TECHNICAL PAPER

BIOSECURITY NEW ZEALAND

Port of Nelson

Second baseline survey for non-indigenous marine species (Research Project ZBS2000-04)

MAF Biosecurity New Zealand Technical Paper No: 2008/05

Prepared for MAFBNZ Post Border Directorate
by Graeme Inglis, Nick Gust, Isla Fitridge, Don Morrisey, Oliver Floerl, Chris Woods, Marie Kospartov, Barbara Hayden, Graham Fenwick

NIWA
Taihoro Nukurangi

ISBN No: 978-0-478-32139-5 (Print)
ISBN No: 978-0-478-32132-6 (Online)

ISSN No: 1176-838X (Print)
ISSN No: 1177-6412 (Online)

June 2006

Ministry of Agriculture and Forestry
Te Manatū Ahuwhenua, Ngāherehere

Disclaimer

While every effort has been made to ensure the information in this publication is accurate, the Ministry of Agriculture and Forestry does not accept any responsibility or liability for error or fact omission, interpretation or opinion which may be present, nor for the consequences of any decisions based on this information.

Any view or opinions expressed do not necessarily represent the official view of the Ministry of Agriculture and Forestry.

The information in this report and any accompanying documentation is accurate to the best of the knowledge and belief of the National Institute of Water & Atmospheric Research Ltd (NIWA) acting on behalf of the Ministry of Agriculture and Forestry. While NIWA has exercised all reasonable skill and care in preparation of information in this report, neither NIWA nor the Ministry of Agriculture and Forestry accept any liability in contract, tort or otherwise for any loss, damage, injury, or expense, whether direct, indirect or consequential, arising out of the provision of information in this report.

Requests for further copies should be directed to:

Biosecurity Surveillance Group
Post-border Directorate

MAF Biosecurity New Zealand
Pastoral House,
25 The Terrace
P O Box 2526
WELLINGTON

Tel: 04 894 4100
Fax: 04 894 4227

This publication is also available on the MAF Biosecurity New Zealand website at
http://www.biosecurity.govt.nz/about-us/our-publications/technical-papers

Contents **Page**

Executive summary

- This report describes the results of a repeat port baseline survey of the Port of Nelson undertaken in December 2004. The survey provides a second inventory of native, non indigenous and cryptogenic marine species within the port and compares the biota with the results of an earlier port baseline survey of the Port of Nelson undertaken in January 2002.

- 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.

- To allow a direct comparison between the initial baseline survey and the resurvey of the Port of Nelson, the survey used the same methodologies and sampled the same sites used in the initial baseline survey. To improve the description of the biota of the port, some additional survey sites were added during the repeat survey.

- Sampling methods used in both surveys were based on protocols developed by the Australian Centre for Research on Introduced Marine Pests (CRIMP) for baseline surveys of non-indigenous species (NIS) in ports. Modifications were made to the CRIMP protocols for use in New Zealand port conditions. These are described in more detail in the body of the report.

- A wide range of sampling techniques was used to collect marine organisms from 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.

- Sampling effort was distributed in the Port of Nelson according to priorities identified in the CRIMP protocols, which are designed to maximise the chances of detecting non-indigenous species. Most effort was 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 193 species or higher taxa were identified in the first survey of the Port of Nelson in January 2002. They consisted of 130 native species, 13 non-indigenous species, 20 cryptogenic species (those whose geographic origins are uncertain) and 30 species indeterminata (taxa for which there is insufficient taxonomic or systematic information available to allow identification to species level).

- During the repeat survey, 257 species or higher taxa were recorded, including 176 native species, 13 non-indigenous species, 32 cryptogenic species and 36 species indeterminata. Many species were common to both surveys. Around 48% of the native species, 54% of non-indigenous species, and 38% of cryptogenic species recorded during the repeat survey were also found in the earlier survey.

- The 13 non-indigenous organisms found in the repeat survey of the Port of Nelson included representatives of 5 taxanomic groups. The non-indigenous species detected were: (Annelida) *Hydroides elegans*; (Bryozoa) *Bugula flabellata, Cryptosula pallasiana, Electra tenella, Celleporaria nodulosa, Watersipora subtorquata*; (Hydrozoa) *Lafoeina amirantensis, Filellum serpens?, Synthecium campylocarpum, Synthecium subventricosum*; (Mollusca) *Crassostrea gigas, Theora lubrica* and (Macroalgae) *Undaria pinnatifida*. Six of these species - *Hydroides elegans, Electra tenella, Filellum serpens?, Synthecium campylocarpum, Synthecium subventricosum* and *Undaria pinnatifida* - were not recorded in the earlier baseline survey of the Port of Nelson. In addition, 6 non-indigenous species that were present in the first survey – *Polydora hoplura* (Annelida), *Conopeum seurati, Electra angulata, Schizoporella errata, Anguinella palmata* (Bryozoa) and *Ciona intestinalis* (Urochordata) – were not found during the repeat survey.

- Ten species recorded in the repeat survey are new records for New Zealand waters. Two of these were newly discovered non-indigenous species (a bryozoan, *Celleporaria nodulosa*, and a hydroid, *Lafoeina amirantensis*). The others are sponges that do not correspond with existing descriptions from New Zealand or overseas and may be new to science.

- 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.

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

- Approximately 68 % (13 of 19 species) of NIS in the Port of Nelson are likely to have been introduced in hull fouling assemblages, 5 % (one species) via ballast water and 22 % (four species) could have been introduced by either ballast water or hull fouling vectors. One species (5%) is suspected to have arrived on drift plastic.

- 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 (see 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; Carlton 1999; AMOG Consulting 2002; Coutts et al. 2003). Transport by shipping has 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; Leppakoski et al. 2002).

Like many other coastal nations, New Zealand is just beginning to document the numbers, identity, distribution and impacts of non-indigenous species in its coastal waters. A review of existing records suggested that by 1998, at least 148 marine species had been recorded from New Zealand, with around 90 % of these establishing permanent populations (Cranfield et al. 1998). Since that review, an additional 41 non-indigenous species or suspected non-indigenous species (i.e. Cryptogenic type 1 – see "Definitions of species categories", in methods section) have been recorded from New Zealand waters. 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 (NIS) in New Zealand's major shipping ports and other high risk points of entry for vessels entering New Zealand from overseas. 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 (Figure 1). Marine biosecurity functions are now vested in MAF Biosecurity New Zealand.

The New Zealand baseline port surveys were based on protocols developed in Australia by the CSIRO Centre for Research on Introduced Marine Pests (CRIMP) for port surveys of introduced marine species (Hewitt and Martin 1996; Hewitt and Martin 2001). They are best described as "*generalised pest surveys*", as they are broad-based investigations whose primary purpose is to identify and inventory the range of non-indigenous species present in a port (Wittenberg and Cock 2001; Inglis et al. 2003).

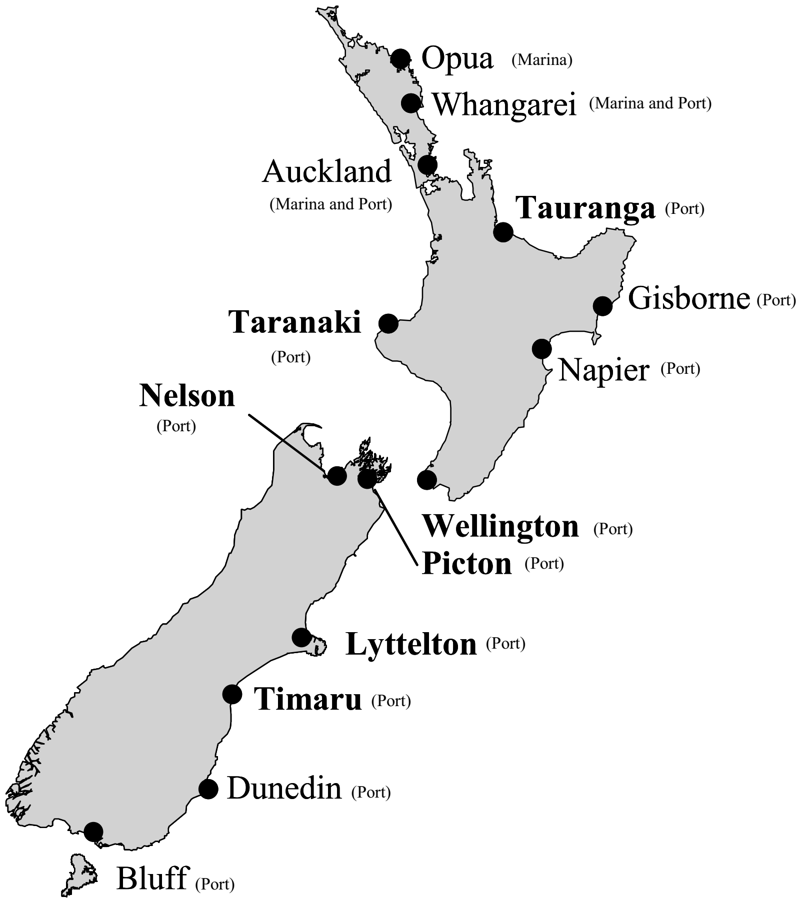

Figure 1: Commercial shipping ports in New Zealand where baseline non-indigenous species surveys have been conducted. Group 1 ports surveyed in the summer of 2001/2002 and re-surveyed in the summer of 2004/2005 are indicated in bold and Group 2 ports surveyed in the summer of 2002/2003 are indicated in plain font. Marinas were also surveyed for NIS in Auckland, Opua and Whangarei in 2002/2003.

The surveys have two stated objectives:

i. To provide a baseline assessment of native, non-indigenous and cryptogenic[1] 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 (Hewitt and Martin 2001).

Initial surveys were completed in New Zealand's 13 major shipping ports and 3 marinas of first entry during the summers of 2001/2002 and 2002/2003 (Figure 1). These surveys recorded more than 1300 species; 124 of which were known or suspected to have been introduced to New Zealand. At least 18 of the non-indigenous species were recorded for the first time in New Zealand in the port baseline surveys. In addition, 106 species that are potentially new to science were discovered during the surveys and await more formal taxonomic description.

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

Worldwide, port surveys based on the CRIMP protocols have been completed in at least 37 Australian ports, at demonstration sites in China, Brasil, the Ukraine, Iran, South Africa, India, Kenya, and the Seychelles Islands, at six sites in the United Kingdom, and are underway at 10 sites in the Mediterranean (Raaymakers 2003). Despite their wide use, there have been few evaluations of the survey methods or survey design to determine their sensitivity for individual unwanted species or to determine the completeness of biodiversity inventories based upon them. Inglis et al. (2003) used a range of biodiversity metrics to evaluate the adequacy of sample effort and distribution during the initial New Zealand survey of the Port of Wellington and compared the results with those from seven Australian port baseline surveys. In general, they concluded that the surveys provided an adequate description of the richness of the assemblage of non-indigenous species present in the ports, but that the total richness of native and cryptogenic species present in the survey area was likely to be under estimated. The authors made a number of recommendations for future surveys that included increasing the sample effort for benthic infauna, maximising dispersion of samples throughout the survey area (rather than allocation based on CRIMP priorities) and modification of survey methods or design components which had high complementarity in species composition. Both Inglis et al. (2003) and a more recent study by Hayes et al. (2005) on the sensitivity of the survey methods concluded that generalised port surveys, such as these, are likely to under-sample species that are very rare or which have restricted distributions within the port environments and, as such, should not be considered surveys for early detection of unwanted species.

Instead, the port surveys are intended to provide a baseline for monitoring the rate of new incursions by non-indigenous marine species in port environments, and to assist international risk profiling of problem species through the sharing of information with other shipping nations (Hewitt and Martin 2001). Despite the large number of ports that have been surveyed using modifications of the CRIMP protocols, no ports have been completely re-surveyed. This means that there has been no empirical determination of the background rate of new arrivals or of the surveys' ability to detect temporal changes in the composition of native and non-indigenous assemblages.

This report describes the results of a second, repeat survey of the Port of Nelson undertaken in December 2004, approximately 3 years after the initial baseline survey. In the manner of the first survey report (Inglis et al. 2006a), we provide an inventory of species recorded during the survey and their biogeographic status as either native, introduced ("non-indigenous") or cryptogenic. Organisms that could not be identified to species level are also listed, as species indeterminata (see "Definitions of species categories", in methods section).

The report is intended as a stand-alone record of the re-survey and, as such, we reiterate background information on the Port of Nelson, including its history, physical environment, shipping and trading patterns, development and maintenance activities, and biological environment. Where available, this information is updated with new data that have become available in the time between the two surveys.

DESCRIPTION OF THE PORT OF NELSON

General features

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.; Figure 2). 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.

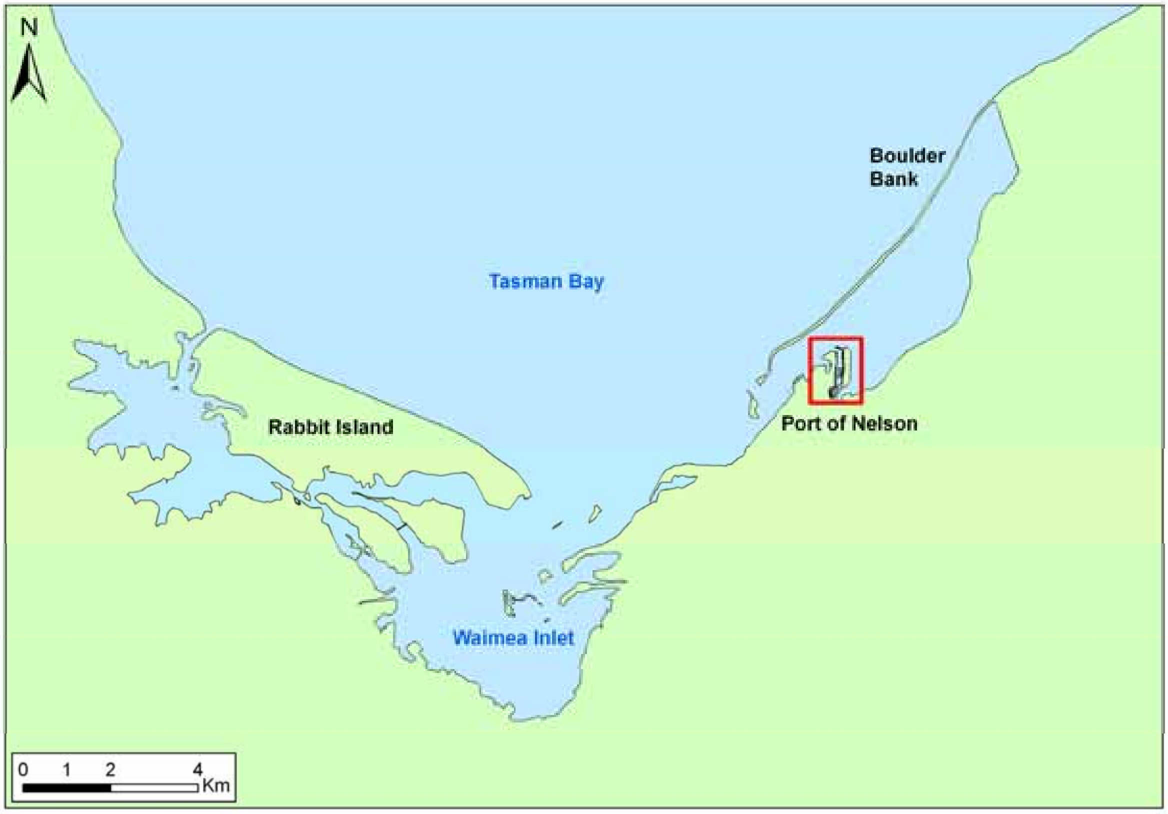

Figure 2: Tasman Bay and Port Nelson map

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).

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 Ltd. 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 Ltd. 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).

Port operation, development and maintenance activities

The Port of Nelson (Figure 3) 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). In 2000, there were 79 registered fishing vessels in Port Nelson (Sinner et al. 2000). 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. The port has MAF inspection and quarantine, and customs clearance facilities.

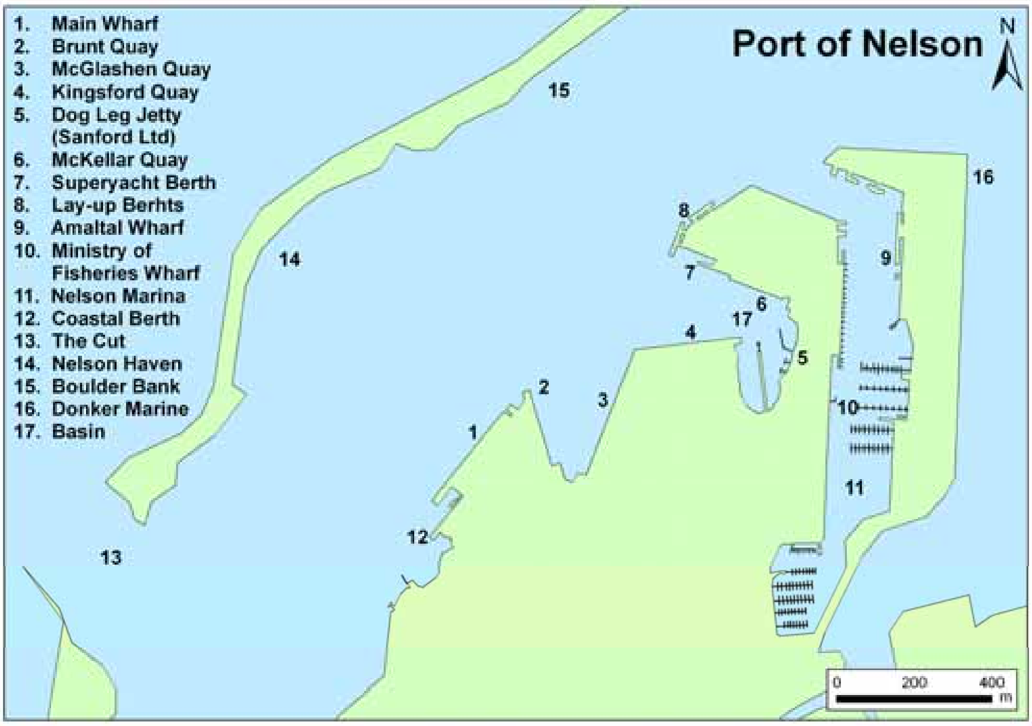

Figure 3: **Port of Nelson map**

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.govt.nz). Additional berths have been constructed over the past few years and it is expected that the marina will reach full capacity in two to three years. The port also contains a superyacht berth where yachts larger than 20 m are able to moor.

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).

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 and Nelson Haven sand banks, with approximately 50,000 m^3 of spoil removed per annum (Port Nelson Ltd 2005). The spoil is taken out into southern Tasman Bay where it is deposited in consented spoil grounds approximately 3.5 km west of the harbour entrance (Port Nelson Ltd 2005). In addition to maintenance dredging, capital dredging of 50,000 m^3 was conducted in 2002-2003 to increase the approach channel and inner harbour depth by 300 mm (M. McGuire, Port Nelson Ltd., pers. comm.). The Tasman Bay spoil grounds also received the dredge spoil originating from additional berth constructions at the Nelson marina (in 2005, 10,000 m^3 from the marina was deposited in these spoil grounds; D. Carter, Port Nelson Ltd., pers. comm.).

Capital works since the port baseline survey in January 2002 have included a squaring-off the west end of Brunt Quay wharf, completed in June 2005 (D. Carter, pers. comm.). The new section has a concrete deck and steel piles (M. McGuire, pers. comm.). Each year approximately five to ten piles are replaced or encased in concrete in general maintenance works, mostly on Main Wharf North and some on McGlashen Quay (D. Carter, pers. comm.).

In terms of future development, Port Nelson Ltd is proposing a small reclamation behind Main Wharf South (D. Carter, pers. comm.).

Imports and exports

Port Nelson is a net export facility; a higher volume of cargo is loaded than unloaded (Taylor 1998). In 2004, cargo volumes reached a record 2.5 million tonnes, driven by a strong performance from the fruit, forestry and fishing sectors, and this volume increased again in 2005, to over 2.6 million tonnes (Port Nelson Ltd 2005). Increased containerisation of export apples and timber products resulted in a record container throughput of 51,128 TEU[2] in 2004. This was exceeded in 2005, reaching 57,144 TEU (Port Nelson Ltd 2005).

The volumes and value of goods imported and exported through the Port of Nelson are summarised below. These data describe only cargo being loaded for, or unloaded from, overseas ports and do not include domestic cargo (Statistics New Zealand 2006b). Also available from Statistics New Zealand (2006a) was a breakdown of cargo value by country of orgin or destination and by commodity for each calendar year; we analysed the data for the period 2002 to 2005 inclusive (ie. the period between the first and second baseline surveys).

Imports

The weight of cargo unloaded at the Port of Nelson has increased each year since the 2002 initial baseline survey, with 139,461 tonnes gross weight being unloaded in the year ended June 2005 (Statistics New Zealand 2006b). This represents an increase in weight of almost 43% compared to the year ending June 2002 (Table 2). The value of cargo unloaded dropped slightly in 2003 and 2004, but returned to its 2002 level of $222 million in 2005. Overseas cargo unloaded at the Port of Nelson accounted for less than 1% both by weight and by value of the total overseas cargo unloaded at New Zealand’s seaports (Table 2).

[2] TEU = twenty foot equivalent unit. This is a standard size of container and a common measure of capacity in the container logistics business.

The Port of Nelson imported cargo in 92 different commodity categories between 2002 and 2005 inclusive (Statistics New Zealand 2006a). The dominant commodities by value imported at the Port of Nelson during this time were vehicles (52 %), boilers and machinery (6 %), animal-originated products not elsewhere specified (5 %), fertilisers (5 %), and wood and wooden articles (4 %; Figure 4). Of these five commodities, vehicles ranked first each year, and both fertilisers and boilers/machinery ranked in the top five each year. Animal-originated products ranked in the top 5 every year except 2005 where it was replaced by fish and aquatic invertebrates, and wooden articles ranked in the top 5 only in 2005.

The Port of Nelson received imports from 75 countries of initial origin[3] between 2002 and 2005 inclusive (Statistics New Zealand 2006a). During this time, the Port of Nelson imported most of its overseas cargo by value from Japan (45 %), Australia (16 %), Thailand (7 %), China (4 %) and France (4 %; Figure 5). Japan and Australia were ranked first and second, respectively, each year. Thailand ranked third every year except 2005, where China was third and Thailand was fourth. France, Germany and the United States also ranked in the top five in some years (Statistics New Zealand 2006a).

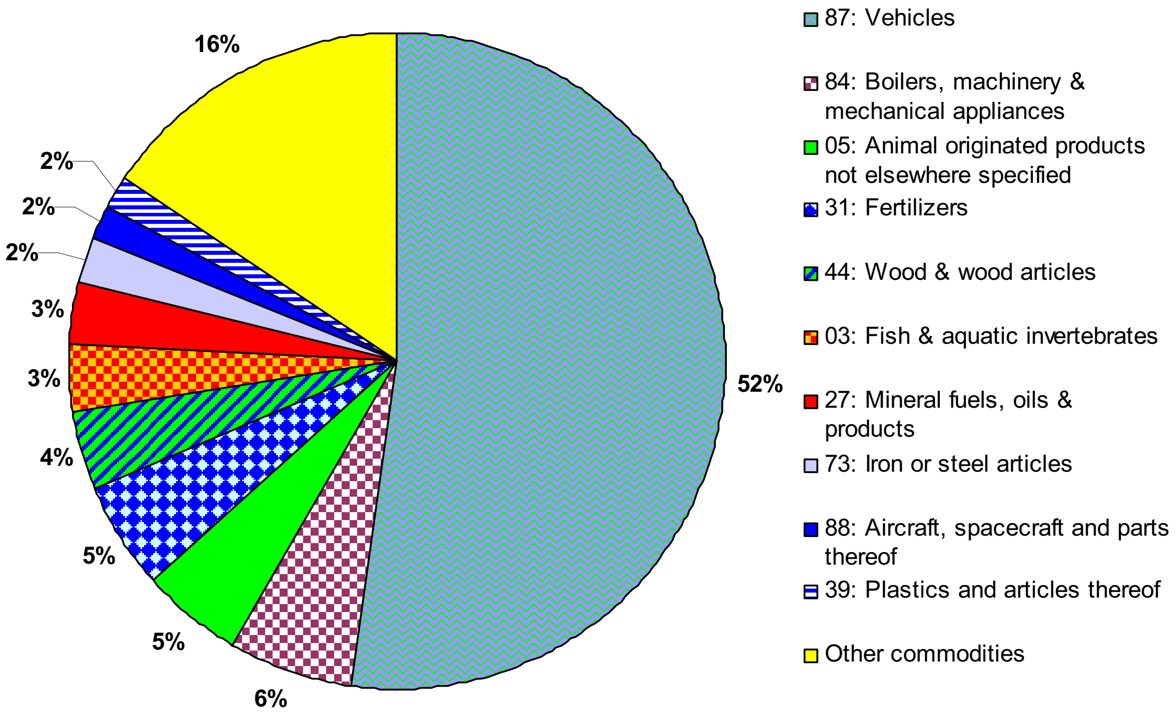

Figure 4: Top 10 commodities by value unloaded at the Port of Nelson summed over the period January 2002 to December 2005 inclusive (data sourced from Statistics New Zealand 2006a). Commodity category descriptions have been summarised for brevity; category numbers are provided in the legend and full descriptions are available at Statistics New Zealand (2006a).

[3] The country of initial origin is not necessarily the country that the ship carrying the commodity was in immediately before arriving at the Port of Nelson; for ship movements see the section on "Shipping movements and ballast discharge patterns"

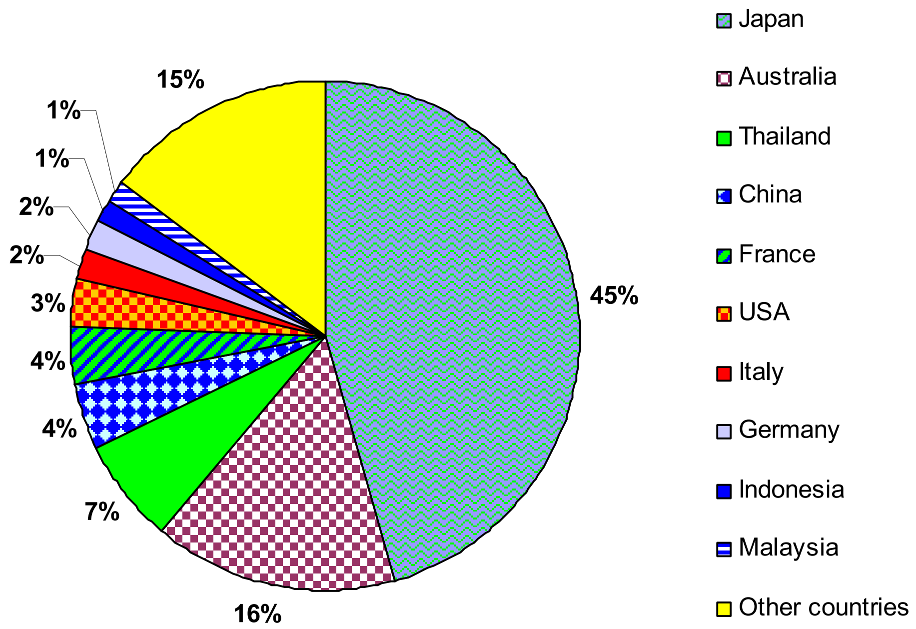

Figure 5: Top 10 countries of initial origin that cargo was unloaded from at the Port of Nelson. The data are percentages of the total volume of cargo unloaded in the period January 2002 to December 2005 inclusive (data sourced from Statistics New Zealand 2006a).

Exports

In the year ending June 2005, the Port of Nelson loaded 1,187,575 tonnes of cargo for export (Statistics New Zealand 2006b). This represented an increase on 2003 and 2004 figures, but a drop of 3.5 % compared to the year ending June 2002 (Table 3). The value of this cargo has declined by almost 13 % since the year ending June 2002, with a value of $699 million in the year ending June 2005. For the financial years ending June 2002 to 2005, overseas cargo loaded at the Port of Nelson accounted for around 5 % by weight and around 3 % by value of the total overseas cargo loaded at New Zealand's seaports (Table 3).

The Port of Nelson exported cargo in 76 different commodity categories between 2002 and 2005 inclusive (Statistics New Zealand 2006a). The dominant commodity categories (as defined by Statistics New Zealand 2006a) by value loaded at the Port of Nelson for export during this time were wood and wooden articles (31 %), fish and other aquatic invertebrates (30 %) and fruit and nuts (22 %; Figure 6). Fish and wood ranked in the top two each year and fruit ranked third each year (Statistics New Zealand 2006a).

The Port of Nelson loaded cargo for export to 103 countries of final destination[4] between 2002 and 2005 inclusive (Statistics New Zealand 2006a). During this time, the Port of Nelson exported most of its overseas cargo by value to Australia (20 %), Japan (19 %), the USA (10 %), China (9 %) and unknown destinations in the European Union (8 %; Figure 7). Australia ranked first and Japan second in all years except 2002, when their ranks were reversed. The USA and China ranked third or fourth each year except in 2004 when the USA ranked fifth and "Destination unknown – EU" ranked third (Statistics New Zealand 2006a).

[4] The country of final destination is not necessarily the country that the ship carrying the commodity goes to immediately after departing from the Port of Nelson; it is the final destination of the goods. For ship movements see "Shipping movements and ballast discharge patterns"

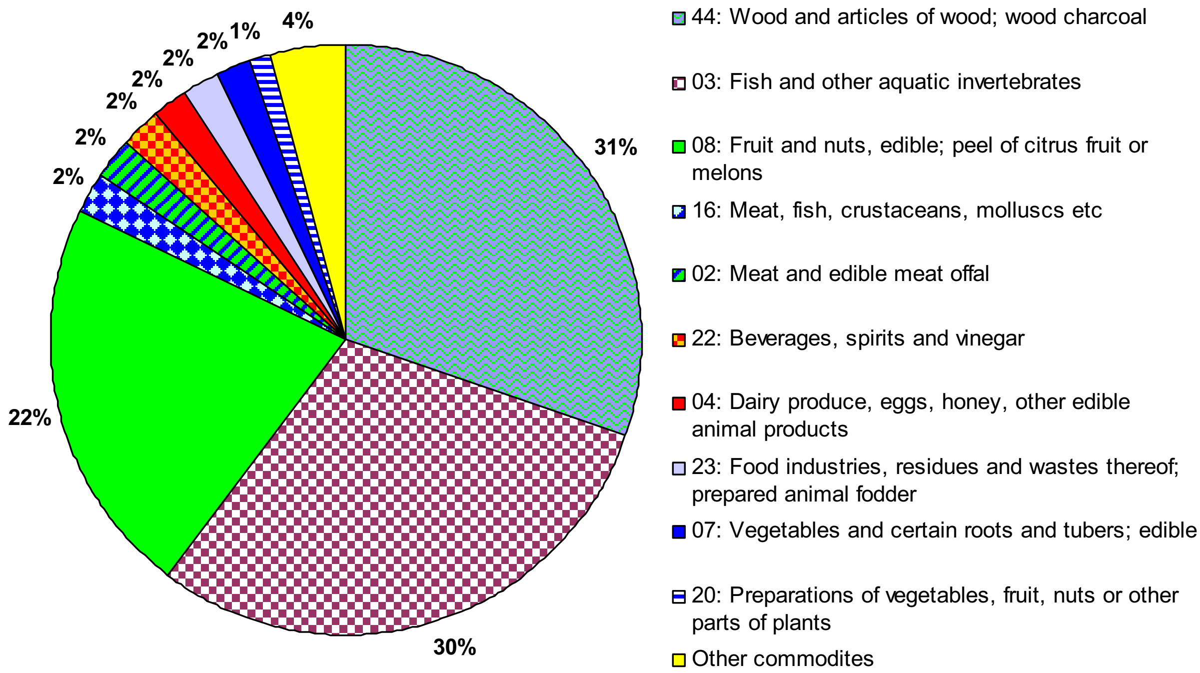

Figure 6: Top 10 commodities by value loaded at the Port of Nelson summed over the period January 2002 to December 2005 inclusive (data sourced from Statistics New Zealand 2006a). Commodity category descriptions have been summarised for brevity; category numbers are provided in the legend and full descriptions are available at Statistics NZ (2006a).

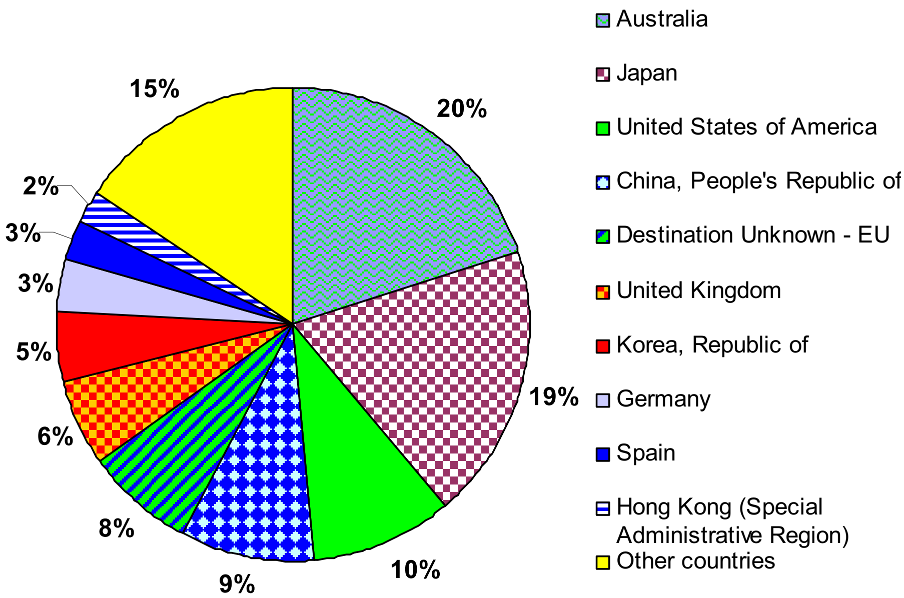

Figure 7: Top 10 countries of final destination that overseas cargo was loaded for at the Port of Nelson summed over the period January 2002 to December 2005 inclusive (data sourced from Statistics New Zealand 2006a).

