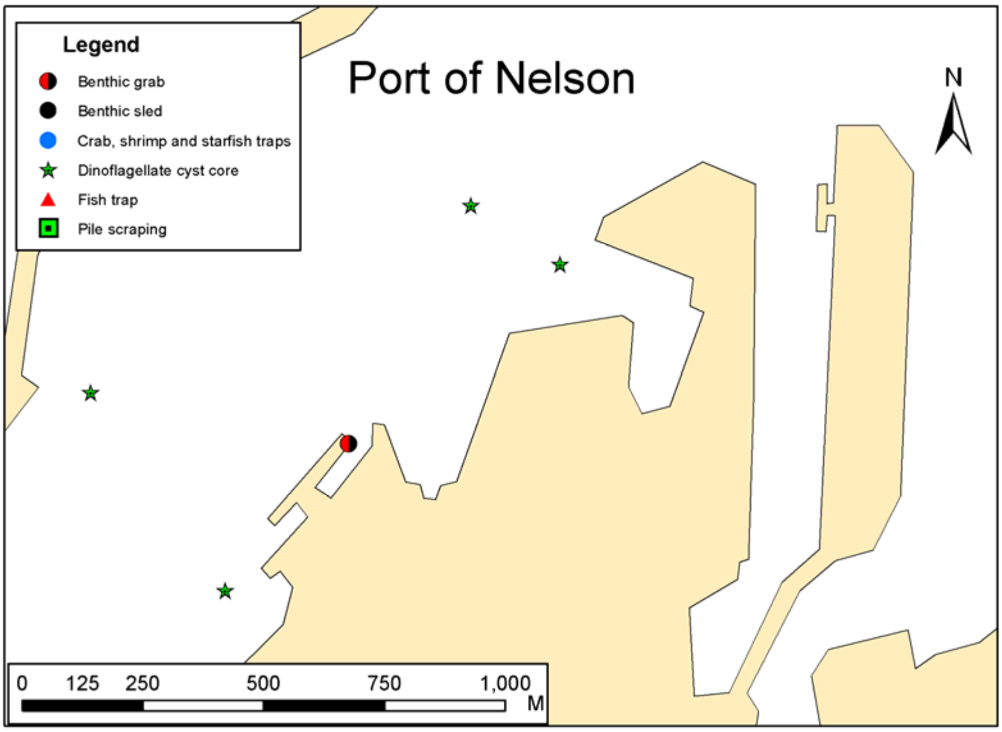

Figure 13: Javelin core and shipek grab sites.

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 given below.

Native species

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

Non-indigenous species (NIS)

Non-indigenous species (NIS) are known or suspected to have been introduced to New Zealand as a result of human activities. They were determined using a series of questions posed by Chapman and Carlton (1991, 1994) as a guide; 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 which 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 196 species or higher taxa were identified from the Nelson Port survey. This collection consisted of 133 native (Table 6), 15 cryptogenic (Table 7), 14 non-indigenous species (Table 8) and 34 species indeterminata (Table 9, Fig 14). The biota included a diverse array of organisms from 12 Phyla (Fig 15). Six species from the Port of Nelson 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.

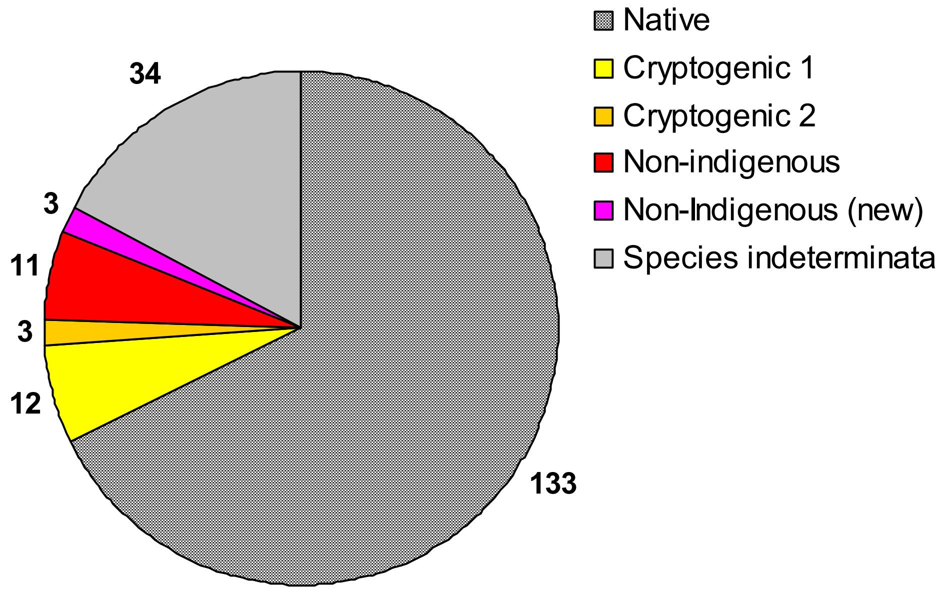

Figure 14: Diversity of marine species sampled in the Port of Nelson. Values indicate the number of species in native, cryptogenic, non-indigenous and species indeterminata categories.

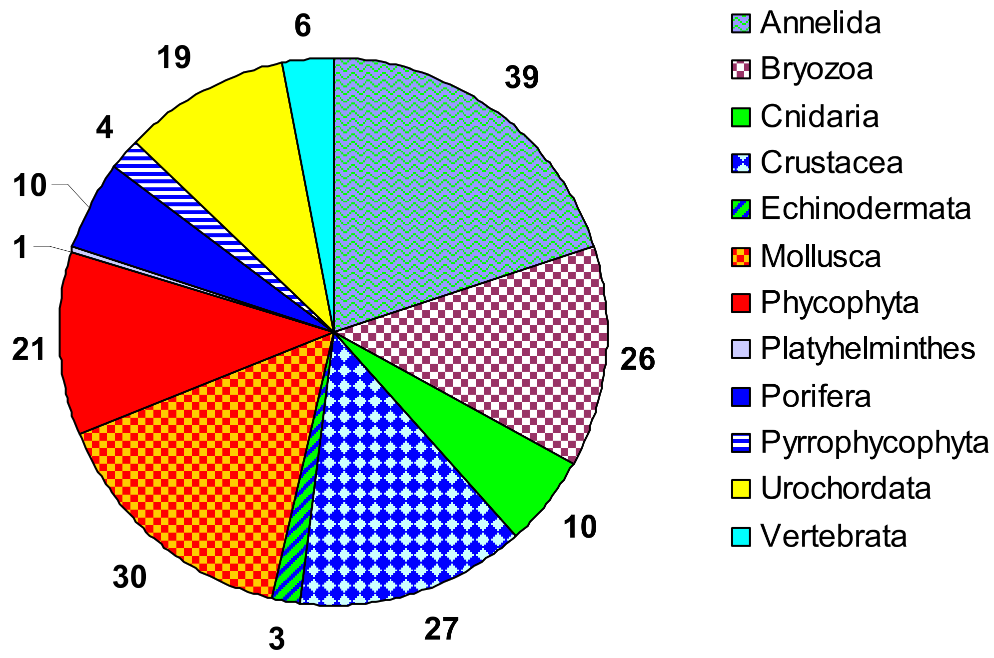

Figure 15: Marine Phyla sampled in the Port of Nelson. Values indicate the number of species in each of the major taxonomic groups.

NATIVE SPECIES

A total of 133 native species was identified from the Port of Nelson. Native species (Table 6) represent 67.9 % of all species identified from this location and included diverse assemblages of annelids (30 species), bryozoans (16 species), crustaceans (23 species) and molluscs (26 species). A number of other less diverse phyla were also sampled from the Port including cnidarians, echinoderms, phycophyta, porifera, pyrrophycophyta, urochordata and vertebrates (Table 6).

CRYPTOGENIC SPECIES

Fifteen cryptogenic species were discovered in the Port of Nelson. Cryptogenic species represent 7.6 % of all species or higher taxa identified from the Port. The cryptogenic organisms identified included 12 Category one and three Category two species as defined in Section 2.8 above. These organisms included one bryozoan, two cnidarians, one crustacean, one mollusc, four sponges and six ascidian species (Table 7). Many of the Category one cryptogenic species 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). For example, the ascidians *Aplydium phortax*, *Astereocarpa cerea*, *Botrylloides leachi*, and *Corella eumyota*, which were present in Nelson, were first recorded in New Zealand before 1900. These ascidians, and *Styela plicata* (first reported in 1948) have cosmopolitan distributions, with early descriptions (i.e. pre-1900) also originating from Australia, and the north-eastern and north-western Atlantic.

Also recorded from Port Nelson was the colonial ascidian *Didemnum vexillum* (Kott, 2002). This species was first described from Whangamata, New Zealand, in 2001 when it formed nuisance growths on ship's hulls, wharf piles and other submerged structures (Kott 2002). It has subsequently been reported from several other port environments in the Bay of Plenty and upper South Island (Port Nelson and Shakespeare Bay, Picton) and a local control programme was trialled in the Marlborough Sounds to prevent its spread to aquaculture sites (Coutts 2002). The appearance of *D. vexillum* in New Zealand was followed closely by reports of other nuisance species in this genus from the Atlantic coast of the USA, Mediterranean, North Sea and English Channel, but these now appear to be different species (Kott 2004).

Three of the sponges (*Halichondria n. sp. 5, Haliclona n. sp. 1* and *Haliclona n. sp. 7*) listed in the C2 category in this Port, have not been previously described in New Zealand waters. *Haliclona* n. sp. 1 was the only one of these three species to be recorded from another port during the national baseline surveys. It was also recorded for the first time from Picton and Wellington.

NON-INDIGENOUS SPECIES

Fourteen non-indigenous species (NIS) were recorded from the Port of Nelson (Table 8). NIS included one annelid, eight bryozoans, one cnidarian, two molluscs and two urochordates. NIS represents 7.1 % of all identified species from this location. Three of these species; the bryozoan *Celleporaria nodulosa,* the cnidarian *Lafoeina amirantensis* and the urochordate *Cnemidocarpa sp*., were not previously known from New Zealand waters. 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 listed 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). NIS are presented below by phyla in the same order as Table 8.

***Polydora hoplura* (Clapar ède, 1870)**

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

Polydora hoplura had previously been recorded from Wellington and the Marlborough Sounds (Cranfield et al. 1998) and was recorded from Whangarei, Tauranga, Wellington, Picton, and Dunedin during the baseline port surveys (Table 10). In Port Nelson this species occurred in pile scrape samples taken at McGlashen Quay (Fig 16).

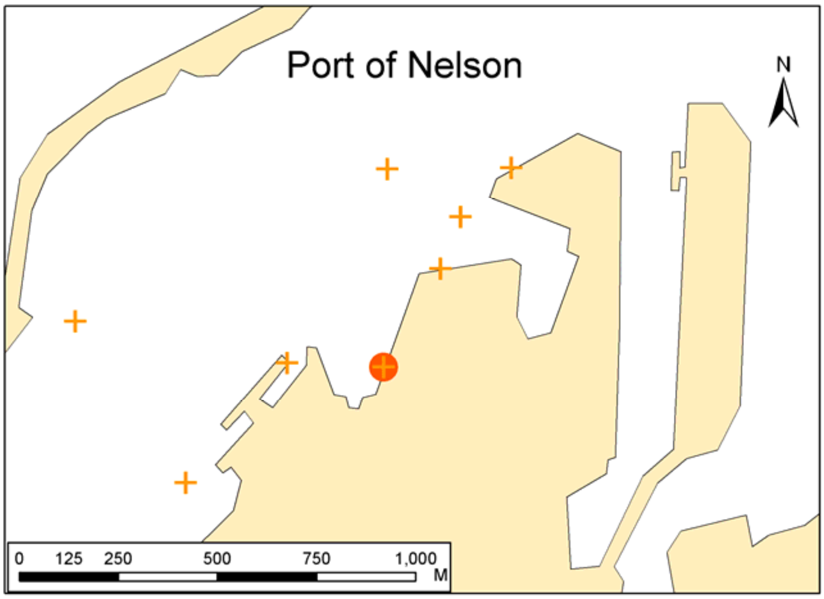

Figure 16: *Polydora hoplura* presence (circle) and absence (cross) In the Port of Nelson

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

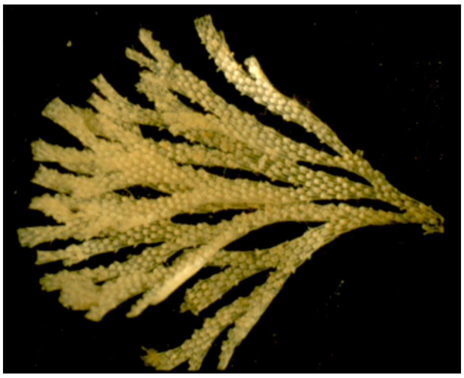

Image and information: NIMPIS (2002a)

Bugula flabellata is an erect bryozoan with broad, flat branches. It is a colonial organism and consists of numerous 'zooids' connected to one another. It is pale pink and can grow to about 4 cm high and attaches to hard surfaces such as rocks, pilings and pontoons or the shells of other marine organisms. It is often found growing with other erect bryozoan species such as *B. neritina* or growing on encrusting bryozoans. Vertical, shaded, sub-littoral rock surfaces also form substrata for this species. It has been recorded down to 35 m. *Bugula flabellata* is native to the British Isles and North Sea and has been introduced to Chile, Florida and the Caribbean and the northern east and west coasts of the USA, as well as Australia and New Zealand. It is cryptogenic on the Atlantic coasts of Spain, Portugal and France. *Bugula flabellata* has been present in New Zealand since at least 1949 and is present in most New Zealand ports. It is a dominant component of fouling assemblages in ports and harbours, particularly on vessel hulls, pilings and pontoons, and has also been reported from offshore oil platforms. There have been no recorded impacts from *B. flabellata.* During the current baseline surveys it was recorded from Opua marina, Whangarei, Auckland, Tauranga, Napier, Taranaki, Wellington, Picton, Nelson, Lyttelton, Timaru, Dunedin and Bluff. In Port Nelson this species occurred in pile scrapings taken from the Lay-up Berth (Fig 17).