Shipping movements and ballast discharge patterns

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 m^3 from Japan, 9,335 m^3 from Taiwan, 3,243 m^3 from Australia, and 100,238 m^3 unspecified.

Port Nelson Ltd recorded 1,178 vessel arrivals in the 2005 financial year, slightly lower than the 1,267 arrivals in the 2004 financial year (Port Nelson Ltd 2005). As well as a high volume of domestic shipping traffic, Port Nelson handles vessels from a range of international destinations. Since June 2005, vessels have been required to comply with the Import Health Standard for Ships' Ballast Water from All Countries (www.fish.govt.nz/sustainability/biosecurity). No ballast water is allowed to be discharged without the express permission of an MAF (Ministry of Agriculture and Forestry) inspector. To allow discharge, vessels Masters are responsible for providing the inspector with evidence of either: discharging ballast water at sea (200 nautical miles from the nearest land, and at least 200 m depth); demonstrating ballast water is fresh (2.5 ppt sodium chloride) or having the ballast water treated by a MAF approved treatment system.

To gain a more detailed understanding of international and domestic vessel movements to and from the Port of Nelson between 2002 and 2005 inclusive, we analysed a database of vessel movements generated and updated by Lloyds Marine Intelligence Unit, called 'SeaSearcher.com'. Drawing on real-time information from a network of Lloyd's agents and other sources around the world, the database contains arrival and departure details of all ocean going merchant vessels larger than 99 gross tonnes for all of the ports in the Group 1 and Group 2 surveys. The database does not include movement records for domestic or international ferries plying scheduled routes, small domestic fishing vessels or recreational vessels. Cruise ships, coastal cargo vessels and all other vessels over 99 gross tonnes are included in the database. The database therefore gives a good indication of the movements of international and domestic vessels involved in trade. Definitions of geographical area and vessel type categories are given in Appendix 1.

International vessel movements

Based on an analysis of the LMIU 'SeaSearcher.com' database, there were 311 vessel arrivals to the Port of Nelson from overseas ports between 2002 and 2005 inclusive (Table 4). These came from 28 different countries represented by most regions of the world. The greatest number of overseas arrivals during this period came from the following areas: Australia (75), Japan (70), the northwest Pacific (42), Pacific Islands (29), and the east Asian seas (20; Table 4). The previous ports of call for 12 of the international arrivals were not stated in the database. Vessels arriving from Australia came mostly from ports in Queensland (22 arrivals) and New South Wales (21), followed by 15 arrivals from Victoria, 8 from Tasmania, 5 from South Australia and 4 from Western Australia (
Table 5). The major vessel types arriving from overseas at the Port of Nelson were general cargo vessels (116 arrivals), bulk /cement carriers (106 arrivals), and container ships and ro/ro (43 arrivals; Table 4).

According to the 'SeaSearcher.com' database, during the same period 849 vessels departed from the Port of Nelson to 28 different countries, also represented by most regions of the world. The greatest number of departures for overseas went to Australian ports as their next port of call (376 movements) followed by Japan (274) and the northwest Pacific (90;
Table 6). The major vessel types departing to overseas ports from the Port of Nelson were container ships and ro/ro (358 movements), passenger / vehicle / livestock carriers (266), bulk / cement carriers (103) and general cargo vessels (93;
Table 6).

Domestic vessel movements

The 'SeaSearcher.com' database contains movement records for 2,420 vessel arrivals to the Port of Nelson from New Zealand ports between 2002 and 2005 inclusive. These arrived from

16 different ports in both the North and South Islands (Table 7). The greatest number of domestic arrivals during this period came from Wellington (761 arrivals), Lyttelton (494 arrivals), Napier (223 arrivals), Nelson (ie. closed-loop trips; 212 arrivals), and Auckland (158 arrivals). Container ships and ro/ro's were by far the dominant vessel type arriving at the Port of Nelson from other New Zealand ports (1158 arrivals) followed by general cargo vessels (444 arrivals), passenger / vehicle / livestock carriers (266 arrivals), bulk / cement carriers (247 arrivals) and fishing vessels (183 arrivals; Table 7).

During the same period, the 'SeaSearcher.com' database contains movement records for 1,876 vessel departures from the Port of Nelson to 17 New Zealand ports in both the North and South Islands. The largest numbers of domestic movements from the Port of Nelson travelled to Wellington (439 movements), Napier (255), Tauranga (246) and Nelson (ie. closed-loop trips; 212 departures, Table 8). Container ships and ro/ro's dominated the vessel types leaving the Port of Nelson on domestic voyages (841 movements), followed by general cargo vessels (466 movements), bulk / cement carriers (250 movements) and fishing vessels (193 movements; Table 8).

EXISTING BIOLOGICAL INFORMATION

Over the last two decades a number of biological surveys have been carried out in Nelson Port, although few of these have specifically focused on collecting and identifying non-indigenous species, However, the exceptions being the *Undaria pinnatifida* studies described below and the NIWA Client Report by Inglis et al. (2006b) which showed particular emphasis on surveillance for early detection of unwanted organisims in New Zealand Ports.). In addition, the intial NIWA baseline survey (see following section) of the Port of Nelson has made a valuable addition to the biological information available in the area. Most ecological studies have been undertaken within the Port environment, mainly for Port Nelson Limited. We briefly review these studies and their 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 diversity and numbers were thought to be associated with their presence.

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 Asian 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). The extent of this kelp in Port Nelson and Nelson Haven is assessed annually as part of the Nelson State of the Environment Report for coastal areas (Nelson City Council 2004). The 2003 Nelson State of the Environment Report (Nelson City Council 2003) 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 (including the outer Boulder Bank and the seaward side of Haulashore Island), 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, coexisting with *Undaria* in some areas and apparently dominating it in other areas (Nelson City Council 2004). It has been deemed impractical to eradicate *Undaria* from Nelson Haven, and *Undaria* has been included in the Nelson/Tasman Regional Pest Management Strategy as a regional surveillance pest (Nelson City Council 2004).

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.

Monitoring surveys have been conducted every three years since 1994 on behalf of Port Nelson Ltd to assess the environmental affects of spoil disposal, particularly long-term effects of spoil associated contaminants. The monitored sites are outside of the port, in southern Tasman Bay. Sites are monitored in the disposal area, the surrounding “spreading zone” and more distant “control zone”, for factors including macrofaunal community composition and trace metal concentrations. The non-indigenous bivalve *Theora lubrica* was the only non-indigenous species recorded in the 2001 survey (Hopkins 2001). The 2001 survey showed that the macrofaunal community composition within the dumping zone was considerably different to the communities at the spreading and control zones, apparently due to differences in physical habitat caused by the spoil disposal. The bristle worms *Prionospio* sp. and *Armandia maculata* were relatively abundant at the dumping sites but were not present at the spreading or control sites, and sabellid and glycerid worms were also more abundant at the dumping sites than at the control and spreading sites. The control and spreading sites had a high abundance of the bivalve *Nucula nitidula* and moderate abundances of the gastropod *Autrofusus glans,* the non-indigenous bivalve *Theora lubrica* and the spionid polychaete *Cossura* sp, all of which were absent from the dumping sites. The report provides a list of benthic macrofauna taxa and their abundances at each site. The report also found that there was no evidence of significant contaminated-related ecological impacts from Port Nelson’s dredge spoil disposal operation. Trace metal concentrations in sediments and contaminant levels in shellfish were within guideline levels and there were no significant changes in contaminant concentrations compared with previous surveys.

In 2003, Port Nelson Ltd and Nelson City Council jointly initiated a four-year monitoring programme for the port area to provide a long-term database of environmental quality in the port area. Physical characteristics such as sediment metal concentration and grain size are monitored annually, whilst additional physical characteristics (sediment toxicity and organotins, and semi volatile organic compounds) and biological indicators (benthic macrofauna abundance and shellfish bioaccumulation) are monitored over the four year period. In the second year of monitoring (the 2004-2005 summer), three sites were monitored for benthic macrofauna, with lower species richness and abundance at site NCC-02 (Saltwater

Creek, south of the port) compared to sites PNL-05 (Wood-chip pile, near McGlashen Quay, Port Nelson) and PNL-10 (Sealord Wharf near McKellar Quay, Port Nelson). The report suggested that this pattern may reflect the narrower ecological niche provided by the intertidal estuarine environment at Saltwater Creek (Hopkins and Barter 2006). The most abundant taxa at the two port sites were the non-indigenous bivalve *Theora lubrica* and the polychaetes *Prionospio* sp., *Heteromastus filiformis,* and *Cossura consimilis*. Full species lists were provided, and *Theora lubrica* was the only non-indigenous species recorded during the survey. The physical component of the same monitoring survey found that some sites had elevated contaminant levels and shellfish contamination levels which exceeded those recommended for safe human consumption (Hopkins and Barter 2006).

RESULTS OF THE FIRST BASELINE SURVEY

An initial baseline survey of the Port of Nelson was completed in January 2002 (Inglis et al. 2006a). The report identified a total of 196 species or higher taxa. 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 had not previously been described from New Zealand waters. Three of these were newly discovered non-indigenous species (the bryozoan *Celleporaria nodulosa*, the hydroid *Lafoeina amirantensis* and the ascidian *Cnemidocarpa sp.*) and three were considered cryptogenic (the sponges *Halichondria n. sp. 5*, *Haliclona n. sp. 1*, Haliclona n. sp. 7). The sponges did not match existing species descriptions and may have been new to science.

Since the first survey was completed, several species recorded in it have been re-classified as a result of new information or re-examination of specimens during identification of material from the repeat baseline survey. For example, the ascidian, *Cnemidocarpa* sp., was subsequently re-identified as a native species (*Cnemidocarpa nisiotus).* The revised summary statistics for the Port of Nelson following re-classification were a total of 193 species or higher taxa, consisting of 130 native species, 13 non-indigenous species, 20 cryptogenic species and 30 species indeterminata. These revisions have been incorporated into the comparison of data from the two surveys below.

The 13 non-indigenous organisms described from the Port of Nelson included representatives of five phyla. The non-indigenous species detected were: *Polydora hoplura* (Annelida), *Bugula flabellata, Cryptosula pallasiana, Conopeum seurati, Electra angulata, Celleporaria nodulosa, Schizoporella errata, Watersipora subtorquata, Anguinella palmata* (Bryozoa), *Lafoeina amirantensis* (Hydrozoa), *Crassostrea gigas*, *Theora lubrica* (Mollusca), and *Ciona intestinalis* (Urochordata). None of these species are listed on the New Zealand register of unwanted organisms. One of the non-indigenous species recorded, the bivalve *Crassostrea gigas*, is listed on the Australian ABWMAC schedule of non-indigenous pest species. Approximately 77 % (10 of 13 species) of non-indigenous species recorded in the Port of Nelson initial baseline survey were likely to have been introduced in hull fouling assemblages, 8 % (one species) via ballast water and 15 % (two species) could have been introduced by either ballast water or hull fouling vectors.

Methods

SURVEY METHOD DEVELOPMENT

To allow a direct comparison between the initial baseline survey and the resurvey of the Port of Nelson, the survey used the same methodologies, occurred in the same season, and sampled the same sites used in the initial baseline survey (as requested by Biosecurity NZ).

To improve the description of the biota of the port, some additional survey sites were added during the repeat survey. These are described below.

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; Hewitt and Martin 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 9. 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 re-survey of the Port of Nelson. The survey was undertaken from December 13th to 17th 2004.

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 (Figure 8). 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 FAUNA

Benthic infauna was sampled using a Shipek grab sampler deployed from a research vessel moored adjacent to the berth (Figure 9), with samples collected from within 5 m of the edge of the berth. The Shipek grab removes a sediment sample of ~3 *l* and covers an area of approximately 0.04 m^2 on the seafloor to a depth of about 10 cm. It is designed to sample unconsolidated sediments ranging from fine muds and sands to hard-packed clays and small cobbles. Because of the strong torsion springs and single, rotating scoop action, the Shipek grab is generally more efficient at retaining samples intact than conventional VanVeen or Smith McIntyre grabs with double jaws (Fenwick *pers obs*). Three grab samples were taken at haphazard locations along each sampled berth. Sediment samples were washed through a 1-mm mesh sieve and animals retained on the sieve were returned to the field laboratory for sorting and preservation.

Figure 8: Diver sampling organisms on pier piles.

Figure 9: 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 and height of 0.2 m. A short yoke of heavy chain connects the sled to a tow line (Figure 10). 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 2 mm. Sleds were towed for a standard time of two minutes at approximately two knots. During this time, the sled typically traversed between 80 – 100 m of seafloor before being retrieved. Two to three sled tows were completed adjacent to each sampled berth within the port, and the entire contents were sorted.

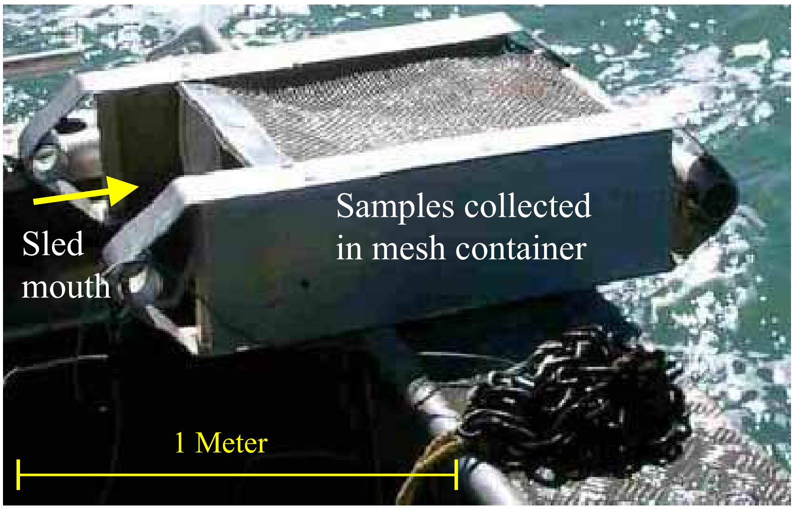

Figure 10: Benthic sled

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 (Figure 11). 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).

MOBILE EPIBENTHOS

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

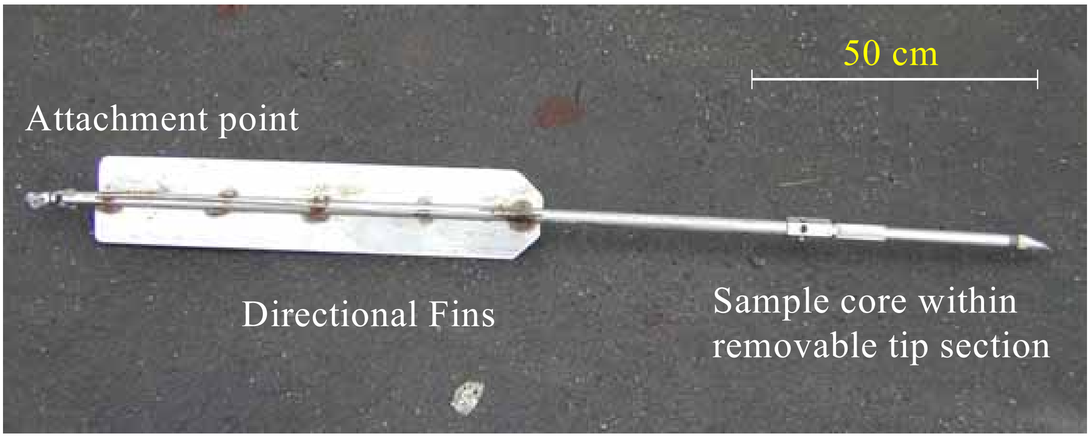

Figure 11: Javelin corer

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 (Figure 12). 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 (Figure 12). 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 (Figure 12). 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.

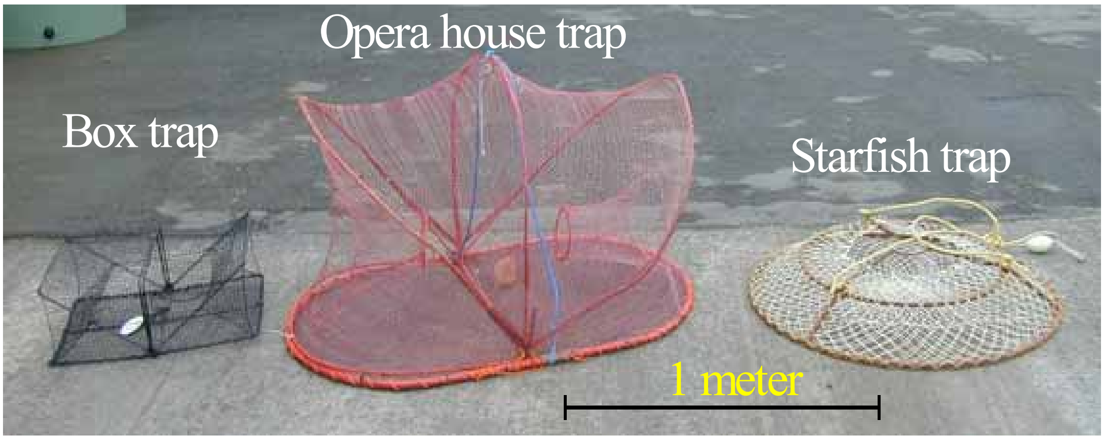

Figure 12: Trap types deployed in the port.

SAMPLING EFFORT

A summary of sampling effort during the second baseline survey of the Port of Nelson is provided in Table 10, and the exact geographic locations of sample sites are given in Appendix 2. The distribution of effort 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.

During the initial baseline survey, most sample effort was concentrated around four berths – Kingsford Quay, Lay-up & Repair Facility, Main Wharf and McGlashen Quay - that were spread throughout the port and that represented a range of active berths and lay-up areas (Figure 3). Duplicate javelin cores were taken from four sites distributed throughout the port basin (Inglis et al. 2006a). These same locations were sampled during the re-survey of the port. To improve description of the flora and fauna in the resurvey, we increased replication by adding additional sites within the port, harbour and marina. Additional trapping took place at Boulder Bank and the Ministry of Fisheries Wharf; trapping, benthic sleds and grab samples at Nelson Haven, The Cut and the marina; and trapping and diver pile scraping at the Superyacht Berth. Six sites were sampled for dinoflagellate cysts using the javelin corer.

The spatial distribution of sampling effort for each of the sample methods is indicated in the following figures: diver pile scrapings (Figure 13), benthic sledding (Figure 14), box, starfish and shrimp trapping (Figure 15), opera house fish trapping (Figure 16), shipek grab sampling (Figure 17) and javelin cyst coring (Figure 18).

SORTING AND IDENTIFICATION OF SPECIMENS

Each sample collected in the survey was allocated a unique code on waterproof labels and transported to a nearby field laboratory where it was sorted by a team into broad taxonomic groups (e.g. ascidians, barnacles, sponges etc.). These groups were then preserved and individually labelled. Details of the preservation techniques varied for many of the major taxonomic groups collected, and the protocols adopted and preservative solutions used are indicated in Table 11. Specimens were subsequently sent to over 25 taxonomic experts (Appendix 3) 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 12) and the marine pest list produced by the Australian Ballast Water Management Advisory Council (Table 13).

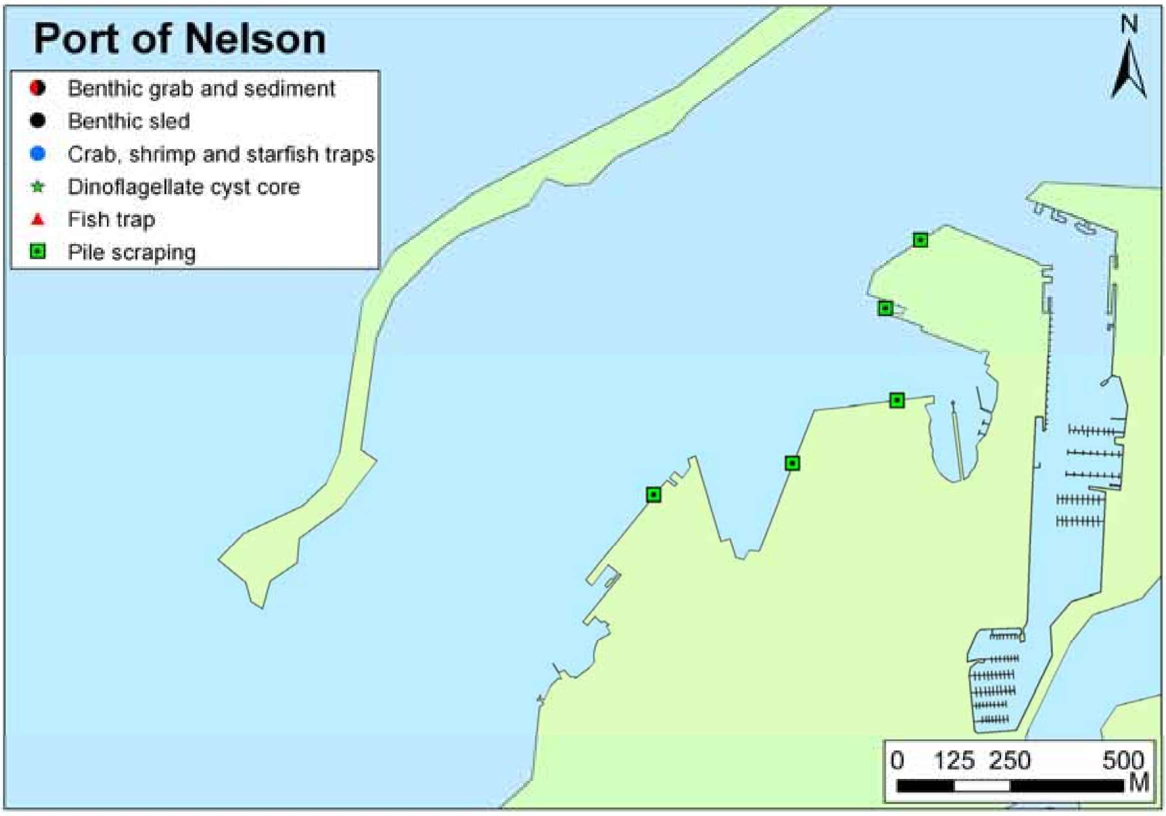

Figure 13: Diver pile scraping sites

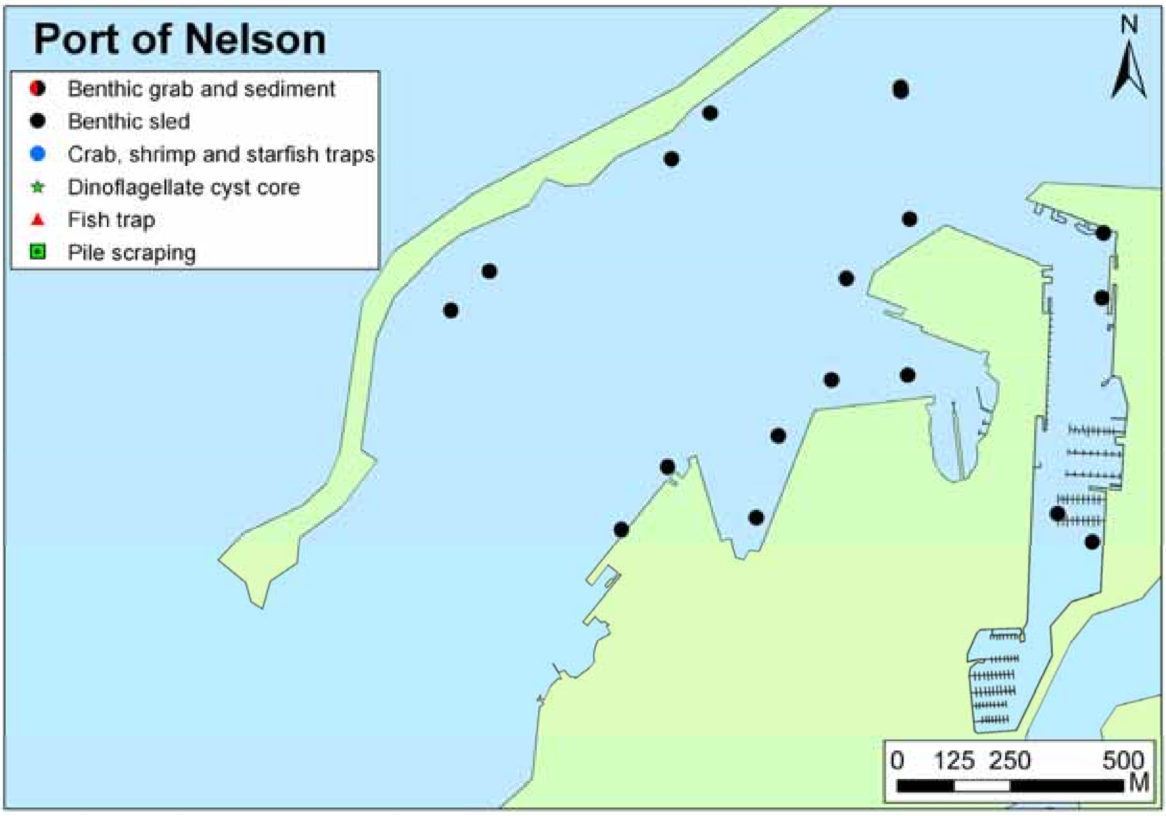

Figure 14: Benthic sled sites

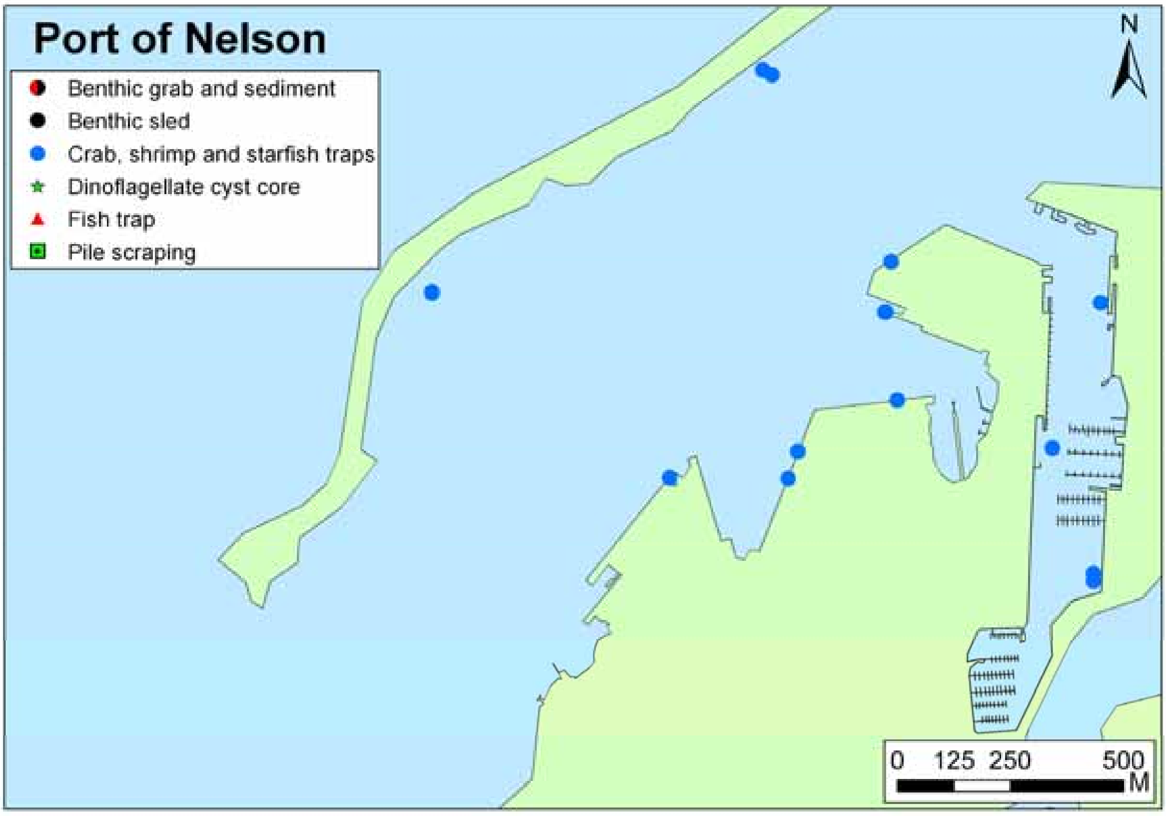

Figure 15: Sites trapped using box (crab), shrimp and starfish traps

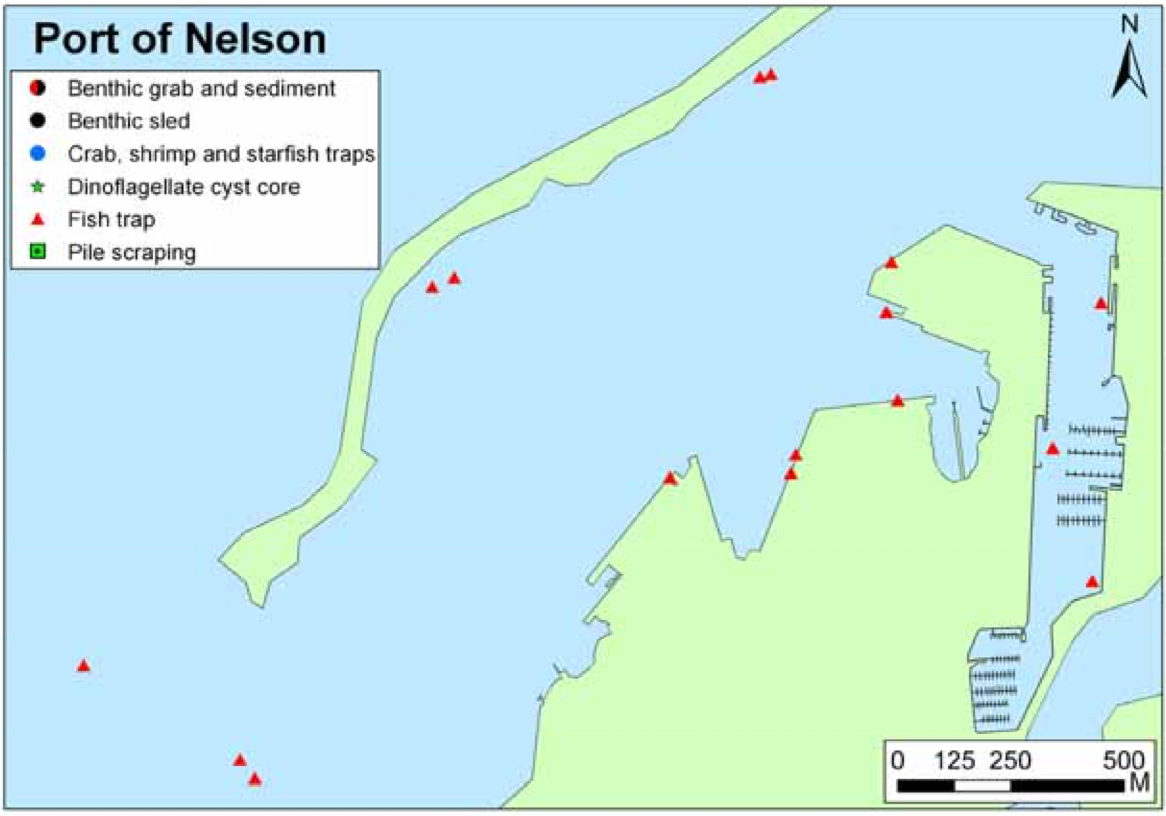

Figure 16: Opera house (fish) trapping sites

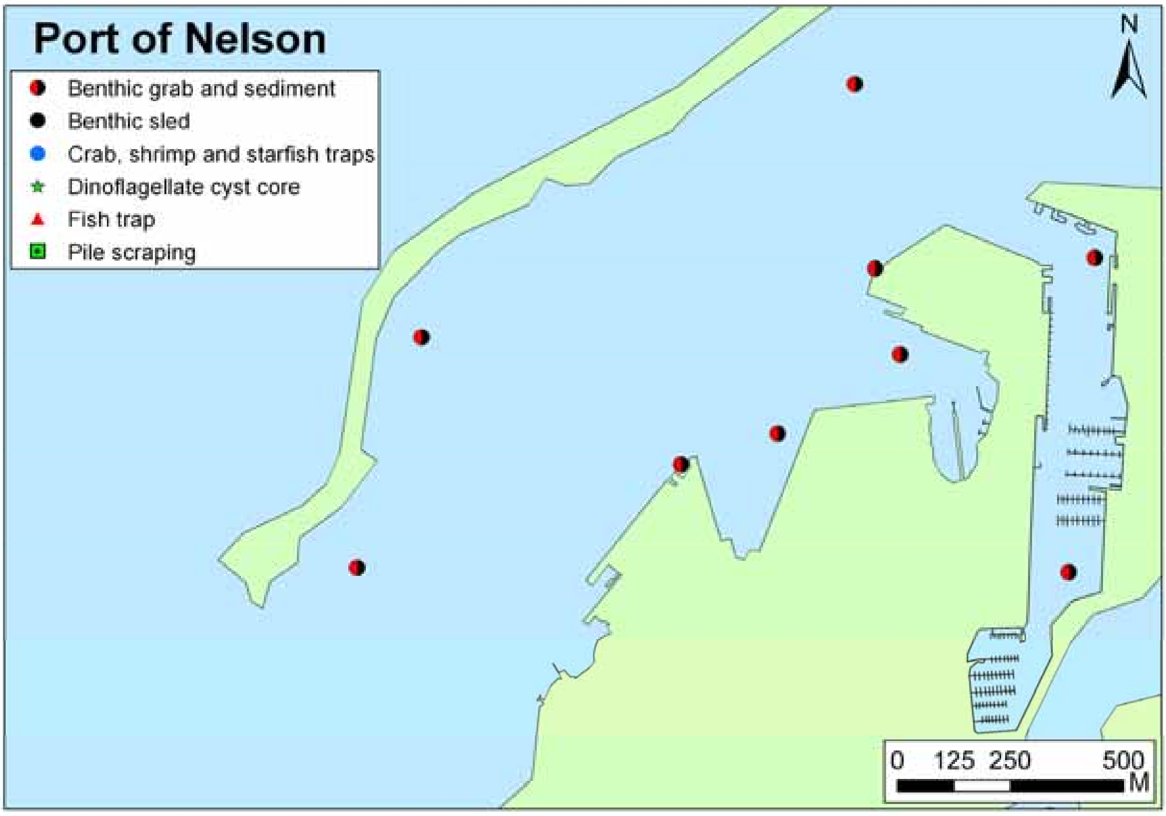

Figure 17: Shipek benthic grab sites

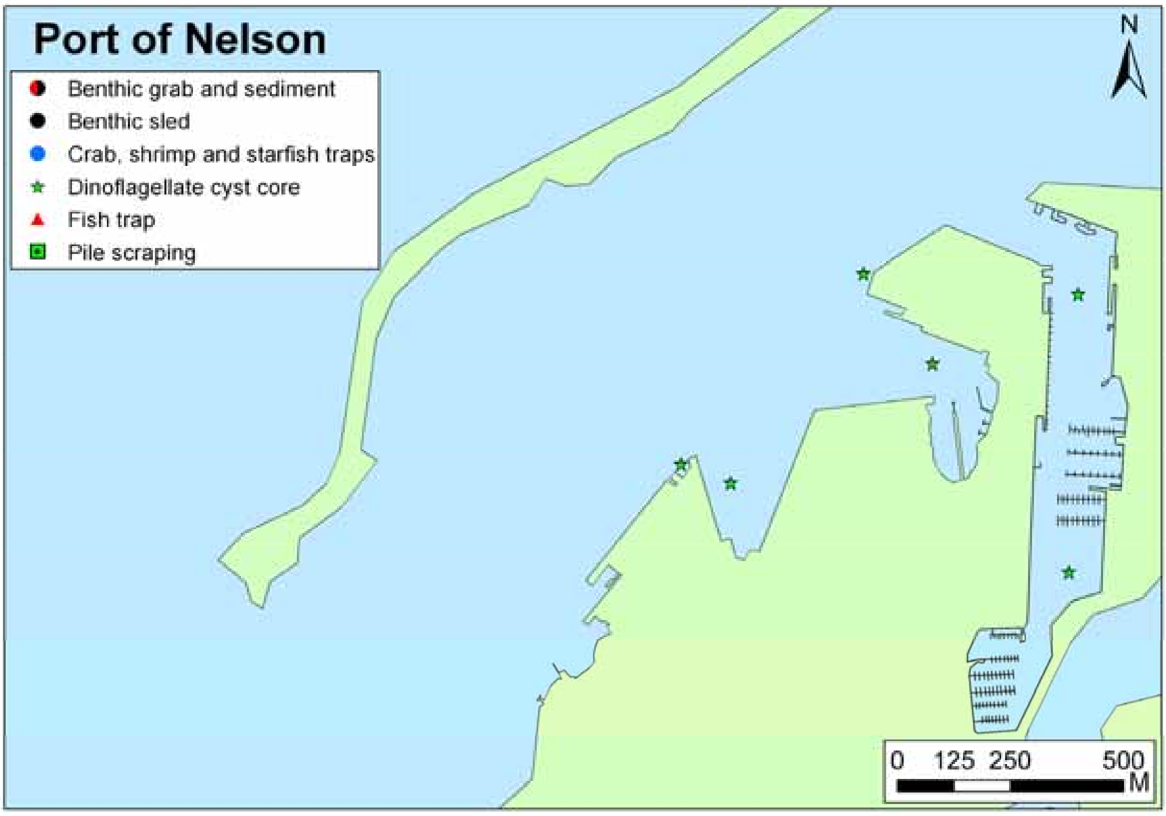

Figure 18: Javelin core sites

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

Native species

Native species have occurred within the New Zealand biogeographical region historically 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 as a guide by Chapman and Carlton (1991; 1994); as exemplified by Cranfield et al. (1998).