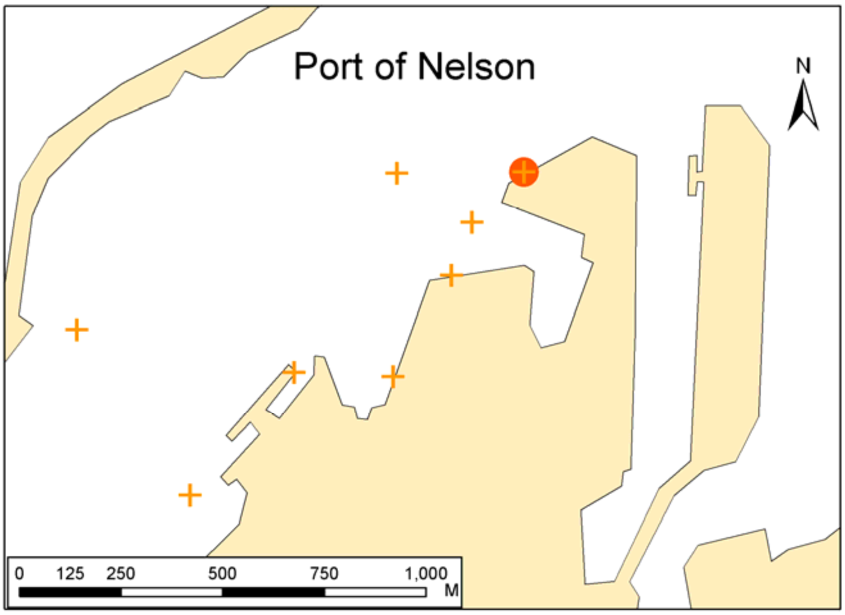

Figure 17: ***Bugula flabellata*** **presence (circle) and absence (cross) in the Port of Nelson**

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

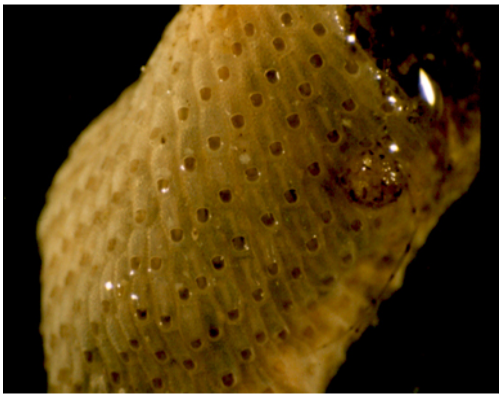

Image and information: NIMPIS (2002d)

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

C. pallasiana has been recorded from all New Zealand ports (Cranfield et al. 1998). In Port Nelson this species occurred in pile-scrapes from the Lay-up Berth (Fig 18).

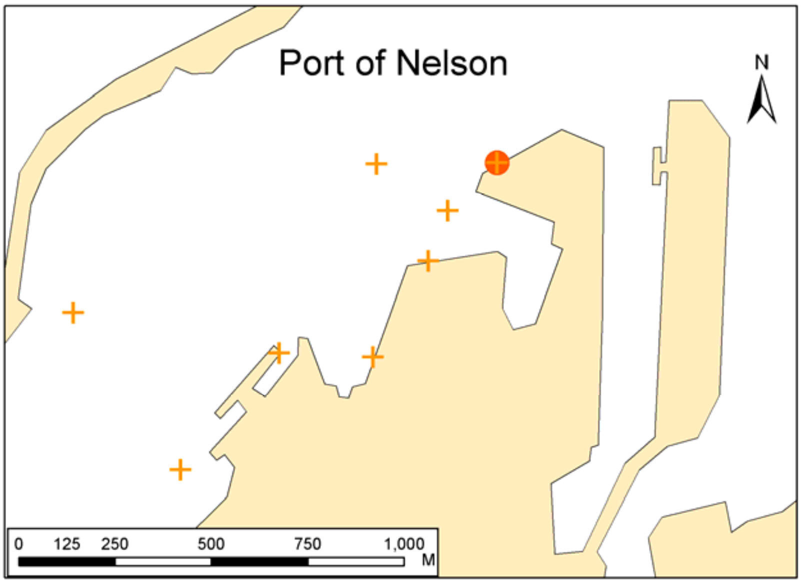

Figure 18: *Cryptosula pallasiana* presence (circle) and absence (cross) in the Port of Nelson

***Conopeum seurati* (Canu, 1908)**

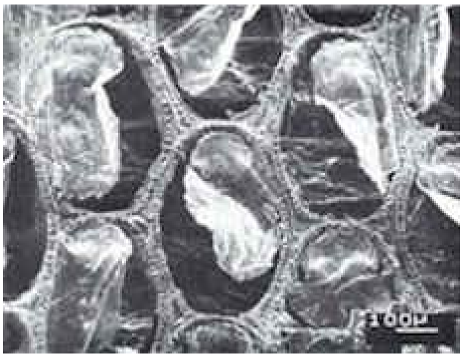

Image and information: Cranfield et al 1998; Gordon and Matawari 1992; Smithsonian Institution (available at http://www.sms.si.edu/irlspec/Conope_seurat.htm)

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 Port Nelson this species was sampled from pile scrapings at the K-, Lay-up, Main-, and McGlashen Quay berths (Fig 19).

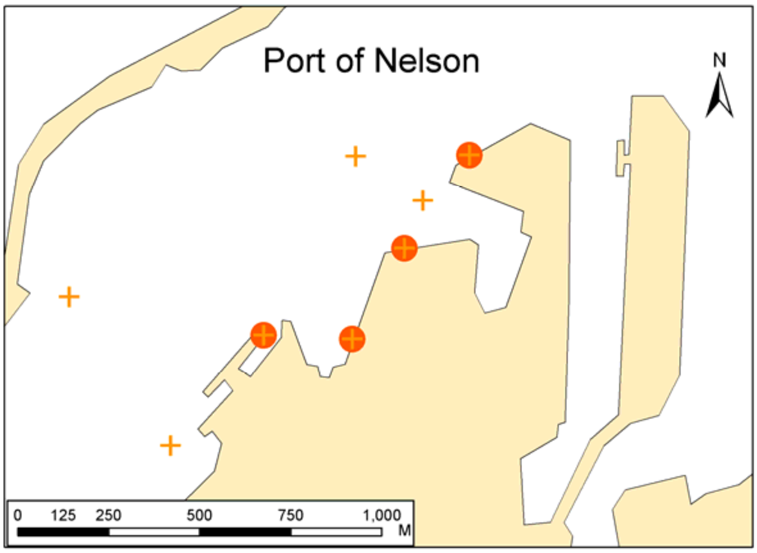

Figure 19: ***Conopeum seurati*** **presence (circle) and absence (cross) in the Port of Nelson**

Electra angulata **(Levinsen, 1909)**

Electra angulata is an encrusting bryozoan that forms small whitish colonies on a variety of substrata. *Electra angulata* is known from the Indo-Pacific, from Thailand and Japan. Its impacts on native organisms are unknown. In Port Nelson this species was sampled from benthic grab and pile scrape samples taken near the Main Berth (Fig 20).

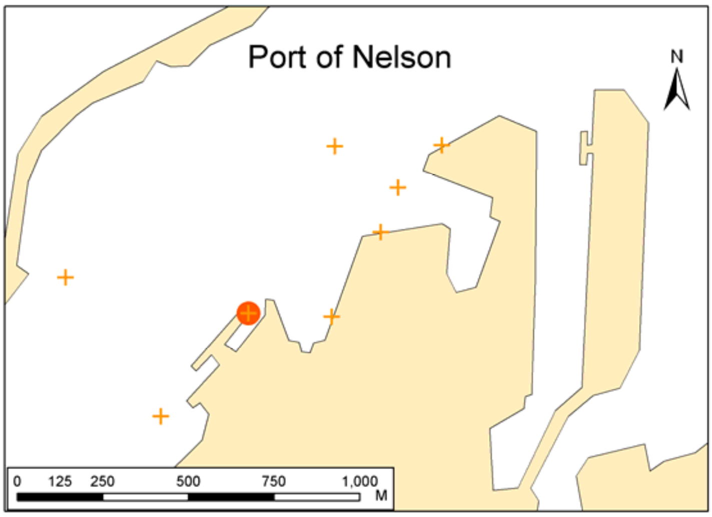

Figure 20. ***Electra angulata*** **presence (circle) and absence (cross) in the Port of Nelson**

***Celleporaria nodulosa* (Busk, 1881)**

Celleporaria nodulosa is an encrusting bryozoan in the family Lepraliellidae. There are more than 100 species in the genus *Celleporaria* world-wide. The type specimen for *C. nodulosa* was first described from the southeastern coast of Australia, where it is widespread. It forms low, flat, spreading colonies that have a blue-green tinge. This is the first record of this species in New Zealand (D. Gordon, pers. comm.). During the port baseline surveys, it was also recorded from the port of Gisborne. No information exists on its likely impacts on native species. In Port Nelson, *C. nodulosa* was recorded in pile scrapings taken from K-Berth (Fig 21).

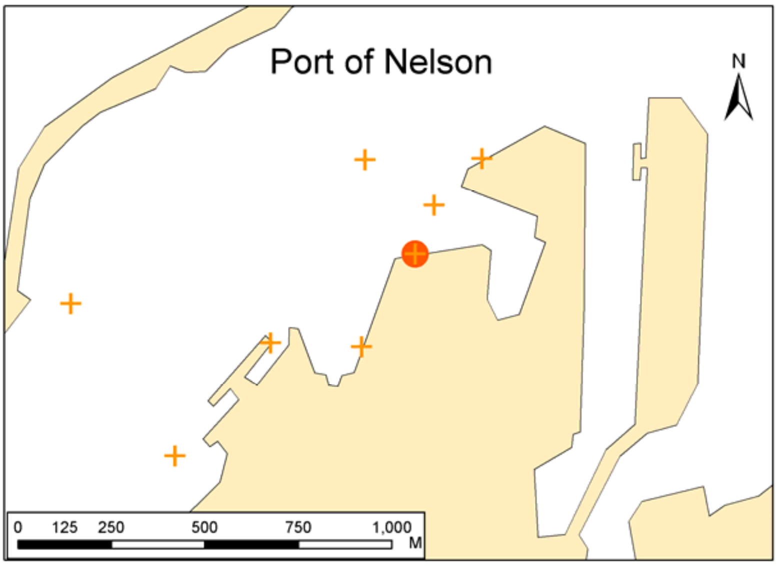

Figure 21: *Celleporaria nodulosa* presence (circle) and absence (cross) in the Port of Nelson

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

Image: O. Floerl 2003; information: Eldredge and Smith (2001)

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

Schizoporella errata is thought to be native to the Mediterranean. It has been introduced to many worldwide locations in warm temperate-subtropical seas. It has been reported from West Africa, the Red Sea, the Persian Gulf, South Australia, New Zealand, the Hawaiian

Islands, the Pacific coast of North America, the east coast of North America through to the Caribbean and Brazil. *S. errata* occurs in shallow water on various hard substrates (pilings, hulls, coral rubble, etc.) in harbours and embayments. It is also occasionally found on rocky or coral reefs. *S. errata* can compete with other fouling organisms for space and large encrustations of this species are known to smother other biota (Cocito et al. 2000). It is present in Waitemata Harbour and the Bay of Islands and was also recorded from Gulf Harbour Marina and Whangarei Harbour during the baseline port surveys (Table 10). In Port Nelson it occurred in benthic grab samples taken from the Main Berth (Fig 22).

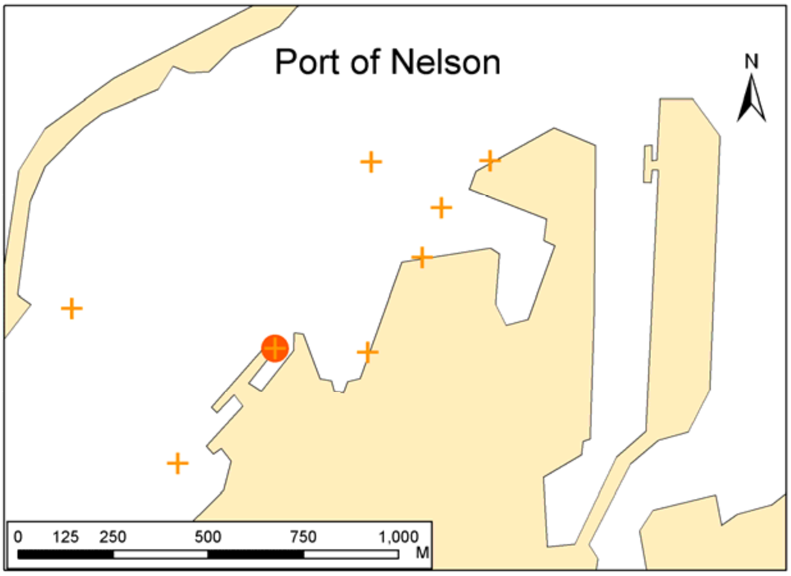

Figure 22: *Schizoporella errata* presence (circle) and absence (cross) in the Port of Nelson

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

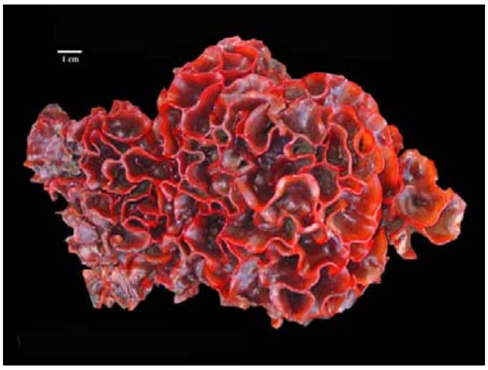

Image: California Academy of Sciences.
Information: Gordon and Matawari (1992)

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-western 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 Port Nelson this species was recovered from pile scrapings at the K-, Lay-up, Main and McGlashen Berths (Fig 23).