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

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

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

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

Cryptogenic species Category 1

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

Cryptogenic species Category 2

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

Species indeterminata

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

DATA ANALYSIS

Comparison with the initial baseline survey

Several approaches were used to compare the results of the current survey with the earlier baseline survey of the Port of Nelson, completed in 2002 (Inglis et al. 2006a).

Summary statistics were compiled on the total number of species and phyla found in each survey and on the numbers of species in each biogeographic category (i.e. native, non-indigenous, etc) recovered by each survey method. Several taxa (Order Tanaidacea (tanaids), Class Scyphozoa (jellyfish), Phylum Platyhelminthes (flatworms) and Class Anthozoa (sea anemones) were specifically excluded from analyses as, at the time the reports were prepared, we had been unable to secure identification of specimens from the resurvey.

While these summary data give the numbers of species actually observed in each survey they do not, by themselves, provide a robust basis for comparison, since they do not account for differences in sample effort between the surveys, variation in the relative abundance of species at the time of each survey (for a discussion of these issues, see Gotelli and Colwell 2001), or the actual species composition of the recorded assemblages. The latter is important if port surveys are to be used to estimate and monitor the rate of new incursions by non-indigenous species.

In any single survey, the number of species observed will always be less than the actual number present at the site. This is because a proportion of species remain undetected due to bias in the survey methods, local rarity, or insufficient sampling effort. A basic tenet of sampling biological assemblages is that the number of species observed will increase as more samples are taken, but that the rate at which new species are added to the survey tends to decline and gradually approaches an asymptote that represents the total species richness of the assemblage (Colwell and Coddington 1994). In very diverse assemblages, however, where a large proportion of the species are rare, this asymptote is not reached, even when very large numbers of samples are taken. In these circumstances, comparisons between surveys are complicated by the large number of species that remain undetected in each survey. This issue has received considerable attention in recent literature and new statistical methods have been developed to allow better comparisons among surveys (Gotelli and Colwell 2001; Colwell et al. 2004; Chao et al. 2005). We use several of these new techniques – sample-based rarefaction curves (Colwell et al. 2004), non-parametric species richness estimators (Colwell and Coddington 1994), and bias-adjusted similarity indices (Chao et al. 2005) - to compare results from the two surveys of the Port of Nelson.

Sample-based rarefaction curves

Sample-based rarefaction curves depict the number of species that would be expected in a given number of samples (*n*) taken from the survey area, where $n_{(max)}$ is the total number of samples taken in the field survey. The shape of the curves and the number of species expected for a given *n* can be used as the basis for comparing the surveys and evaluating the benefit of reducing or increasing sample effort in subsequent surveys (Gotelli and Colwell 2001). For each baseline survey we computed separate sample-based rarefaction curves (Gotelli and Colwell 2001) for each survey method. The curves were computed from the presence or absence of each recorded species in each sample unit (i.e. replicated incidence data) using the analytical formula developed by Colwell et al. (2004) (the Mau Tau index) and the software *EstimateS* (Colwell 2005).

Separate curves were computed for each of six methods: pile scraping, benthic sleds, benthic grabs, crab traps, fish traps and starfish traps. The remaining methods did not usually recover enough taxa to allow meaningful analyses. For pile scrapes, only quadrat samples were used; specimens collected on qualitative visual searches of piles were not included. Since the purpose of the port surveys is primarily inventory of non-indigenous species, we generated separate curves for native species, cryptogenic category 2 species, and the combined species pool of non-indigenous and cryptogenic category 1 taxa, where there were sufficient numbers of taxa to produce meaningful curves (arbitrarily set at > 8 taxa per category). This was possible for pile scrapes and benthic sleds; for the other survey methods, all taxa (excluding species indeterminata) were pooled in order to have sufficient numbers of taxa.

Note that, by generating rarefaction curves we are assuming that the samples can reasonably be considered a random sample from the same universe (Gotelli and Colwell 2001). Strictly, this does not represent the way that sample units were allocated in the survey. For example, quadrat samples were taken from fixed depths on inner and outer pilings at each berth, rather than distributed randomly throughout the 'universe' of pilings in the port. Previously, we showed that there is greater dissimilarity between assemblages in these strata than between replicates taken within each stratum, although the difference is marginal (range of average similarity between strata = 22%-30% and between samples = 25%-35 %, Inglis et al. 2003). This stratification is an example of the common tension in biodiversity surveys between optimising the complementarity of samples (i.e. reducing overlap or redundancy in successive samples so that the greatest number of species is included) and adequate description of diversity within a particular stratum (Colwell and Coddington 1994). In practice, no strategy for sampling biodiversity is completely random or unbiased. The effect of the stratification is likely to be an increase in the heterogeneity of the samples, equivalent to increasing the patchiness of species distribution across quadrats. This is likely to mean slower initial rate of accumulation of new species and slower accumulation of rare species (Chazdon et al. 1998). Because the same survey strategy was used in both port surveys, this systematic bias should not unduly affect comparisons between the two surveys. Furthermore, preliminary trials, where we pooled quadrat samples to form more homogenous units (e.g. piles or berths as the sample unit) and compared the curves to total randomisation of the smallest unit (quadrats), had little effect on the rate of accumulation (Inglis et al. 2003).

Estimates of total species richness

Estimates of total species richness (or more appropriately total "species density") in each survey were calculated using the Chao 2 estimator. This is a non-parametric estimate of the true number of species in an assemblage that is calculated using the numbers of rare species (those that occur in just one or two sample units) in the sample (Colwell and Coddington 1994). That is, it estimates the total number of species present, including the proportion that was present, but not detected by the survey ("unseen" species). As recommended by Chao (in Colwell 2005), we used the bias-corrected Chao 2 formula, except when the CV > 0.5, in which case the estimates were recalculated using the Chao 2 classic formula, and the higher of the Chao 2 classic and the ICE (Incidence-based Coverage Estimator) was reported.

Plots of the relationship between the species richness estimates and sample size were compared with the sample-based rarefaction curve for each combination of survey, method, and species category. Convergence of the observed (the rarefaction curve) and estimated (Chao 2 or ICE curve) species richness provides evidence of a relatively thorough inventory (Longino et al. 2002).

Similarity analyses

A range of indices is available to measure the compositional similarity of samples from biological assemblages using presence-absence data (Koleff et al. 2003). Many of these are based on the relative proportions of species that are common to both samples ("shared species") or which occur in only a single sample. The classic indices typically perform poorly for species rich assemblages and are sensitive to sample size, since they do not account for the detection probabilities of rare ("unseen") species. Chao et al. (2005) have recently developed new indices based on the classic Jaccard and Sorenson similarity measures that incorporate the effects of unseen species. We used the routines in EstimateS (Colwell 2005) to compare samples from the two surveys using the new Chao estimators, but also report the classic Jaccard and Sorenson measures. Separate comparisons were done for each combination of survey method and species category where there were sufficient taxa (see above).

Survey results

A total of 257 species or higher taxa were identified from the re-survey of the Port of Nelson. This collection consisted of 176 native (Table 14), 32 cryptogenic (Table 15), and 13 non-indigenous species (Table 16), with the remaining 36 taxa being made up of species indeterminata. In comparison, 193 taxa were recorded from the initial survey of the port in January 2002, comprising 130 native species, 20 cryptogenic species, 13 non-indigenous species and 30 species indeterminata.

The biota in the re-survey included a diverse array of organisms from 14 major taxonomic groups (Figure 20). For general descriptions of the main groups of organisms (major taxonomic groups) encountered during this study refer to Appendix 4, and for detailed species lists collected using each method refer to Appendix 6.

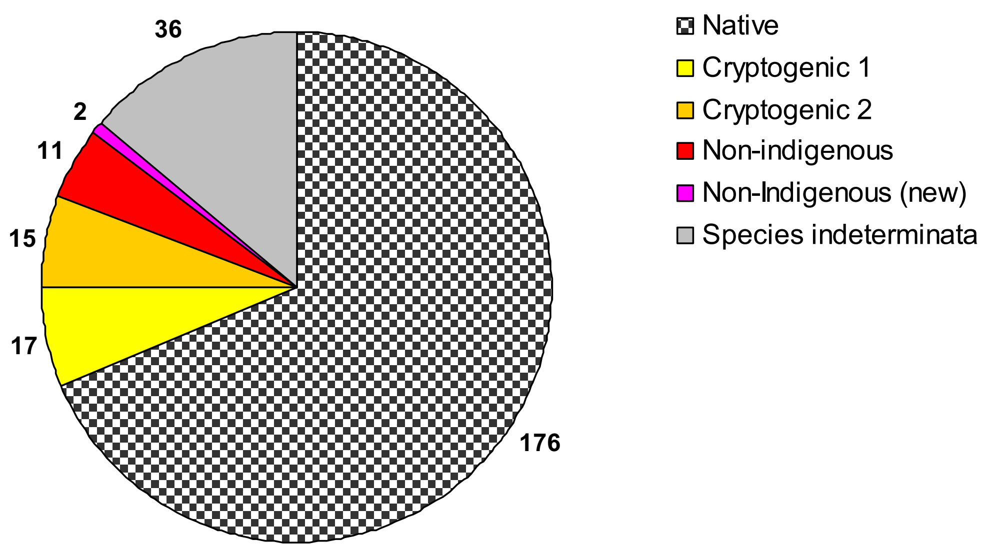

Figure 19: Diversity of marine species sampled in the Port of Nelson. Values indicate the number of taxa in each category.

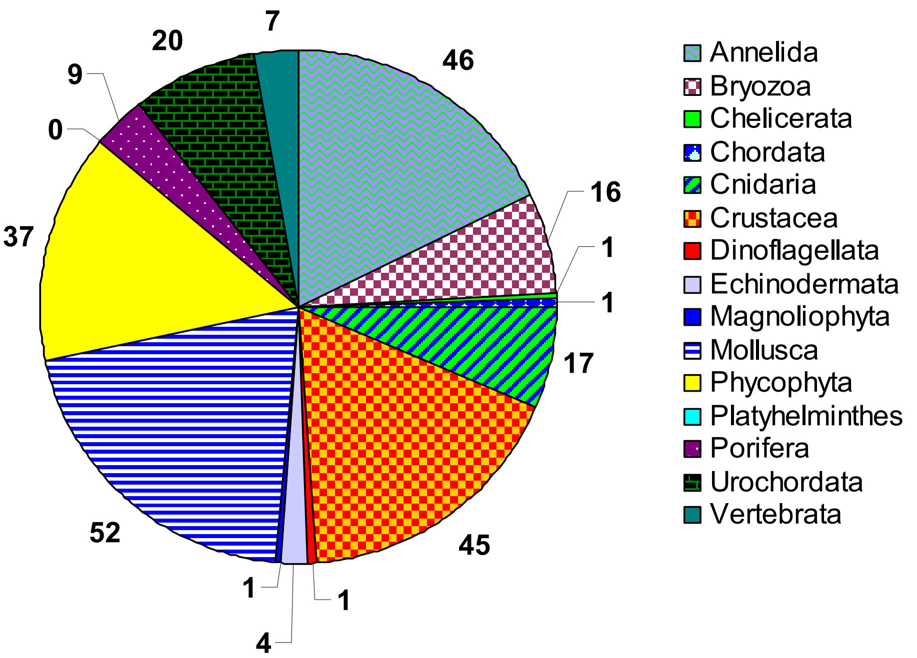

Figure 20: Major taxonomic groups sampled in the Port of Nelson. Values indicate the number of taxa in each of the major taxonomic groups.

NATIVE SPECIES

The 176 native species recorded during the resurvey of the Port of Nelson represented 68 % of all species identified from this location (Table 14) and included diverse assemblages of annelids (35 species), algae (21 species), crustaceans (33 species), molluscs (46 species), bryozoans (9 species), porifera (4 species) and urochordates (11 species). A number of other less diverse phyla including echinoderms, vertebrates, pycnogonids, dinoflagellates and cnidarians were also recorded from the Port (Table 14).

CRYPTOGENIC SPECIES

Cryptogenic species (*n* = 32) represented 12 % of all species or higher taxa identified from the Port. The cryptogenic organisms identified included 17 Category 1 and 15 Category 2 species as defined in "Definitions of species categories" above. These organisms included 7 annelids, 1 bryozoan, 6 cnidaria, 4 crustaceans, 1 mollusc, 5 sponges and 8 ascidian species (Table 15). Seven of the Category 1 cryptogenic species (the annelid *Eulalia bilineata*, the bryozoan *Rhynchozoon larreyi*, the hydroids *Obelia dichotoma*, *Phialella quadrata, Halecium delicatulum,* the amphipod *Aora typica* and the ascidian *Microcosmus squamiger*) were not recorded in the initial baseline survey of the port. Only four of the 17 Category 1 species recorded in the initial baseline survey of the Port of Nelson were not found during the re-survey (the bryozoan *Scruparia ambigua*, the sponge *Hymeniacidon perleve*, and the ascidians *Microcosmus australis* and *Styela plicata*). Several of the Category 1 cryptogenic species (e.g the ascidians *Asterocarpa cerea*, *Botrylloides leachii* and *Corella eumyota*) 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).

Two cryptogenic category 1 species that have recently spread rapidly and which are dominant habitat modifiers are worthy of note. The colonial ascidians *Didemnum vexillum* (Kott 2002) and *Didemnum incanum* were among the cryptogenic Category 1 species recorded in the initial New Zealand port baseline surveys. One of these species, *Didemnum vexillum*, was recorded in the first baseline survey of the Port of Nelson. *Didemnum vexillum* was first described in 2001 when it formed nuisance growths on ship's hulls, wharf piles and other submerged structures in Whangamata, New Zealand (Kott 2002). It has subsequently been reported from several other port environments including Shakespeare Bay in Picton and the Bay of Plenty, 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 2004b). Although the type specimen of *D. vexillum* was described from New Zealand, we have included it in the Cryptogenic 1 category because of uncertainty about its true geographic origins. *Didemnum incanum* is one of the few species of Didemnid that occurs both in Australia and New Zealand (Kott 2004a). Unlike *D. vexillum*, there have been no reports of local proliferation by this species (but see below).

The taxonomy of the Didemnidae is complex. The colonies do not display many distinguishing characters at either species or genus level and are comprised of very small, simplified zooids (Kott 2004a). Six species have been described in New Zealand (Kott 2002) and 241 in Australia (Kott 2004a). Most are recent descriptions and, as a result, there are few experts who can distinguish the species reliably. Specimens of *Didemnum* obtained during the initial port baseline surveys were examined by the world authority on this group, Dr Patricia Kott (Queensland Museum). Because, at the time of writing, we had been unable to secure Dr Kott's services to examine specimens from the repeat-baseline surveys, we have reported these species collectively, as a species group (*Didemnum* sp.; Table 15).

In the first baseline survey of the Port of Nelson, *D. vexillum* occurred in pile scrape samples taken from Kingsford Quay, the Lay-up and Repair facility and McGlashen Quay, and unidentified specimens of Didemnidae (specimens that did not fit the morphological charcters for *D. vexillum* or *D. incanum*) were recorded from pile scrape samples taken from Kingsford Quay, Main Wharf, the Lay-up and Repair facility and McGlashen Wharf. They were also noted in benthic sled samples from Kingsford Quay and the Lay-up and Repair facility. In the repeat survey of the Port of Nelson, species in the *Didemnum* group were recorded in pile scrape samples taken from Main Wharf, the Lay-up and Repair facility, Kingsford Quay, McGlashen Quay and the Superyacht berth.

NON-INDIGENOUS SPECIES

The 13 non-indigenous species (NIS) recorded in the re-survey of the Port of Nelson included 1 annelid worm, 1 alga, 5 bryozoans, 4 hydroids and 2 molluscs (Table 16). Six species found in the re-survey were not recorded during the initial baseline survey in January 2002. These were: the polychaete *Hydroides elegans*, the bryozoan *Electra tenella*, the algae *Undaria pinnatifida* and the hydroids *Filelum serpens?*, *Synthecium campylocarpum* and *Synthecium subventricosum*. Six NIS recorded in the initial survey (the polychaete *Polydora hoplura*, the ascidian *Ciona intestinalis,* and the bryozoans *Conopeum seurati*, *Electra angulata, Schizoporella errata* and *Anguinella palmata*) were not recorded in the re-survey. Two of these species were present in numerous samples (6 samples from 2 berths for *C. intestinalis* and 7 samples from 4 berths for *C. seurati*), and their absence during the re-survey may suggest that their populations have declined in size. The other four species were present in only one or two samples in the first survey, and their absence may suggest that their populations have not persisted, or have remained small.

Two of the NIS (the bryozoan *Celleporaria nodulosa* and the hydroid *Lafoeina amirantensis*) are new to New Zealand. *Celleporaria nodulosa* was recorded for the first time during the initial baseline port surveys of Gisborne and Nelson (see the species description below). *Lafoeina amirantensis* was identified for the first time in New Zealand during the initial baseline port survey of Nelson (see the species description below). A list of Chapman and Carlton's (1994) criteria (see "Definitions of species categories", above) that were met by the non-indigenous species sampled in this survey is given in Appendix 5.

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 3 and from regional databases on non-indigenous marine species in Australia (National Introduced Marine Pest Information System, Hewitt et al. 2002) and the USA (National Exotic Marine and Estuarine Species Information System, Fofonoff et al. 2003). Distribution maps for each NIS in the port are composites of multiple replicate samples. Where overlayed presence and absence symbols occur on the map, this indicates the NIS was found in at least one, but not all replicates at that GPS location. NIS are presented below by phyla in the same order as Table 16.

Hydroides elegans Haswell, 1883

Image and information: NIMPIS (2002d)

Hydroides elegans is a small, tube dwelling polychaete worm that grows to up to 20mm in length. It constructs hard, sinuous, calcareous tubes. The worm has 65-80 body segments, and an opercular crown with 14-17 spines. *Hydroides elegans* is a fouling species on both natural and artificial structures. It is found subtidally and is highly tolerant of contaminated waters. Although the type specimen for this species was described from Sydney Harbour, Australia, the native range of *H. elegans* is unknown, as it is possible it was introduced to Australia prior to 1883 (Australian Faunal Directory 2005). *H. elegans* is present in the Caribbean Sea, Brazil, Argentina, northwest Europe, Japan, the Mediterranean, north-west and south-east Africa, and New Zealand. This species is able to grow in high densities, particularly in tropical and sub-tropical ports, sometimes heavily fouling any newly immersed structure. It creates microhabitat for some species and competes with others for food and space. *H. elegans* has been present in New Zealand since at least 1952 and has been recorded from Waitemata and Lyttelton Harbours (Cranfield et al. 1998). During the initial port baseline surveys, *H. elegans* was recorded in Gulf Harbour marina and the Port of Auckland (Table 18). During the second baseline surveys of Group 1 ports it was recorded from the Port of Nelson, where it occurred in a pile scrape sample from McGlashen Quay (Figure 21).

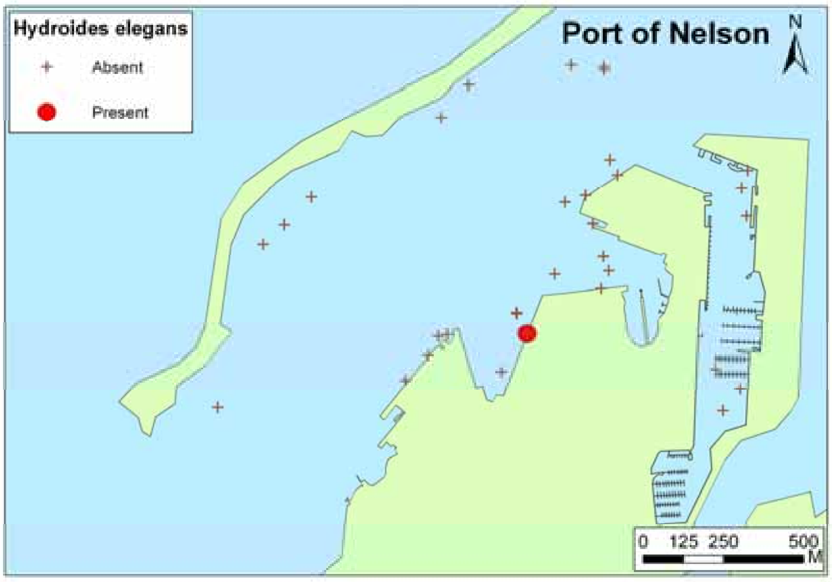

Figure 21: *Hydroides elegans* distribution in the re-survey of the Port of Nelson (December 2004).

***Bugula flabellata* (Thompson in Gray, 1848)**

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* is a major fouling bryozoan in ports and harbours, particularly on vessel hulls, pilings and pontoons and has also been reported from offshore oil platforms. *Bugula flabellata* has been present in New Zealand since at least 1949 and is present in most New Zealand ports. There have been no recorded impacts from *B. flabellata.* During the initial port baseline surveys it was recorded from Opua marina, Whangarei (Marsden Point and Whangarei Port), and the ports of Auckland, Tauranga, Napier, Taranaki, Wellington, Picton, Nelson, Lyttelton, Timaru, Dunedin and Bluff (Table 18). During the initial baseline survey of the Port of Nelson, *B. flabellata* was recorded from the Lay-up and Repair Facility (Figure 22). During the second baseline surveys of Group 1 ports it was recorded from the ports of Tauranga, Taranaki, Wellington, Picton, Nelson, Lyttelton and Timaru. In the Port of Nelson *B. flabellata* occurred in pile scrape samples taken from the Main Wharf, McGlashen Quay and the Superyacht berth (Figure 23).

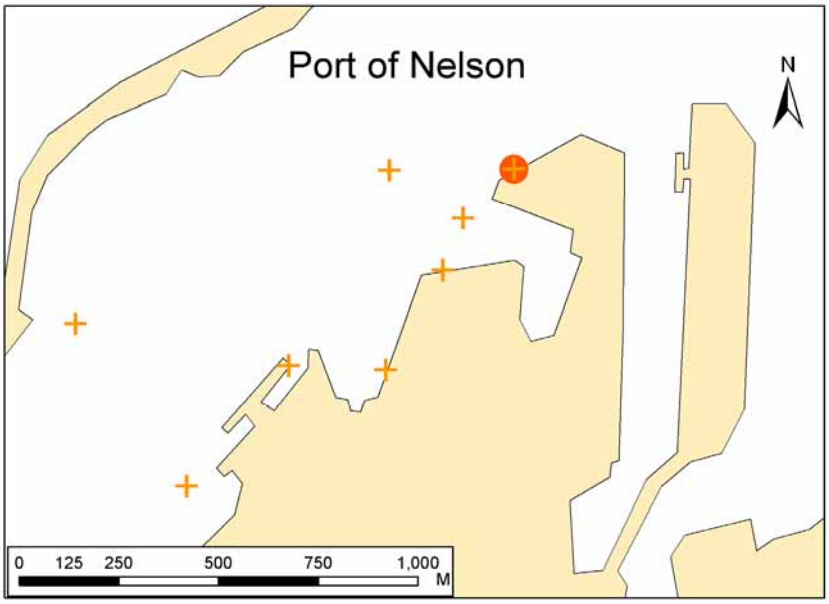

Figure 22: *Bugula flabellata* distribution in the initial baseline survey of the Port of Nelson (January 2002).

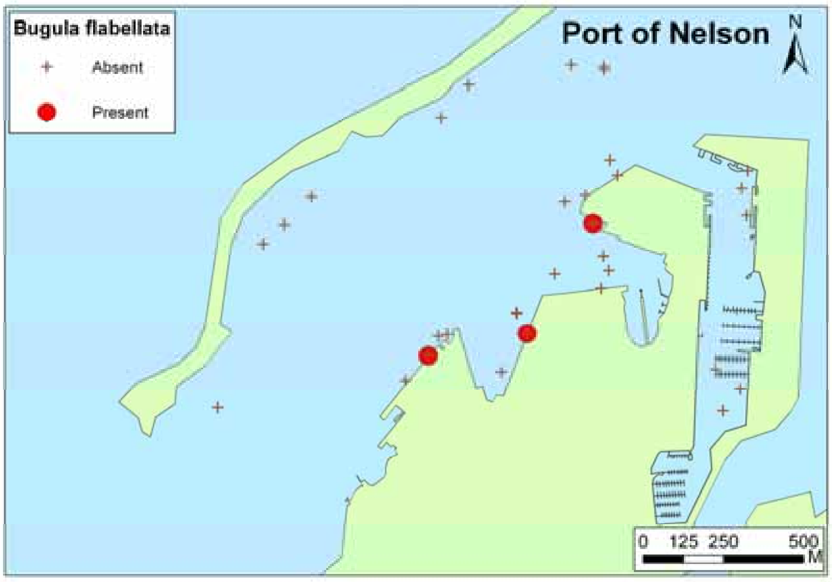

Figure 23: *Bugula flabellata* distribution in the re-survey of the Port of Nelson (December 2004).

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

Image and information: NIMPIS (2002c)

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

C. pallasiana has been known in New Zealand waters since at last the 1890's (Gordon and Mawatari 1992) and has been recorded from all New Zealand ports (Cranfield et al. 1998). During the initial port baseline surveys it was recorded from Whangarei (Marsden Point), Taranaki, Gisborne, Wellington, Nelson, Lyttelton, Timaru and Dunedin (Table 18). In the Port of Nelson it was recorded from the Lay-up and Repair Facility (Figure 24). During the second baseline surveys of Group 1 ports it was recorded from the ports of Taranaki, Wellington, Picton, Nelson, Lyttelton and Timaru. In the Port of Nelson it occurred in a pile scrape sample taken from McGlashen Quay (Figure 25).

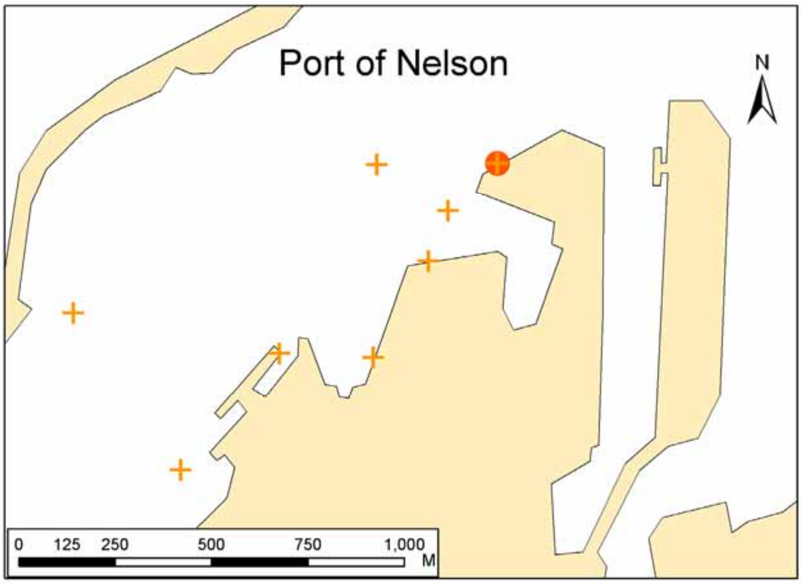

Figure 24: ***Cryptosula pallasiana* distribution in the initial baseline survey of the Port of Nelson (January 2002).**

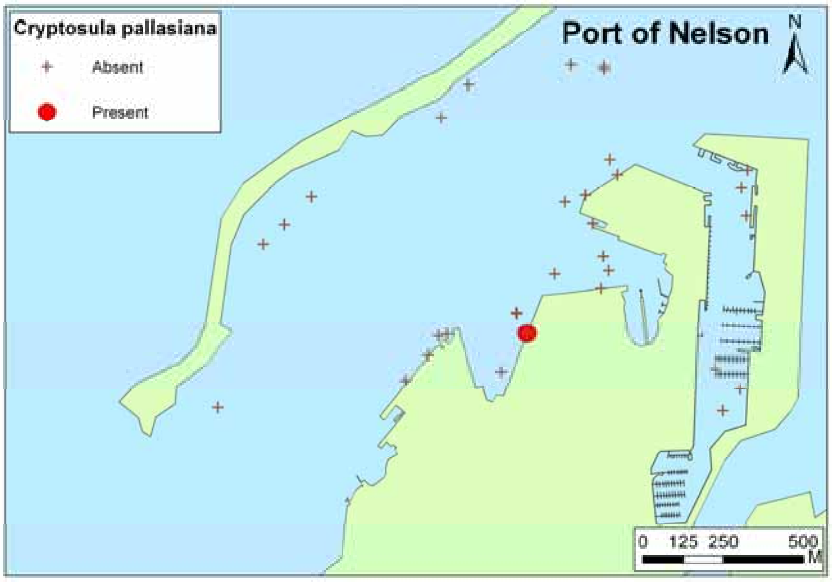

Figure 25: ***Cryptosula pallasiana* distribution in the re-survey of the Port of Nelson (December 2004).**

***Electra tenella* (Hincks, 1880)**
No image available.

Electra tenella is an encrusting cheilostome bryozoan that grows to several centimetres diameter. The type specimen is from the Atlantic coast of Florida, and it has also been reported from Puerto Rico as *Conopeum reticulum* (see Winston 1982), and from Brazil (Winston 1982), Jamaica (Bock 2004), Japan (see Winston 1977), the Bay of Bengal (Rao 1992), Botany Bay in Australia (Pollard and Pethebridge 2002), China (D. Gordon, pers. comm.), and northern New Zealand (Gordon and Mawatari 1992). *E. tenella* has been reported as occurring on hard substrata, especially dead shells and barnacles in shallow water harbour areas (Osburn 1940, in Winston 1982), but it has rarely been recorded as a fouling species (Winston 1982). Its abundance in Florida appears to be chiefly due to the abundance of drift plastic in this area, which *E. tenella* effectively colonises. Drift plastic may be an important vector for the expansion of the range of this species (Winston 1982). The first record of *E. tenella* in New Zealand was from Pakiri Beach in Northland, where it was found on dead *Atrina* shells in 1977 (Gordon and Mawatari 1992). Prior to 1992 it had also been recorded in Gisborne and Napier and on plastic debris in the Hauraki Gulf (Gordon and Mawatari 1992). *E. tenella* was not recorded during the initial baseline surveys of Group 1 and Group 2 ports. During the second baseline surveys of Group 1 ports it was recorded from the ports of Tauranga and Nelson (Table 18), with both these records representing extensions of its known range in New Zealand (D. Gordon, NIWA, pers comm.). In the Port of Nelson it occurred in a pile scrape from the Lay-up and Repair Facility (Figure 26).