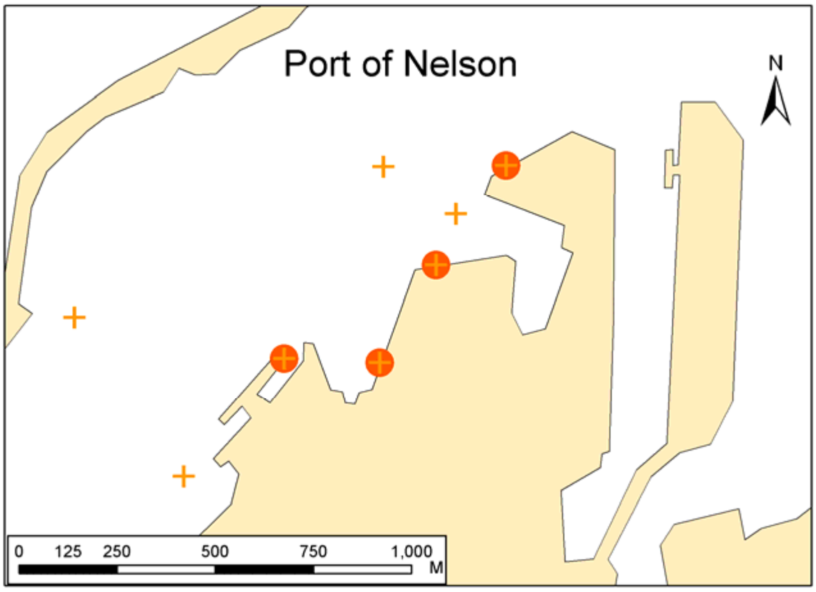

Figure 23: ***Watersipora subtorquata*** **presence (circle) and absence (cross) in the Port of Nelson**

Anguinella palmata **(van Beneden, 1845)**

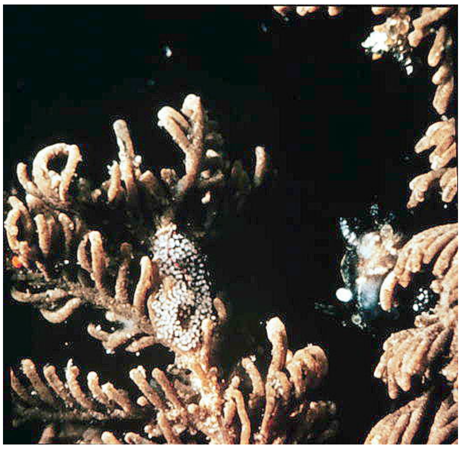

Image and information: Gordon and Matawari (1992)

Anguinella palmata is a bryozoan that forms erect and uncalcified tufts that are pale beige in colour. The tufts comprise a main axis with numerous branches of tubular zooids slightly incurved toward the axis. The New Zealand specimens reach up to 6 cm in length, but specimens of 20 cm have been reported from other countries. This species occurs in both intertidal and subtidal habitats. The native range of *Anguinella palmata* is unknown, but is thought to be southern Europe. Its current distribution includes Britain, the North Sea, Senegal, Ghana, Zaire, the Atlantic coast of North America, Brazil and Australia. *A. palmata* has been present in New Zealand since at least 1960 and has been recorded from Waitemata Harbour and Nelson (Gordon and Matawari 1992). In Port Nelson this species was found in pile scrapings taken from McGlashen Quay (Fig24). There are no known impacts of *A. palmata*.

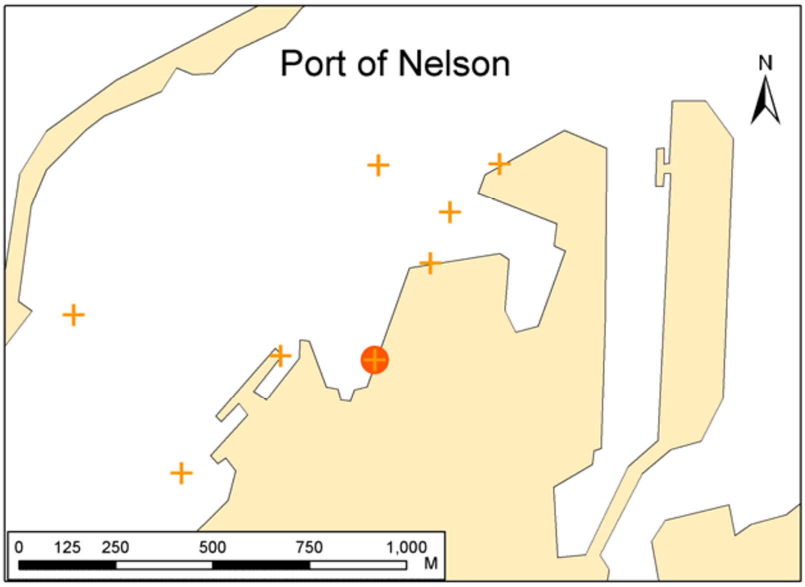

Figure 24: *Anguinella palmata* presence (circle) and absence (cross) in the Port of Nelson

***Lafoeina amirantensis* (Millard & Bouillon, 1973)**

Lafoeina amirantensis is a small epizootic hydroid in the family Campanulariidae. It is known from South Australia, Tasmania, the Seychelles (Indian Ocean), Panama, and Brazil (Smithsonian Tropical Research Institute 2004, Migotto and Cabral 2005). Details of its native range and ecological impacts are unknown. The specimens found in the port of Nelson are the first records of this species from New Zealand. In Port Nelson *L. amirantensis* was recovered from a benthic sled tow near the Main Berth (Fig 25).

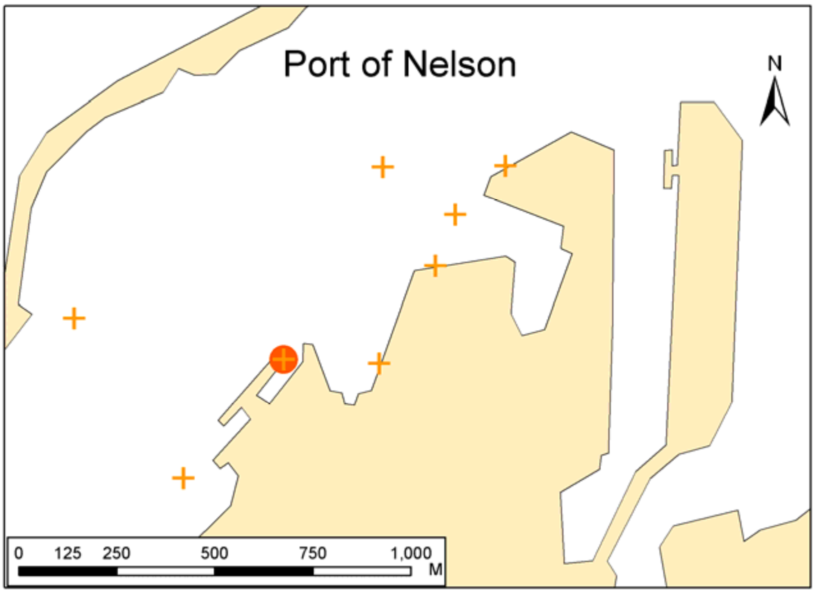

Figure 25: *Lafoeina amirantensis* presence (circle) and absence (cross) in the Port of Nelson

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

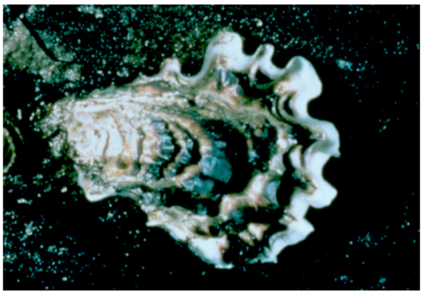

Image and information: NIMPIS (2002c)

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

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

C. gigas has been present in New Zealand since the early 1960s. Little is known about the impacts of this species in New Zealand, but it is now a dominant structural component of fouling assemblages and intertidal shorelines in northern harbours of New Zealand and the upper South Island. *C. gigas* is now the basis of New Zealand's oyster aquaculture industry, having displaced the native rock oyster, *Saccostrea glomerata*. *C. gigas* was recorded from Opua marina, Whangarei Harbour, Gulf Harbour marina, Auckland, Taranaki, Nelson and Dunedin during the port baseline surveys (Table 10). In Port Nelson this species was sampled from benthic grab samples and pile scrapings taken from the K-, Lay-up, Main and McGlashen Quay Berths (Fig 26).

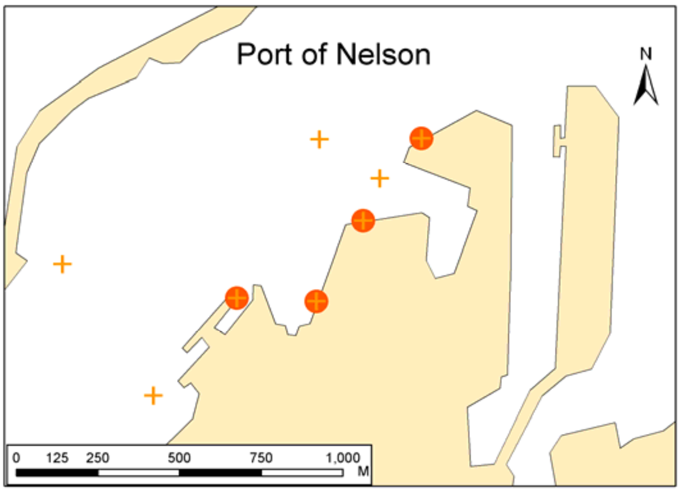

Figure 26:*Crassostrea gigas* presence (circle) and absence (cross) in the Port of Nelson

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

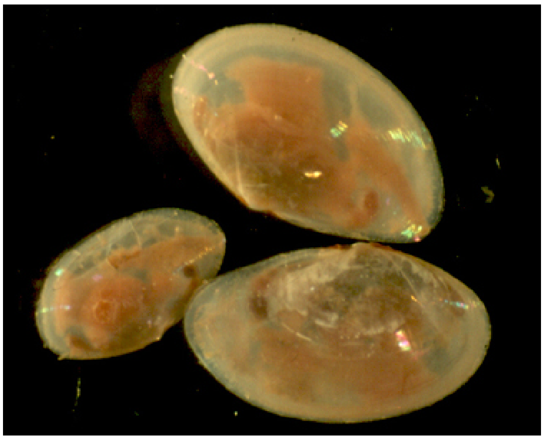

Image and information: NIMPIS (2002e)

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 Port Nelson, *T. lubrica* was occurred in benthic sled samples taken from near the K- and McGlashen Berths (Fig 27).

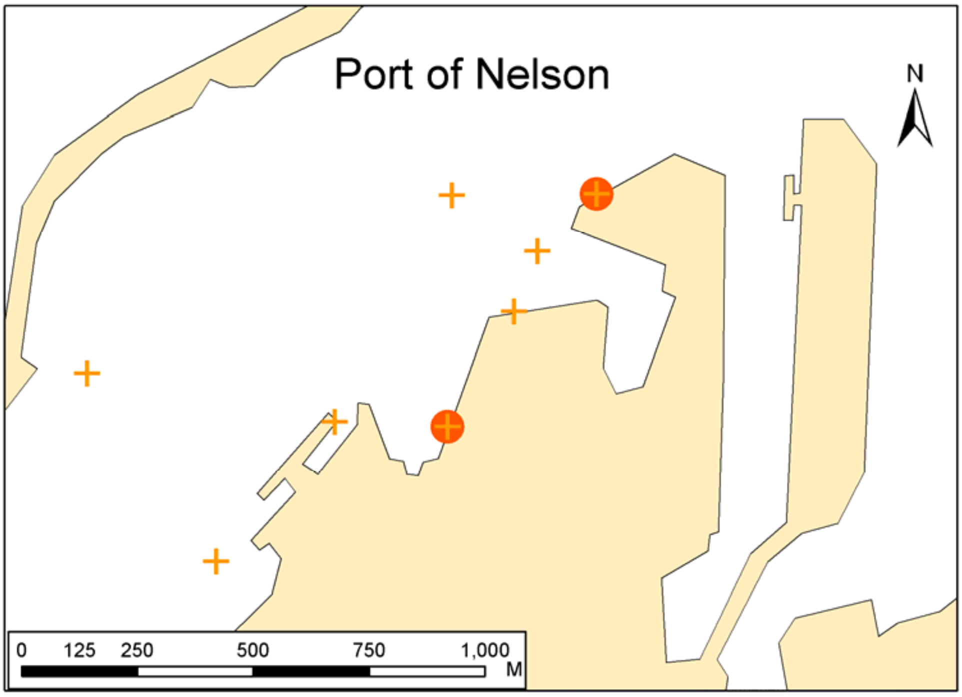

Figure 27: *Theora lubrica* presence (circle) and absence (cross) in the Port of Nelson.

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

Image and information: NIMPIS (2002b)

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. In Port Nelson this species was recorded in benthic sled samples and pile scrapes taken from the Lay-up and McGlashen Quay berths (Fig 28).

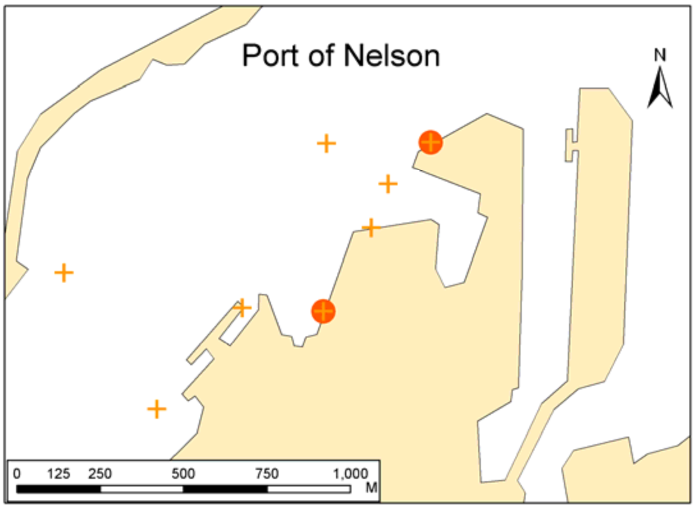

Figure 28:*Ciona intestinalis* presence (circle) and absence (cross) in the Port of Nelson

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

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 Port Nelson, specimens of *Cnemidocarpa* sp. were recovered from pile scrapings taken at the Lay-up and McGlashen Quay berths (Fig 29).

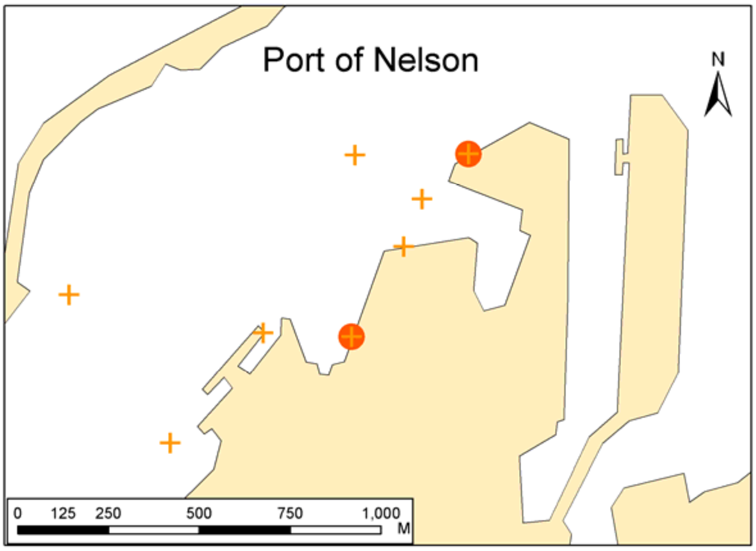

Figure 29: *Cnemidocarpa* sp presence (circle) and absence (cross) in the Port of Nelson

SPECIES INDETERMINATA

Thirty-four organisms from the Port of Nelson were classified as species indeterminata. If each of these organisms is considered a species of unresolved identity, then together they represent 17.3 % of all species collected from this survey (Fig 15). Species indeterminata from the Port of Nelson included eight species of Annelid worms, one Bryozoan, three Cnidarians, three Crustaceans, one Mollusc, 15 Phycophyta, one Platyhelminth and two Urochordate species (Table 9).

NOTIFIABLE AND UNWANTED SPECIES

Of the NIS identified from Port Nelson, none is currently listed as an unwanted species on the New Zealand register of unwanted organisms (Table 5a). However, the non-indigenous bivalve *Crassostrea gigas* was found in Port Nelson during this study and is included on the ABWMAC list of unwanted species in Australia (Table 5b).

The Asian kelp *Undaria pinnatifida* was not recorded during the present survey, despite being present in Port Nelson since 1997. *U. pinnatifida* has an annual heteromorphic lifecycle, characterised by a macroscopic sporophyte stage and a microscopic gametophyte stage. Macrosporophyte are typically most abundant in winter and early spring, but are absent in late summer (Thompson 2004). At the time the baseline survey was conducted (January 2002), adult sporophytes of *U. pinnatifida* are expected to be senescent or in low density, with only microscopic gametophytes or juvenile sporophytes present (Thompson 2004). *U. pinnatifida* sporophytes were subsequently detected in large abundance during NIWA surveys of Port Nelson in both 2003 and 2004 as part of a related Biosecurity New Zealand project on surveillance for marine pests (Project ZBS2001/01). *Undaria pinnatifida* is listed both in the New Zealand register of unwanted organisms (Table 5a) and ABWMAC (Table 5b), and is known to be widespread in New Zealand.

SPECIES NEW TO NEW ZEALAND

Six species from the Port of Nelson had not previously been recorded from New Zealand waters. These species are classified either as Category 2 cryptogenic species in Table 7, or are marked as new records in the non-indigenous species list (Table 8). Three species of sponge found in the Port of Nelson (Table 7) do not match existing species descriptions from New Zealand or overseas and may be new to science. The previously undescribed non-indigenous species found in the Port of Nelson included the Bryozoan *Celleporaria nodulosa* (see section 3.3.5 above), the Cnidarian *Lafoeina amirantensis* (see section 3.3.9 above), and the Ascidian *Cnemidocarpa sp.* (see section 3.3.13 above).

CYST-FORMING SPECIES

Cysts of four species of dinoflagellate were collected during this survey. They are listed as members of the Pyrrophycophyta in Table 6. No toxic, cryptogenic or non-indigenous dinoflagellate species were collected from this Port.

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

The non-indigenous species located in Port Nelson are mostly 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 7 % (one of the 14 NIS) probably arrived via ballast water, 79 % probably were introduced to New Zealand waters via hull fouling, and 14 % could have arrived via either of these mechanisms.

COMPARISON WITH OTHER PORTS

Sixteen locations (13 ports and three marinas) were surveyed during the summers of 2001/2002 and 2002/2003 (Fig. 1). The total number of species identified in these surveys varied from 336 in the Port of Wellington to 56 in Whangarei Town Basin Marina (Fig. 30a). 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, when we allow for differences in sampling effort between locations, the Port of Nelson had an above-average number of native, cryptogenic 1 and non-indigenous species, and a below-average number of cryptogenic 2 species (Fig 31). 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 31c, Studentised residual = 3.87).

Native organisms represented over 60 % of the species diversity sampled in each surveyed location, with a minimum contribution of 61 % in the Port of Lyttelton and a maximum of 68.5 % in Picton (Fig. 30b). Species indeterminata organisms represented between 10.6 % and 25.2 % of the sampled diversity in each location. Non-indigenous and category one and two cryptogenic species were present in each port and marina, although their relative contributions differed between locations (Fig. 30b). In the Port of Nelson, NIS comprised

7.1% of the total sampled diversity (Fig. 30b), which ranked it seventh highest in percentage composition of NIS from the sixteen locations surveyed.

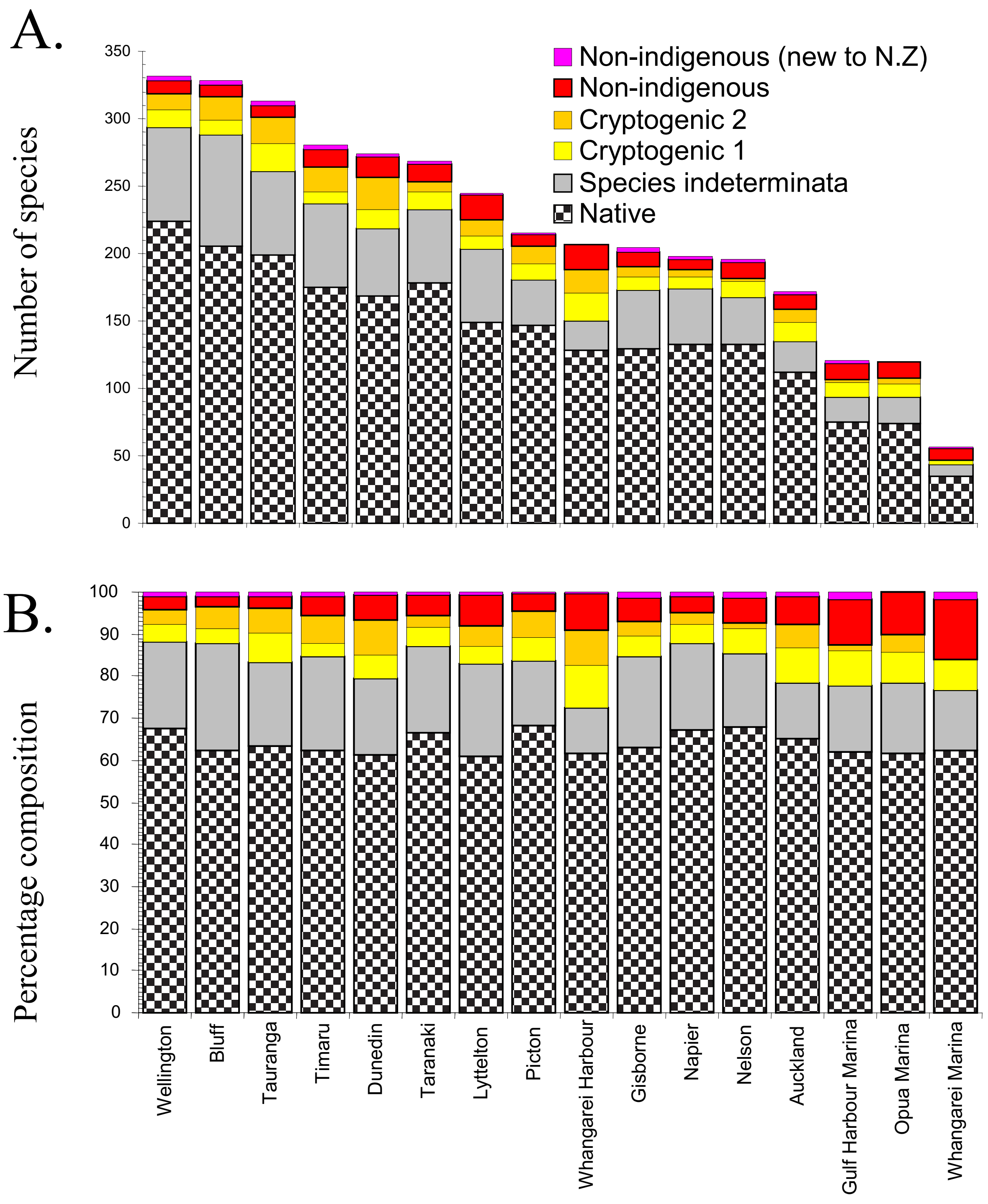

Figure 30: Differences in (a) the number of species, and (b) the relative proportions of non-indigenous, cryptogenic, species indeterminata and native categories among the sixteen locations sampled over the summers of 2001 – 2002, and 2002-2003. Locations are presented in order of decreasing species diversity recorded.

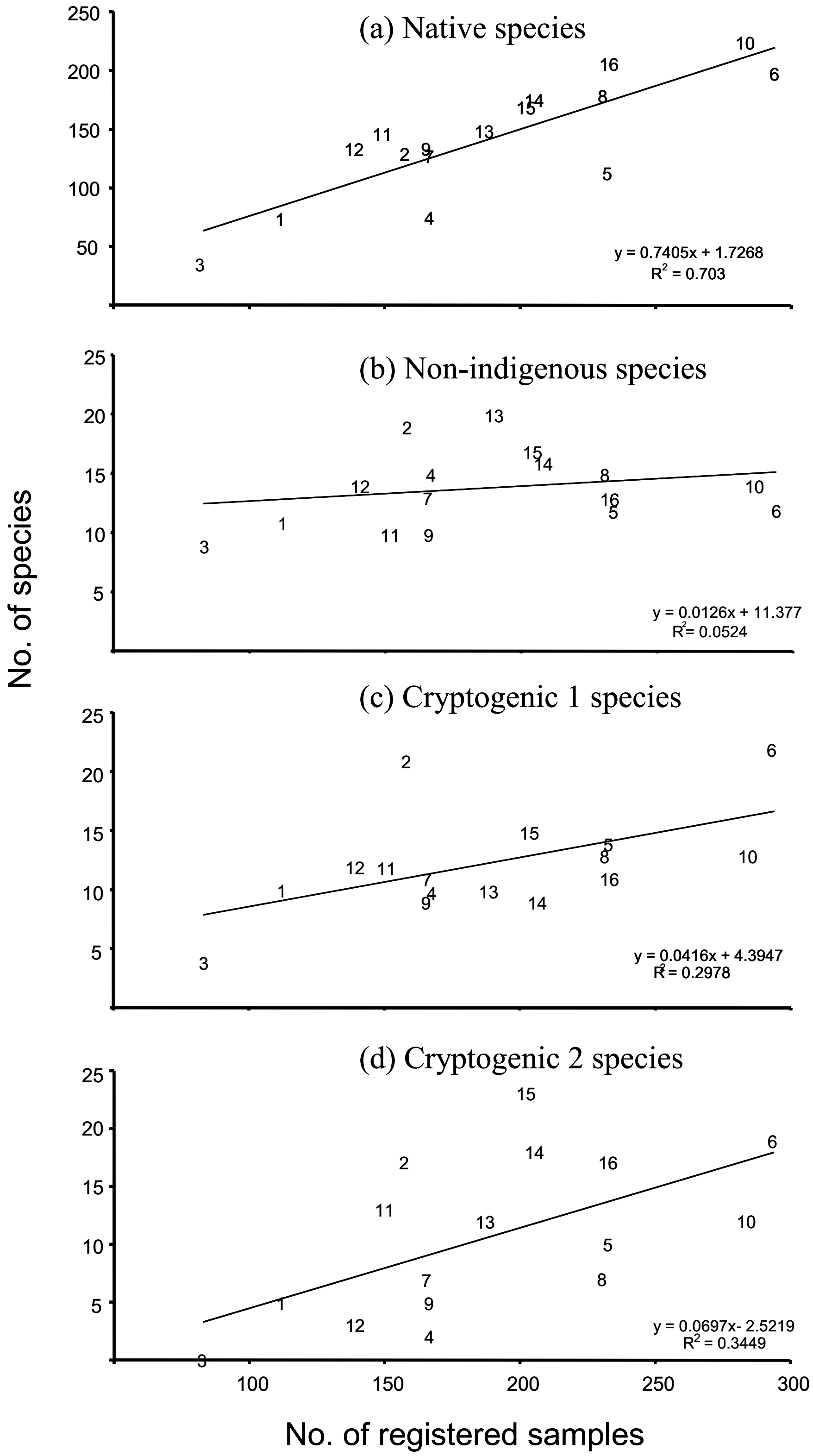

Figure 31: Linear regression equations relating numbers of species detected to sample effort at the 16 locations surveyed nation-wide. Location codes are as follows; 1 = Opua, 2 = Whangarei Port, 3 = Whangarei Marina, 4 = Gulf Harbour Marina, 5 = Auckland Port, 6 = Tauranga Port, 7 = Gisborne Port, 8 = 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

Assessment of the risk of new introductions to 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 northwest Pacific, and southern Australia (Cranfield et al. 1998). Commercial shipping arriving in the port of Nelson from overseas comes predominantly from temperate regions of the northwest Pacific (56 %), northeast Pacific (7 %) and Australia (7 %). Although some commercial international shipping arrives from the tropics including the Arabian Seas (7 %), and south Pacific (4%), the vast majority of commercial shipping arrives from temperate regions of the world where environments are broadly comparible to those in Nelson Harbour.