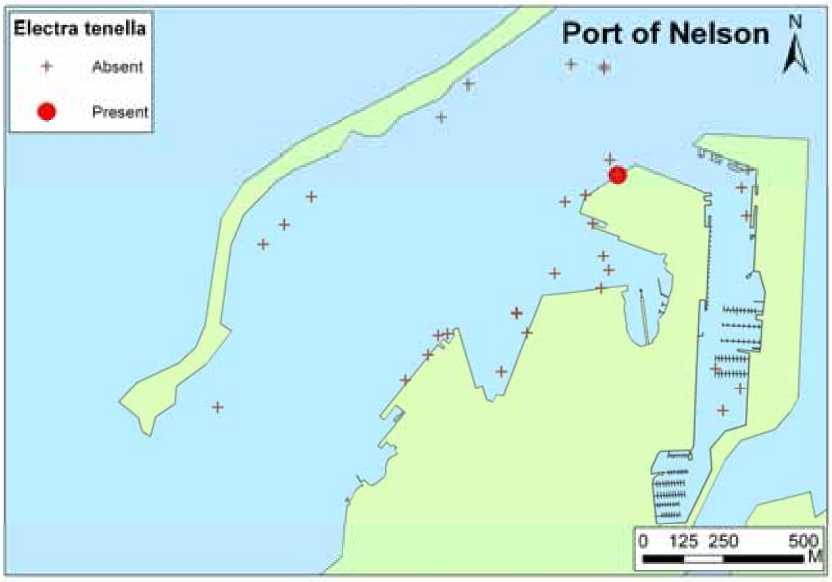

Figure 26: ***Electra tenella*** **distribution in the re-survey of the Port of Nelson (December 2004).**

Celleporaria nodulosa (Busk, 1881)

No image available.

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. No information exists on its likely impacts on native species. During the initial port baseline surveys it was recorded from the ports of Nelson (the first record of this species in New Zealand; D. Gordon, NIWA, pers. comm.) and Gisborne (Table 18). In the Port of Nelson it was recorded from Kingsford Quay (Figure 27). During the second baseline surveys of Group 1 ports it was recorded from the ports of Nelson and Timaru. In the Port of Nelson, *C. nodulosa* was recorded in pile scrapings taken from Kingsford Quay, McGlashen Quay and the Superyacht berths (Figure 28).

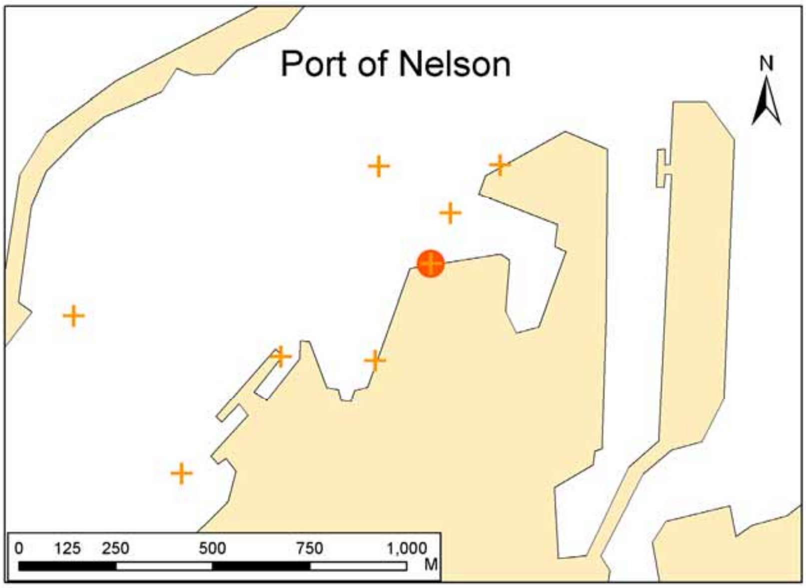

Figure 27: ***Celleporaria nodulosa*** **distribution in the initial baseline survey of the Port of Nelson (January 2002).**

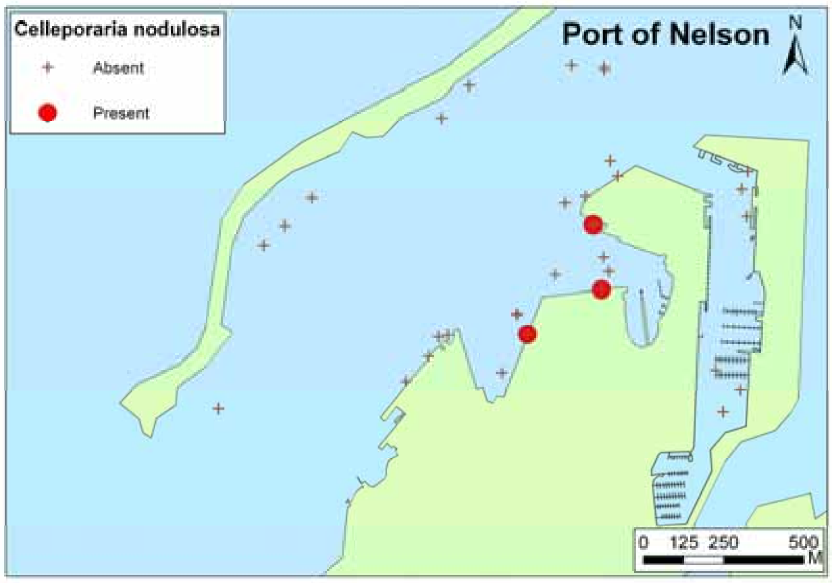

Figure 28: ***Celleporaria nodulosa*** **distribution in the re-survey of the Port of Nelson (December 2004).**

***Watersipora subtorquata* (d'Orbigny, 1852)**

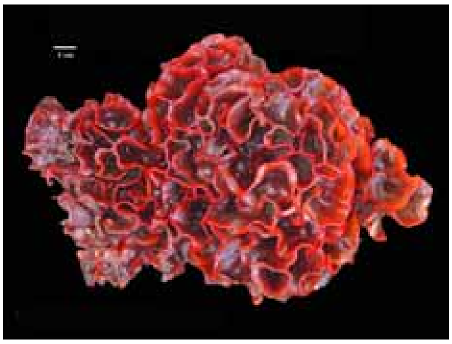

Image: Cohen (2005)
Information: Gordon and Matawari (1992)

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. *W. 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. It also occurs in the north-west Pacific, Torres Strait and northeastern and southern Australia.

Watersipora subtorquata is a common 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. *W. 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.

Watersipora subtorquata has been present in New Zealand since at least 1982 and is now present in most ports from Opua to Bluff. During the initial port baseline surveys, it was recorded from the Opua and Gulf Harbour marinas, Whangarei Harbour (Marsden Point and Whangarei Port) and the ports of Tauranga, Gisborne, Napier, Taranaki, Wellington, Picton, Nelson, Lyttelton, Timaru, Dunedin and Bluff (Table 18). In the Port of Nelson it was recorded from Kingsford Quay, McGlashen Quay, Main Wharf and the Lay-up and Repair Facility (Figure 29). During the second baseline surveys of Group 1 ports *W. subtorquata* was recorded from the ports of Tauranga, Taranaki, Wellington, Picton, Nelson, Lyttelton and Timaru. In the Port of Nelson it occurred in pile scrape samples taken from Kingsford Quay, McGlashen Quay, Main Wharf and the Superyacht berth (Figure 30).

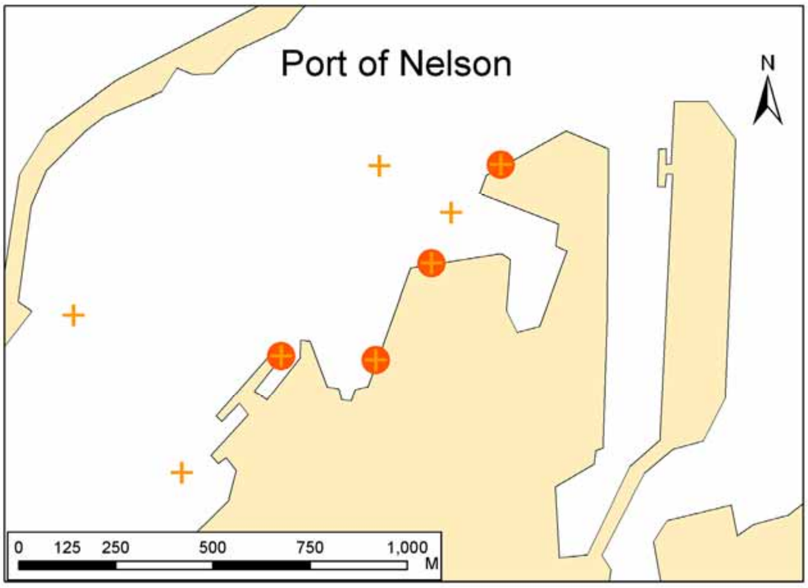

Figure 29: *Watersipora subtorquata* distribution in the initial baseline survey of the Port of Nelson (January 2002).

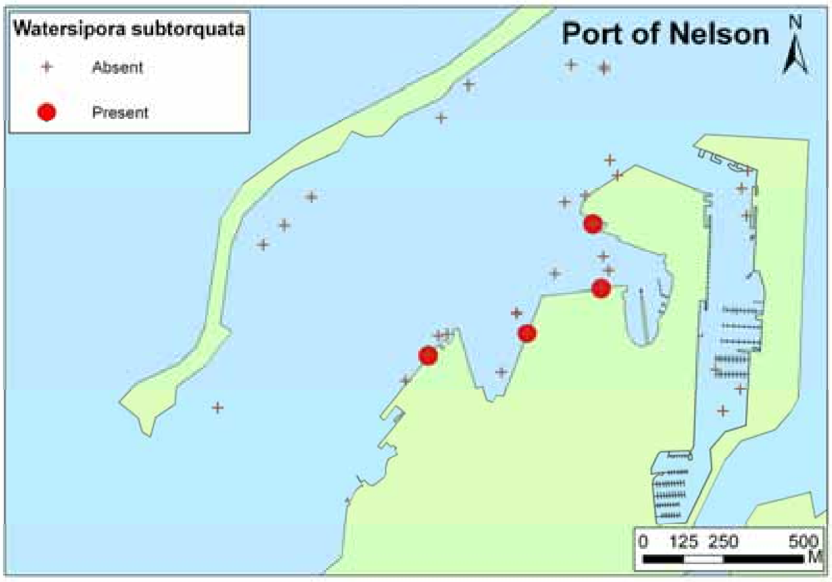

Figure 30: *Watersipora subtorquata* distribution in the re-survey of the Port of Nelson (December 2004).

***Lafoeina amirantensis* (Millard & Bouillon, 1973)**
No image available.

Lafoeina amirantensis is a small epizootic hydroid in the family Campanulariidae. It is known from South Australia, Tasmania, the Seychelles (Indian Ocean), Belize, Panama, and Brazil (Smithsonian Tropical Research Institute 2004; Migotto and Cabral 2005). Details of its native range and ecological impacts are unknown. During the initial port baseline surveys, *L. amirantensis* was recorded only from the Port of Nelson, in a sample taken from Main Wharf (Figure 31), and the specimens obtained were the first known records of this species in New Zealand. During the second baseline surveys of Group 1 ports *L. amirantensis* was again recorded from the Port of Nelson (Table 18), in a pile scrape sample from the Lay-up and Repair Facility (Figure 32).

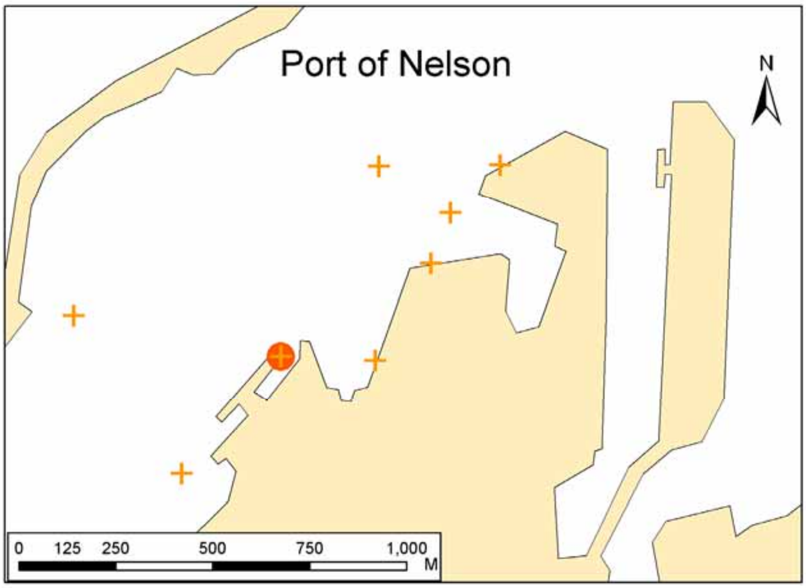

Figure 31: ***Lafoeina amirantensis*** **distribution in the initial baseline survey of the Port of Nelson (January 2002).**

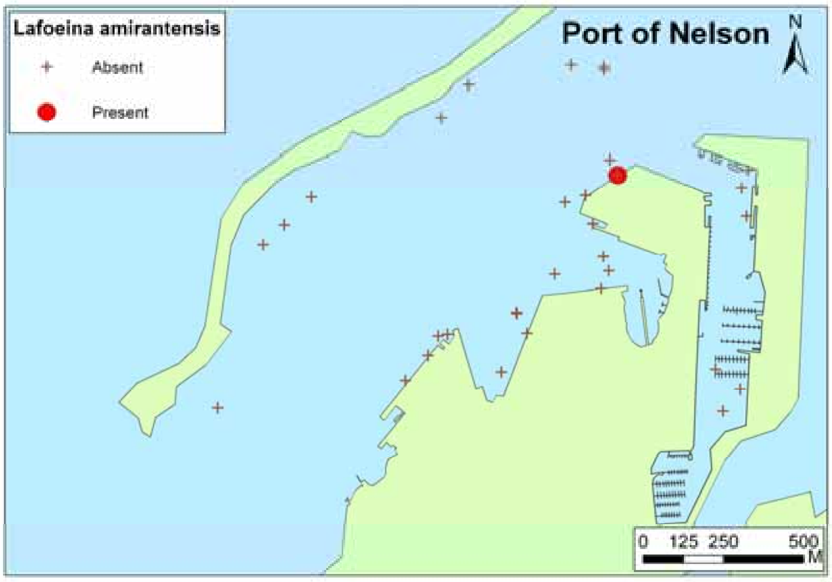

Figure 32: ***Lafoeina amirantensis*** **distribution in the re-survey of the Port of Nelson (December 2004).**

Filellum serpens **(Hassall, 1848)**

No image available.

Filellum serpens is a hydroid in the family Lafoeidae. It occurs on many species of hydroids and on bryozoans (Vervoort and Watson 2003). The type locality is Dublin, on the Irish Sea. The species is regarded as having a cosmopolitan distribution (Vervoort and Watson 2003), including records from the Svalbard Archipelago in the Arctic Circle (Weslawski 2003), Iceland (Schuchert 2000), the Bay of Fundy in the northwest Atlantic (Henry and

Kenchington 2004), the Gulf of Mexico and Gulf of Texas (Deevey 1950) and Port Phillip Bay in Australia (Parliament of Victoria 1997). However, the species can only be recognised with certainty when fertile, and sterile colonies may easily be confused with *Filellum serratum* (Clarke, 1879) and *Filellum antarcticum* (Hartlaub, 1904). *F. serratum* and *F. antarcticum* have both been recorded in New Zealand (see Vervoort and Watson 2003). *F. serratum* is a cosmopolitan species with its type locality in the Caribbean. The type locality of *F. antarcticum* is the Bellinghausen Sea, in Antarctica. *F. serpens* is believed to occur with *F. serratum* in suitable habitats all around New Zealand, but specimens examined have been infertile (including the specimen from the present survey) and therefore the true presence of *F. serpens* in New Zealand is still to be proven by records of fertile colonies (Vervoort and Watson 2003). *F. serpens* was not recorded during the initial baseline surveys. During the second baseline surveys of Group 1 ports an infertile specimen was recorded from the Port of Nelson, in a pile scrape sample from Main Wharf (Figure 33; Table 18).

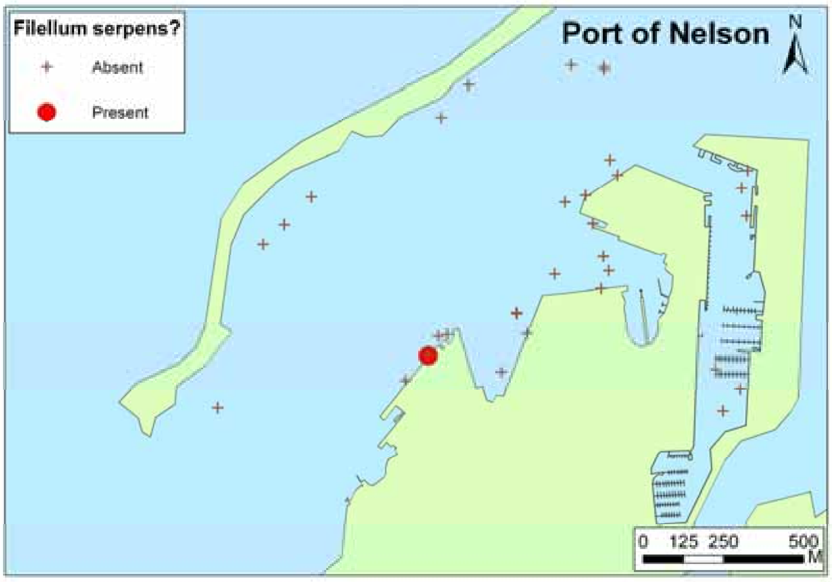

Figure 33: ***Filellum serpens?* distribution in the re-survey of the Port of Nelson (December 2004).**

Synthecium campylocarpum Allman, 1888

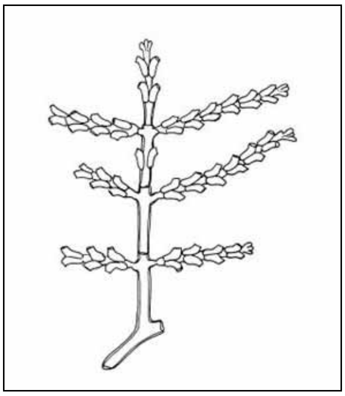

Image: Watson (2002)
Information: Watson (2002), Vervoort and Watson (2003)

Synthecium campylocarpum is a hydroid in the family Syntheciidae. It is native to Australia, with its type locality being New South Wales. Colonies are pale yellow. The exact pattern of distribution of the species is quite obscure due to frequent erroneous synonymisation, but it is probably restricted to (sub) tropical waters of the eastern part of Indonesia, the north of

Australia, and New Zealand (Auckland). *Synthecium campylocarpum* was not recorded during the initial baseline surveys. During the second baseline surveys of Group 1 ports it was recorded from the Port of Nelson, representing an extension to its known range in New Zealand. It occurred in a pile scrape sample from the Superyacht berth, a crab trap from Main Wharf and a benthic sled tow from McGlashen Quay (Figure 34; Table 18).

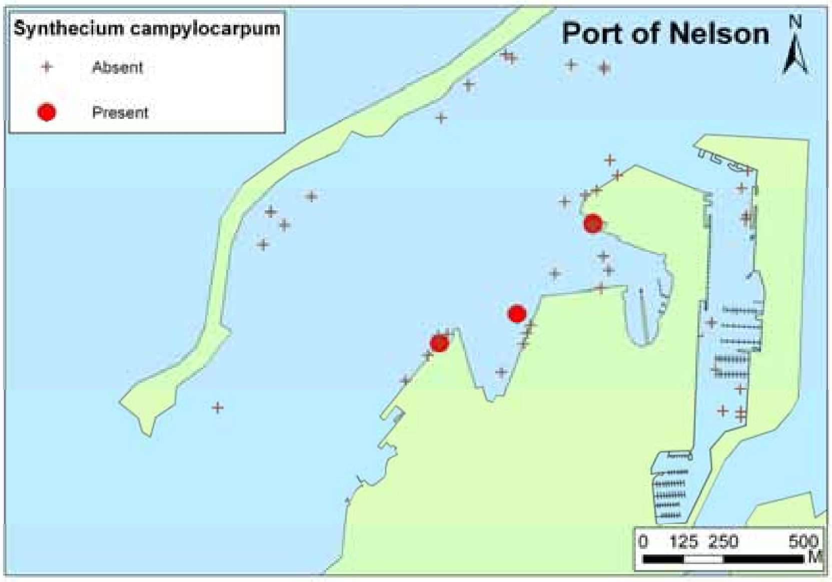

Figure 34: ***Synthecium campylocarpum* distribution in the re-survey of the Port of Nelson (December 2004).**

***Synthecium subventricosum* Bale, 1914**

No image available.

Synthecium subventricosum is a hydroid in the family Syntheciidae. Colonies are usually straggly with a strong tendency towards the formation of stolonal tendrils that develop short, secondary stems (Vervoort and Watson 2003). The type locality is the Great Australian Bight, at water depths between 73-183 m. The species is widely distributed around New Zealand, with records from depths between 37 and 302 m (Vervoort and Watson 2003). *Synthecium subventricosum* was not recorded during the initial baseline surveys. During the second baseline surveys of Group 1 ports it was recorded from the ports of Nelson and Timaru (Table 18), where all specimens recorded were infertile colonies. In the Port of Nelson, it was found growing on bryozoan stems in pile scrape samples from Main Wharf and the Lay-up and Repair Facility (Figure 35).

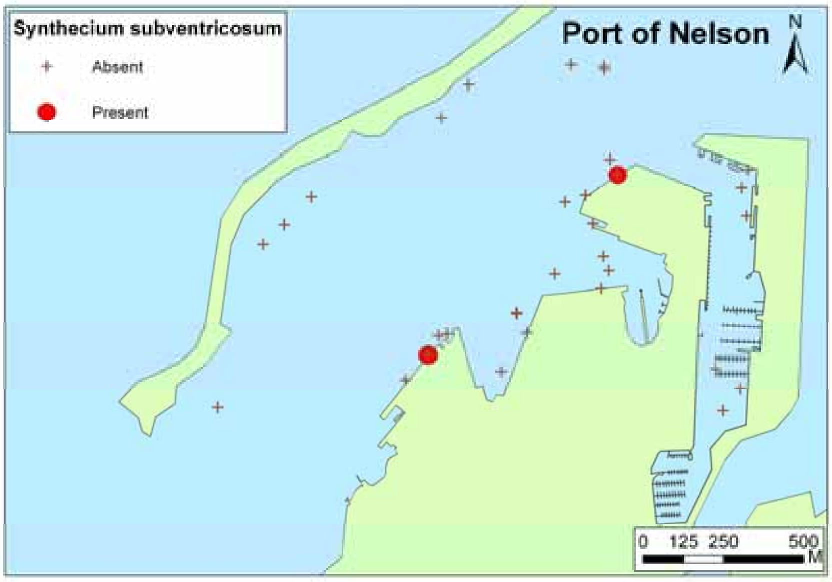

Figure 35: *Synthecium subventricosum* distribution in the re-survey of the Port of Nelson (December 2004).

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

Image and information: NIMPIS (2002b)

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

C. gigas has been present in New Zealand since the early 1960s. Little is known about the impacts of this species in New Zealand, but it is now a dominant structural component of fouling assemblages and intertidal shorelines in northern harbours of New Zealand and the upper South Island. *C. gigas* is now the basis of New Zealand's oyster aquaculture industry, having displaced the native rock oyster, *Saccostrea glomerata*. During the initial port baseline surveys *C. gigas* was recorded from the Opua and Gulf Harbour marinas, Whangarei Harbour (Whangarei Port and Town Basin marina), and the ports of Auckland, Taranaki, Nelson and Dunedin (Table 18). In the Port of Nelson it occurred in samples from Kingsford Quay, Main Wharf, McGlashen Quay and the Lay-up and Repair Facility (Figure 36). During the second baseline surveys of Group 1 ports it was recorded from the ports of Taranaki and Nelson. In the Port of Nelson it occurred in pile scrape samples taken from Kingsford Quay, Main Wharf, McGlashen Quay, the Superyacht berth and the Lay-up and Repair Facility (Figure 37).

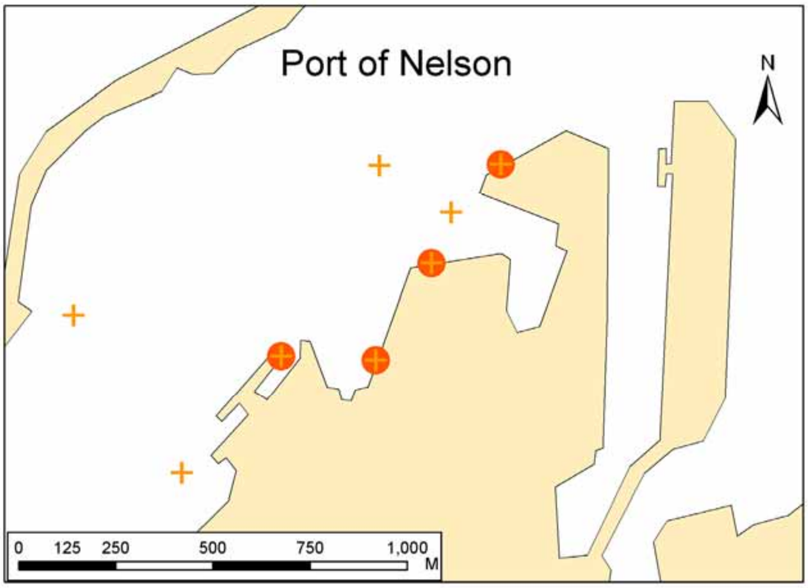

Figure 36: ***Crassostrea gigas* distribution in the initial baseline survey of the Port of Nelson (January 2002).**

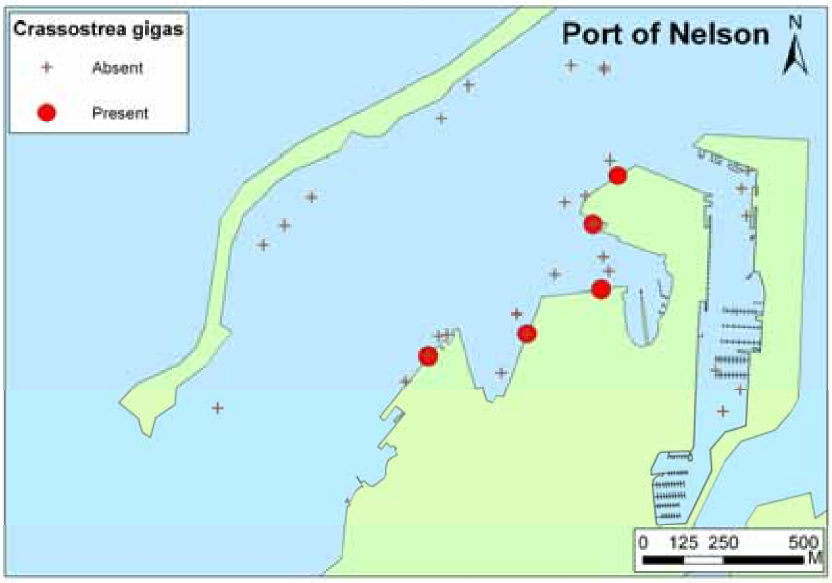

Figure 37: ***Crassostrea gigas* distribution in the re-survey of the Port of Nelson (December 2004).**

***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 (see Cranfield et al. 1998). It occurs in estuaries of the northeast coast of the North Island, including the Bay of Islands, Whangarei Harbour, Waitemata Harbour, Wellington and Pelorus Sound. During the initial port baseline surveys, it was recorded from Opua marina, Whangarei port and marina, Gulf Harbour marina, and the ports of Auckland, Gisborne, Napier, Taranaki, Wellington, Nelson, and Lyttelton (Table 18). In the Port of Nelson it occurred in samples from McGlashen Quay and Kingsford Quay (Figure 38). During the second baseline surveys of Group 1 ports *T. lubrica* was recorded from the ports of Taranaki, Wellington, Picton, Nelson and Lyttelton. In the Port of Nelson it occurred in benthic sled samples taken from the Amaltal Wharf, Kingsford Quay, Main Wharf, McGlashen Quay, the Marina, Nelson Haven North and The Cut. It also occurred in benthic grab samples from the Amaltal Wharf, Kingsford Quay, the Marina, Nelson Haven South and The Cut (Figure 39).

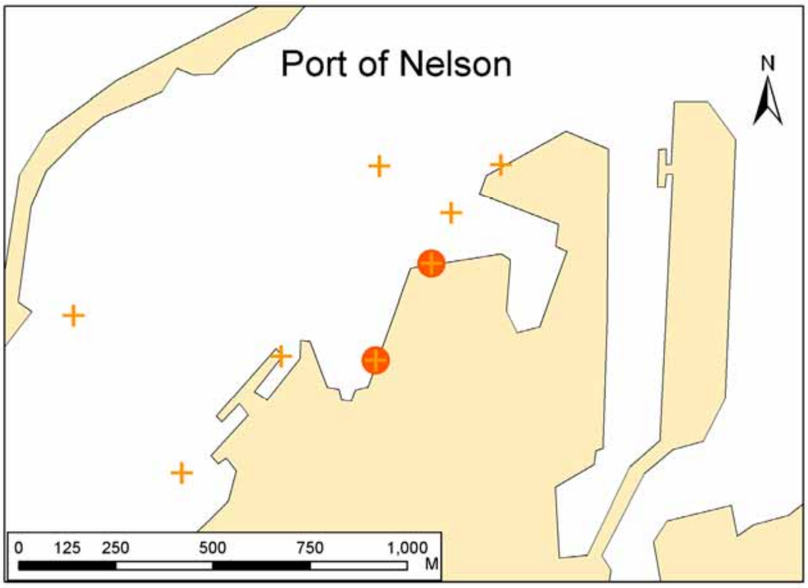

Figure 38: *Theora lubrica* distribution in the initial baseline survey of the Port of Nelson (January 2002).

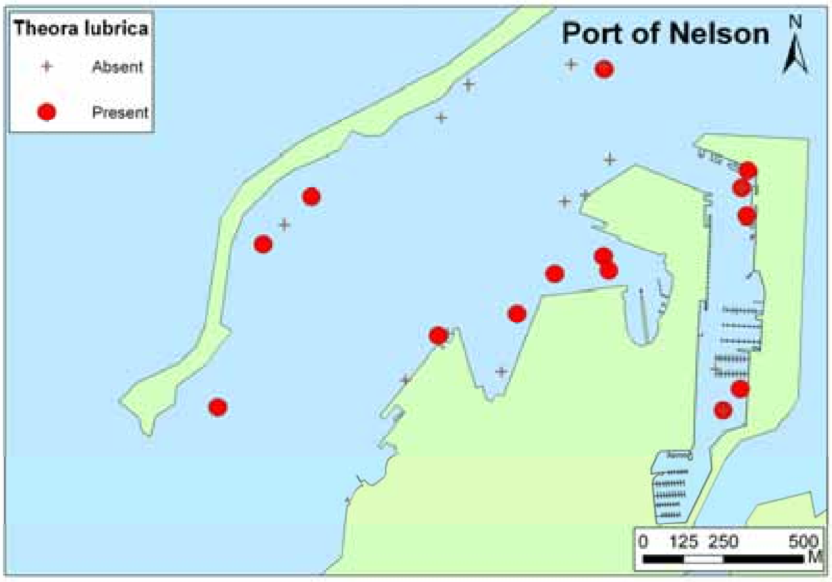

Figure 39: ***Theora lubrica*** **distribution in the re-survey of the Port of Nelson (December 2004).**

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

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

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

Undaria pinnatifida is an opportunistic alga that has the ability to rapidly colonise disturbed or new surfaces. It grows from the intertidal zone down to the subtidal zone to a depth of 15-20 metres, particularly in sheltered reef areas subject to oceanic influence. It does not tend to become established successfully in areas with high wave action, exposure and abundant local vegetation. *U. pinnatifida* is highly invasive, grows rapidly and has the potential to overgrow and exclude native algal species. The effects on the marine communities it invades are not yet well understood, although its presence may alter the food resources of herbivores that would normally consume native species. In areas of Tasmania (Australia) it has become very common, growing in large numbers in areas where sea urchins have depleted stocks of native algae. It can also become a problem for marine farms by increasing labour costs due to fouling problems. *U. pinnatifida* is known to occur in a range of ports and marinas throughout eastern New Zealand, from Gisborne to Stewart Island. During the initial port baseline surveys, it was recorded from the ports of Gisborne, Napier, Wellington, Picton, Lyttelton, Timaru and Dunedin (Table 18). During the second baseline surveys of Group 1 ports *U. pinnatifida* was recorded from the ports of Taranaki, Wellington, Picton, Nelson, Lyttelton, Waitemata Harbour, Auckland, Tauranga Harbour and Timaru. In the Port of Nelson, *U. pinnatifida* occurred in benthic sled samples taken from The Cut and the Marina, and in a starfish trap taken near the Ministry of Fisheries wharf (Figure 40).

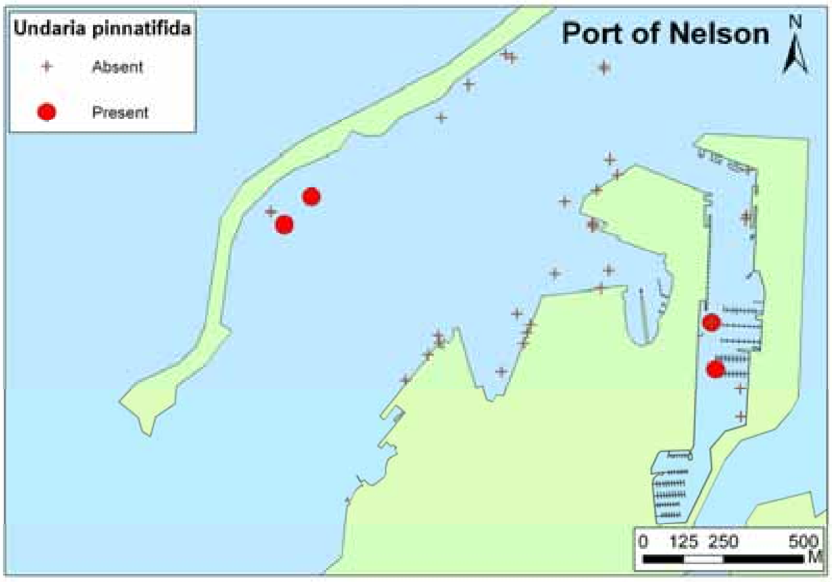

Figure 40: *Undaria pinnatifida* distribution in the re-survey of the Port of Nelson (December 2004).

SPECIES INDETERMINATA

Thirty six 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 14 % of all species collected from this survey (Figure 19). Species indeterminata from the Port of Nelson included 3 annelid worms, 1 bryozoan, 1 cnidarian, 8 crustaceans, 3 molluscs, 1 pycnogonid, 15 algae, 1 ascidian, 1 dinoflagellate, 1 seagrass and one fish (Table 17).

NOTIFIABLE AND UNWANTED SPECIES

One species recorded from the Port of Nelson, the Asian seaweed, *Undaria pinnatifida*, is currently listed on the New Zealand Register of Unwanted Organisms (Table 12). The Pacific oyster, *Crassostrea gigas*, is the only species recorded from Nelson that is on the ABWMAC Australian list of marine pest species (Table 13). Australia has recently prepared an expanded list of priority marine pests that includes 53 non-indigenous species that have already established in Australia and 37 potential pests that have not yet reached its shores (Hayes et al. 2004). A similar watch list for New Zealand is currently being prepared by MAF Biosecurity New Zealand. Nine of the 53 Australian priority domestic pests are present in the Port of Nelson. These are listed in descending order of the impact potential ranking attributed to them by Hayes et al. (2004): *Crassostrea gigas*, *Ciona intestinalis*, *Schizoporella errata*, *Bugula flabellata*, *Undaria pinnatifida*, *Watersipora subtorquata*, *Theora lubrica, Cryptosula pallasiana* and *Bougainvillia muscus*. None of the 37 priority international pests identified by Hayes et al. (2004) was recorded in the Port of Nelson.

PREVIOUSLY UNDESCRIBED SPECIES IN NEW ZEALAND

Four species recorded from the re-survey of the Port of Nelson are new records from New Zealand waters: the cryptogenic sponges *Adocia new sp. 1*, *Dactylia new sp. 1*, *Haliclona new sp. 1* and *Hymenacidon new sp. 1*. A further 6 species from the present survey were described for the first time during the initial port baseline surveys. These included two non-indigenous species - the bryozoan *Celleporaria nodulosa* and the hydroid *Lafoeina amirantensis* – and four cryptogenic species – the sponge *Adocia new sp. 2*, and the ascidians *Distaplia sp*., *Microcosmus squamiger* and *Pyura sp*.. The two non-indigenous species were recorded during the earlier port baseline survey of the Port of Nelson. The remainder represent new records for this location.

CYST-FORMING SPECIES

Cysts of only one species of dinoflagellate were collected during the second baseline survey of the Port of Nelson. The species in question - *Protoperidinium sp*. - could not be reliably identified to species level and therefore falls into the species indeterminata category. However, species in the genera *Protoperidinium* are not known to be harmful (Hay et al. 2000; Faust and Gulledge 2002; New Zealand Food Safety Authority 2003).

COMPARISON OF RESULTS FROM THE INITIAL AND REPEAT BASELINE SURVEYS OF THE PORT OF NELSON

Pile scrape samples

Native species

Rarefaction curves and estimates of total richness of native species in pile scrape samples taken from the two baseline surveys of the Port of Nelson are presented in Figure 41a. The observed density of native species was slightly greater in the second survey with, on average, ~25% more species being recorded in the same number of samples (Survey 1, $S_{n=54} = 83$; Survey 2, $S_{n=54} = 104$). In each survey, the observed richness increased steadily as more samples were taken and did not approach an asymptote. Survey effort for the pile scrapes was increased in the second survey with the addition of an extra sample site (i.e. 16 more quadrat samples). The increase in effort captured ~38 % more species than in the initial baseline survey, reflecting both the greater number of samples taken and the greater overall density of species (Table 19). Estimates of total species richness in each survey also continued to increase with sample size and did not plateau or converge with observed richness, indicating a high proportion of unsampled species in the assemblages. Indeed, as sample size increased, more unique species (i.e. those that occurred in only one sample) were added to the survey sample. These 'rare' species comprised 42% and 36 % of the native species observed in each survey, respectively (Table 19). The large proportion of uniques had a strong influence on the estimated number of unsampled species in the assemblage, which varied between 57 % (in the first survey) and 41 % (second survey) of the total estimated number of species in the assemblage (Figure 41a).

Fifty-nine of the 139 species (42 %) recorded in the two surveys were observed on both occasions (Table 19). Again, this reflects the large number of comparatively rare species in the assemblage, with non-detection of many of these probably accounting for much of the difference observed between the two surveys. For example, the classic Jaccard and Sorenson measures of compositional similarity indicate low-to-moderate similarity between the assemblages observed in the initial and repeat baseline surveys of Nelson (Classic Jaccard = 0.424, Classic Sorenson = 0.596). In contrast, the new Chao similarity indices, which adjust for the effects of non-detection of rare species, suggest much closer resemblance of the two samples (Chao bias-adjusted Jaccard = 0.766; Chao bias-adjusted Sorenson = 0.867; Table 19).

Cryptogenic category 2 species

Rarefaction curves for cryptogenic category two species also did not reach an asymptote in either survey (Figure 41b), but, because of the much smaller pool of species in this group, increased slower with sample size than the rarefaction curve for native species. More cryptogenic category 2 species were observed in the second survey than in the first. Indeed, the total number of species observed in the second survey (S_{max} = 14) exceeded the estimated total richness of the first survey (Survey 1, Mean Chao 2 estimate = 10.9 species). This reflected much greater density of cryptogenic category 2 species in samples from the repeat survey and the increase in survey effort (Table 19). It is unclear what caused the differences in species density and estimated species richness between surveys, but they may be associated with temporal variation in the abundance of species within the assemblage or immigration of new species into it.

Many of the species recorded in each survey occurred in just a single sample ("uniques", Table 19). In the first survey, 4 of the 5 (80%) cryptogenic category 2 species occurred in only one sample; in the second survey, 8 of the 14 species (57%) were uniques. In contrast, there were no species in either survey that occurred in exactly two samples ("duplicates"). Because the Chao estimators of richness in the assemblage are calculated using the ratio of the number of uniques relative to the number of duplicates, the estimates are unstable when there are few, or no, duplicates in the sample. This was the case in both surveys. The richness estimates rose sharply as more samples were added and, in the second survey, was almost 3x larger than the observed number of species (Figure 41b). In these circumstances, the estimate is likely to be unreliable.

There was comparatively high turn-over in cryptogenic category 2 species composition between the two surveys. Only 2 of the 17 species in this category (12%) were common to both surveys (Table 19). This is reflected in comparatively low similarity between the assemblages, even when adjustment is made for undetected rare species (Chao bias-adjusted Jaccard = 0.324; Chao bias-adjusted Sorenson = 0.489; Table 19).

Non-indigenous and cryptogenic category 1 species

Rarefaction curves for non-indigenous and cryptogenic category 1 species observed in the two surveys were almost identical (Figure 41c). The slightly larger number of species recorded in the second survey (Survey 1, S_{max} = 24 species; Survey 2, S_{max} = 27 species) was attributable solely to the greater number of samples taken, as the average densities of species per sample were very similar in each survey (Figure 41c, Table 19). Neither rarefaction curve reached an asymptote.

Estimates of total species richness in each survey showed contrasting patterns of change with sample size (Figure 41c). In the first survey, the richness estimate increased sharply after more than 30 samples had been added (Figure 41c). Again, this instability appears to be caused by the small number of duplicates in the sample. Only one species occurred in exactly two samples in the first baseline survey. Although similar numbers of uniques were recorded in each survey (12 species in survey 1; 11 species in Survey 2; Table 19), the greater number of duplicates present in the sample from the repeat survey (4 species) allowed a more stable estimate of total richness, at around 42 species (Figure 41c).
The difference between the observed and estimated richness in the second survey suggested a relatively large number of unsampled species in the assemblage (~15 species). Only 14 of the 37 species (38%) recorded in the two surveys were common to both (Table 19). Despite low-

to-moderate similarity in the observed species composition of the two surveys (Classic Jaccard = 0.378, Classic Sorenson = 0.549), the large proportion of potentially unsampled species meant that the estimated assemblages were quite similar (Chao bias-adjusted Jaccard = 0.830; Chao bias-adjusted Sorenson = 0.907; Table 19).

Benthic sled samples

Native species

Survey effort for the benthic sled samples was more than doubled in the repeat baseline survey of Nelson in an attempt to improve description of the epibenthic fauna of the port (Figure 42a). The sled samples were characterised by relatively high per sample diversity, but extremely patchy distributions of species. Samples from both surveys were dominated by uniques (57% of native species in Survey 1 and 55% of species in Survey 2; Table 19). The rates of species accumulation in the samples were almost identical in the two surveys (Figure 42a) with, again, the greater number of species observed in the repeat survey as a result of greater survey effort, rather than greater per sample diversity. Neither rarefaction curve reached an asymptote or converged with its associated estimate of total species richness (Figure 42a). In each survey, the Chao 2 richness estimates also increased with sample size, reflecting the large number of uniques that continued to be added to the inventory as more samples were taken.

Eighty-nine species were recorded in total from the benthic sled samples. Only 22 of these (25%) occurred in both surveys (Table 19). Nevertheless, because of the large estimated number of unsampled species in the two assemblages, there was comparatively high similarity between the two surveys (Chao bias-adjusted Jaccard = 0.761; Chao bias-adjusted Sorenson = 0.864; Table 19).

Cryptogenic category 2 species

Too few species were recorded in this category for quantitative comparison of the two baseline surveys. No cryptogenic category 2 species were collected in the initial survey from the benthic sled samples and only 3 species from this category were recorded in the second survey (Table 19).

Non-indigenous and cryptogenic category 1 species

Rarefaction curves for the combined non-indigenous and cryptogenic category 1 species are presented in Figure 42b. The per-sample density of species was much greater in the first survey than in the second survey, with more species recorded from a much smaller number of samples (Survey 1, S_{max} = 6 species, n = 8 sled samples; Survey 2, S_{max} = 4 species, n = 18 sled samples). A total of 9 non-indigenous and cryptogenic category 1 species were captured in the two surveys using the benthic sled. Only one of these species (the deposit feeding bivalve *Theora lubrica*) occurred in both surveys. The sampled assemblages in each survey were, again, dominated by comparatively rare species. Between 67% (Survey 1) and 50% (Survey 2) of the assemblages, respectively, were uniques (Table 19). A consequence was that rarefaction curves for each survey did not reach an asymptote, as more uniques were added to the inventory as sample size increased. The Chao 2 estimated richness of the assemblages also increased with sample size and, in the second survey, did not converge with the observed species density. Because of the low overlap in species composition of the samples, the similarities of both the observed (Classic Jaccard = 0.111, Classic Sorenson = 0.200) and estimated assemblages (Chao bias-adjusted Jaccard = 0.220; Chao bias-adjusted Sorenson = 0.360) in each survey were relatively low (Table 19).

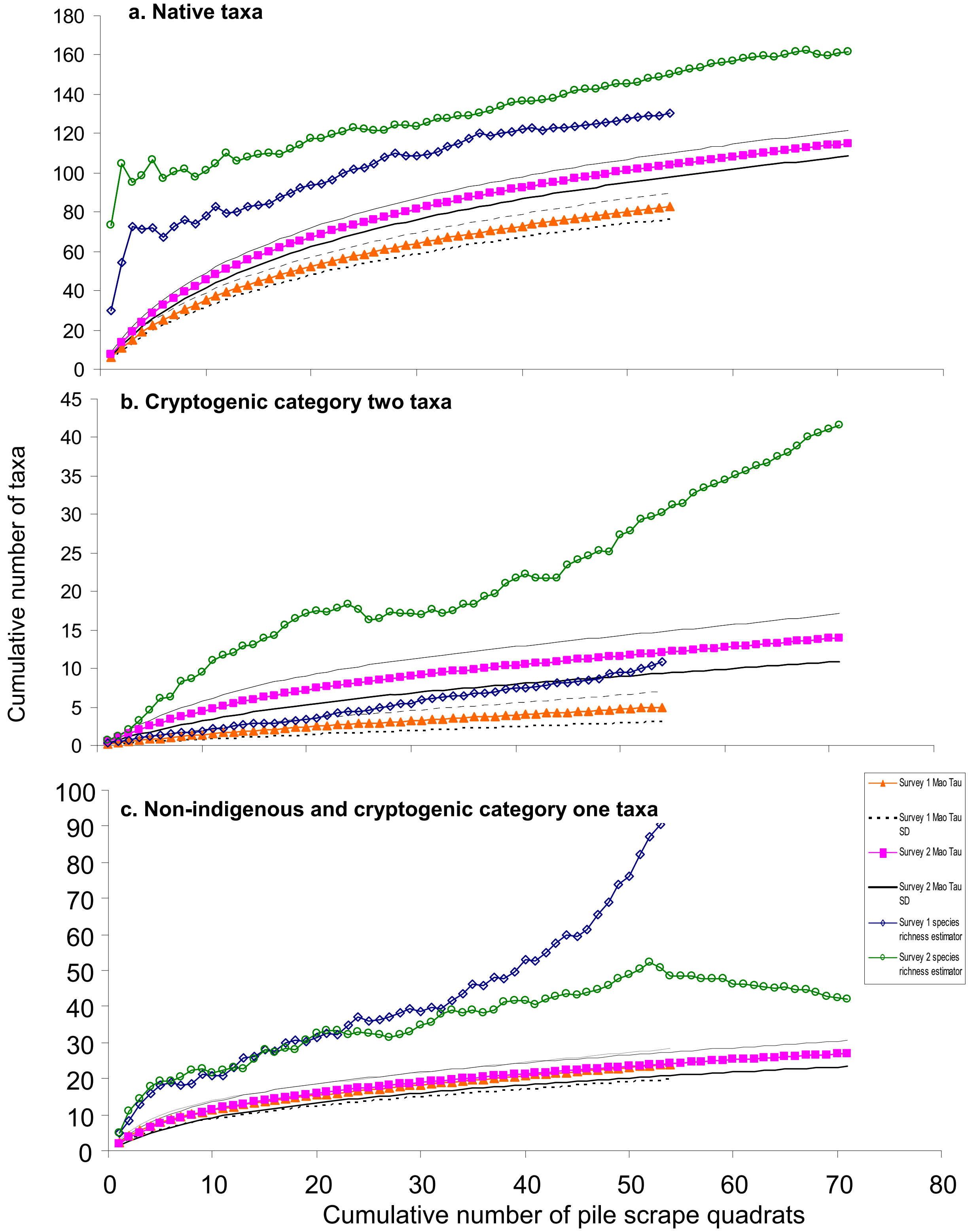

Figure 41: Rarefaction curves (Mao Tau) for native (top), cryptogenic category two (middle) and non-indigenous and cryptogenic category one (bottom) taxa from pile scrape quadrats for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). Species richness estimators are also shown for the first survey (empty diamonds) and second survey (empty circles); the Chao 2 bias-corrected formula was used in all instances.

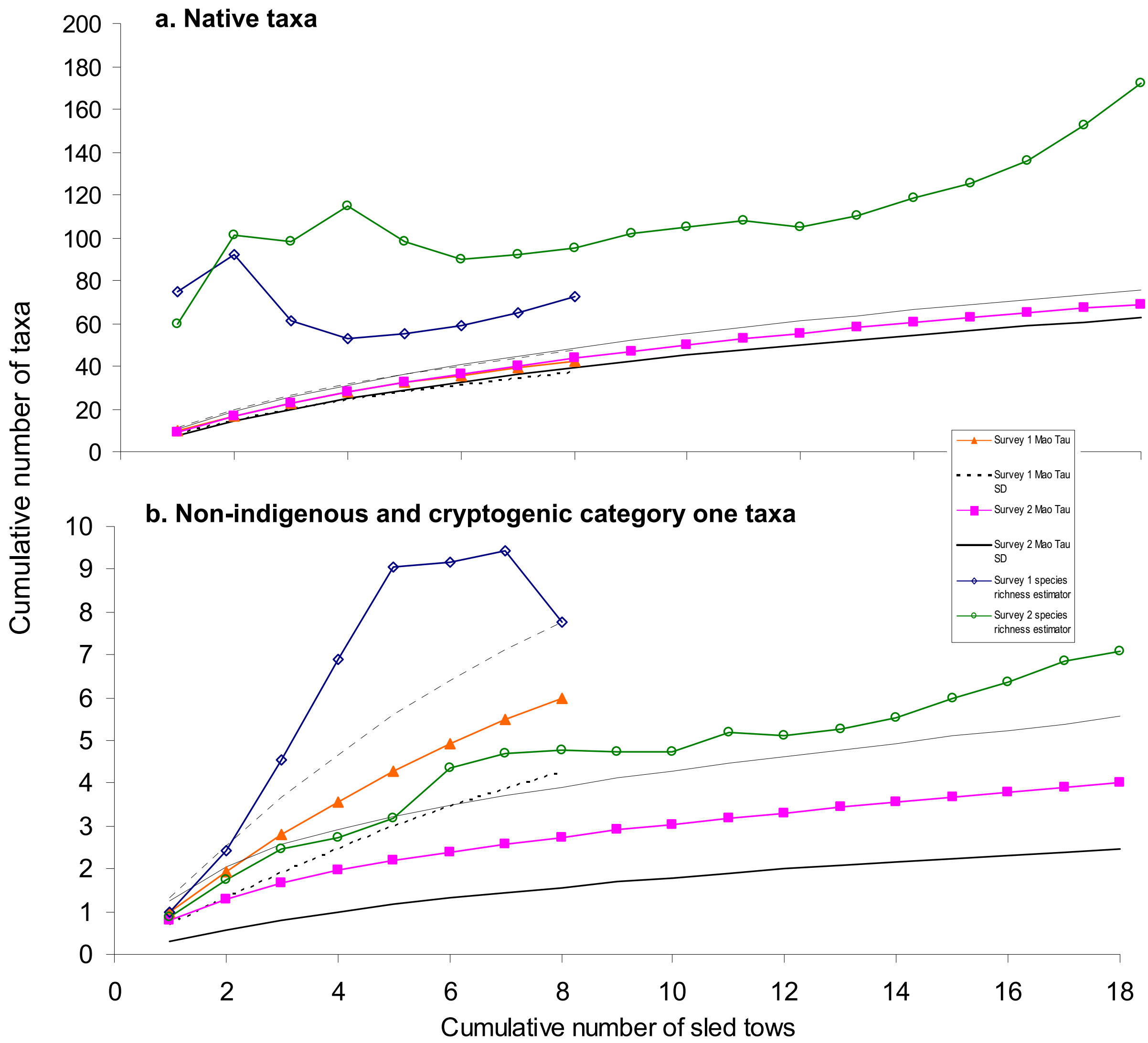

Figure 42: Rarefaction curves (Mao Tau) for native (top), and non-indigenous and cryptogenic category one (bottom) taxa from benthic sled tows for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). Species richness estimators are also shown for the first survey (empty diamonds) and second survey (empty circles); the Chao 2 bias-corrected formula was used for the first survey, the ICE Mean was used for NIS & C1 taxa in the second survey and the Chao 2 classic formula was used for native taxa in the second survey.

Benthic grab samples

The benthic grab was damaged during the first survey of Nelson in January 2002, so that only 2 samples were taken with this method. Consequently, most of the discussion below concerns samples obtained during the second baseline survey in December 2004, when 27 grab samples were taken (Table 19). The benthic assemblage sampled by the grab contained relatively few non-indigenous and cryptogenic category 1 species (5 species in total) or cryptogenic category 2 species (2 species) in either survey. For this reason, analysis was done on the pooled species assemblage (Table 19).

The grab samples were characterised by relatively few species per sample (Mean ± S.E. = 2.8 ± 0.4 species per grab), a large number of unique species (19 of 32 species recorded), and few duplicates (3 of 32 species). A consequence was that the rarefaction curve showed no sign of approaching an asymptote and the species richness estimate was large and unstable (Figure 43). The Chao 2 estimate did, however, reach a plateau at an average of 92 species, approximately three times the observed number of species. At the slow rate of accumulation observed in the survey, approximately 80 more grab samples would be needed to sample this number of species.

Crab trap samples

Samples obtained using baited crab traps were also characterised by relatively few species per sample (Survey 1, Mean ± S.E. = 1.2 + 0.4 species per trap; Survey 2, Mean ± S.E. = 1.4 ± 0.3 species per trap) and few non-indigenous and cryptogenic species (Table 19). This was a feature of all of the passive trapping techniques (see below). In total, 28 species were sampled using the crab traps over both surveys. Most species (19 of 28 species) were recorded in the second survey. The larger number of species reflected both greater species density and a larger number of samples taken in the second survey (Figure 44, Table 19). More than twice as many traps were set in the second survey in an attempt to improve description of the fauna sampled by this technique. Nevertheless, samples recovered in both surveys contained large proportions of uniques (56% and 57% of the observed species, respectively). Neither rarefaction curve reached an asymptote or converged with its associated estimate of total species richness (Figure 44). In each survey, however, the Chao 2 estimate of richness did reach an asymptote. In the first baseline survey, this occurred at a maximum of 16 species, after an average of 7 trap samples had been added to the inventory. In the second survey, the estimate of richness stabilised at around 36 species after 22 samples were taken (Figure 44). In each case, the large difference between the observed and estimated species richness suggests a large proportion of unsampled species. It is worth noting, however, that this is not necessarily a problem of undersampling, since the observed number of species in the second survey exceeded the richness estimate from the first survey. What these results indicate is that as more samples are taken, more unique species were added to the inventory, such that a large proportion of the fauna sampled by this technique are relatively uncommon.

Only 4 of the 28 species (14%) recovered from the crab traps were found in both surveys (Table 19). The species compositions of the two observed assemblages were, therefore, relatively dissimilar (Classic Jaccard similarity index = 0.143, Classic Sorenson similarity index = 0.250), but because of the large proportion of uniques in the samples, there was low-to-moderate similarity between the estimated assemblages, once unsampled species had been taken into account (Chao bias-adjusted Jaccard = 0.331; Chao bias-adjusted Sorenson = 0.498, Table 19).

Fish trap samples

Almost equal numbers of species were captured in the fish traps in each survey, despite much greater sample effort in the repeat baseline survey (Survey 1, S_{max} = 13 species, n = 16; Survey 2, S_{max} = 12, n = 42; Table 19). As with samples from the crab traps, few non-indigenous or cryptogenic species were recovered from the fish traps and, as a result, analysis was done on the pooled species assemblage (Table 19).

Despite the smaller sample size, species density was much greater in the initial baseline survey with, on average, twice as many species recorded for the same sample effort (Survey 1, $S_{n=16}$ = 12 species; Survey 2, $S_{n=16}$ = 4.9 species; Figure 45). Although the rarefaction curve for the first survey did not reach an asymptote, there were relatively few uniques in the sample (38%, Table 19) and the curve did converge with the Chao 2 estimate of total species richness, indicating a relatively complete inventory. The proportion of uniques was much larger in the second survey (50%, Table 19). The low species density meant that the rate of species accumulation was very slow and did not reach an asymptote, despite the larger number of samples that was taken. The richness estimate for the second survey also continued to increase slowly as more samples were added, suggesting that many of the species that were being added to the inventory were unique to the sample (Figure 45). At the observed rate of species accumulation, a further doubling of sample size would be needed to capture the estimated number of species in the assemblage.

Only 2 of the 23 species captured in the fish traps occurred in both surveys (Table 19). The low overlap in species composition resulted in low similarity between the observed assemblages (Classic Jaccard = 0.087, Classic Sorenson = 0.160) and only low-to-moderate similarity in the estimated assemblages, once potentially unsampled species were taken into account (Chao bias-adjusted Jaccard = 0.271; Chao bias-adjusted Sorenson = 0.427; Table 19).

Starfish trap samples

Too few non-indigenous and cryptogenic species were captured in the starfish traps to allow separate comparison of these groups between the two baseline surveys. Twenty species in total were captured using this survey method (Table 19). Rarefaction curves from each survey exhibited almost identical trajectories with, typically, low rates of capture per trap and slow accumulation of species into the inventory (Figure 46). Indeed, a large proportion of the traps set in each survey returned no catch (50% of traps in the first survey and 57% in the repeat survey). The greater number of species recorded in the repeat baseline survey was attributable to the larger number of traps that were set in that survey (Table 19), since there was no observed difference in the density of species in the two surveys (Figure 46). Both samples were dominated by uniques (78% and 71% of species observed, respectively). These catch characteristics – a large number of zero catches, high proportion of uniques, and slow species accumulation – suggest a large number of species may remain undetected in the assemblage. Estimates of the total assemblage richness on each survey continued to increase steeply with sample size and diverged from the rarefaction curves (Figure 46). This pattern of species accumulation suggests that even large increases in survey effort would not sample a large proportion of the estimated assemblage, as most species added to the sample are relatively uncommon.

Only three of the 20 species captured in the starfish traps were found on both surveys (Table 19). The large number of uniques in the samples meant that, despite low similarity in the species composition of the observed assemblages (Classic Jaccard = 0.150, Classic Sorenson = 0.261), there was moderate similarity in the estimated assemblages from which the samples were taken (Chao bias-adjusted Jaccard = 0.358; Chao bias-adjusted Sorenson = 0.527; Table 19).

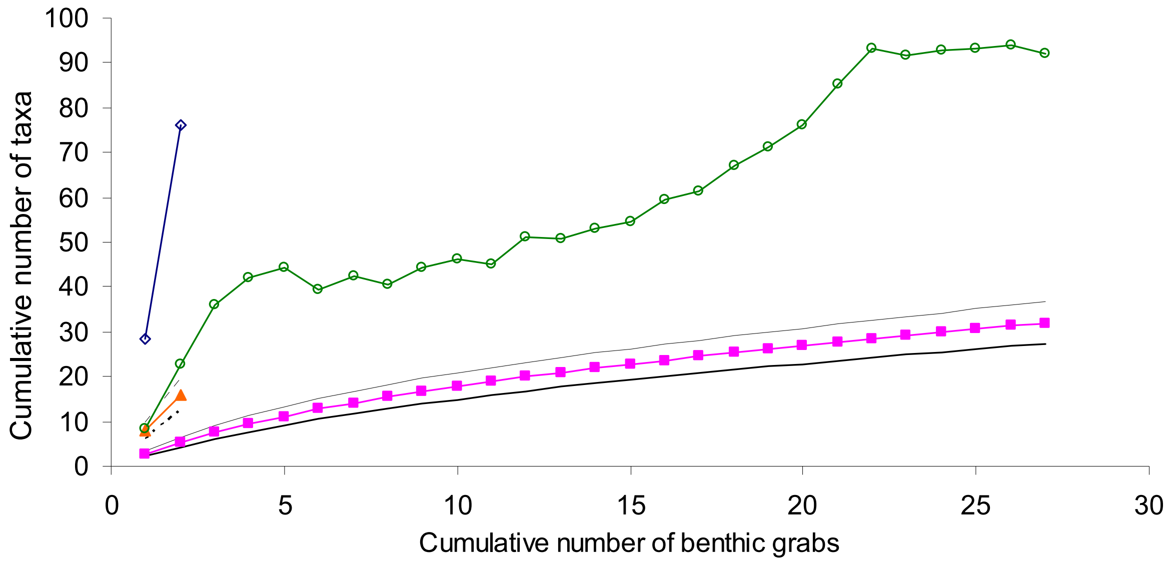

Figure 43: **Rarefaction curves (Mao Tau) for native, cryptogenic and non-indigenous taxa combined, from benthic grabs for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). Species richness estimators are also shown for the first survey (empty diamonds) and second survey (empty circles); the Chao 2 classic formula was used for both surveys.**

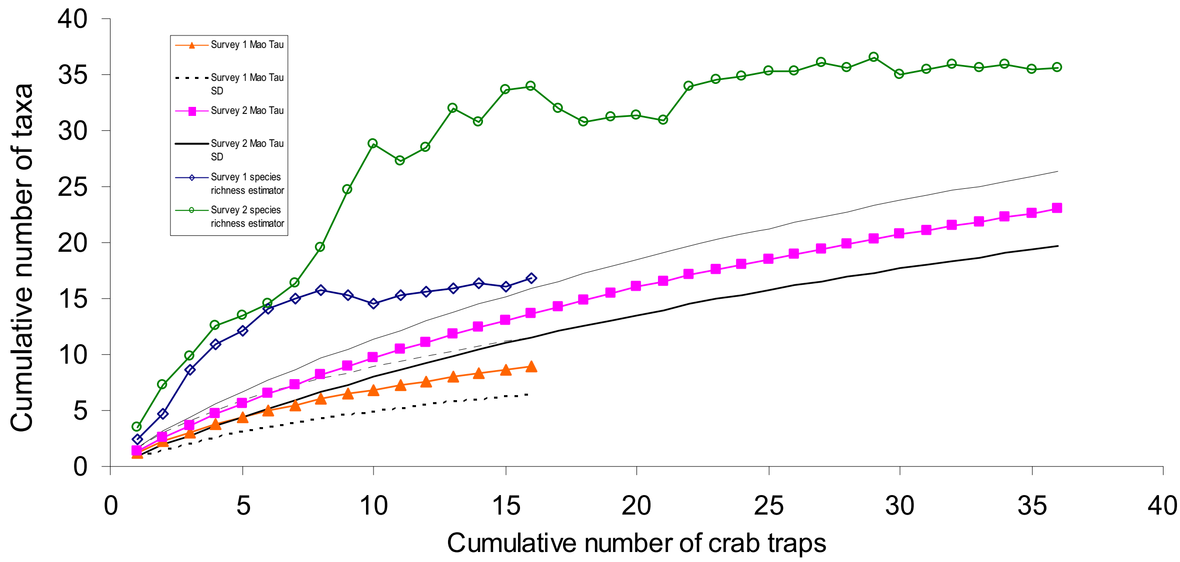

Figure 44: **Rarefaction curves (Mao Tau) for native, cryptogenic and non-indigenous taxa combined, from crab traps for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). Species richness estimators are also shown for the first survey (empty diamonds, ICE formula) and second survey (empty circles, Chao 2 bias-corrected formula).**

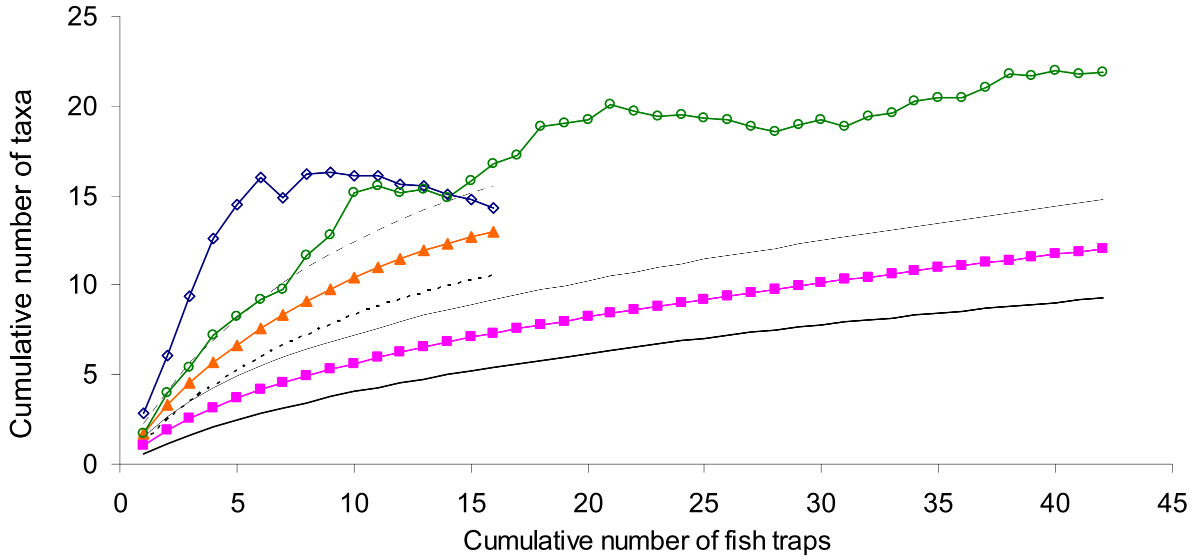

Figure 45: **Rarefaction curves (Mao Tau) for native and cryptogenic taxa from fish traps for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). No alien taxa were encountered. Species richness estimators are also shown for the first survey (empty diamonds, Chao 2 bias-corrected formula) and second survey (empty circles, ICE formula).**

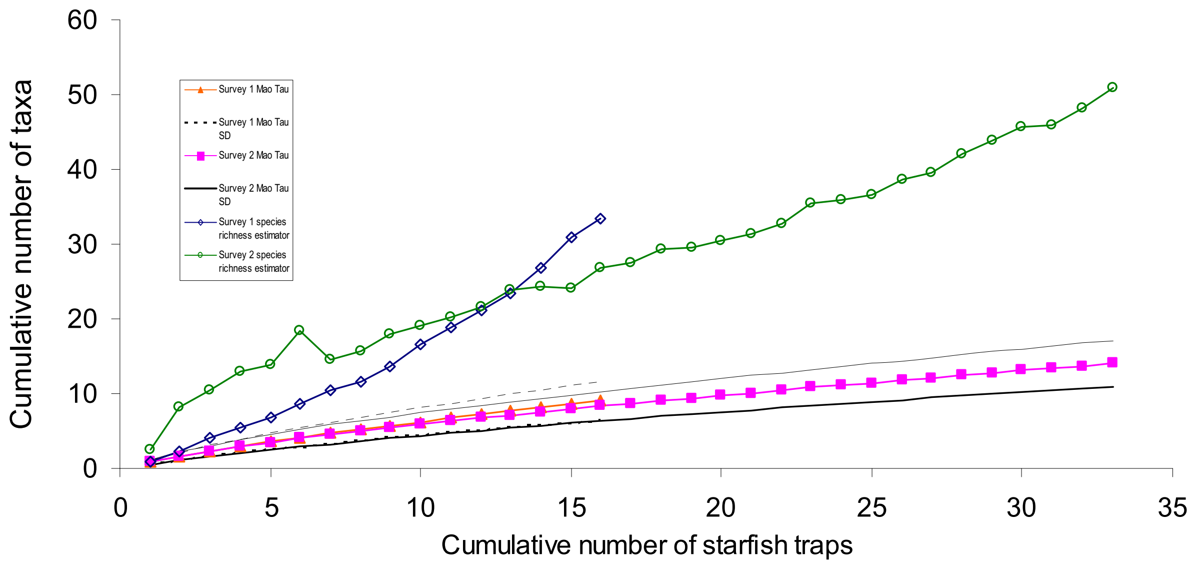

Figure 46: **Rarefaction curves (Mao Tau) for native, cryptogenic and alien taxa combined from starfish traps for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). No alien or cryptogenic category two taxa were encountered. Species richness estimators are also shown for the first survey (empty diamonds, Chao 2 classic formula) and second survey (empty circles, ICE formula).**

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

The non-indigenous species located in the Port of Nelson are thought to have arrived in New Zealand via international shipping. They may have reached the Port of Nelson directly from overseas or through domestic spread (natural and/or anthropogenic) from other New Zealand ports. Table 16 indicates the possible vectors for the introduction of each NIS recorded from the Port of Nelson during the baseline port surveys. Likely vectors of introduction are largely derived from Cranfield et al. (1998) and expert opinion. They suggest that only one of the 19 NIS (5%) probably arrived via ballast water, 13 species (68%) were most likely to be associated with hull fouling, one species (5%) is suspected to have arrived on drift plastic and four species (22%) could have arrived via either hull fouling or ballast water.