Relative to other ports in New Zealand, the Port of Nelson has a high number of visits from reefer ships carrying frozen foods (41% of international arrivals) and large fishing vessels (19 % of international vessel arrivals). The Port receives a moderate number of bulk carriers (21 % of arrivals) that trade volumes of bulk cargoes, and often export aquaculture products and fruit. The Port of Nelson received the fifth highest volume of reported ballast water discharge to New Zealand ports in 1999 (Inglis 2001). The total volume of ballast discharged in Port Nelson in 1999 was 157,000 m^3, and was sourced from Japan (43,099 m^3), Taiwan (9,335 m^3) and Australia (3,243 m^3), with an additional 100,238 m^3 of ballast water discharged from unspecified source countries. Shipping from Japan, Taiwan and Australian regions thus presents an on-going risk of introduction of new NIS to Nelson Harbour. However, since the origin of 64% of the ballast water discharged into the port was not recorded, considerable uncertainty exists in the potential source of new NIS and warrants additional investigation.

Assessment of translocation risk for introduced species found in the port

Nelson is connected by frequent shipping traffic to the ports of Wellington, Picton, and Lyttelton with more than two domestic vessel visits per week. Less frequent vessel movements also connect it to the Port of New Plymouth 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 Nelson survey have been recorded previously in New Zealand, there were three notable exceptions: *Celleporaria nodulosa, Lafoeina amirantensis* and *Cnemidocarpa sp.* These three species were first described from New Zealand waters during these port surveys.

The bryozoan *Celleporaria nodulosa* was found to be present in the Ports of Nelson and Gisborne. Although it is known to have a widespread distribution on the southeastern coast of Australia, little is currently known about this species' native range or impacts in its introduced range. The cnidarian *Lafoeina amirantensis* was first discovered in New Zealand waters from the Port of Nelson, and was not detected in any of the fifteen other locations searched nationwide. This hydroid is known to occur in South Australia and the Seychelles, although details of its native and introduced range and ecological impacts are unknown. The ascidian *Cnemidocarpa sp.* was found to be present in Auckland, Gisborne, Gulf Harbour Marina, Nelson, Picton, Tauranga, Taranaki, Timaru and Wellington ports. Again, little is currently known about this species, however it now appears to be widely spread through New Zealand's shipping ports where it may be competing for space with native fauna in fouling assemblages.

The highly invasive alga, *Undaria pinnatifida*, has been present in Nelson since 1997. This species was not detected during the January 2002 port survey, but its continuing presence in the port was confirmed by NIWA surveys in both 2003 and 2004 (Project ZBS2001/01). *Undaria* has been spread through shipping and other vectors to 11 of the 16 ports and marinas surveyed during the baseline surveys (the exceptions are Opua, Whangarei Port and Marina, Gulf Harbour Marina and Tauranga Port). A control programme in Bluff Harbour has subsequently removed *Undaria* populations established there. Nevertheless, vessels departing from Nelson 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 Nelson, coal barges, recreational craft, and seasonal fishing vessels that are laid up for significant periods of time pose a particularly high risk for the spread of these species.

Management of existing non-indigenous species in the port

Many of the NIS detected in this survey appear to be well established in the Port of Nelson. For instance, *Conopeum seurati, Watersipora subtorquata, Crassostrea gigas, Ciona intestinalis* and *Cnemidocarpa sp.* were all detected from multiple samples or sites within the port. However a number of NIS were only found from a single replicate during the survey and it is unclear whether they have formed viable populations in the Port. These species include the newly discovered *Celleporaria nodulosa* and *Lafoeina amirantensis*. Further surveys that target these species are necessary to determine the true extent of their populations in the 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 Nelson are widespread and local population controls are unlikely to be effective. Management should be directed toward preventing spread of potentially harmful species established in Nelson Harbour to locations where they do not presently occur. Such management will require better understanding of the frequency of movements by vessels of different types from Nelson 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 Nelson 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 Nelson (probably responsible for 79% 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). Many of the species thought to have been introduced to Australiasia by hull fouling are likely to be historical introductions (> 80 years ago; Hewitt et al 1999). However, the fact that some recent marine introductions (e.g. *Undaria pinnatifida*, *Codium fragile sp. tomentosoides*) have been facilitated by hull fouling suggests that hull fouling remains an important transport mechanism for unwanted marine species (Cranfield et al 1998; Hewitt et al 1999).

Non-indigenous marine species can have a range of adverse impacts on natural ecosystems and upon the economic, social and cultural values that they support. For instance, NIS can cause ecological impacts through competition with native species for resources, predator-prey interactions, hybridisation, parasitism or toxicity and can modify the physical environment through altering habitat structure (Ruiz et al 1999; Ricciardi 2001). Although more than 140 non-indigenous species have been reported from New Zealand coastal waters, there have been few studies of their impacts. Detailed studies have been conducted on just three species: the cord grass, *Spartina anglica*, the Japanese kelp, *Undaria pinnatifida*, and the Asian nestling mussel, *Musculista senhousia*. 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 are needed to establish the abundance and potential impacts of the non-indigenous species encountered in this port to determine the threat they represent to New Zealand's native ecosystems.

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Tables

Table 1: Berthage facilities in the Port of Nelson.

Berth	Section No.	Purpose	Construction	Length (m)	Depth (m below chart datum)
Coastal Berth		Multipurpose	Concrete deck/wood piles	85	6
Main Wharf	North	Heavy-duty cargo, petroleum products	Wood deck/wood piles	160	9
	South		Concrete deck/concrete piles + wooden fender piles	119	10.5
Brunt Quay		Heavy-duty cargo	Concrete deck/concrete piles + wooden fender piles	196	10.3
McGlashen Quay	North	General and break-bulk cargoes	Concrete deck/wood piles	155	9.2
	South	Bitumen and methanol discharge	Concrete deck/wood piles	200	9.2
Kingsford Quay		Break bulk, general cargoes, logs	Concrete deck/wood piles	174	9.5
	East	Break bulk, general cargoes, logs, vessel	Concrete deck/wood piles	85	6.5
Lay-up Berth	1	Lay-up, fish unloading	Solid concrete	85	8
	2		Solid concrete	65	6.5
	3 + pontoon		Solid concrete + steel pontoon on wood piles	105	5.5
McKellar Quay (Sealord)	East	Independently operated fishing vessels	Concrete deck/wood piles	128	7
	Centre		Concrete deck/wood piles	60	5
	West		Concrete deck/wood piles	45	5.5
Dog Leg (Sanford Ltd)			Concrete deck/wood piles	43	5.5
Amaltal Fishing Co.			Concrete deck/wood piles	130	7
Donker Marine			Concrete deck/wood piles	70	5

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	20µm 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 µm 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	

Taxa sampled	CRIMP Protocol Survey method	 Sample procedure	NIWA Method Survey method	 Sample procedure	Notes
Sedentary / encrusting biota	Quadrat scraping	0.10 m^2 quadrats sampled at -0.5 m, -3.0 m and -7.0 m on 3 outer piles per berth	Quadrat scraping	0.10 m^2 quadrats sampled at -0.5 m, -1.5 m, -3.0 m and -7 m on 2 inner and 2 outer piles per berth	Workshop recommended extra quadrat in high diversity algal zone (-1.5 m) and to sample inner pilings for shade tolerant species
Sedentary / encrusting biota	Video / photo transect	Video transect of pile/rockwall facing. Still images taken of the three 0.10 m^2 quadrats	Video / photo transect	Video transect of pile/rockwall facing. Still images taken of the four 0.10 m^2 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 Nelson sampling effort.

Sample method	Number of shipping berths sampled	Number of replicate samples taken
Benthic Sled Tows	4	8
Benthic Grab (Shipek)	1[a]	2
Box traps	4	16
Diver quadrat scraping	4	55
Opera house fish traps	4	16
Starfish traps	4	16
Shrimp traps	4	16
Javelin cores	N/A	8

[a] Shipek grab malfunctioned during the Port of Nelson sampling.

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

Sample Depth (m)	Outer Piles	Inner Piles
0.5	2 concrete, 6 wood	2 concrete, 6 wood
1.5	2 concrete, 6 wood	2 concrete, 6 wood
3.5	2 concrete, 6 wood	2 concrete, 3 wood
7	2 concrete, 6 wood	1 wood
Miscellaneous	Nil	1 concrete

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

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

Phylum, Class	Order	Family	Genus and species
Annelida			
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea australiensis*
Polychaeta	Eunicida	Lumbrineridae	*Lumbricalus aotearoae*
Polychaeta	Eunicida	Onuphidae	*Kinbergonuphis proalopus*
Polychaeta	Phyllodocida	Glyceridae	*Glycera lamelliformis*
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	Nereididae	*Perinereis pseudocamiguina*
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia microphylla*
Polychaeta	Phyllodocida	Polynoidae	*Lepidastheniella comma*
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus polychromus*
Polychaeta	Phyllodocida	Sigalionidae	*Labiosthenolepis laevis*
Polychaeta	Sabellida	Oweniidae	*Owenia petersenae*
Polychaeta	Sabellida	Sabellidae	*Demonax aberrans*
Polychaeta	Sabellida	Sabellidae	*Euchone pallida*
Polychaeta	Sabellida	Serpulidae	*Galeolaria hystrix*
Polychaeta	Sabellida	Serpulidae	*Spirobranchus cariniferus*
Polychaeta	Spionida	Spionidae	*Boccardia acus*
Polychaeta	Spionida	Spionidae	*Boccardia chilensis*
Polychaeta	Spionida	Spionidae	*Boccardia lamellata*
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris nuchalis*
Polychaeta	Terebellida	Cirratulidae	*Timarete anchylochaetus*
Polychaeta	Terebellida	Flabelligeridae	*Flabelligera affinis*
Polychaeta	Terebellida	Terebellidae	*Nicolea armilla*
Polychaeta	Terebellida	Terebellidae	*Nicolea maxima*
Polychaeta	Terebellida	Terebellidae	*Pista pegma*
Polychaeta	Terebellida	Terebellidae	*Pseudopista rostrata*
Polychaeta	Terebellida	Terebellidae	*Streblosoma toddae*
Bryozoa			
Gymnolaemata	Cheilostomata	Antroporidae	*Akatopora circumsaepta*
Gymnolaemata	Cheilostomata	Arachnopusiidae	*Arachnopusia unicornis*
Gymnolaemata	Cheilostomata	Beaniidae	*Beania n. sp. [whitten]*
Gymnolaemata	Cheilostomata	Beaniidae	*Beania plurispinosa*
Gymnolaemata	Cheilostomata	Buffonellodidae	*Aimulosia marsupium*
Gymnolaemata	Cheilostomata	Celleporidae	*Celleporina sinuata*
Gymnolaemata	Cheilostomata	Celleporidae	*Galeopsis porcellanicus*
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperiopsis cervicornis*
Gymnolaemata	Cheilostomata	Hippoporidridae	*Odontoporella adpressa*
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella tongima*
Gymnolaemata	Cheilostomata	Microporellidae	*Fenestrulina thyreophora*
Gymnolaemata	Cheilostomata	Microporellidae	*Microporella speculum*
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides angela*
Gymnolaemata	Cheilostomata	Romancheinidae	*Exochella conjuncta*
Gymnolaemata	Cheilostomata	Smittinidae	*Smittina palisada*
Gymnolaemata	Cheilostomata	Smittinidae	*Smittina torques*
Cnidaria			
Hydrozoa	Hydroida	Lafoeidae	*Hebellopsis scandens*

Phylum, Class	Order	Family	Genus and species
Hydrozoa	Hydroida	Phialellidae	*Opercularella humilis*
Hydrozoa	Hydroida	Sertulariidae	*Parascyphus simplex*
Hydrozoa	Hydroida	Syntheciidae	*Synthecium elegans*
Crustacea			
Cirripedia	Thoracica	Balanidae	*Austrominius modestus*
Malacostraca	Amphipoda	Aoridae	*Haplocheira barbimana*
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe trailli*
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia vesca*
Malacostraca	Anomura	Paguidae	*Pagurus traversi*
Malacostraca	Anomura	Paguridae	*Lophopagurus (L.) thompsoni*
Malacostraca	Anomura	Porcellanidae	*Petrolisthes elongatus*
Malacostraca	Anomura	Porcellanidae	*Petrolisthes novaezelandiae*
Malacostraca	Brachyura	Cancridae	*Cancer novaezelandiae*
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus innominatus*
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus varius*
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus whitei*
Malacostraca	Brachyura	Hymenosomatidae	*Halimena aoteoroa*
Malacostraca	Brachyura	Hymenosomatidae	*Neohymenicus pubescens*
Malacostraca	Brachyura	Majidae	*Notomithrax minor*
Malacostraca	Brachyura	Majidae	*Notomithrax ursus*
Malacostraca	Brachyura	Ocypodidae	*Macrophthalmus hirtipes*
Malacostraca	Brachyura	Pinnotheridae	*Pinnotheres novaezelandiae*
Malacostraca	Brachyura	Portunidae	*Nectocarcinus antarcticus*
Malacostraca	Brachyura	Xanthidae	*Pilumnus lumpinus*
Malacostraca	Caridea	Crangonidae	*Pontophilus hamiltoni*
Malacostraca	Caridea	Palemonidae	*Palaemon affinis*
Malacostraca	Isopoda	Cirolanidae	*Natatolana rossi*
Echinodermata			
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias muricata*
Asteroidea	Valvatida	Asterinidae	*Patiriella regularis*
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus mollis*
Mollusca			
Bivalvia	Myoida	Hiatellidae	*Hiatella arctica*
Bivalvia	Mytiloida	Mytilidae	*Modiolarca impacta*
Bivalvia	Mytiloida	Mytilidae	*Perna canaliculus*
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus pulex*
Bivalvia	Nuculoida	Nuculidae	*Nucula hartvigiana*
Bivalvia	Ostreoida	Anomiidae	*Pododesmus zelandicus*
Bivalvia	Ostreoida	Ostreidae	*Ostrea chilensis*
Bivalvia	Veneroida	Psammobiidae	*Soletellina siliquens*
Bivalvia	Veneroida	Semelidae	*Leptomya retiaria*
Bivalvia	Veneroida	Veneridae	*Dosinia lambata*
Bivalvia	Veneroida	Veneridae	*Ruditapes largillierti*
Bivalvia	Veneroida	Veneridae	*Tawera spissa*
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria australis*
Gastropoda	Cephalaspidea	Philinidae	*Philine auriformis*
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella tenuis*
Gastropoda	Littorinimorpha	Turritellidae	*Maoricolpus roseus*
Gastropoda	Neogastropoda	Buccinidae	*Buccinulum vittatum*
Gastropoda	Neogastropoda	Muricidae	*Xymene plebeius*
Gastropoda	Neogastropoda	Muricidae	*Xymene pusillus*
Gastropoda	Notaspidea	Pleurobranchidae	*Pleurobranchaea maculata*