Assessment of the risk of new introductions to the port

Many non-indigenous species introduced to New Zealand ports by shipping 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).

Between 2002 and 2005, there were 311 vessel arrivals from overseas to the Port of Nelson. The greatest number of these came from Australia (75, including 49 from southeastern Australia), Japan (70), the northwest Pacific (42, predominantly from China and Korea) and the Pacific Islands (29; Table 4). With the exception of the Pacific Islands, most of this trade is with ports from other temperate regions that have coastal environments similar to New Zealand's.

Bulk carriers and tankers that arrive empty carry the largest volumes of ballast water. In the Port of Nelson these came predominantly from the northwest Pacific (35 visits), Japan (33 visits) and Australia (29 visits; Table 4). Smaller, slower moving vessels, such as barges and fishing boats, tend to carry a greater density of fouling organisms than faster cargo vessels. In the port of Nelson, these came predominantly from Australia and undisclosed locations (Table 4).

Based on the shipping patterns described above, shipping from southern Australia, the northwest Pacific (predominantly China and Korea) and Japan present the greatest risk of introducing new non-indigenous species to the Port of Nelson. Because of the relatively short transit time, shipping originating in southern Australia (particularly Victoria and Tasmania) carries, perhaps, the greatest overall risk. Furthermore, six of the eight marine pests on the New Zealand Register of Unwanted Organisms are already present in southern Australia (*Carcinus maenas*, *Asterias amurensis*, *Undaria pinnatifida*, *Sabella spallanzanii*, *Caulerpa taxifolia*, and *Styela clava*). The native range of other two species – *Eriocheir sinensis* and *Potamocorbula amurensis* – is the northwestern Pacific, including China and Japan.

Assessment of translocation risk for introduced species found in the port

Between 2002 and 2005, vessels departing from the Port of Nelson travelled to 16 other ports throughout New Zealand. Wellington, Napier and Tauranga were the next ports of call for the most domestic vessel movements from Nelson (Table 8). Although many of the non-indigenous species found in the re-survey of the Port of Nelson have been recorded in other locations throughout New Zealand (Table 18), they were not detected in all of the other ports surveyed. There is, therefore, a risk that species established in the Port of Nelson could be spread to other New Zealand locations.

Of particular note is the one species present in Nelson that is on the New Zealand Unwanted Species Register: the invasive alga *Undaria pinnatifida*. *Undaria* has been present in New Zealand since at least 1987 and has spread through shipping and other vectors to 11 of the 16 ports and marinas surveyed during the baseline surveys (the exceptions being Opua, Whangarei Port and Marina, Gulf Harbour Marina and Tauranga Port). Until recently, it was absent from the Ports of Taranaki (New Plymouth) and Tauranga. Mature sporophytes were discovered in the Port of Taranaki during the repeat baseline port survey there in March 2005. Some isolated sporophytes have also been discovered independently on rocky reefs near the Port of Tauranga (Environment Bay of Plenty, pers. comm.), but the alga does not appear to be established in the port itself. Bulk carriers, general cargo and container vessels regularly ply between Nelson and the Port of Tauranga. There is, therefore, a risk that it could be spread to this location by shipping from Nelson.

The Port of Nelson receives regular traffic from Lyttelton Harbour, by a range of vessel types. Lyttelton is one of only two locations nationwide that the club-shaped ascidian, *Styela clava*, has been recorded from outside the Hauraki Gulf; the other being Tutukaka Marina (Gust et al. 2006a). This species is on the New Zealand Register of Unwanted Species, and is considered a significant pest of aquaculture (particularly long-line mussel culture). There is concern about the potential for it to spread to important mussel growing areas in the Marlborough Sounds (which lies on the shipping route between Lyttelton and Nelson) and the Coromandel.

Because they are fouling organisms, the risk of translocating *U. pinnatifida* from Nelson and *S. clava* into Nelson is highest for slow-moving vessels, such as yachts and barges, and vessels that have long residence times in port. In the Port of Nelson, cargo and bulk (including fuel) carriers, recreational craft, and seasonal fishing vessels that are laid up for significant periods of time pose a particular risk for the introduction and spread of these species.

Slow-moving vessels may also pose a particular risk for the spread of the two non-indigenous species recorded from Nelson that were recently reported to New Zealand. Both the bryozoan *Celleporaria nodulosa* and the hydroid *Lafoeina amirantensis* appear to have relatively restricted distributions nationwide (based on the baseline survey and resurvey results) and are likely to be transported as hull fouling (*Lafoeina amirantensis* may also be transported in ballast water). *Celleporaria nodulosa* was recorded in the Ports of Nelson and Gisborne in the first baseline survey, and in Nelson and Timaru in the second baseline surveys of Group 2 ports. 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. *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. It is known to occur in South Australia and the Seychelles, although details of its native and introduced range and ecological impacts are unknown.

Management of existing non-indigenous species in the port

More than half of the NIS detected in this survey appear to be well established in the port. However, there were five NIS recorded in this survey that were recorded from only one site (Table 18). They included three species that were not recorded during the intial baseline survey of Nelson (the polychaete worm *Hydroides elegans*, the bryozoan *Electra tenella*, and the hydroid *Filellum serpens?*) and two species that were present in only a single sample each in the initial baseline survey of Nelson (the hydroid *Lafoeina amirantensis* and the bryozoan *Cryptosula pallasiana*). With the exception of *C. pallasiana*, all of these species occur in no, or few, other New Zealand ports, and thus do not appear to be widely distributed in New Zealand. An attempt to eradicate or control these species may be warranted only if their distribution in the port is limited, there is potential for them to cause significant harm should they spread, and management measures are likely to be effective. *Hydoides elegans* is known to be a problem fouling species that can cause overgrowth of native species and densely cover submerged marine structures (see species summary above). There is only limited information about potential impacts of the other species.

For most marine NIS, eradication by physical removal or chemical treatment is not yet a cost-effective option. Local population controls are unlikely to be effective for species that are widespread in the Port of Nelson. They may be worth considering for the more restricted species noted above, but a more detailed delimitation survey is needed for these species to determine their current distribution and abundance more accurately before any control measures are considered. is recommended that management activity be directed toward mitigating the spread of species established in the port to locations where they do not presently occur. Such management will require better description of its distribution within the Port and of the location and frequency of movements of potential vectors that might spread it from Nelson to other domestic and international locations.

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. MAF 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. Until effective risk mitigation options are developed, it is recommended that local authorities and port companies assess the risk of activities such as in-water cleaning of vessel hulls and sea-chests. These activities can increase the likelihood of non-indigenous fouling species being released and potentially becoming established within the port. They should be discouraged where the risk is considered unacceptable. Slow moving barges or vessels that are laid up in overseas ports for long periods before travelling to New Zealand can carry large densities of non-indigenous marine organisms with them. Cleaning and maintenance of these vessels should be encouraged by port authorities and shipping companies prior to their departure for New Zealand waters.

Studies of historical patterns of invasion 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; Hayden et al. in review). 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 and native 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 to be introduced to New Zealand waters by shipping. There is a need for continued monitoring of non-indigenous marine species 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.

The repeat survey of the Port of Nelson recorded 257 species or higher taxa, including 13 non-indigenous species. Although many species also occurred in the initial, January 2002 baseline survey of the port, the degree of overlap was not high. Around 52% of the native species, 46% of non-indigenous species, and 62% of cryptogenic species recorded during the repeat survey were not found in the earlier survey. The species assemblage in each survey was characterised by high diversity, a comparatively large proportion of uncommon species, and patchy local distributions that are typical of marine biota. As a consequence, the estimated numbers of undetected species were comparatively high. In the initial baseline survey, for example, six of the 13 non-indigenous species (46 %) were each found in just a single sample. The rate of recovery of two of these species (*Bugula flabellata* and *Celleporaria nodulosa*) increased in the second survey along with the increased sampling effort, but the other four species were either undetected in the second survey (*Schizoporella errata* and *Anguinella palmata*) or were again found in just a single sample (*Cryptosula pallasiana* and *Lafoeina amirantensis*). Furthermore, of the six non-indigenous species that were detected only in the second survey, three (50 %) were present in just a single sample. This makes it difficult to determine if the new records in the second survey represent incursions that occurred after the first survey or, rather, are species that were present, but undetected during the first survey due to their sparse densities or distribution. Similarly, the absence in the second survey of six non-indigenous species that were recorded in the first survey (the polychaete *Polydora hoplura*, the ascidian *Ciona intestinalis* and the bryozoans *Conopeum seurati, Electra angulata, Schizoporella errata* and *Anguinella palmata*) could be explained either by sampling error or local extinction since the initial baseline survey. For most of these species, sampling error is the most likely explanation. *Anguinella palmata*, *Ciona intestinalis*, *Conopeum seurati*, *Cryptosula pallasiana*, *Schizoporella errata*, and *Polydora hoplura* have all been present in New Zealand for more than 40 years and have been recorded in other studies in the Nelson region (Cranfield et al. 1998). Their absence from one, or other, of the baseline surveys is most likely to be attributed to low prevalence during the time of the survey. However, although *Electra tenella* and *Synthecium campylocarpum* are known from other locations in New Zealand, the specimens recorded from Nelson represent new distribution records and, therefore, are potentially recent incursions.

As several recent analyses have shown, the large area of habitat available for marine organisms within shipping ports and the logistic difficulties of sampling in these environments mean that detection probabilities are likely to be comparatively low for species with low prevalence, even when species-specific survey methods are used (Inglis 2003; Inglis et al. 2003; Hayes et al. 2005; Gust et al. 2006b; Inglis et al. in press). In generalised pest surveys, such as the baseline port surveys, this problem is compounded by the high cost of identifying all specimens (native and non-indigenous) which constrains the total number of samples that can be taken (Inglis 2003). A consequence is that a high proportion of comparatively rare species will remain undetected by any single survey. This problem is not limited to non-indigenous species, as up to 40% of native species recorded in the surveys also occurred in just a single sample. Nor is it unique to marine assemblages. These results reflect the spatial and temporal variability that are features of marine biological assemblages (Morrisey et al. 1992a, b) and the difficulties that are involved in characterising diversity within hyper-diverse assemblages (Gray 2000; Gotelli and Colwell 2001; Longino et al. 2002).

Nevertheless, the baseline surveys continue to reveal new records of non-indigenous species in New Zealand ports and, with repetition, the cumulative number of undetected species should decline over time. This type of sequential analysis of occupancy and detection probability requires a series of three (or more) surveys, which should allow more accurate estimates of the rate of new incursions and extinctions (MacKenzie et al. 2004). Hewitt and Martin (2001) recommend repeating the baseline surveys on a regular basis to ensure they remain current. It may also be prudent to repeat at least components of a survey over a shorter time frame to achieve better estimates of occupancy without the confounding effects of temporal variation and recent incursions.

This survey, alone, cannot determine the threat to New Zealand's native ecosystems that is presented by the non-indigenous species encountered in this port. It does, however, provide a starting point for further investigations of the distribution, abundance and ecology of the species described within it. Non-indigenous marine species can have a range of adverse impacts through interactions with native organisms. These include competition with native species, predator-prey interactions, hybridisation, parasitism or toxicity and modification of the physical environment (Ruiz et al. 1999; Ricciardi 2001). Assessing the impact of a NIS in a given location ideally requires information on a range of factors, including the mechanism of their impact and their local abundance and distribution (Parker et al. 1999). To predict or quantify their 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).

Acknowledgements

We thank the Port of Nelson for access to its facilities and assistance during the survey, and Dick Carter and Murray McGuire for port information. We also thank Anna Bradley, Stephen Brown, Dan Cairney, Niki Davey, Sean Handley, Kate Neill, Lisa Northcote and Barry and Linley Bird for field assistance. Many thanks to to Martin Unwin for database assistance and Lisa Peacock for mapping assistance.

We also extend our thanks to the numerous taxonomists involved in this programme: Geoff Read, Jeff Forman, Dennis Gordon, David Staples, Jan Watson, Colin McLay, Niel Bruce, Niki Davey, Bruce Marshall, Wendy Nelson, Kate Neill, Sean Handley, Michelle Kelly-Shanks, Hoe Chang, Rob Stewart, Mike Page, Anna Bradley, Clive Roberts and Andrew Stewart.

References

Allan, R. (1954). The History of Port Nelson. Whitcombe and Tombs, Wellington.

AMOG Consulting. (2002). Hull fouling as a vector for the translocation of marine organisms. Phase I: Hull fouling research. Ballast Water Research Series, Report No. 14. Department of Agriculture, Fisheries and Forestry Australia, Canberra, 142 p.

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

ASR Marine Consulting and Research Ltd. (2003). Port Nelson reclamation: physical environmental assessment. Prepared for Port Nelson Ltd. Hamilton, ASR Ltd.

Australian Faunal Directory (2005). Australian Biological Resources Study Web publication <http://www.deh.gov.au/biodiversity/abrs/online-resources/fauna/afd/index.html>, Accessed 22/07/2005.

Barter, P. (1999). Sediment assessment in the Port Nelson slipway basin. Report No. 509. Prepared for Port Nelson Ltd. Nelson, Cawthron Institute.

Bock, P. (2004). *Electra* Lamouroux, 1816. RMIT University Civil & Geological Engineering web publication <http://www.civgeo.rmit.edu.au/bryozoa/cheilostomata/electridae/electra.html>, Date of access: 28/04/2006.

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

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

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

Carlton, J.; Geller, J. (1993). Ecological roulette: The global transport of nonindigenous marine organisms. *Science 261(5117)*: 78-82.

Carlton, J.T. (1992). Blue immigrants: the marine biology of maritime history. *The log of Mystic Seaport Museum 44(2)*: 31-36.

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

Chao, A.; L., C.R.; Colwell, R.K.; Shen, T.J. (2005). A new statistical approach for assessing compositional similarity based on incidence and abundance data. *Ecology Letters 8*: 148-159.

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

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

Chazdon, R.L.; Colwell, R.K.; Denslow, J.S.; Guariguata, M.R. (1998). Statistical methods for estimating species richness of woody regeneration in primary and secondary rain forests of NE Costa Rica. *In*: Dallmeier, F.; Comiskey, J.A. (eds). Forest biodiversity research, monitoring and modeling: Conceptual background and Old World case studies, pp. 285-309. Parthenon Publishing, Paris.

Cohen, A.N. (2005). Guide to the exotic species of San Francisco Bay. San Francisco Estuary Institute, Oakland, CA. Web publication <http://www.exoticsguide.org/>, Accessed 24/03/2006. Oakland, CA, San Francisco Estuary Institute.

Cohen, A.N.; Carlton, J.T. (1995). Nonindigenous aquatic species in a United States estuary: a case study of the biological invasions of the San Francisco Bay and delta. Report for the U. S. Fish and Wildlife Service, Washington DC.

Colwell, R. (2005). EstimateS: Statistical estimation of species richness and shared species from samples. Version 7.5. User's Guide and application published at: http://purl.oclc.org/estimates.

Colwell, R.K.; Coddington, J.A. (1994). Estimating terrestrial biodiversity through extrapolation. *Philosophical Transactions of the Royal Society of London B 345*: 101-118.

Colwell, R.K.; Mao, C.X.; Chang, J. (2004). Interpolating, extrapolating, and comparing incidence-based species accumulation curves. *Ecology 85*: 2717-2727.

Coutts, A. (2002). A biosecurity investigation of a barge in the Marlborough Sounds. Prepared for Heli Harvest Limited. Nelson, Cawthron Institute, Report No. 744.

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

Cranfield, H.; Gordon, D.; Willan, R.; Marshall, B.; Battershill, C.; Francis, M.; Nelson, W.; Glasby, C.; Read, G. (1998). Adventive marine species in New Zealand. NIWA technical report No. 34. Hamilton, NIWA.

Deevey, E.J. (1950). Hydroids from Louisiana and Texas, with remarks on the Pleistocene biogeography of the western Gulf of Mexico. *Ecology 31(3)*: 334-367.

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

Faust, M.A.; Gulledge, R.A. (2002). Identifying harmful marine dinoflagellates. *Smithsonian Contributions from the United States National Herbarium 42*: 1-144. Available online at <http://www.nmnh.si.edu/botany/projects/dinoflag/index.htm>.

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

Fletcher, R.L.; Farrell, P. (1999). Introduced brown algae in the North East Atlantic, with particular respect to *Undaria pinnatifida* (Harvey) Suringar. *Helgoländer Meeresuntersuchungen 52*: 259-275.

Fofonoff, P.; Ruiz, G.; Steves, B.; Hines, A.; Carlton, J. (2003). National Exotic Marine and Estuarine Species Information System. Web publication <http://invasions.si.edu/nemesis/>.

Forrest, B.; Roberts, R. (1995). Effects of stormwater runoff from log and woodchip stockpile areas, Port Nelson. Prepared for Port Nelson Ltd. Nelson, Cawthron Institute Report No. 280.

Gordon, D.; Mawatari, S. (1992). Atlas of marine fouling bryozoa of New Zealand Ports and Harbours. Miscellaneous Publications of the New Zealand Oceanographic Institute Vol 107. New Zealand Oceanographic Institute.

Gotelli, N.J.; Colwell, R.K. (2001). Quantifying biodiversity: procedures and pitfalls in the measurement and comparison of species richness. *Ecology Letters 4*: 379-391.

Gray, J.S. (2000). The measurement of marine species diversity, with an application to the benthic fauna of the Norwegian continental shelf. *Journal of Experimental Marine Biology and Ecology 250*: 23-49.

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

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

Gust, N.; Inglis, G.J.; Peacock, L.; Miller, S.; Floerl, O.; Hayden, B.J.; Fitridge, I.; Johnston, O.; Hurren, H. (2006a). Rapid nationwide delimitation surveys for *Styela clava*. NIWA Client Report: CHC2006-24. Prepared for Biosecurity New Zealand Project ZBS2005-32. Christchurch, NIWA. 81 pp.

Gust, N.; Inglis, G.J.; Peacock, L.; Miller, S.; Floerl, O.; Hayden, B.J.; Fitridge, I.; Johnston, O.; Hurren, H. (2006b). Rapid nationwide delimitation surveys for *Styela clava*. NIWA Client Report: CHC2006-24. Prepared for Biosecurity New Zealand Project ZBS2005-32. Christchurch, NIWA. 81 pp.

Hay, B.; Grant, C.; McCoubrey, D. (2000). A review of the marine biotoxin monitoring programme for non-commercially harvested shellfish. Part 1: Technical Report. A report prepared for the NZ Ministry of Health by AquaBio Consultants Ltd. NZ Ministry of Health.

Hayden, B.J.; Inglis, G.J.; Schiel, D.R. (in review). Marine invasions in New Zealand: a history of complex supply-side dynamics. *In*: Rilov, G.; Crooks, J. (eds). Marine Bioinvasions: Ecology, Conservation and Management Perspectives, pp. Springer, Heidelberg.

Hayes, K.; Sliwa, C.; Migus, S.; McEnnulty, F.; Dunstan, P. (2004). National priority pests. Part II, Ranking of Australian marine pests. Report undertaken for the Department of Environment and Heritage by CSIRO Marine Research. Commonwealth of Australia.

Hayes, K.R.; Cannon, R.; Neil, K.; Inglis, G.J. (2005). Sensitivity and cost considerations for the detection and eradication of marine pests in ports. *Marine Pollution Bulletin 50*: 823-834.

Henry, L.; Kenchington, E. (2004). Differences between epilithic and epizoic hydroid assemblages from commercial scallop grounds in the Bay of Fundy, northwest Atlantic. *Marine Ecology Progress Series 266*: 123-134.

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

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

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

Hewitt, C.; Martin, R.; Sliwa, C.; McEnnulty, F.; Murphy, N.; Jones, T.; Cooper, S. (eds). (2002). National Introduced Marine Pest Information System. Web publication <http://crimp.marine.csiro.au/nimpis>.

Hopkins, G. (2001). Tasman Bay dredge spoil disposal: 2001 environmental monitoring. Nelson, Cawthron Institute.

Hopkins, G.; Barter, P. (2001). Assessment of variations to dredging disposal at Port Nelson. Nelson, Cawthron Institute.

Hopkins, S.; Barter, P. (2006). Port Nelson long-term monitoring programme: 2004-2005. Prepared for Port Nelson Limited and Nelson City Council. Nelson, Cawthron Institute Report No. 1104.

Inglis, G.J. (2001). Criteria for identifying and selecting high value locations and locations at risk of invasion by exotic marine organisms in New Zealand. Final research report for Ministry of Fisheries research project ZBS2000/01A, objectives 1 & 2. Wellington. 27p, National Institute of Water and Atmospheric Research.

Inglis, G.J. (2003). Invasive aquatic species surveys and monitoring in New Zealand. *In*: Raaymakers, S. (ed.). 1st International Workshop on Guidelines and Standards for Invasive Aquatic Species Surveys and Monitoring, Arraial do Cabo, Brazil, 13-17 April 2003. Workshop Report. GloBallast Monograph Series, I.M.O. London., pp.

Inglis, G.J.; Gust, N.; Fitridge, I.; Fenwick, G.D.; Floerl, O.; Hayden, B.J. (2003). Surveillance design for new exotic marine organisms in New Zealand's ports and other high risk entry points. Final Research Report for Ministry of Fisheries Research Projects ZBS2000/04 Objective 5. NIWA Client Report. Wellington. 47p, National Institute of Water and Atmospheric Research.

Inglis, G.J.; Gust, N.; Fitridge, I.; Floerl, O.; Hayden, B.J.; Fenwick, G.D. (2006a). Port of Nelson: baseline survey for non-indenous marine species. Biosecurity New Zealand Technical Paper No: 2005/02. Prepared for Biosecurity New Zealand Post-clearance Directorate for Project ZBS2000-04. 56 pp. + Appendices.

Inglis, G.J.; Hurren, H.; Gust, N.; Oldman, J.; Fitridge, I.; Floerl, O.; Hayden, B.J. (2006b). Surveillance design for early detection of unwanted exotic marine organisms in New Zealand. Biosecurity New Zealand Technical Paper No: 2005-17. Prepared for Biosecurity New Zealand Post-clearance Directorate for Project ZBS2001-01. 110 pp + Appendices.

Inglis, G.J.; Hurren, H.; Oldman, J.; Haskew, R. (in press). Development and evaluation of habitat suitability index and particle dispersion models to guide early detection surveys for marine pests. *Ecological Applications*.

Koleff, P.; Gaston, K.J.; Lennon, J.J. (2003). Measuring beta diversity for presence-absence data. *Journal of Animal Ecology 72*: 367-382.

Kott, P. (2002). A complex didemnid ascidian from Whangamata, New Zealand. *Journal of Marine Biology Association of the United Kingdom 82*: 625-628.

Kott, P. (2004a). New and little-known species of Didemnidae (Ascidiacea, Tunicata) from Australia (part 2). *Journal of Natural History 38*: 2455-2526.

Kott, P. (2004b). A new species of *Didemnum* (Ascidiacea, Tunicata) from the Atlantic coast of North America. *Zootaxa 732*: 1-10.

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

Longino, J.T.; Coddington, J.; Colwell, R.K. (2002). The ant fauna of a tropical rain forest: estimating species richness three different ways. *Ecology 83*: 689-702.

Mack, R.; Simberloff, D.; Lonsdale, W.; Evans, H.; Clout, M.; Bazzaz, F. (2000). Biotic invasions: causes, epidemiology, global consequences and control. *Ecological Applications 10(3)*: 689-710.

MacKenzie, D.I.; Royle, J.A.; Brown, J.A.; Nichols, J.D. (2004). Occupancy estimation and modelling for rare and elusive populations. *In*: Thompson, W.R. (ed.). Sampling rare or elusive species: concepts, designs, and techniques for estimating population parameters, pp. 149-171. Island Press, Washington.

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

Migotto, A.; Cabral, A. (2005). *Lafoeina amirantensis* (Cnidaria: Hydrozoa, Campanulinoidea), the hydroid stage of the medusa *Cirrholovenia tetranema* (Cnidaria: Hydrozoa, Lovenelloidea). *Zootaxa 919*: 1-16.

Ministry of Works and Development (1986). Port of Nelson hydrodynamic model study. Volume 2. Prepared for Nelson Harbour Board. Hamilton, Ministry of Works and Development.

Morrisey, D.J.; Howitt, L.; Underwood, A.J.; Stark, J.S. (1992a). Spatial variation in soft-sediment benthos. *Marine Ecology Progress Series 81*: 197-204.

Morrisey, D.J.; Howitt, L.; Underwood, A.J.; Stark, J.S. (1992b). Temporal variation in soft-sediment benthos. *Journal of Experimental Marine Biology and Ecology 164*: 233-245.
Nelson City Council (2003). Nelson State of the Environment Report: Coast - 2003. Nelson, Nelson City Council.
Nelson City Council (2004). Nelson City State of the Environment Review: 1999-2004. Nelson, Nelson City Council.
New Zealand Food Safety Authority (2003). Non-Commercial Marine Biotoxin Monitoring in New Zealand Risk-Based Programme Enhancement - Final Report May 2003.
NIMPIS (2002a). *Bugula flabellata* species summary. National Introduced Marine Pest Information System (Eds: Hewitt CL, Martin RB, Sliwa C, McEnnulty FR, Murphy NE, Jones T & Cooper S). Web publication <http://crimp.marine.csiro.au/nimpis>, Date of access: 3/25/2004.
NIMPIS (2002b). *Crassostrea gigas* species summary. National Introduced Marine Pest Information System (Eds: Hewitt CL, Martin RB, Sliwa C, McEnnulty FR, Murphy NE, Jones T & Cooper S). Web publication <http://crimp.marine.csiro.au/nimpis>, Date of access: 3/24/2004.
NIMPIS (2002c). *Cryptosula pallasiana* species summary. National Introduced Marine Pest Information System (Eds: Hewitt CL, Martin RB, Sliwa C, McEnnulty FR, Murphy NE, Jones T & Cooper S). Web publication <http://crimp.marine.csiro.au/nimpis>, Date of access: 3/25/2004.
NIMPIS (2002d). *Hydroides elegans* species summary. National Introduced Marine Pest Information System (Eds: Hewitt C.L., Martin R.B., Sliwa C., McEnnulty, F.R., Murphy, N.E., Jones T. & Cooper, S.). Web publication <http://crimp.marine.csiro.au/nimpis>, Date of access: 17/07/2006.
NIMPIS (2002e). *Theora lubrica* species summary. National Introduced Marine Pest Information System (Eds: Hewitt CL, Martin RB, Sliwa C, McEnnulty FR, Murphy NE, Jones T & Cooper S). Web publication <http://crimp.marine.csiro.au/nimpis>, Date of access: 3/25/2004.
NIMPIS (2002f). *Undaria pinnatifida* species summary. National Introduced Marine Pest Information System (Eds: Hewitt CL, Martin RB, Sliwa C, McEnnulty FR, Murphy NE, Jones T & Cooper S). Web publication <http://crimp.marine.csiro.au/nimpis>, Date of access: 3/25/2004.
Parker, I.; Simberloff, D.; Lonsdale, W.; Goodell, K.; Wonham, M.; Kareiva, P.; Williamson, M.; Holle, B.V.; Moyle, P.; Byers, J.; Goldwasser, L. (1999). Impact: Toward a Framework for Understanding the Ecological Effects of Invaders. *Biological Invasions 1*: 3-19.
Parliament of Victoria (1997). Report on Ballast Water and Hull Fouling in Victoria. Inquiry report of the Parliament of Victoria's Environment and Natural Resources Committee. Available online at <http://www.parliament.vic.gov.au/enrc_old/ballast/bwp.htm>.
Pollard, D.; Pethebridge, R. (2002). Report on Port of Botany Bay introduced marine pest species survey. *New South Wales Fisheries Final Report Series No. 40*.
Port Nelson Ltd (2005). Annual Report 2005. Nelson, Port Nelson Ltd.
Raaymakers, S. (2003). AIS survey network spreads. *Ballast Water News 15*: 5-7.
Rao, K. (1992). Breeding and seasonal abundance of inter-tidal Bryozoa (Ectoprocta) at Visakhapatnam, Bay of Bengal. *Proceedings of the National Academy of Sciences of India. Section B. Biological sciences 62(4)*: 535-541.
Ricciardi, A. (2001). Facilitative interactions among aquatic invaders: is an "invasional meltdown" occurring in the Great Lakes? *Canadian Journal of Fisheries and Aquatic Sciences 58*: 2513-2525.
Roberts, R. (1992). Impact of dredging and dredgings disposal in Nelson: a consideration of chemical contaminants. Prepared for Port Nelson Ltd. Nelson, Cawthron Institute.

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

Schuchert, P. (2000). Hydrozoa (Cnidaria) of Iceland collected by the BIOICE programme. *Sarsia 85*: 411-438.

Sinner, J.; Forrest, B.; Taylor, M. (2000). A strategy for managing the Asian kelp *Undaria*: final report. Cawthron Report 578, 119pp. Prepared for Ministry of Fisheries.

Smithsonian Tropical Research Institute (2004). Bocas del Toro Species Database. Web publication <http://striweb.si.edu/bocas_database/details.php?id=2373>, Accessed 22/07/2005.

Statistics New Zealand (2006a). Exports and Imports Tables. http://www.stats.govt.nz/products-and-services/table-builder/table-builder-exports-imports.htm accessed 8/12/06.

Statistics New Zealand (2006b). Overseas cargo statistics - information releases. http://www.stats.govt.nz/products-and-services/info-releases/oseas-cargo-info-releases.htm accessed 8/12/06.

Stevens, L. (1997). Assessment of the effects of four reclamation and dredging options at Port Nelson. Prepared for Port Nelson Ltd. Nelson, Cawthron Institute.

Taylor, M. (1998). Considerations for assessing the risks of introducing foreign marine life to the Nelson-Marlborough region by shipping: a talk given to the Port Nelson Environmental Committee. Nelson, Cawthron Institute.

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

Thompson, R.M.C. (1981). A bibliography of the major ports and harbours of New Zealand (marine geology, physical oceanography and related topics). Wellington, New Zealand Oceanographic Institute Misc. publication 93.

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

Vervoort, W.; Watson, J. (2003). The marine fauna of New Zealand: Leptothecata (Cnidaria: Hydrozoa) (Thecate Hydroids). NIWA Biodiversity Memoir 119. Wellington, NIWA.

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

Watson, J. (2002). Hydroids (Cnidaria: Hydrozoa) from southern Queensland. *Memoirs of the Museum of Victoria 59(2)*: 337-354.

Weslawski, S. (2003). European Marine Biodiversity Research Svalbard Sites - Kongsfjorden & Hornsund. Web publication <http://www.iopan.gda.pl/projects/biodaff/index.html>, Accessed 02/05/2006.

Wilcove, D.; Rothstein, D.; Dubow, J.; Phillips, A.; Losos, E. (1998). Quantifying threats to imperiled species in the United States. *Bioscience 48(8)*: 607-615.

Winston, J. (1977). Distribution and ecology of estuarine ecotoprocts: a critical review. *Chesapeake Science 18(1)*: 34-57.

Winston, J. (1982). Drift plastic - an expanding niche for a marine invertebrate? *Marine Pollution Bulletin 13(10)*: 348-351.

Wittenberg, R.; Cock, M. (2001). Invasive alien species. How to address one of the greatest threats to biodiversity: a toolkit of best prevention and management practices. Wallingford, Oxon, U.K, CAB International.

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

www.ncc.govt.nz. Nelson City Council website. Accessed 04/04/06.

www.portnelson.co.nz. Port Nelson website. Accessed 17/06/05.

www.teara.govt.nz. Whats the story? The Encyclopedia of New Zealand. Ministry for Culture and Heritage website, accessed 17/6/05.

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
Layup Berths	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 Jetty (Sanford Ltd)			Concrete deck/wood piles	43	5.5
Amaltal Wharf (Fishing Co.)			Concrete deck/wood piles	130	7
Donker Marine			Concrete deck/wood piles	70	5

Table 2: Weight and value of overseas cargo unloaded at the Port of Nelson between the 2001-2002 and 2004-2005 financial years (data from Statistics New Zealand (2006b))

Year ended June	Gross weight (tonnes)	% weight change from previous year	Value (CIF[1]) ($million)	% value change from previous year	Proportion by weight of all NZ Seaports	Proportion by value of all NZ Seaports
2002	97,808		222		0.6	0.9
2003	98,072	0.3	196	-11.7	0.6	0.8
2004	113,664	15.9	215	9.7	0.6	0.8
2005[P]	139,461	22.7	222	3.3	0.7	0.8
Change from 2002 to 2005	41,653	42.6	0	0.0		

[1] CIF: Cost including insurance and freight

[P] Provisional statistics – at the time of access, data for the final two months of the 2005 year were provisional

Table 3: Weight and value of overseas cargo loaded at the Port of Nelson between the 2001-2002 and 2004-2005 financial years (data from Statistics New Zealand (2006b))

Year ended June	Gross weight (tonnes)	% weight change from previous year	Value (FOB[2]) ($million)	% value change from previous year	Proportion by weight of all NZ Seaports	Proportion by value of all NZ Seaports
2002	1,231,021		802		5.0	2.9
2003	1,132,804	-8.0	760	-5.2	4.5	3.0
2004	1,116,514	-1.4	759	-0.1	5.0	3.0
2005[P]	1,187,575	6.4	699	-7.9	5.4	2.7
Change from 2002 to 2005	-43,446	-3.5	-103	-12.8		

[1] FOB: Free on board

[P] Provisional statistics – at the time of access, data for the final two months of the 2005 year were provisional

Table 4: Number of vessel arrivals from overseas to the Port of Nelson by each general vessel type and previous geographical area, between 2002 and 2005 inclusive (data from LMIU "SeaSearcher.com" database)

Geographical area of previous port of call	Bulk/ cement carrier	Bulk/ oil carrier	Dredge	Fishing	General cargo	LPG/ LNG	Passenger/ vehicle/ livestock	Other (inc pontoons, barges, mining & supply ships, etc)	Passenger ro/ro	Research	Tanker (inc chemical/ oil and ashphalt)	Container/ unitised carrier and ro/ro	Tug	Total
Australia	26			5	18		11	1			3	9	2	75
Japan	33			1	31		3					2		70
Northwest Pacific	35			2	3							2		42
Pacific Islands	3			2	10							14		29
East Asian seas	4				2			1			1	11	1	20
West coast North America inc USA, Canada & Alaska					12							1		13
Red Sea coast inc up to the Persian Gulf					12									12
Unknown (not stated in database)			1	6	1							3	1	12
Gulf States	3				6									9
U.S, Atlantic coast including part of Canada					6									6
South America Pacific coast					4									4
South & East African coasts	1				1		1							3
United Kingdom inc Eire				1	1			1						3
Central America inc Mexico to Panama					1		1							2
Gulf of Mexico					2									2
North African coast					2									2
Scandinavia inc Baltic, Greenland, Iceland etc				1								1		2
Africa Atlantic coast					1									1
European Mediterranean coast					1									1
N.E. Canada and Great Lakes	1													1
North European Atlantic coast					1									1
South America Atlantic coast					1									1
Total	106	0	1	18	116	0	16	3	0	0	4	43	4	311

Table 5: Number of vessel arrivals from Australia to the Port of Nelson by each general vessel type and Australian state, between 2002 and 2005 inclusive (data from LMIU “SeaSearcher.com” database)

Australian state of previous port of call	Bulk/ cement carrier	Bulk/ oil carrie r	Dredge	Fishing	General cargo	LPG/ LNG	Passenger/ vehicle/ livestock	Other (inc pontoons, barges, mining & supply ships, etc)	Passenger ro/ro	Research	Tanker (inc chemical/ oil and ashphalt)	Container/ unitised carrier and ro/ro	Tug	Total
Queensland	11				4							5	2	22
New South Wales	5			1	11		1	1			1	1		21
Victoria	4						9				1	1		15
Tasmania	2			2	2							2		8
South Australia	4						1							5
Western Australia				2	1						1			4
Total	26	0	0	5	18	0	11	1	0	0	3	9	2	75

Table 6: Number of vessel departures from the Port of Nelson to overseas ports, by each general vessel type and next geographical area, between 2002 and 2005 inclusive (data from LMIU "SeaSearcher.com" database)

Geographical area of next port of call	Bulk/ cement carrier	Bulk/ oil carrier	Dredge	Fishing	General cargo	LPG/ LNG	Passenger/ vehicle/ livestock	Other (inc pontoons, barges, mining & supply ships, etc)	Passenger ro/ro	Research	Tanker (inc chemical/ oil and ashphalt)	Container/ unitised carrier and ro/ro	Tug	Total
Australia	3			3	15		3	1			8	338	5	376
Japan	31			1	3		230				2	7		274
Northwest Pacific	62			1	6		21							90
East Asian seas	3				4		6				4	8	1	26
North European Atlantic coas					25									25
U.S, Atlantic coast including part of Canada					21									21
United Kingdom inc Eire					12									12
Pacific Islands				2	1		2					4		9
West coast North America inc USA, Canada & Alaska	1				5							1		7
Central Indian Ocean	3													3
South America Atlantic coast							2							2
South America Pacific coast					1		1							2
Gulf States							1							1
South & East African coasts				1										1
Total	103	0	0	8	93	0	266	1	0	0	14	358	6	849

Table 7: Number of vessel arrivals from New Zealand ports to the Port of Nelson by each general vessel type and previous port, between 2002 and 2005 inclusive (data from LMIU "SeaSearcher.com" database)

Previous port of call	Bulk/ cement carrier	Bulk/ oil carrier	Dredge	Fishing	General cargo	LPG/ LNG	Passenger/ vehicle/ livestock	Other (includes pontoons, barges, mining & supply ships, etc)	Passenger ro/ro	Research	Tanker (including chemical/ oil and ashphalt)	Container / unitised carrier and ro/ro	Tug	Total
Wellington	21			6	33		65				19	609	8	761
Lyttelton	30		1	10	118		148	2			19	165	1	494
Napier	19				42						10	152		223
Nelson				147	11		1	2				45	6	212
Auckland	19			6	35		18				5	75		158
Tauranga	52				45						6	25	1	129
Timaru	5			13	7						4	68	1	98
Dunedin	12			1	18		32					10		73
New Plymouth	19				34	2					9	2	4	70
Bluff	16				47						1			64
Onehunga	6				51							1		58
Westport	26		6				1						1	34
Whangarei	14				3						11			28
Picton							1	1				6	1	9
Gisborne	8													8
Greymouth													1	1
Total	247	0	7	183	444	2	266	5	0	0	84	1158	24	2420

Table 8: Number of vessel departures from the Port of Nelson to New Zealand ports by each general vessel type and next port of call, between 2002 and 2005 inclusive (data from LMIU "SeaSearcher.com" database)

Next port of call	Bulk/ cement carrier	Bulk/ oil carrier	Dredge	Fishing	General cargo	LPG/ LNG	Passenger/ vehicle/ livestock	Other (includes pontoons, barges, mining & supply ships, etc)	Passen ger ro/ro	Research	Tanker (including chemical/ oil and ashphalt)	Container / unitised carrier and ro/ro	Tug	Total
Wellington	18			6	2		7				6	396	4	439
Napier	31				114		1				6	103		255
Tauranga	69			1	89						6	76	5	246
Nelson				147	11		1	2				45	6	212
Auckland	14			4	87			2			4	52		163
New Plymouth	21			1	20	2					16	100	2	162
Onehunga	12				113			1				4		130
Lyttelton	21		1	15	12		5	1			21	33	2	111
Timaru	6			17	4						1	24		52
Westport	19		7											26
Whangarei	11										13			24
Dunedin	10			2	8		1					1		22
Picton	8						1					6		15
Bluff	5				4						2			11
Gisborne	5													5
Mount Maunganui					1							1		2
Tarakohe					1									1
Total	250	0	8	193	466	2	16	6	0	0	75	841	19	1876

Table 9: 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	

	CRIMP Protocol		NIWA Method		
Taxa sampled	**Survey method**	**Sample procedure**	**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 10: Summary of sampling effort in the Port of Nelson. Exact geographic locations of survey sites are provided in Appendix 2.

	Sampling method and survey (T1 = first survey; T2 = second survey)																			
	Crab traps		Fish traps		Shrimp traps		Starfish traps		Benthic grabs		Benthic sleds		Pile scrape quadrats		Photo stills and video		Qualitative visual searches (on wharf pilings)		Javelin cores (for cysts)	
Site name	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Port of Nelson																				
Amaltal Wharf										3		2								2
Basin																				2
Boulder Bank		4		4		4		4												
Kingsford Quay	4	4	4	4	4	4	4	4		3	2	2	13	14	13	14	4	4		
Lay-up Berths (& repair facility)	4	4	4	4	4	4	4	4		3	2	2	14	14	14	14	4	4		2
Main Wharf	4	4	4	4	4	4	4	4	2	3	2	2	12	15	12	15	4	4		2
McGlashen Quay	4	4	4	4	4	4	4	4		3	2	2	15	14	15	14	4	4		2
Nelson Haven		6		4		4		4												
Nelson Haven North										3		2								
Nelson Haven South										3		2								
Site 1																			2	
Site 2																			2	
Site 3																			2	
Site 4																			2	
Superyacht Berth		4		4		4		4						14		14		4		
The Cut				8						3		2								
Nelson Marina																				
Marina (Marina)		4		4		4		4		3		2								2
Ministry of Fisheries Wharf		2		2				1												
Total	16	36	16	42	16	32	16	33	2	27	8	18	54	71	54	71	16	20	8	12

Table 11: Preservatives used for the major taxonomic groups of organisms collected during the port survey. [1] indicates photographs were taken before preservation, [2] indicates they were relaxed in menthol prior to preservation and [3] indicates a formalin fix was carried out before final preservation took place.

5 % Formalin solution	10 % Formalin solution	70 % Ethanol solution	80 % Ethanol solution	100 % Ethanol solution
Macroalgae	Ascidiacea (colonial) [1, 2]	Alcyonacea [2]	Ascidiacea (solitary) [1]	Bryozoa
	Asteroidea	Crustacea (small)		
	Brachiopoda	Holothuria [1, 2]		
	Crustacea (large)	Mollusca (with shell)		
	Ctenophora [1]	Mollusca [1, 2] (without shell)		
	Echinoidea	Platyhelminthes [1, 3]		
	Hydrozoa	Porifera [1]		
	Nudibranchia [1]	Zoantharia [1, 2]		
	Ophiuroidea			
	Polychaeta			
	Scleractinia			
	Scyphozoa [1, 2]			
	Vertebrata [1] (pisces)			

NB: Changes since the first survey:

Ascidians now considered separately as colonial and solitary species, and preserved in different solutions. The solitary species are no longer relaxed prior to preservation and the strength of preservative for these species has been increased. The colonials are now preserved in formalin as opposed to ethanol.

The Bryozoa are now initially preserved in 100% ethanol, then air dried at a later date prior to identification.

Platyhelminthes are now fixed in formalin, rather than relaxed, before preservation in ethanol.

Table 12: 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	Sabellida	*Sabella spallanzanii*
Arthropoda	Malacostraca	Decapoda	*Carcinus maenas*
Arthropoda	Malacostraca	Decapoda	*Eriocheir sinensis*
Echinodermata	Asteroidea	Forcipulatida	*Asterias amurensis*
Mollusca	Bivalvia	Myoida	*Potamocorbula amurensis*
Chlorophyta	Ulvophyceae	Caulerpales	*Caulerpa taxifolia*
Ochrophyta	Phaeophyceae	Laminariales	*Undaria pinnatifida*
Chordata	Ascidiacea	Pleurogona	*Styela clava*[1]

[1]*Styela clava* was added to the list of unwanted organisms in 2005, following its discovery in Auckland Harbour

Table 13: Marine pest species listed on the Australian Ballast Water Management Advisory Council's (ABWMAC) schedule of non-indigenous pest species.

Major taxonomic groups	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*
Macroalgae	Dinophyceae	*Alexandrium catenella*
Macroalgae	Dinophyceae	*Alexandrium minutum*
Macroalgae	Dinophyceae	*Alexandrium tamarense*
Macroalgae	Dinophyceae	*Gymnodinium catenatum*

Table 14: Native species recorded from the Port of Nelson in the first (T1) and second (T2) surveys.

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Annelida					
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea australiensis*	1	1
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris sphaerocephala*	0	1
Polychaeta	Eunicida	Onuphidae	*Kinbergonuphis proalopus*	1	0
Polychaeta	Phyllodocida	Glyceridae	*Glycera benhami*	0	1
Polychaeta	Phyllodocida	Glyceridae	*Glycera lamelliformis*	1	1
Polychaeta	Phyllodocida	Glyceridae	*Hemipodus simplex*	0	1
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus verrilli*	1	1
Polychaeta	Phyllodocida	Nereididae	*Neanthes kerguelensis*	1	1
Polychaeta	Phyllodocida	Nereididae	*Nereis falcaria*	1	1
Polychaeta	Phyllodocida	Nereididae	*Perinereis amblyodonta*	1	1
Polychaeta	Phyllodocida	Nereididae	*Perinereis camiguinoides*	1	1
Polychaeta	Phyllodocida	Nereididae	*Perinereis pseudocamiguina*	1	1
Polychaeta	Phyllodocida	Nereididae	*Platynereis Platynereis_australis_group*	0	1
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia microphylla*	1	1
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe macrolepidota*	0	1
Polychaeta	Phyllodocida	Polynoidae	*Lepidastheniella comma*	1	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus polychromus*	1	1
Polychaeta	Phyllodocida	Polynoidae	*Ophiodromus angustifrons*	0	1
Polychaeta	Phyllodocida	Sigalionidae	*Labiosthenolepis laevis*	1	1
Polychaeta	Sabellida	Oweniidae	*Owenia petersenae*	1	1
Polychaeta	Sabellida	Sabellidae	*Demonax aberrans*	1	0
Polychaeta	Sabellida	Sabellidae	*Euchone pallida*	1	0
Polychaeta	Sabellida	Sabellidae	*Megalomma suspiciens*	0	1
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla laciniosa*	0	1
Polychaeta	Sabellida	Serpulidae	*Galeolaria hystrix*	1	1
Polychaeta	Sabellida	Serpulidae	*Spirobranchus cariniferus*	1	0
Polychaeta	Scolecida	Opheliidae	*Armandia maculata*	0	1
Polychaeta	Scolecida	Scalibregmatidae	*Hyboscolex longiseta*	0	1
Polychaeta	Spionida	Spionidae	*Boccardia acus*	1	0
Polychaeta	Spionida	Spionidae	*Boccardia chilensis*	1	0
Polychaeta	Spionida	Spionidae	*Boccardia lamellata*	1	1
Polychaeta	Spionida	Spionidae	*Boccardia syrtis*	0	1
Polychaeta	Terebellida	Acrocirridae	*Acrocirrus trisectus*	0	1
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris nuchalis*	1	1
Polychaeta	Terebellida	Cirratulidae	*Timarete anchylochaetus*	1	1
Polychaeta	Terebellida	Flabelligeridae	*Flabelligera affinis*	1	1
Polychaeta	Terebellida	Pectinariidae	*Pectinaria australis*	0	1
Polychaeta	Terebellida	Terebellidae	*Nicolea armilla*	1	1
Polychaeta	Terebellida	Terebellidae	*Nicolea maxima*	1	1
Polychaeta	Terebellida	Terebellidae	*Pista pegma*	1	1
Polychaeta	Terebellida	Terebellidae	*Pseudopista rostrata*	1	1
Polychaeta	Terebellida	Terebellidae	*Streblosoma toddae*	1	1
Bryozoa					
Gymnolaemata	Cheilostomata	Aeteidae	*Aetea truncata*	0	1
Gymnolaemata	Cheilostomata	Antroporidae	*Akatopora circumsaepta*	1	0

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Gymnolaemata	Cheilostomata	Arachnopusiidae	*Arachnopusia unicornis*	1	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania new sp. [whitten]*	1	0
Gymnolaemata	Cheilostomata	Beaniidae	*Beania plurispinosa*	1	1
Gymnolaemata	Cheilostomata	Beaniidae	*Beania sp.*	0	1
Gymnolaemata	Cheilostomata	Buffonellodidae	*Aimulosia marsupium*	1	0
Gymnolaemata	Cheilostomata	Celleporidae	*Celleporina sinuata*	1	1
Gymnolaemata	Cheilostomata	Celleporidae	*Galeopsis porcellanicus*	1	1
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperiopsis cervicornis*	1	0
Gymnolaemata	Cheilostomata	Eurystomellidae	*Eurystomella foraminigera*	0	1
Gymnolaemata	Cheilostomata	Hippoporidridae	*Odontoporella adpressa*	1	0
Gymnolaemata	Cheilostomata	Hippothoidae	*Celleporella tongima*	1	1
Gymnolaemata	Cheilostomata	Microporellidae	*Fenestrulina thyreophora*	1	0
Gymnolaemata	Cheilostomata	Microporellidae	*Microporella speculum*	1	1
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides angela*	1	1
Gymnolaemata	Cheilostomata	Romancheinidae	*Exochella conjuncta*	1	0
Gymnolaemata	Cheilostomata	Smittinidae	*Smittina palisada*	1	0
Gymnolaemata	Cheilostomata	Smittinidae	*Smittina torques*	1	0
Chordata					
Chondrichthyes	Carcharhiniformes	Scyliorhinidae	*Cephaloscyllium isabellum*	0	1
Cnidaria					
Hydrozoa	Hydroida	Campanulariidae	*Clytia elongata*	0	1
Hydrozoa	Hydroida	Lafoeidae	*Hebellopsis scandens*	1	1
Hydrozoa	Hydroida	Phialellidae	*Opercularella humilis*	1	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia bispinosa*	0	1
Hydrozoa	Hydroida	Sertulariidae	*Dictyocladium reticulatum*	0	1
Hydrozoa	Hydroida	Sertulariidae	*Parascyphus simplex*	1	1
Hydrozoa	Hydroida	Sertulariidae	*Sertularella robusta*	0	1
Hydrozoa	Hydroida	Syntheciidae	*Synthecium elegans*	1	0
Crustacea					
Cirripedia	Thoracica	Balanidae	*Austrominius modestus*	1	1
Malacostraca	Amphipoda	Ampeliscidae	*Ampelisca chiltoni*	0	1
Malacostraca	Amphipoda	Aoridae	*Haplocheira barbimana*	1	1
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine pacifica*	0	1
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe trailli*	1	1
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia angusta*	0	1
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia stephenseni*	0	1
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia vesca*	1	1
Malacostraca	Amphipoda	Phoxocephalidae	*Protophoxus australis*	0	1
Malacostraca	Amphipoda	Phoxocephalidae	*Torridoharpinia hurleyi*	0	1
Malacostraca	Amphipoda	Phtisicidae	*Caprellina longicollis*	0	1
Malacostraca	Amphipoda	Talitridae	*Parorchestia tenuis*	0	1
Malacostraca	Anomura	Diogenidae	*Paguristes setosus*	0	1
Malacostraca	Anomura	Paguridae	*Lophopagurus (L.) thompsoni*	1	1
Malacostraca	Anomura	Paguridae	*Pagurus novizealandiae*	0	1
Malacostraca	Anomura	Paguridae	*Pagurus traversi*	1	1
Malacostraca	Anomura	Porcellanidae	*Petrolisthes elongatus*	1	1
Malacostraca	Anomura	Porcellanidae	*Petrolisthes novaezelandiae*	1	1

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Malacostraca	Brachyura	Cancridae	*Metacarcinus novaezelandiae*	1	0
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus innominatus*	1	1
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus varius*	1	1
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus whitei*	1	0
Malacostraca	Brachyura	Hymenosomatidae	*Halimena aoteoroa*	1	0
Malacostraca	Brachyura	Hymenosomatidae	*Neohymenicus pubescens*	1	1
Malacostraca	Brachyura	Majidae	*Notomithrax minor*	1	1
Malacostraca	Brachyura	Majidae	*Notomithrax ursus*	1	0
Malacostraca	Brachyura	Ocypodidae	*Macrophthalmus hirtipes*	1	1
Malacostraca	Brachyura	Pinnotheridae	*Pinnotheres novaezelandiae*	1	1
Malacostraca	Brachyura	Portunidae	*Nectocarcinus antarcticus*	1	0
Malacostraca	Brachyura	Xanthidae	*Pilumnus lumpinus*	1	1
Malacostraca	Brachyura	Xanthidae	*Pilumnus novaezealandiae*	0	1
Malacostraca	Caridea	Crangonidae	*Pontophilus australis*	0	1
Malacostraca	Caridea	Crangonidae	*Pontophilus hamiltoni*	1	0
Malacostraca	Caridea	Hippolytidae	*Hippolyte bifidirostris*	0	1
Malacostraca	Caridea	Palemonidae	*Palaemon affinis*	1	1
Malacostraca	Caridea	Palemonidae	*Periclimenes yaldwyni*	0	1
Malacostraca	Isopoda	Cirolanidae	*Natatolana rossi*	1	0
Malacostraca	Isopoda	Sphaeromatidae	*Cilicaea caniculata*	0	1
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma campbellensis*	0	1
Echinodermata					
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias muricata*	1	1
Asteroidea	Valvatida	Asterinidae	*Meridiastra mortenseni*	0	1
Asteroidea	Valvatida	Asterinidae	*Patiriella regularis*	1	1
Echinoidea	Spatangoida	Loveniidae	*Echinocardium cordatum*	0	1
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus mollis*	1	0
Mollusca					
Bivalvia	Myoida	Hiatellidae	*Hiatella arctica*	1	1
Bivalvia	Mytiloida	Mytilidae	*Modiolarca impacta*	1	1
Bivalvia	Mytiloida	Mytilidae	*Modiolus areolatus*	0	1
Bivalvia	Mytiloida	Mytilidae	*Perna canaliculus*	1	1
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus pulex*	1	1
Bivalvia	Nuculoida	Nuculidae	*Nucula hartvigiana*	1	1
Bivalvia	Nuculoida	Nuculidae	*Nucula nitidula*	0	1
Bivalvia	Ostreoida	Ostreidae	*Ostrea chilensis*	1	1
Bivalvia	Pterioida	Anomiidae	*Pododesmus zelandicus*	1	1
Bivalvia	Pterioida	Pectinidae	*Talochlamys zelandiae*	0	1
Bivalvia	Veneroida	Cardiidae	*Pratulum pulchellum*	0	1
Bivalvia	Veneroida	Kelliidae	*Kellia cycladiformis*	0	1
Bivalvia	Veneroida	Lasaeidae	*Arthritica bifurca*	0	1
Bivalvia	Veneroida	Lasaeidae	*Lasaea hinemoa*	0	1
Bivalvia	Veneroida	Mactridae	*Cyclomactra ovata*	0	1
Bivalvia	Veneroida	Psammobiidae	*Gari stangeri*	0	1
Bivalvia	Veneroida	Psammobiidae	*Soletellina siliquens*	1	0
Bivalvia	Veneroida	Semelidae	*Leptomya retiaria*	1	1
Bivalvia	Veneroida	Tellinidae	*Macomona liliana*	0	1
Bivalvia	Veneroida	Veneridae	*Austrovenus stutchburyi*	0	1

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Bivalvia	Veneroida	Veneridae	*Dosinia lambata*	1	0
Bivalvia	Veneroida	Veneridae	*Ruditapes largillierti*	1	1
Bivalvia	Veneroida	Veneridae	*Tawera spissa*	1	1
Gastropoda	Basommatophora	Ellobiidae	*Leuconopsis obsoleta*	0	1
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria australis*	1	0
Gastropoda	Caenogastropoda	Turritellidae	*Maoricolpus roseus*	1	1
Gastropoda	Cephalaspidea	Philinidae	*Philine auriformis*	1	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella tenuis*	1	0
Gastropoda	Littorinimorpha	Iravadiidae	*Nozeba emarginata*	0	1
Gastropoda	Littorinimorpha	Littorinidae	*Austrolittorina antipodum*	0	1
Gastropoda	Littorinimorpha	Littorinidae	*Risellopsis varia*	0	1
Gastropoda	Neogastropoda	Buccinidae	*Buccinulum vittatum*	1	1
Gastropoda	Neogastropoda	Buccinidae	*Cominella adspersa*	0	1
Gastropoda	Neogastropoda	Buccinidae	*Cominella glandiformis*	0	1
Gastropoda	Neogastropoda	Muricidae	*Xymene plebeius*	1	1
Gastropoda	Neogastropoda	Muricidae	*Xymene pusillus*	1	0
Gastropoda	Neotaenioglossa	Velutinidae	*Lamellaria ophione*	0	1
Gastropoda	Notaspidea	Pleurobranchidae	*Pleurobranchaea maculata*	1	1
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris lanuginata*	0	1
Gastropoda	Nudibranchia	Dorididae	*Aphelodoris luctuosa*	0	1
Gastropoda	Nudibranchia	Dorididae	*Archidoris wellingtonensis*	0	1
Gastropoda	Nudibranchia	Dorididae	*Doriopsis flabellifera*	1	0
Gastropoda	Systellomatophora	Onchidiidae	*Onchidella nigricans*	1	1
Gastropoda	Vetigastropoda	Fissurellidae	*Scutus breviculus*	0	1
Gastropoda	Vetigastropoda	Trochidae	*Micrelenchus huttonii*	0	1
Gastropoda	Vetigastropoda	Trochidae	*Trochus tiaratus*	1	1
Gastropoda	Vetigastropoda	Turbinidae	*Cookia sulcata*	0	1
Gastropoda	Vetigastropoda	Turbinidae	*Turbo smaragdus*	1	1
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona violacea*	0	1
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona zelandica*	1	0
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus porosus*	0	1
Polyplacophora	Ischnochitonina	Chitonidae	*Rhyssoplax aerea*	0	1
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton pelliserpentis*	1	1
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton sinclairi*	0	1
Macroalgae					
Florideophyceae	Ceramiales	Ceramiaceae	*Antithamnionella adnata*	1	1
Florideophyceae	Ceramiales	Ceramiaceae	*Ceramium apiculatum*	0	1
Florideophyceae	Ceramiales	Ceramiaceae	*Ceramium flaccidum*	0	1
Florideophyceae	Ceramiales	Ceramiaceae	*Ceramium rubrum*	0	1
Florideophyceae	Ceramiales	Dasyaceae	*Dasya collabens*	0	1
Florideophyceae	Ceramiales	Dasyaceae	*Dasya subtilis*	0	1
Florideophyceae	Ceramiales	Dasyaceae	*Heterosiphonia squarrosa*	1	1
Florideophyceae	Ceramiales	Delesseriaceae	*Caloglossa leprieurii*	0	1
Florideophyceae	Ceramiales	Delesseriaceae	*Erythroglossum undulatissimum*	0	1
Florideophyceae	Ceramiales	Delesseriaceae	*Hymenena variolosa*	0	1
Florideophyceae	Ceramiales	Delesseriaceae	*Myriogramme denticulata*	1	1
Florideophyceae	Ceramiales	Delesseriaceae	*Schizoseris dichotoma*	0	1
Florideophyceae	Ceramiales	Rhodomelaceae	*Aphanocladia delicatula*	0	1
Florideophyceae	Ceramiales	Rhodomelaceae	*Bostrychia harveyi*	0	1

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Florideophyceae	Ceramiales	Rhodomelaceae	*Bostrychia moritziana*	0	1
Florideophyceae	Ceramiales	Rhodomelaceae	*Cladhymenia oblongifolia*	1	0
Florideophyceae	Ceramiales	Rhodomelaceae	*Symphyocladia marchantioides*	0	1
Florideophyceae	Gelidiales	Gelidiaceae	*Gelidium caulacantheum*	0	1
Florideophyceae	Gigartinales	Gigartinaceae	*Gigartina atropurpurea*	0	1
Florideophyceae	Gigartinales	Phyllophoraceae	*Stenogramme interrupta*	0	1
Florideophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia novazelandica*	0	1
Phaeophyceae	Fucales	Sargassaceae	*Carpophyllum maschalocarpum*	0	1
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha linza*	1	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha ramulosa*	1	0
Porifera					
Calcarea	Leucosolenida	Sycettidae	*Sycon pedicellatum*	1	0
Demospongiae	Haplosclerida	Chalinidae	*Haliclona cf. punctata*	1	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona glabra*	1	1
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas fulva*	1	1
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia) tasmani*	1	0
Demospongiae	Poecilosclerida	Tedaniidae	*Tedania battershilli*	1	1
Dinophyta					
Dinophyceae	Peridinales	Peridiniaceae	*Protoperidinium conicum*	1	0
Dinophyceae	Peridinales	Peridiniaceae	*Protoperidinium conicum cf. conicoides*	1	0
Dinophyceae	Peridinales	Peridiniaceae	*Scrippsiella trochoidea*	1	0
Urochordata					
Ascidiacea	Aplousobranchia	Didemnidae	*Lissoclinum notti*	1	1
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium adamsi*	0	1
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula mortenseni*	1	1
Ascidiacea	Stolidobranchia	Polyzoinae	*Polyzoa opuntia*	0	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura cancellata*	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura carnea*	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura pulla*	0	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura rugata*	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura subuculata*	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa bicornuta*	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa nisiotus*	1	1
Vertebrata					
Actinopterygii	Anguilliformes	Anguillidae	*Anguilla dieffenbachii*	1	0
Actinopterygii	Anguilliformes	Congridae	*Conger verreauxi*	0	1
Actinopterygii	Gadiformes	Moridae	*Pseudophycis bachus*	1	0
Actinopterygii	Gasterosteiformes	Syngnathidae	*Hippocampus abdominalis*	1	1
Actinopterygii	Mugiliformes	Mugilidae	*Aldrichetta forsteri*	0	1
Actinopterygii	Perciformes	Cheilodactylidae	*Nemadactylus macropterus*	0	1
Actinopterygii	Perciformes	Labridae	*Notolabrus celidotus*	1	1
Actinopterygii	Perciformes	Sparidae	*Pagrus auratus*	0	1
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina capito*	1	0
Actinopterygii	Pleuronectiformes	Pleuronectidae	*Peltorhamphus latus*	1	0

* 1 = Present, 0 = Absent

Table 15: Cryptogenic marine species recorded from the Port of Nelson in the first (T1) and second (T2) surveys. Category 1 cryptogenic species (C1); Category 2 cryptogenic species (C2). Refer to "Definitions of species categories" for definitions.

Major taxonomic groups, Class	Order	Family	Genus and species	Status	T1*	T2*
Annelida						
Polychaeta	Phyllodocida	Nereididae	*Perinereis Perinereis-A*	C2	1	1
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia bilineata*	C1	0	1
Polychaeta	Phyllodocida	Syllidae	*Eusyllis Eusyllis-A*	C2	0	1
Polychaeta	Phyllodocida	Syllidae	*Eusyllis Eusyllis-B*	C2	0	1
Polychaeta	Sabellida	Sabellidae	*Megalomma Megalomma-A*	C2	1	0
Polychaeta	Spionida	Spionidae	*Paraprionospio Paraprionospio-A [pinnata]*	C2	0	1
Polychaeta	Terebellida	Ampharetidae	*Amphicteis Amphicteis-A*	C2	1	0
Polychaeta	Terebellida	Terebellidae	*Lanassa Lanassa-A*	C2	1	1
Polychaeta	Terebellida	Terebellidae	*Terebella Terebella-B*	C2	0	1
Bryozoa						
Gymnolaemata	Cheilostomata	Phidoloporidae	*Rhynchozoon larreyi*	C1	0	1
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia ambigua*	C1	1	0
Cnidaria						
Hydrozoa	Hydroida	Bougainvilliidae	*Bougainvillia muscus*	C1	1	1
Hydrozoa	Hydroida	Campanulariidae	*Clytia hemisphaerica*	C1	1	1
Hydrozoa	Hydroida	Campanulariidae	*Obelia dichotoma*	C1	0	1
Hydrozoa	Hydroida	Campanulinidae	*Phialella quadrata*	C1	0	1
Hydrozoa	Hydroida	Haleciidae	*Halecium delicatulum*	C1	0	1
Hydrozoa	Hydroida	Plumulariidae	*Plumularia setacea*	C1	1	1
Crustacea						
Malacostraca	Amphipoda	Aoridae	*Aora typica*	C1	0	1
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia sp. aff. P. stephenseni*	C2	0	1
Malacostraca	Brachyura	Grapsidae	*Plagusia chabrus*	C1	1	1
Malacostraca	Brachyura	Portunidae	*Nectocarcinus sp.*	C2	0	1

Major taxonomic groups, Class	Order	Family	Genus and species	Status	T1*	T2*
Mollusca						
Bivalvia	Mytiloida	Mytilidae	*Mytilus galloprovincialis*	C1	1	1
Porifera						
Demospongiae	Halichondrida	Halichondriidae	*Halichondria new sp. 5*	C2	1	0
Demospongiae	Halichondrida	Halichondriidae	*Hymeniacidon new sp. 1*	C2	0	1
Demospongiae	Halichondrida	Halichondriidae	*Hymeniacidon perleve*	C1	1	0
Demospongiae	Haplosclerida	Callyspongiidae	*Dactylia new sp. 1*	C2	0	1
Demospongiae	Haplosclerida	Chalinidae	*Adocia new sp. 1*	C2	0	1
Demospongiae	Haplosclerida	Chalinidae	*Adocia new sp. 2*	C2	0	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona new sp. 1*	C2	0	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona new sp. 7*	C2	1	0
Urochordata						
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum* species group (includes *D.vexillum, D. incanum,* and other *Didemnum species)*	C1	1	1[#]
Ascidiacea	Aplousobranchia	Holozoidae	*Distaplia sp.*	C2	0	1
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium phortax*	C1	1	1
Ascidiacea	Phlebobranchia	Rhodosomatidae	*Corella eumyota*	C1	1	1
Ascidiacea	Stolidobranchia	Botryllinae	*Botrylliodes leachii*	C1	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus australis*	C1	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Microcosmus squamiger*	C1	0	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura sp.*	C2	0	1
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa cerea*	C1	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Styela plicata*	C1	1	0

* 1 = Present, 0 = Absent

\# Because of the complex taxonomy of this genus, *Didemnum* specimens from the second survey could not be identified to species level, but are reported here collectively as a species group "*Didemnum* sp."