Phylum, Class	Order	Family	Genus and species
Gastropoda	Nudibranchia	Dorididae	*Doriopsis flabellifera*
Gastropoda	Systellomatophora	Onchidiidae	*Onchidella nigricans*
Gastropoda	Vetigastropoda	Trochidae	*Trochus tiaratus*
Gastropoda	Vetigastropoda	Turbinidae	*Turbo smaragdus*
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona zelandica*
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton pelliserpentis*
Phycophyta			
Rhodophyceae	Ceramiales	Ceramiaceae	*Antithamnionella adnata*
Rhodophyceae	Ceramiales	Dasyaceae	*Heterosiphonia squarrosa*
Rhodophyceae	Ceramiales	Delesseriaceae	*Myriogramme denticulata*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Cladhymenia oblongifolia*
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha linza*
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha ramulosa*
Porifera			
Calcarea	Leucosolenida	Sycettidae	*Sycon pedicellatum*
Demospongiae	Haplosclerida	Chalinidae	*Haliclona cf. punctata*
Demospongiae	Haplosclerida	Chalinidae	*Haliclona glabra*
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas fulva*
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia) tasmani*
Demospongiae	Poecilosclerida	Tedaniidae	*Tedania battershilli*
Pyrrophycophyta			
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium conicum*
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium conicum cf. conicoides*
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium sp.*
Dinophyceae	Peridiniales	Peridiniaceae	*Scrippsiella trochoidea*
Urochordata			
Ascidiacea	Aplousobrancia	Didemnidae	*Lissoclinum notti*
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula mortenseni*
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus australis*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura cancellata*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura carnea*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura rugata*
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura subuculata*
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa bicornuta*
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa nisiotus*
Vertebrata			
Actinopterygii	Anguilliformes	Anguillidae	*Anguilla dieffenbachii*
Actinopterygii	Gadiformes	Moridae	*Pseudophycis bachus*
Actinopterygii	Gasterosteiformes	Syngnathidae	*Hippocampus abdominalis*
Actinopterygii	Perciformes	Labridae	*Notolabrus celidotus*
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina capito*
Actinopterygii	Pleuronectiformes	Pleuronectidae	*Peltorhamphus latus*

Table 7. Cryptogenic marine species recorded from the Port of Nelson survey. Category 1 cryptogenic species (C1); Category 2 cryptogenic species (C2). Refer to section 2.8 for definitions.

Phylum, Class	Order	Family	Genus and species	
Bryozoa				
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia ambigua*	C1
Cnidaria				
Hydrozoa	Hydroida	Campanulariidae	*Clytia hemisphaerica*	C1
Hydrozoa	Hydroida	Plumulariidae	*Plumularia setacea*	C1
Crustacea				
Malacostraca	Brachyura	Grapsidae	*Plagusia chabrus*	C1
Mollusca				
Bivalvia	Mytiloida	Mytilidae	*Mytilus galloprovincialis*	C1
Porifera				
Demospongiae	Halichondrida	Halichondriidae	*Halichondria n. sp. 5*	C2
Demospongiae	Halichondrida	Halichondriidae	*Hymeniacidon perleve*	C1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona n. sp. 1*	C2
Demospongiae	Haplosclerida	Chalinidae	*Haliclona n. sp. 7*	C2
Urochordata				
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum vexillum*	C1
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 Nelson survey. Likely vectors of introduction are largely derived from Cranfield et al (1998), where H = Hull fouling and B = Ballast water transport. NIS not listed in Cranfield et al (1998) or previously encountered by taxonomic experts in New Zealand waters are marked as New Records (NR). For these species and others for which information is scarce, we provide dates of first detection rather than probable dates of introduction.

Phylum, Class	Order	Family	Genus and species	Probable means of introduction	Date of introduction or detection (d)
Annelida					
Polychaeta	Spionida	Spionidae	*Polydora hoplura*	H	Unknown [1]
Bryozoa					
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula flabellata*	H	Pre-1949
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula pallasiana*	H	1890s
Gymnolaemata	Cheilostomata	Electridae	*Conopeum seurati*	H	Pre-1963
Gymnolaemata	Cheilostomata	Electridae	*Electra angulata*	H	Unknown [1]
Gymnolaemata	Cheilostomata	Lepraliellidae	*Celleporaria nodulosa* **(NR)**	H	Jan. 2002 [d]
Gymnolaemata	Cheilostomata	Schizoporellidae	*Schizoporella errata*	H	Pre-1960
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora subtorquata*	H or B	Pre-1982
Gymnolaemata	Ctenostomata	Nolellidae	*Anguinella palmata*	H	1960
Cnidaria					
Hydrozoa	Hydroida	Campanulinidae	*Lafoeina amirantensis* **(NR)**	H or B	Jan. 2002 [d]
Mollusca					
Bivalvia	Ostreoida	Ostreidae	*Crassostrea gigas*	H	1961
Bivalvia	Veneroida	Semelidae	*Theora lubrica*	B	1971
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 Nelson 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	*Nereis Indet*
Polychaeta	Phyllodocida	Nereididae	*Perinereis Perinereis-A*
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotinae Indet*
Polychaeta	Sabellida	Sabellidae	*Megalomma Megalomma-A*
Polychaeta	Spionida	Spionidae	*Polydora Indet*
Polychaeta	Terebellida	Ampharetidae	*Amphicteis Amphicteis-A*
Polychaeta	Terebellida	Terebellidae	*Lanassa Lanassa-A*
Bryozoa			
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella sp.*
Cnidaria			
Hydrozoa	Hydroida	Bougainvilliidae	*Bougainvillia ?muscus*
Hydrozoa	Hydroida	Lafoeidae	*Filellum sp. indeterminate*
Hydrozoa	Hydroida	Tubulariidae	*Ectopleura sp. indeterminate*
Crustacea			
Malacostraca	Decapoda		*Shrimp sp.*
Malacostraca	Isopoda	Sphaeromatidae	*?Cilicaea sp*
Malacostraca	Mysida	Mysidae	*Heteromysis or Mysidetes sp.*
Mollusca			
Gastropoda	Nudibranchia	Dorididae	*Jorunna sp.*
Phycophyta			
Rhodophyceae	Acrochaetiales	Acrochaetiaceae	*Audouinella sp.*
Rhodophyceae	Bangiales	Bangiaceae	*Bangia sp.*
Rhodophyceae	Ceramiales	Ceramiaceae	*Callithamnion sp.*
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium sp.*
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia sp.*
Rhodophyceae	Ceramiales	Dasyaceae	*Dasya sp.*
Rhodophyceae	Ceramiales	Delesseriaceae	*Myriogramme sp.*
Rhodophyceae	Ceramiales	Delesseriaceae	*Schizoseris sp.*
Rhodophyceae	Ceramiales	Delesseriaceae	*Unidentifiable Delesseriaceae*
Rhodophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia sp.*
Rhodophyceae	Corallinales	Corallinaceae	*Non-geniculate coralline*
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia sp.*
Rhodophyceae			*Unidentifiable red*
Ulvophyceae	Cladophorales	Cladophoraceae	*Cladophora sp.*
Ulvophyceae	Ulvales	Ulvaceae	*Ulva sp.*
Platyhelminthes			
Turbellaria	Polycladida		*Indet genus indet sp.*
Urochordata			
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum sp.*
Thaliacea	Salpida	Salpidae	*Salpidae sp*

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

Genus and species	Capture Techniques	Locations detected in Port	Detected in other locations surveyed in ZBS2000_04
Polydora hoplura	Pile scrape	MCGlashen Berth, Fig 16	Dunedin, Picton, Tauranga, Whangarei Harbour, Wellington
Bugula flabellata	Pile scrape	Lay-up Berth, Fig 17	Auckland, Bluff, Dunedin, Lyttelton, Napier, Opua Marina, Picton, Tauranga, Taranaki, Timaru, Whangarei Harbour, Wellington
Cryptosula pallasiana	Pile scrape	Lay-up Berth, Fig 18	Dunedin, Gisborne, Lyttelton, Taranaki, Timaru, Whangarei Harbour, Wellington
Conopeum seurati	Pile scrape	K, Lay-up, Main and MCGlashen Berths, Fig 19	Lyttelton, Whangarei Marina
Electra angulata	Benthic grab, Pile scrape	Main Berth, Fig 20	None
Celleporaria nodulosa	Pile scrape	K Berth, Fig 21	Gisborne
Schizoporella errata	Benthic grab	Main Berth, Fig 22	Gulf Harbour Marina, Whangarei Harbour
Watersipora subtorquata	Pile scrape	K, Lay-up, Main and MCG Berths, Fig 23	Gulf Harbour Marina, Bluff, Dunedin, Gisborne, Lyttelton, Napier, Opua Marina, Picton, Tauranga, Taranaki, Timaru, Whangarei Harbour, Wellington
Anguinella palmata	Pile scrape	MCG Berth, Fig 24	Auckland
Lafoeina amirantensis	Benthic sled	Main Berth, Fig 25	None
Crassostrea gigas	Benthic grab, Pile scrape	K, Lay-up, Main and MCG Berths, Fig 26	Gulf Harbour Marina, Auckland, Dunedin, Opua, Taranaki, Whangarei Harbour
Theora lubrica	Benthic sled	K and MCG Berths, Fig 27	Gulf Harbour Marina, Auckland, Gisborne, Lyttelton, Napier, Opua Marina, Taranaki, Whangarei Harbour, Whangarei Marina, Wellington
Ciona intestinalis	Benthic sled, Pile scrape	Lay-up and MCG Berths, Fig 28	Lyttelton, Napier, Timaru
Cnemidocarpa sp.	Pile scrape	Lay-up and MCG Berths, Fig 29	Gulf Harbour Marina, Auckland, Gisborne, Lyttelton, Picton, Taranaki, Tauranga, 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 Rotman	NIWA Greta Point
Echiura	Echiuroidea	Geoff Read	NIWA Greta Point
Mollusca	Bivalvia. Cephalopoda, Gastropoda, Polyplacophora	Bruce Marshall	Museum of NZ Te Papa Tongarewa
Nemertea	Anopla, Enopla	Geoff Read	NIWA Greta Point
Phycophyta	Phaeophyceae, Rhodophyceae, Ulvophyceae	Wendy Nelson, Kate Neill	NIWA Greta Point
Platyhelminthes	Turbellaria	Sean Handley	NIWA Nelson
Porifera	Demospongiae, Calcarea	Michelle Kelly-Shanks	NIWA Auckland
Priapula	Priapulidae	Geoff Read	NIWA Greta Point
Pyrrophycophyta	Dinophyceae	Hoe Chang, Rob Stewart	NIWA Greta Point
Urochordata	Ascidiacea	Mike Page, Anna Bradley Patricia Kott[1]	NIWA Nelson and [1]Queensland Museum
Vertebrata	Osteichthyes	Clive Roberts, Andrew Stewart	Museum of NZ Te Papa Tongarewa

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

Phylum Annelida
Polychaetes: The polychaetes are the 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 phylum includes the bivalves (organisms with hinged shells e.g. mussels, oysters, etc), gastropods (marine snails, e.g. winkles, limpets,

topshells), chitons, sea slugs and sea hares, as well as the cephalopods (squid, cuttlefish and octopus).

Phylum Phycophyta
Algae: These are the marine plants. Several types were encountered during our survey. Large *macroalgae* were sampled that live attached to submerged natural and artificial surfaces including rocks, pilings, ropes and the shells or carapaces of other species. These include the green algae (phylum Chlorophyta), red algae (phylum Rhodophyta) and brown algae (phylum 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 Nelson.

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

Phylum and species	C1	C2	C3	C4	C5	C6	C7	C8	C9
Annelida									
Polydora hoplura			+		+	+	+	+	+
Bryozoa									
Bugula flabellata	+	+	+		+	+	+	+	+
Cryptosula pallasiana	+	+	+		+	+	+	+	+
Conopeum seurati	+		+	+	+	+	+	+	+
Electra angulata	+	+	+		+		+	+	+
Celleporaria nodulosa	+		+		+		+	+	+
Schizoporella errata	+	+	+			+	+	+	+
Watersipora subtorquata	+	+	+		+	+	+	+	+
Anguinella palmata	+	+			+	+	+	+	+
Cnidaria									
Lafoeina amirantensis	+		+		+		+	+	
Mollusca									
Crassostrea gigas	+	+	+			+	+	+	+
Theora lubrica	+	+			+	+	+	+	+
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 Nelson

Site	Eastings	Northings	NZ Latitude	NZ Longitude	Survey Method	No. of sample units
K	2533026	5994219	-41.2602	173.2748	BSLD	2
K	2533026	5994219	-41.2602	173.2748	CRBTP	4
K	2533026	5994219	-41.2602	173.2748	FSHTP	4
K	2533026	5994219	-41.2602	173.2748	PSC	13
K	2533026	5994219	-41.2602	173.2748	SHRTP	4
K	2533026	5994219	-41.2602	173.2748	STFTP	4
LAY-UP	2533205	5994474	-41.2579	173.2769	BSLD	2
LAY-UP	2533205	5994474	-41.2579	173.2769	CRBTP	4
LAY-UP	2533205	5994474	-41.2579	173.2769	FSHTP	4
LAY-UP	2533205	5994474	-41.2579	173.2769	PSC	15
LAY-UP	2533205	5994474	-41.2579	173.2769	SHRTP	4
LAY-UP	2533205	5994474	-41.2579	173.2769	STFTP	4
MAIN	2532640	5993980	-41.2623	173.2702	BGRB	2
MAIN	2532640	5993980	-41.2623	173.2702	BSLD	2
MAIN	2532640	5993980	-41.2623	173.2702	CRBTP	4
MAIN	2532640	5993980	-41.2623	173.2702	FSHTP	4
MAIN	2532640	5993980	-41.2623	173.2702	PSC	12
MAIN	2532640	5993980	-41.2623	173.2702	SHRTP	4
MAIN	2532640	5993980	-41.2623	173.2702	STFTP	4
MCG	2532883	5993970	-41.2624	173.2731	BSLD	2
MCG	2532883	5993970	-41.2624	173.2731	CRBTP	4
MCG	2532883	5993970	-41.2624	173.2731	FSHTP	4
MCG	2532883	5993970	-41.2624	173.2731	PSC	15
MCG	2532883	5993970	-41.2624	173.2731	SHRTP	4
MCG	2532883	5993970	-41.2624	173.2731	STFTP	4
site 1	2532892	5994472	-41.2579	173.2732	CYST	2
site 2	2533076	5994349	-41.259	173.2754	CYST	2
site 3	2532105	5994086	-41.2614	173.2638	CYST	2
site 4	2532383	5993678	-41.2651	173.2671	CYST	2

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

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

					Berth code	K													LAY-UP														
					Pile replicate	1						2							1								2						
					Pile position	IN		OUT				IN			OUT				IN				OUT				IN			OUT			
Class	Orders	Family	Genus	Species	*Status	1	2	1	2	3	4	1	2	3	1	2	3	4	1	2	3	MISC	1	2	3	4	1	2	3	1	2	3	4
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	1	1	0	0	0	0	1	0	0	1	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*vexillum*	C1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum*	*notti*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1	0	1	1	0
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*subuculata*	N	0	1	1	0	1	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	*Microcosmus*	*australis*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	1	0	0	0	0	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	0	0	0	0	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*rugata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa*	*cerea*	C1	1	0	1	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	1	1	0	1	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*nisiotus*	N	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Ascidiacea	Stolidobranchia	Styelidae	*Styela*	*plicata*	C1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0
Bivalvia	Myoida	Hiatellidae	*Hiatella*	*arctica*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Bivalvia	Mytiloida	Mytilidae	*Perna*	*canaliculus*	N	1	0	1	0	1	1	0	0	0	0	0	1	0	0	1	1	0	0	1	1	0	0	1	1	0	1	1	1
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus*	*pulex*	N	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	1	0	1	0	0	1	1	1	0
Bivalvia	Mytiloida	Mytilidae	*Modiolarca*	*impacta*	N	1	0	1	0	0	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	*Mytilus*	*galloprovincialis*	C1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Bivalvia	Ostreoida	Anomiidae	*Pododesmus*	*zelandicus*	N	0	0	0	0	0	1	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	*Crassostrea*	*gigas*	A	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	1	1	0	1	1	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	0	0	0	0	0
Calcarea	Leucosolenida	Sycettidae	*Sycon*	*pedicellatum*	N	0	0	0	0	0	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	0	0	0	0	0
Crustacea	Anomura	Paguidae	*Pagurus*	*traversi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1
Crustacea	Anomura	Paguridae	*Lophopagurus (L.)*	*thompsoni*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*elongatus*	N	0	0	1	0	1	0	1	0	0	1	0	1	0	1	1	1	0	0	1	1	0	1	1	0	1	1	1	0
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0
Crustacea	Brachyura	Grapsidae	*Plagusia*	*chabrus*	C1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	1	1
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*innominatus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	1	0
Crustacea	Brachyura	Hymenosomatidae	*Halimena*	*aoteoroa*	N	0	0	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Neohymenicus*	*pubescens*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*whitei*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	1
Crustacea	Brachyura	Pinnotheridae	*Pinnotheres*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Xanthidae	*Pilumnus*	*lumpinus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	1	0
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	0
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*n. sp. 5 (fingery 340-400)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Demospongiae	Halichondrida	Halichondriidae	*Hymeniacidon*	*perleve*	C1	0	0	0	0	0	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Demospongiae	Haplosclerida	Chalinidae	*Haliclona*	*glabra*	N	0	0	0	0	0	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*	*n. sp. 7 (fine lacey 240)*	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0	0
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia)*	*tasmani*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demospongiae	Poecilosclerida	Tedaniidae	*Tedania*	*battershilli*	N	0	0	0	0	0	1	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	K													LAY-UP														
					Pile replicate	1						2							1								2						
					Pile position	IN		OUT				IN			OUT				IN				OUT				IN			OUT			
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	0	0	0	0	0
Gastropoda	Neogastropoda	Buccinidae	*Buccinulum*	*vittatum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gastropoda	Nudibranchia	Dorididae	*Doriopsis*	*flabellifera*	N	0	0	0	0	0	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*n. sp. [whitten]*	N	1	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*plurispinosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
Gymnolaemata	Cheilostomata	Celleporidae	*Galeopsis*	*porcellanicus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperiopsis*	*cervicornis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula*	*pallasiana*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	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	0	1	0	1	0	0	0	1	0	0
Gymnolaemata	Cheilostomata	Electridae	*Electra*	*angulata*	A	0	0	0	0	0	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	Hippothoidae	*Celleporella*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Lepraliellidae	*Celleporaria*	*nodulosa*	A	1	0	0	0	0	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	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia*	*ambigua*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0	1	0	0
Gymnolaemata	Ctenostomata	Nolellidae	*Anguinella*	*palmata*	A	0	0	0	0	0	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	Bougainvilliidae	*Bougainvillia*	*?muscus*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Campanulariidae	*Clytia*	*hemisphaerica*	C1	0	0	0	0	0	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	Lafoeidae	*Hebellopsis*	*scandens*	N	0	0	0	0	0	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	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	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Parascyphus*	*simplex*	N	0	0	0	0	0	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	Syntheciidae	*Synthecium*	*elegans*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Hydrozoa	Hydroida	Tubulariidae	*Ectopleura*	*sp. indeterminate*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira*	*barbimana*	N	0	0	0	1	0	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	0	0	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	Lysianassidae	*Parawaldeckia*	*vesca*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
Malacostraca	Decapoda		*Shrimp*	*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	0	0	0	0	0
Malacostraca	Isopoda	Cirolanidae	*Natatolana*	*rossi*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Isopoda	Sphaeromatidae	*?Cilicaea*	*sp*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea*	*australiensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes*	*kerguelensis*	N	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*Perinereis-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	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	0	1	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*amblyodonta*	N	0	0	1	0	0	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*	*camiguinoides*	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*pseudocamiguina*	N	0	0	0	0	0	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	*Nereis*	*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	0	0	0	0	1
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*microphylla*	N	0	0	1	0	0	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	Polynoidae	*Lepidonotus*	*polychromus*	N	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	1	1	0	1	1	1	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidastheniella*	*comma*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotinae*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Demonax*	*aberrans*	N	0	0	1	0	0	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	*Megalomma*	*Megalomma-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	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	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Galeolaria*	*hystrix*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*hoplura*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*acus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*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	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*lamellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Timarete*	*anchylochaetus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris*	*nuchalis*	N	0	0	0	0	0	0	0	0	0	0	0	1	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	K													LAY-UP														
					Pile replicate	1						2							1								2						
					Pile position	IN		OUT				IN			OUT				IN				OUT				IN			OUT			
Polychaeta	Terebellida	Flabelligeridae	*Flabelligera*	*affinis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Polychaeta	Terebellida	Terebellidae	*Pseudopista*	*rostrata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Polychaeta	Terebellida	Terebellidae	*Lanassa*	*Lanassa-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	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	1	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	1	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Pista*	*pegma*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
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	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	0	0	0	0	0
Rhodophyceae	Bangiales	Bangiaceae	*Bangia*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Antithamnionella*	*adnata*	N	0	0	0	0	0	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	*Callithamnion*	*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	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Griffithsia*	*sp.*	SI	0	0	0	0	1	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	Dasyaceae	*Dasya*	*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	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*denticulata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*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	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Schizoseris*	*sp*	SI	0	0	0	1	1	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	1	0	0	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae		Delesseriaceae	*Unidentifiable*	*Delesseriaceae*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Rhodophyceae			*Unidentifiable*	*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	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	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Ulva*	*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	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*linza*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*ramulosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

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

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

					Berth code	MAIN																	MCG														
					Pile replicate	1						2								1							2										
					Pile position	IN		OUT				IN		OUT				IN			OUT				IN				OUT								
Class	Orders	Family	Genus	Species	*Status	1	2	1	2	3	4	1	2	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4					
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	1	0	0	0	0	0					
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	1	1	1	0	0	1	0					
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*vexillum*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0					
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum*	*notti*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0					
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium*	*phortax*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0					
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes*	*leachii*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	0	1	0	0					
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula*	*mortenseni*	N	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0					
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*subuculata*	N	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0					
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus*	*australis*	N	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0					
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura*	*cancellata*	N	0	0	0	1	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	1	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*	*rugata*	N	0	1	0	0	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	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	1	0	1	1	1					
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*nisiotus*	N	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	1	0					
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa*	*bicornuta*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0					
Ascidiacea	Stolidobranchia	Styelidae	*Styela*	*plicata*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Bivalvia	Myoida	Hiatellidae	*Hiatella*	*arctica*	N	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0					
Bivalvia	Mytiloida	Mytilidae	*Perna*	*canaliculus*	N	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	1	0					
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus*	*pulex*	N	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0					
Bivalvia	Mytiloida	Mytilidae	*Modiolarca*	*impacta*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0					
Bivalvia	Mytiloida	Mytilidae	*Mytilus*	*galloprovincialis*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0					
Bivalvia	Ostreoida	Anomiidae	*Pododesmus*	*zelandicus*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Bivalvia	Ostreoida	Ostreidae	*Crassostrea*	*gigas*	A	0	0	0	0	1	0	1	1	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0					
Bivalvia	Ostreoida	Ostreidae	*Ostrea*	*chilensis*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0					
Calcarea	Leucosolenida	Sycettidae	*Sycon*	*pedicellatum*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0					
Cladophorophyceae	Cladophorales	Cladophoraceae	*Cladophora*	*sp.*	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0					
Crustacea	Anomura	Paguidae	*Pagurus*	*traversi*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0					
Crustacea	Anomura	Paguridae	*Lophopagurus (L.)*	*thompsoni*	N	0	0	0	0	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	1	1	1	1	0	0	0	0	0	1	1	0	1	1	0	0	1	0	0	1	1	1	0	0					
Crustacea	Anomura	Porcellanidae	*Petrolisthes*	*novaezelandiae*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Crustacea	Brachyura	Grapsidae	*Plagusia*	*chabrus*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0					
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*innominatus*	N	0	0	0	0	1	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	*Halimena*	*aoteoroa*	N	0	0	0	0	1	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	*Neohymenicus*	*pubescens*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0					
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*whitei*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Crustacea	Brachyura	Pinnotheridae	*Pinnotheres*	*novaezelandiae*	N	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0					
Crustacea	Brachyura	Xanthidae	*Pilumnus*	*lumpinus*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0					
Crustacea	Thoracica	Balanidae	*Austrominius*	*modestus*	N	1	1	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0					
Demospongiae	Halichondrida	Halichondriidae	*Halichondria*	*n. sp. 5 (fingery 340-400)*	C2	0	0	0	0	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	*Hymeniacidon*	*perleve*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0					
Demospongiae	Haplosclerida	Chalinidae	*Haliclona*	*cf. punctata*	N	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	0	0	0					
Demospongiae	Haplosclerida	Chalinidae	*Haliclona*	*glabra*	N	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
Demospongiae	Haplosclerida	Chalinidae	*Haliclona*	*n. sp. 7 (fine lacey 240)*	C2	0	0	0	0	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	1	0	0	0	0	0	0	0	0					
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia)*	*tasmani*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0					
Demospongiae	Poecilosclerida	Tedaniidae	*Tedania*	*battershilli*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1					

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

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

					Berth code	MAIN												MCG														
					Pile replicate	1						2						1							2							
					Pile position	IN		OUT				IN		OUT				IN			OUT				IN				OUT			
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	1	0	0	0
Gastropoda	Neogastropoda	Buccinidae	*Buccinulum*	*vittatum*	N	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Doriopsis*	*flabellifera*	N	0	0	0	0	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	1	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*n. sp. [whitten]*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*plurispinosa*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Celleporidae	*Galeopsis*	*porcellanicus*	N	0	0	0	0	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	Chaperiidae	*Chaperiopsis*	*cervicornis*	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula*	*pallasiana*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Electridae	*Conopeum*	*seurati*	A	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Gymnolaemata	Cheilostomata	Electridae	*Electra*	*angulata*	A	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella*	*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	0	0	0	0
Gymnolaemata	Cheilostomata	Lepraliellidae	*Celleporaria*	*nodulosa*	A	0	0	0	0	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	0	0	0	0
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia*	*ambigua*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora*	*subtorquata*	A	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Gymnolaemata	Ctenostomata	Nolellidae	*Anguinella*	*palmata*	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Hydrozoa	Hydroida	Bougainvilliidae	*Bougainvillia*	*?muscus*	SI	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Campanulariidae	*Clytia*	*hemisphaerica*	C1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Lafoeidae	*Hebellopsis*	*scandens*	N	0	0	0	0	0	1	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	1	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	*Parascyphus*	*simplex*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Syntheciidae	*Synthecium*	*elegans*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Tubulariidae	*Ectopleura*	*sp. indeterminate*	SI	0	0	0	0	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	1	1	0	0	0	1
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe*	*trailli*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0	0	0	0
Malacostraca	Decapoda		*Shrimp*	*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	0	0	0	0
Malacostraca	Isopoda	Cirolanidae	*Natatolana*	*rossi*	N	0	0	0	0	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	*?Cilicaea*	*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	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	1	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	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*Perinereis-A*	SI	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereididae*	*indet*	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*falcaria*	N	0	0	0	0	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	*Perinereis*	*amblyodonta*	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Perinereis*	*camiguinoides*	N	0	0	0	0	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*	*pseudocamiguina*	N	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	*Nereis*	*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	0	0	0	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia*	*microphylla*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus*	*polychromus*	N	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidastheniella*	*comma*	N	0	0	0	0	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	Polynoidae	*Lepidonotinae*	*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	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Demonax*	*aberrans*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Sabellida	Sabellidae	*Megalomma*	*Megalomma-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Sabellida	Serpulidae	*Galeolaria*	*hystrix*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*Indet*	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Polydora*	*hoplura*	A	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*acus*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*chilensis*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Spionida	Spionidae	*Boccardia*	*lamellata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Polychaeta	Terebellida	Cirratulidae	*Timarete*	*anchylochaetus*	N	1	0	0	0	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	*Protocirrineris*	*nuchalis*	N	0	0	0	0	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	MAIN												MCG														
					Pile replicate	1						2						1							2							
					Pile position	IN		OUT				IN		OUT				IN			OUT				IN				OUT			
Polychaeta	Terebellida	Flabelligeridae	*Flabelligera*	*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	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Streblosoma*	*toddae*	N	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0
Polychaeta	Terebellida	Terebellidae	*Pseudopista*	*rostrata*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Lanassa*	*Lanassa-A*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	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	0	0	0	0
Polychaeta	Terebellida	Terebellidae	*Pista*	*pegma*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	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	1	0	0	0	0	0	1	0	1	1	0	0
Rhodophyceae	Bangiales	Bangiaceae	*Bangia*	*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	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Antithamnionella*	*adnata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Callithamnion*	*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	0	0	0	0
Rhodophyceae	Ceramiales	Ceramiaceae	*Ceramium*	*sp.*	SI	0	0	0	0	1	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*	*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	0	0	0	0
Rhodophyceae	Ceramiales	Dasyaceae	*Dasya*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*denticulata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*sp.*	SI	0	0	0	0	1	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	*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	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	0	1	0	0
Rhodophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia*	*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	0	0	0	0
Rhodophyceae		Delesseriaceae	*Unidentifiable*	*Delesseriaceae*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyceae			*Unidentifiable*	*red*	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha*	*linza*	N	0	0	0	0	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	*Enteromorpha*	*ramulosa*	N	0	0	0	0	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 5b. Results from the benthic grab samples.

					Berth code	MAIN	
Class	Order	Family	Genus	Species	*Status	1	2
Bivalvia	Ostreoida	Ostreidae	*Crassostrea*	*gigas*	A	1	0
Crustacea	Anomura	Paguidae	*Pagurus*	*traversi*	N	0	1
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	1	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella*	*tenuis*	N	1	0
Gymnolaemata	Cheilostomata	Antroporidae	*Akatopora*	*circumsaepta*	N	0	1
Gymnolaemata	Cheilostomata	Buffonellodidae	*Aimulosia*	*marsupium*	N	0	1
Gymnolaemata	Cheilostomata	Electridae	*Electra*	*angulata*	A	0	1
Gymnolaemata	Cheilostomata	Hippoporidridae	*Odontoporella*	*adpressa*	N	0	1
Gymnolaemata	Cheilostomata	Microporellidae	*Fenestrulina*	*thyreophora*	N	0	1
Gymnolaemata	Cheilostomata	Microporellidae	*Microporella*	*speculum*	N	0	1
Gymnolaemata	Cheilostomata	Schizoporellidae	*Schizoporella*	*errata*	A	0	1
Polychaeta	Phyllodocida	Glyceridae	*Glycera*	*lamelliformis*	N	0	1
Polychaeta	Sabellida	Oweniidae	*Owenia*	*petersenae*	N	0	1
Polychaeta	Sabellida	Sabellidae	*Euchone*	*pallida*	N	0	1
Polychaeta	Terebellida	Ampharetidae	*Amphicteis*	*Amphicteis-A*	SI	0	1

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

Appendix 5c. Results from the benthic sled samples.

Class	Order	Family	Genus	Species	Berth code *Status	K 1	K 2	LAY-UP 1	LAY-UP 2	MAIN 1	MAIN 2	MCG 1	MCG 2
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	1	1	0	0
Ascidiacea	Aplousobranchia	Cionidae	*Ciona*	*intestinalis*	A	0	0	1	0	0	0	0	0
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum*	*sp.*	SI	0	1	0	1	0	0	0	0
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	0	0	1	0	0	0	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	0	1	1	0	0	0	1
Bivalvia	Nuculoida	Nuculidae	*Nucula*	*hartvigiana*	N	0	0	1	1	0	0	0	1
Bivalvia	Veneroida	Psammobiidae	*Soletellina*	*siliquens*	N	0	0	0	0	0	0	1	1
Bivalvia	Veneroida	Semelidae	*Theora*	*lubrica*	A	0	1	0	0	0	0	1	0
Bivalvia	Veneroida	Semelidae	*Leptomya*	*retiaria*	N	0	0	0	0	0	1	0	0
Bivalvia	Veneroida	Veneridae	*Dosinia*	*lambata*	N	0	0	0	1	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Ruditapes*	*largillierti*	N	0	0	1	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	*Tawera*	*spissa*	N	0	0	1	0	0	0	0	0
Crustacea	Anomura	Paguidae	*Pagurus*	*traversi*	N	0	0	1	0	1	1	0	0
Crustacea	Anomura	Paguridae	*Lophopagurus (L.)*	*thompsoni*	N	0	0	1	1	0	1	0	0
Crustacea	Brachyura	Hymenosomatidae	*Halicarcinus*	*varius*	N	1	0	1	0	1	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	1	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*ursus*	N	0	0	0	0	1	0	0	0
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	1	1	0	1	0	0	1	1
Crustacea	Caridea	Crangonidae	*Pontophilus*	*hamiltoni*	N	0	0	1	0	0	1	0	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	1	1	0	0
Demospongiae	Halichondrida	Halichondriidae	*Hymeniacidon*	*perleve*	C1	0	0	0	0	0	1	0	0
Gastropoda	Cephalaspidea	Philinidae	*Philine*	*auriformis*	N	1	0	0	0	0	0	0	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella*	*tenuis*	N	0	0	1	0	0	0	0	0
Gastropoda	Littorinimorpha	Turritellidae	*Maoricolpus*	*roseus*	N	0	0	0	0	0	1	0	0
Gastropoda	Neogastropoda	Muricidae	*Xymene*	*plebeius*	N	1	0	1	1	0	1	0	1
Gastropoda	Neogastropoda	Muricidae	*Xymene*	*pusillus*	N	0	0	1	0	0	0	0	0
Gastropoda	Notaspidea	Pleurobranchidae	*Pleurobranchaea*	*maculata*	N	1	0	1	0	0	1	0	0
Gastropoda	Vetigastropoda	Trochidae	*Trochus*	*tiaratus*	N	0	0	1	1	0	0	0	0
Gymnolaemata	Cheilostomata	Antroporidae	*Akatopora*	*circumsaepta*	N	0	0	1	0	0	1	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*n. sp. [whitten]*	N	0	0	0	0	1	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania*	*plurispinosa*	N	0	0	0	0	1	0	0	0
Gymnolaemata	Cheilostomata	Celleporidae	*Celleporina*	*sinuata*	N	0	0	1	0	0	1	0	0
Gymnolaemata	Cheilostomata	Hippoporidridae	*Odontoporella*	*adpressa*	N	0	0	0	0	0	1	0	0
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella*	*tongima*	N	0	0	1	0	0	0	0	0
Gymnolaemata	Cheilostomata	Romancheinidae	*Exochella*	*conjuncta*	N	0	0	1	0	0	0	0	0
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia*	*ambigua*	C1	0	0	1	0	0	0	0	0
Gymnolaemata	Cheilostomata	Smittinidae	*Smittina*	*palisada*	N	0	0	1	0	0	0	0	0
Gymnolaemata	Cheilostomata	Smittinidae	*Smittina*	*torques*	N	0	0	1	0	0	0	0	0
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus*	*mollis*	N	0	0	1	0	0	0	0	0
Hydrozoa	Hydroida	Campanulinidae	*Lafoeina*	*amirantensis*	A	0	0	0	0	1	0	0	0
Hydrozoa	Hydroida	Lafoeidae	*Filellum*	*sp. indeterminate*	SI	0	0	0	0	1	0	0	0
Hydrozoa	Hydroida	Lafoeidae	*Hebellopsis*	*scandens*	N	0	0	0	0	0	1	0	0
Hydrozoa	Hydroida	Sertulariidae	*Parascyphus*	*simplex*	N	0	0	0	0	1	0	0	0
Hydrozoa	Hydroida	Syntheciidae	*Synthecium*	*elegans*	N	0	0	0	0	1	0	0	0
Malacostraca	Decapoda		*Shrimp*	*sp.*	SI	0	0	0	0	0	1	0	0
Malacostraca	Mysida	Mysidae	*Heteromysis or Mysidetes*	*sp.*	SI	0	0	1	0	0	0	0	0
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus*	*verrilli*	N	1	1	0	1	0	0	0	1
Polychaeta	Phyllodocida	Sigalionidae	*Labiosthenolepis*	*laevis*	N	1	0	0	0	0	0	1	1
Rhodophyceae	Ceramiales	Dasyaceae	*Heterosiphonia*	*squarrosa*	N	0	0	1	0	0	0	0	0
Rhodophyceae	Ceramiales	Deleseriaceae	*Myriogramme*	*denticulata*	N	0	0	1	0	1	1	0	0
Rhodophyceae	Ceramiales	Rhodomelaceae	*Cladhymenia*	*oblongifolia*	N	0	0	1	0	0	0	0	0
Rhodophyceae	Corallinales	Corallinaceae	*Non-geniculate*	*coralline*	SI	0	0	1	0	0	0	0	0
Rhodophyceae			*Unidentifiable*	*red*	SI	0	0	1	0	0	0	0	0

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

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

					Berth code	site 1		site 2		site 3		site 4	
Class	Order	Family	Genus	Species	*Status	1	2	1	2	1	2	1	2
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium*	*sp.*	N	1	0	0	0	0	0	1	0
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium*	*conicum*	N	0	0	0	0	1	0	0	0
Dinophyceae	Peridiniales	Peridiniaceae	*Protoperidinium conicum*	*cf. conicoides*	N	0	0	0	0	1	0	0	0
Dinophyceae	Peridiniales	Peridiniaceae	*Scrippsiella*	*trochoidea*	N	1	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 5e. Results from the fish trap samples.

				Berth code	K				LAY-UP				MAIN				MCG			
				Line No.	1		2		1		2		1		2		1		2	
Class	Order	Family	Genus	Species	*Status	1	2	3	4	1	2	1	2	1	2	1	2	1	2	1	2
Actinopterygii	Anguilliformes	Anguillidae	*Anguilla*	*dieffenbachii*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Actinopterygii	Gadiformes	Moridae	*Pseudophycis*	*bachus*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	0	0	0	0	1	1	1	1	1	0	1	0	0	0	0	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina*	*capito*	N	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Actinopterygii	Pleuronectiformes	Pleuronectidae	*Peltorhamphus*	*latus*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella*	*eumyota*	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	0	0	1	1	0	1	1	0	0	0	0	1	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Crustacea	Brachyura	Ocypodidae	*Macrophthalmus*	*hirtipes*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Crustacea	Caridea	Palemonidae	*Palaemon*	*affinis*	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus*	*mollis*	N	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Rhodophyceae	Acrochaetiales	Acrochaetiaceae	*Audouinella*	*sp.*	SI	0	0	0	0	0	0	0	0	0	0	1	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

*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		K				LAY-UP				MAIN				MCG			
				Line no.								2		1		2		1		2	
Class	Order	Family	Genus	Species	*Status	1	2	3	4	1	2	1	2	1	2	1	2	1	2	1	2
Actinopterygii	Anguilliformes	Anguillidae	*Anguilla*	*dieffenbachii*	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	1	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	0	0	0	0	1	0	1	1	0	1	1	0	0	0	0
Crustacea	Anomura	Paguidae	*Pagurus*	*traversi*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Cancridae	*Cancer*	*novaezelandiae*	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
Gastropoda	Notaspidea	Pleurobranchidae	*Pleurobranchaea*	*maculata*	N	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Doriopsis*	*flabellifera*	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

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

Appendix 5g. Results from the starfish trap samples.

					Site code	K				LAY-UP				MAIN				MCG			
					Line No.							2		1		2		1		2	
Class	Order	Family	Genus	Species	*Status	1	2	3	4	1	2	1	2	1	2	1	2	1	2	1	2
Actinopterygii	Gasterosteiformes	Syngnathidae	*Hippocampus*	*abdominalis*	N	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Actinopterygii	Perciformes	Labridae	*Notolabrus*	*celidotus*	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias*	*muricata*	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Asteroidea	Valvatida	Asterinidae	*Patiriella*	*regularis*	N	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0
Bivalvia	Myoida	Hiatellidae	*Hiatella*	*arctica*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Majidae	*Notomithrax*	*minor*	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crustacea	Brachyura	Portunidae	*Nectocarcinus*	*antarcticus*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Gastropoda	Nudibranchia	Dorididae	*Jorunna*	*sp.*	SI	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Gastropoda	Vetigastropoda	Turbinidae	*Turbo*	*smaragdus*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus*	*mollis*	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0

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

Appendix 5h. Results from the shrimp trap samples.

					Berth code	K				LAY-UP				MAIN				MCG			
					Line No.							2		1						2	
Class	Order	Family	Genus	Species	*Status	1	2	3	4	1	2	1	2	1	2	3	4	1	2	1	2
Malacostraca	Isopoda	Cirolanidae	*Natatolana*	*rossi*	N	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0

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

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).