Table 16: Non-indigenous marine species recorded from the Port of Nelson during the first survey (T1) and second survey (T2). Likely vectors of introduction are largely derived from Cranfield et al. (1998), where H = Hull fouling and B = Ballast water transport. Novel NIS not listed in Cranfield et al. (1998) or previously encountered by taxonomic experts in New Zealand waters are marked as New Records (NR). For these species and others for which information is scarce, we provide dates of first detection rather than probable dates of introduction.

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*	Probable means of introduction	Date of introduction or detection (d)
Annelida							
Polychaeta	Sabellida	Serpulidae	*Hydroides elegans*	0	1	H or B	Pre-1952
Polychaeta	Spionida	Spionidae	*Polydora hoplura*	1	0	H	Unknown[1]
Bryozoa							
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula flabellata*	1	1	H	Pre-1949
Gymnolaemata	Cheilostomata	Cryptosulidae	*Cryptosula pallasiana*	1	1	H	1890s
Gymnolaemata	Cheilostomata	Electridae	*Conopeum seurati*	1	0	H	Pre-1963
Gymnolaemata	Cheilostomata	Electridae	*Electra angulata*	1	0	H	Unknown[1]
Gymnolaemata	Cheilostomata	Electridae	*Electra tenella*	0	1	Drift plastic	1977
Gymnolaemata	Cheilostomata	Lepraliellidae	*Celleporaria nodulosa* ***(NR)***	1	1	H	Jan 2002[d]
Gymnolaemata	Cheilostomata	Schizoporellidae	*Schizoporella errata*	1	0	H	Pre-1960
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora subtorquata*	1	1	H or B	Pre-1982
Gymnolaemata	Ctenostomata	Nolellidae	*Anguinella palmata*	1	0	H	1960

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*	Probable means of introduction	Date of introduction or detection (d)
Cnidaria							
Hydrozoa	Hydroida	Campanulinidae	*Lafoeina amirantensis* ***(NR)***	1	1	H or B	Jan 2002[d]
Hydrozoa	Hydroida	Lafoeidae	*Filellum serpens?*	0	1	H	1848
Hydrozoa	Hydroida	Syntheciidae	*Synthecium campylocarpum*	0	1	H	1890
Hydrozoa	Hydroida	Syntheciidae	*Synthecium subventricosum*	0	1	H	1955
Mollusca							
Bivalvia	Ostreoida	Ostreidae	*Crassostrea gigas*	1	1	H	1961
Bivalvia	Veneroida	Semelidae	*Theora lubrica*	1	1	B	1971
Macroalgae							
Phaeophyceae	Laminariales	Alariaceae	*Undaria pinnatifida*	0	1	H or B	Pre-1987
Urochordata							
Ascidiacea	Aplousobranchia	Cionidae	*Ciona intestinalis*	1	0	H	Pre-1950

[1] Date of introduction currently unknown but species had been encountered in New Zealand prior to the present survey.
* 1 = Present, 0 = Absent

Table 17: Species indeterminata recorded from the Port of Nelson in the first (T1) and second (T2) surveys. This group includes: (1) organisms that were damaged or juvenile and lacked crucial morphological characteristics, and (2) taxa for which there is not sufficient taxonomic or systematic information available to allow positive identification to species level.

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Annelida					
Polychaeta	Phyllodocida	Nereididae	*Nereididae indet*	1	1
Polychaeta	Phyllodocida	Nereididae	*Nereis Indet*	1	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotinae Indet*	1	0
Polychaeta	Phyllodocida	Syllidae	*Syllidae Indet*	0	1
Polychaeta	Sabellida	Sabellidae	*Euchone sp_undet*	0	1
Polychaeta	Spionida	Spionidae	*Polydora Indet*	1	0
Bryozoa					
			Unidentified Bryozoa	0	1
Gymnolaemata	**Cheilostomata**	**Hippothoidae**	***Celleporella sp.***	**1**	**0**
Chelicerata					
Pycnogonida			*Unidentified Pycnogonida*	0	1
Cnidaria					
Hydrozoa	Hydroida	Lafoeidae	*Filellum sp. indeterminate*	1	0
Hydrozoa	Hydroida	Tubulariidae	*Ectopleura sp. indeterminate*	1	0
Hydrozoa	Hydroida	Clavidae	*Clava sp. ?*	0	1
Crustacea					
Malacostraca	Amphipoda		*Unidentified Amphipoda*	0	1
Malacostraca	Amphipoda	Hyalidae	*Hyale sp.*	0	1
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis indet sp.*	0	1
Malacostraca	Amphipoda	Leucothoidae	*Paraleucothoe sp. A*	0	1
Malacostraca	Anomura	Paguridae	*Pagurus sp.*	0	1
Malacostraca	Brachyura	Majidae	*Notomithrax sp.*	0	1
Malacostraca	Decapoda		*Unidentified Decapoda*	1	0
Malacostraca	Isopoda		*Isopoda sp.*	0	1
Malacostraca	Isopoda	Sphaeromatidae	*?Cilicaea sp*	1	0
Malacostraca	Mysida	Mysidae	*Heteromysis or Mysidetes sp.*	1	0
Malacostraca	Mysida	Mysidae	*Tenogomysis sp. 2*	1	0
Malacostraca	Tanaidacea		*Tanaidacea sp.*	0	1
Magnoliophyta					

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Liliopsida	Najadales	Zosteraceae	*Zostera sp.*	0	1
Mollusca					
Bivalvia	Nuculoida	Nuculidae	*Nucula sp.*	0	1
Gastropoda	Caenogastropoda	Turritellidae	*Zeacolpus sp.*	0	1
Gastropoda	Neogastropoda	Buccinidae	*Cominella sp.*	0	1
Gastropoda	Nudibranchia	Dorididae	*Jorunna sp.*	1	0
Macroalgae					
Florideophyceae			*Unidentified Rhodophyceae*	1	1
Florideophyceae	Acrochaetiales	Acrochaetiaceae	*Audouinella sp.*	1	0
Florideophyceae	Bangiales	Bangiaceae	*Bangia sp.*	1	0
Florideophyceae	Ceramiales	Ceramiaceae	*Callithamnion sp.*	1	1
Florideophyceae	Ceramiales	Ceramiaceae	*Ceramium sp.*	1	1
Florideophyceae	Ceramiales	Ceramiaceae	*Griffithsia sp.*	1	0
Florideophyceae	Ceramiales	Dasyaceae	*Dasya sp.*	1	1
Florideophyceae	Ceramiales	Delesseriaceae	*Unidentified Delesseriaceae*	1	1
Florideophyceae	Ceramiales	Delesseriaceae	*Erythroglossum sp.*	0	1
Florideophyceae	Ceramiales	Delesseriaceae	*Myriogramme sp.*	1	0
Florideophyceae	Ceramiales	Delesseriaceae	*Schizoseris sp.*	1	1
Florideophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia sp.*	1	1
Florideophyceae	Ceramiales	Rhodomelaceae	*Stictosiphonia sp.*	0	1
Florideophyceae	Corallinales	Corallinaceae	*Unidentified Corallinaceae*	1	1
Florideophyceae	Gigartinales	Kallymeniaceae	*?Thamnophyllis?*	0	1
Florideophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia aff. dichotoma*	0	1
Florideophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia sp.*	1	1
Ulvophyceae	Cladophorales	Cladophoraceae	*Cladophora sp.*	1	0
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha sp.*	0	1
Ulvophyceae	Ulvales	Ulvaceae	*Ulva sp.*	1	1
Platyhelminthes					
Turbellaria	Polycladida		*Unidentified Polycladida*	1	0
Dinophyta					

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Dinophyceae	Peridinales	Peridiniaceae	*Protoperidinium sp.*	1	1
Urochordata					
Ascidiacea	Aplousobranc hia	Didemnidae	*Unidentified Didemnidae*	0	1
Thaliacea	Salpida	Salpidae	*Salpidae sp.*	1	0
Vertebrata					
Actinopterygii	Perciformes	Tripterygiidae	*Tripterygiidae sp.*	0	1

* 1 = Present, 0 = Absent

Table 18: Non-indigenous marine organisms recorded from the Port of Nelson survey and the techniques used to capture each species. Species distributions throughout the port and in other ports and marinas around New Zealand are indicated.

Genus & species	Capture techniques in the Port of Nelson	Locations detected in the Port of Nelson		Detected in other locations surveyed in ZBS2000_04
		First survey	Second survey	
Annelida				
Hydroides elegans	Pile scrape		McGlashen Quay (See Figure 21)	Auckland
Polydora hoplura	Pile scrape	McGlashen Quay		Dunedin, Lyttelton, Picton, Tauranga, Timaru, Wellington, Whangarei
Bryozoa				
Anguinella palmata	Pile scrape	McGlashen Quay		Auckland
Bugula flabellata	Pile scrape	Lay-Up & Repair Facility (See Figure 22)	Main Wharf, McGlashen Quay, Superyacht (See Figure 23)	Auckland, Bluff, Dunedin, Lyttelton, Napier, New Plymouth, Opua, Picton, Tauranga, Timaru, Wellington, Whangarei
Cryptosula pallasiana	Pile scrape	Lay-Up & Repair Facility (See Figure 24)	McGlashen Quay (See Figure 25)	Dunedin, Gisborne, Lyttelton, New Plymouth, Picton, Timaru, Wellington, Whangarei
Electra angulata	Benthic grab, pile scrape	Main Wharf		
Electra tenella	Pile scrape		Lay-Up & Repair Facility (See Figure 26)	Tauranga
Celleporaria nodulosa	Pile scrape	Kingsford Quay (See Figure 27)	Kingsford Quay, McGlashen Quay, Superyacht (See Figure 28)	Gisborne, Timaru
Conopeum seurati	Pile scrape	Kingsford Quay, Lay-Up & Repair Facility, Main Wharf, McGlashen Quay		Lyttelton, Whangarei
Schizoporella errata	Benthic grab	Main Wharf		Auckland, Whangarei
Watersipora subtorquata	Pile scrape	Kingsford Quay, Lay-Up & Repair Facility, Main Wharf, McGlashen Quay (See Figure 29)	Kingsford Quay, Main Wharf, McGlashen Quay, Superyacht (See Figure 30)	Auckland, Bluff, Dunedin, Gisborne, Lyttelton, Napier, New Plymouth, Opua, Picton, Tauranga, Timaru, Wellington, Whangarei
Cnidaria				
Lafoeina amirantensis	Benthic sled, Pile scrape	Main Wharf (See Figure 31)	Lay-Up & Repair Facility (See Figure 32)	

Genus & species	Capture techniques in the Port of Nelson	Locations detected in the Port of Nelson		Detected in other locations surveyed in ZBS2000_04
		First survey	Second survey	
*Filellum serpens?**	Pile scrape		Main Wharf (See Figure 33)	
Synthecium campylocarpum	Benthic sled, crab trap, pile scrape		Main Wharf, McGlashen Quay, Superyacht (See Figure 34)	
Synthecium subventricosum	Pile scrape		Lay-Up & Repair Facility, Main Wharf (See Figure 35)	Timaru
Mollusca				
Crassostrea gigas	Pile scrape	Kingsford Quay, Lay-Up & Repair Facility, Main Wharf, McGlashen Quay (See Figure 36)	Kingsford Quay, Lay-Up & Repair Facility, Main Wharf, McGlashen Quay, Superyacht (See Figure 37)	Auckland, Dunedin, New Plymouth, Opua, Whangarei
Theora lubrica	Benthic sled, benthic grab	Kingsford Quay, McGlashen Quay (See Figure 38)	Amaltal Wharf, Kingsford Quay, Main Wharf, Marina, McGlashen Quay, Nelson Haven North, Nelson Haven South, The Cut (See Figure 39)	Auckland, Gisborne, Lyttelton, Napier, New Plymouth, Opua, Picton, Wellington, Whangarei
Macroalgae				
Undaria pinnatifida	Benthic sled, Starfish trap		Marina, The Cut, Ministry of Fisheries Wharf (See Figure 40)	Dunedin, Gisborne, Lyttelton, Napier, New Plymouth, Picton, Timaru, Wellington,
Urochordata				
Ciona intestinalis	Benthic sled, pile scrape	Lay-Up & Repair Facility, McGlashen Quay		Lyttelton, Napier, Timaru

* Identification is questionable for this species due to presence of infertile colonies only

Table 19: Summary statistics for taxon assemblages collected in the Port of Nelson using six different methods, and similarity indices comparing assemblages between the first and second survey. See "Definitions of species categories" for definitions of Native, C1 and C2 (cryptogenic category 1 and 2) and NIS (non-indigenous species) taxa.

	No. of samples in first survey	No. of samples in second survey	No. of taxa in first survey	No. of taxa in second survey	No. (%) of taxa shared between surveys	No. of taxa in first survey only	No. of taxa in second survey only	No. (%) of taxa in only one sample in first survey	No. (%) of taxa in only one sample in second survey	Chao Shared Esimated	Jaccard Classic	Sorensen Classic	Chao-Jaccard-Est Incidence-based	Chao-Sorensen-Est Incidence-based
Pile scrape quadrats														
Native	54	71	83	115	59 (42%)	24	56	35 (42%)	41 (36%)	77.62	0.424	0.596	0.766	0.867
C2	54	71	5	14	2 (12%)	3	12	4 (80%)	8 (57%)	2.625	0.118	0.211	0.324	0.489
NIS & C1	54	71	24	27	14 (38%)	10	13	12 (50%)	11 (41%)	32.505	0.378	0.549	0.83	0.907
Benthic sleds														
Native	8	18	42	69	22 (25%)	20	47	24 (57%)	38 (55%)	29.692	0.247	0.396	0.761	0.864
C2	8	18	0	3	0 (0%)	0	3	0 (0%)	2 (67%)	Not enough taxa encountered for a meaningful analysis				
NIS & C1	8	18	6	4	1 (11%)	5	3	4 (67%)	2 (50%)	1	0.111	0.2	0.22	0.36
Benthic grabs														
Native	2	27	12	29	3 (8%)	9	26	12 (100%)	17 (58%)	See analysis for all taxa combined				
C2	2	27	1	1	0 (0%)	1	1	1 (100%)	1 (100%)	Not enough taxa encountered for a meaningful analysis				
NIS & C1	2	27	3	2	0 (0%)	3	2	3 (100%)	1 (50%)	Not enough taxa encountered for a meaningful analysis				
Native, C2, NIS & C1 taxa combined	2	27	16	32	3 (7%)	13	29	16 (100%)	19 (59%)	6.75	0.067	0.125	0.139	0.243
Crab traps														
Native	16	36	9	19	4 (17%)	5	15	5 (56%)	10 (53%)	See analysis for all taxa combined				

	No. of samples in first survey	No. of samples in second survey	No. of taxa in first survey	No. of taxa in second survey	No. (%) of taxa shared between surveys	No. of taxa in first survey only	No. of taxa in second survey only	No. (%) of taxa in only one sample in first survey	No. (%) of taxa in only one sample in second survey	Chao Shared Esimated	Jaccard Classic	Sorensen Classic	Chao-Jaccard-Est Incidence-based	Chao-Sorensen-Est Incidence-based
C2	16	36	0	0	0 (0%)	0	0	0 (0%)	0 (0%)	No taxa encountered				
NIS & C1	16	36	0	4	0 (0%)	0	4	0 (0%)	3 (75%)	Not enough taxa encountered for a meaningful analysis				
Native, C2, NIS & C1 taxa combined	16	36	9	23	4 (14%)	5	19	5 (56%)	13 (57%)	6.757	0.143	0.25	0.331	0.498
Fish traps														
Native	16	42	12	10	2 (10%)	10	8	4 (33%)	4 (40%)	See analysis for all taxa combined				
C2	16	42	0	1	0 (0%)	0	1	0 (0%)	1 (100%)	Not enough taxa encountered for a meaningful analysis				
C1 (No NIS were encountered)	16	42	1	1	0 (0%)	1	1	1 (100%)	1 (100%)	Not enough taxa encountered for a meaningful analysis				
Native, C2 and C1 taxa combined	16	42	13	12	2 (9%)	11	10	5 (38%)	6 (50%)	2	0.087	0.16	0.271	0.427
Starfish traps														
Native	16	33	9	11	3 (18%)	6	8	7 (78%)	7 (64%)	See analysis for all taxa combined				
C2	16	33	0	2	0 (0%)	0	2	0 (0%)	2 (100%)	Not enough taxa encountered for a meaningful analysis				
NIS (No C1 taxa were encountered)	16	33	0	1	0 (0%)	0	1	0 (0%)	1 (100%)	Not enough taxa encountered for a meaningful analysis				
Native, C2 and NIS taxa combined	16	33	9	14	3 (15%)	6	11	7 (78%)	10 (71%)	4.804	0.15	0.261	0.358	0.527

Appendices

Appendix 1: Definitions of vessel types and geographical areas used in analyses of the LMIU shipping movements database

A. Groupings of countries into geographical areas. A country may be included in more than one geographical area category if different parts of that country are considered (by LMIU) to belong to different geographical areas (for example, Canada occurs in the NE Canada and Great Lakes area and in the West Coast North America area). Only countries that occur in the database are listed in the table below.

Geographical area	Countries/locations included
Africa Atlantic coast	Angola
	The Congo
	Nigeria
Antarctica (includes Southern Ocean)	Antarctica
	Australia (Macquarie Island)
Australia	Australia (general)
	Australia (VIC)
	Australia (QLD)
	Australia (NSW)
	Australia (TAS)
	Australia (WA)
	Australia (NT)
	Australia (SA)
Black Sea coast	Russian Federation
Caribbean Islands	Bahamas
	Cuba
	Jamaica
	Puerto Rico
Central America inc Mexico to Panama	Costa Rica
	El Salvador
	Guatemala
	Mexico
	Panama
Central Indian Ocean	Bangladesh
	India
	Pakistan
	Sri Lanka
East Asian seas	Indonesia
	Malaysia
	Philippines
	Republic of Singapore
	Sultanate of Brunei
	Thailand
Eastern Mediterranean inc Cyprus, Turkey	Turkey
European Mediterranean coast	France

Geographical area	Countries/locations included
	Gibraltar
	Italy
	Malta
	Spain
Gulf of Mexico	United States of America
Gulf States	Iran
	Kuwait
	Saudi Arabia
	State of Qatar
	Sultanate of Oman
	United Arab Emirates
Japan	Japan
N.E. Canada and Great Lakes	Canada
New Zealand	New Zealand
Northwest Pacific	People's Republic of China
	Republic of Korea
	Russian Federation
	Taiwan
	Vietnam
North African coast	Algeria
	Arab Republic of Egypt
	Morocco
	Spain
	Tunisia
	Western Sahara
North European Atlantic coast	Belgium
	France
	Germany
	Netherlands
Pacific Islands	American Samoa
	Cook Islands
	Fiji
	French Polynesia
	Guam
	Independent State of Samoa
	Kiribati
	Marshall Islands
	New Caledonia
	Niue Island
	Norfolk Island
	Northern Marianas
	Papua New Guinea
	Pitcairn Islands
	Solomon Islands
	Tokelau Islands

Geographical area	Countries/locations included
	Tonga
	Tuvalu
	Vanuatu
	Wallis & Futuna
Red Sea coast inc up to the Persian Gulf	Arab Republic of Egypt
	Saudi Arabia
	Sudan
	Yemeni Republic
Scandinavia inc Baltic, Greenland, Iceland etc	Denmark
	Norway
	Poland
	Russian Federation
South & East African coasts	Heard & McDonald Islands
	Kenya
	Mauritius
	Mozambique
	Republic of Djibouti
	Republic of Namibia
	Reunion
	South Africa
South America Atlantic coast	Argentina
	Aruba
	Brazil
	Colombia
	Falkland Islands
	Netherlands Antilles
	Uruguay
	Venezuela
South America Pacific coast	Chile
	Ecuador
	Peru
Spain / Portugal inc Atlantic Islands	Canary Islands
	Portugal
	Spain
U.S, Atlantic coast including part of Canada	United States of America
United Kingdom inc Eire	United Kingdom
West coast North America inc USA, Canada & Alaska	Canada
	United States of America

B. Groupings of vessel sub-types according to LMIU definitions.

Vessel type definition in this report	General type as listed in LMIU database	Sub type code from LMIU database	Definition of sub type in LMIU database
Bulk/ cement carrier	B	BU	bulk
	B	CB	bulk/c.c.
	B	CE	cement
	B	OR	ore
	B	WC	wood-chip
Bulk/ oil carrier	C	BO	bulk/oil
	C	OO	ore/oil
Dredge	D	BD	bucket dredger
	D	CH	cutter suction hopper dredger
	D	CS	cutter suction dredger
	D	DR	dredger
	D	GD	grab dredger
	D	GH	grab hopper dredger
	D	HD	hopper dredger
	D	SD	suction dredger
	D	SH	suction hopper dredger
	D	SS	sand suction dredger
	D	TD	trailing suction dredger
	D	TS	trailing suction hopper dredger
Fishing	F	FC	fish carrier
	F	FF	fish factory
	F	FP	fishery protection
	F	FS	fishing
	F	TR	trawler
	F	WF	whale factory
	F	WH	whaler
General cargo	G	CT	cargo/training
	G	GC	general cargo
	G	PC	part c.c.
	G	RF	ref
LPG / LNG	L	FP	floating production
	L	FS	floating storage
	L	NG	Lng
	L	NP	Lng/Lpg
	L	PG	Lpg

Vessel type definition in this report	**General type as listed in LMIU database**	**Sub type code from LMIU database**	**Definition of sub type in LMIU database**
Passenger/ vehicle/ livestock	M	LV	livestock
	M	PR	passenger
	M	VE	vehicle
Other (includes pontoons, barges, mining & supply ships, etc)	O	BA	barge
	O	BS	buoy ship/supply
	O	BY	buoy ship
	O	CL	cable
	O	CP	cable pontoon
	O	CS	crane ship
	O	CX	crane barge
	O	DE	depot ship
	O	DS	diving support
	O	ES	exhibition ship
	O	FL	floating crane
	O	FY	ferry
	O	HB	hopper barge
	O	HF	hydrofoil
	O	HL	semi-sub HL vessel
	O	HS	hospital ship
	O	HT	semi-sub HL/tank
	O	IB	icebreaker
	O	IF	icebreaker/ferry
	O	IS	icebreaker/supply
	O	IT	icebreaker/tender
	O	LC	landing craft
	O	LT	lighthouse tender
	O	MN	mining ship
	O	MS	mission ship
	O	MT	maintenance
	O	OS	offshore safety
	O	PA	patrol ship
	O	PC	pollution control vessel
	O	PD	paddle
	O	PI	pilot ship
	O	PL	pipe layer

Vessel type definition in this report	General type as listed in LMIU database	Sub type code from LMIU database	Definition of sub type in LMIU database
	O	PO	pontoon
	O	PP	pipe carrier
	O	RD	radio ship
	O	RN	ro/ro pontoon
	O	RP	repair ship
	O	RX	repair barge
	O	SB	storage barge
	O	SC	sludge carrier
	O	SP	semi-sub pontoon
	O	SS	storage ship
	O	SU	support
	O	SV	salvage
	O	SY	supply
	O	SZ	standby safety vessel
	O	TB	tank barge
	O	TC	tank cleaning ship
	O	TN	tender
	O	TR	training
	O	WA	waste ship
	O	WO	work ship
	O	YT	yacht
Passenger ro/ro	P	RR	passenger ro/ro
Research	R	HR	hydrographic research
	R	MR	meteorological research
	R	OR	oceanographic research
	R	RB	research/buoy ship
	R	RE	research
	R	RS	research/supply ship
	R	SR	seismographic research
Tanker (including chemical/ oil / ashphalt etc)	T	AC	acid tanker
	T	AS	asphalt tanker
	T	BK	bunkering tanker
	T	CH	chem.tank
	T	CO	chemical/oil carrier
	T	CR	crude oil tanker

Vessel type definition in this report	General type as listed in LMIU database	Sub type code from LMIU database	Definition of sub type in LMIU database
	T	EO	edible oil tanker
	T	FJ	fruit juice tanker
	T	FO	fish oil tanker
	T	FP	floating production
	T	FS	floating storage
	T	MO	molasses tanker
	T	NA	naval auxiliary
	T	PD	product tanker
	T	TA	non specific tanker
	T	WN	wine tank
	T	WT	water tanker
Container/ unitised carrier and ro/ro	U	BC	barge carrier/c.c.
	U	BG	barge carrier
	U	CC	c.c. container/unitised carrier
	U	CR	c.c.ref
	U	RC	ro/ro/c.c.
	U	RR	ro/ro
Tug	X	AA	anchor handling salvage tug
	X	AF	anchor handling firefighting tug/supply
	X	AG	anchor handling firefighting tug
	X	AH	anchor handling tug/supply
	X	AT	anchor handling tug
	X	CT	catamaran tug
	X	FF	firefighting tug
	X	FS	firefighting tug/supply
	X	FT	firefighting tractor tug
	X	PT	pusher tug
	X	ST	salvage tug
	X	TG	tug
	X	TI	tug/icebreaker
	X	TP	tug/pilot ship
	X	TR	tractor tug
	X	TS	tug/supply
	X	TT	tug/tender
	X	TX	tug/support

Appendix 2. Geographic locations of sample sites in the Port of Nelson second baseline survey (NZGD49)

Site	Easting	Northing	Survey Method*	Number of sample units
Amaltal	2533584	5994545	BGRB	1
Amaltal	2533584	5994545	BGRB	1
Amaltal	2533584	5994545	BGRB	1
Amaltal	2533599	5994457	BSLD	1
Amaltal	2533603	5994600	BSLD	1
Amaltal	2533547	5994465	CYST	2
Basin	2533225	5994312	CYST	2
Boulder Bank (Opp Marina)	2532870	5994950	CRBTP	1
Boulder Bank (Opp Marina)	2532870	5994950	CRBTP	1
Boulder Bank (Opp Marina)	2532850	5994961	CRBTP	1
Boulder Bank (Opp Marina)	2532850	5994961	CRBTP	1
Boulder Bank (Opp Marina)	2532843	5994946	FSHTP	2
Boulder Bank (Opp Marina)	2532867	5994952	FSHTP	2
Boulder Bank (Opp Marina)	2532850	5994961	SHRTP	2
Boulder Bank (Opp Marina)	2532870	5994950	SHRTP	2
Boulder Bank (Opp Marina)	2532870	5994950	STFTP	1
Boulder Bank (Opp Marina)	2532850	5994961	STFTP	1
Boulder Bank (Opp Marina)	2532850	5994961	STFTP	1
Boulder Bank (Opp Marina)	2532870	5994950	STFTP	1
Kingsford Quay	2533154	5994331	BGRB	3
Kingsford Quay	2533170	5994287	BSLD	1
Kingsford Quay	2533002	5994276	BSLD	1
Kingsford Quay	2533147	5994231	CRBTP	4
Kingsford Quay	2533147	5994231	FSHTP	3
Kingsford Quay	2533147	5994231	FSHTP	1
Kingsford Quay	2533147	5994231	PSC	14
Kingsford Quay	2533147	5994231	SHRTP	4
Kingsford Quay	2533147	5994231	STFTP	4
Lay-Up & Repair Facility	2533098	5994522	BGRB	1
Lay-Up & Repair Facility	2533098	5994522	BGRB	1
Lay-Up & Repair Facility	2533098	5994522	BGRB	1
Lay-Up & Repair Facility	2533174	5994632	BSLD	1
Lay-Up & Repair Facility	2533034	5994501	BSLD	1
Lay-Up & Repair Facility	2533133	5994537	CRBTP	2

Site	Easting	Northing	Survey Method*	Number of sample units
Lay-Up & Repair Facility	2533596	5994446	CRBTP	2
Lay-Up & Repair Facility	2533072	5994511	CYST	2
Lay-Up & Repair Facility	2533133	5994537	FSHTP	1
Lay-Up & Repair Facility	2533596	5994446	FSHTP	2
Lay-Up & Repair Facility	2533133	5994537	FSHTP	1
Lay-Up & Repair Facility	2533198	5994585	PSC	14
Lay-Up & Repair Facility	2533133	5994537	SHRTP	2
Lay-Up & Repair Facility	2533596	5994446	SHRTP	2
Lay-Up & Repair Facility	2533133	5994537	STFTP	2
Lay-Up & Repair Facility	2533596	5994446	STFTP	2
Main Wharf	2532669	5994088	BGRB	3
Main Wharf	2532640	5994083	BSLD	1
Main Wharf	2532538	5993944	BSLD	1
Main Wharf	2532644	5994059	CRBTP	4
Main Wharf	2532669	5994088	CYST	2
Main Wharf	2532644	5994059	FSHTP	2
Main Wharf	2532644	5994059	FSHTP	1
Main Wharf	2532644	5994059	FSHTP	1
Main Wharf	2532609	5994022	PSC	15
Main Wharf	2532644	5994059	SHRTP	4
Main Wharf	2532644	5994059	STFTP	3
Main Wharf	2532644	5994059	STFTP	1
Marina	2533526	5993849	BGRB	3
Marina	2533579	5993917	BSLD	1
Marina	2533502	5993979	BSLD	1
Marina	2533581	5993847	CRBTP	1
Marina	2533490	5994125	CRBTP	1
Marina	2533581	5993830	CRBTP	1
Marina	2533490	5994125	CRBTP	1
Marina	2533526	5993849	CYST	2
Marina	2533577	5993830	FSHTP	1
Marina	2533577	5993830	FSHTP	1
Marina	2533490	5994125	FSHTP	2
Marina	2533490	5994125	SHRTP	2
Marina	2533581	5993830	SHRTP	1
Marina	2533581	5993830	SHRTP	1
Marina	2533490	5994125	STFTP	2

Site	Easting	Northing	Survey Method*	Number of sample units
Marina	2533581	5993830	STFTP	1
Marina	2533581	5993830	STFTP	1
McGlashen Quay	2532883	5994156	BGRB	2
McGlashen Quay	2532883	5994156	BGRB	1
McGlashen Quay	2532836	5993971	BSLD	1
McGlashen Quay	2532885	5994152	BSLD	1
McGlashen Quay	2532927	5994117	CRBTP	2
McGlashen Quay	2532906	5994058	CRBTP	1
McGlashen Quay	2532906	5994058	CRBTP	1
McGlashen Quay	2532779	5994047	CYST	2
McGlashen Quay	2532922	5994110	FSHTP	1
McGlashen Quay	2532911	5994069	FSHTP	2
McGlashen Quay	2532922	5994110	FSHTP	1
McGlashen Quay	2532916	5994091	PSC	14
McGlashen Quay	2532906	5994058	SHRTP	2
McGlashen Quay	2532927	5994117	SHRTP	2
McGlashen Quay	2532906	5994058	STFTP	1
McGlashen Quay	2532927	5994117	STFTP	1
McGlashen Quay	2532906	5994058	STFTP	1
McGlashen Quay	2532927	5994117	STFTP	1
Ministry Of Fisheries Wharf	2533490	5994125	CRBTP	1
Ministry Of Fisheries Wharf	2533490	5994125	CRBTP	1
Ministry Of Fisheries Wharf	2533490	5994125	FSHTP	2
Ministry Of Fisheries Wharf	2533490	5994125	STFTP	1
Nelson Haven	2532119	5994467	CRBTP	1
Nelson Haven	2532119	5994467	CRBTP	1
Nelson Haven	2532119	5994467	CRBTP	1
Nelson Haven	2532119	5994470	CRBTP	1
Nelson Haven	2532119	5994470	CRBTP	1
Nelson Haven	2532119	5994467	CRBTP	1
Nelson Haven	2532168	5994502	FSHTP	2
Nelson Haven	2532119	5994482	FSHTP	2
Nelson Haven	2532119	5994467	SHRTP	2
Nelson Haven	2532119	5994470	SHRTP	2
Nelson Haven	2532119	5994467	STFTP	1
Nelson Haven	2532119	5994470	STFTP	1
Nelson Haven	2532119	5994467	STFTP	1

Site	Easting	Northing	Survey Method*	Number of sample units
Nelson Haven	2532119	5994470	STFTP	1
Nelson Haven_N	2533054	5994929	BGRB	2
Nelson Haven_N	2533054	5994929	BGRB	1
Nelson Haven_N	2533156	5994914	BSLD	1
Nelson Haven_N	2533155	5994923	BSLD	1
Nelson Haven_S	2532096	5994369	BGRB	1
Nelson Haven_S	2532096	5994369	BGRB	1
Nelson Haven_S	2532096	5994369	BGRB	1
Nelson Haven_S	2532649	5994764	BSLD	1
Nelson Haven_S	2532734	5994866	BSLD	1
Superyacht	2533119	5994426	CRBTP	1
Superyacht	2533122	5994426	CRBTP	2
Superyacht	2533122	5994426	CRBTP	1
Superyacht	2533122	5994426	FSHTP	2
Superyacht	2533122	5994426	FSHTP	2
Superyacht	2533121	5994434	PSC	14
Superyacht	2533119	5994426	SHRTP	2
Superyacht	2533122	5994426	SHRTP	2
Superyacht	2533119	5994426	STFTP	2
Superyacht	2533122	5994426	STFTP	2
The Cut	2531954	5993859	BGRB	1
The Cut	2531954	5993859	BGRB	2
The Cut	2532161	5994430	BSLD	1
The Cut	2532246	5994517	BSLD	1
The Cut	2531349	5993644	FSHTP	1
The Cut	2531694	5993436	FSHTP	2
The Cut	2531727	5993395	FSHTP	1
The Cut	2531727	5993395	FSHTP	1
The Cut	2531349	5993644	FSHTP	3

*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 3 Specialists engaged to identify specimens obtained from the New Zealand port surveys.

Major taxonomic groups	Class	Specialist Survey 1 samples	Specialist Survey 2 samples	Institution
Annelida	Polychaeta	Geoff Read[1], Jeff Forman[1]	Geoff Read[1], Jeff Forman[1]	[1]NIWA Greta Point
Bryozoa	Gymnolaemata	Dennis Gordon[1]	Dennis Gordon[1]	[1]NIWA Greta Point
Chelicerata	Pycnogonida	David Staples[2]	David Staples[2]	[2]Melbourne Museum, Victoria, Australia
Cnidaria	Anthozoa	Adorian Ardelean[3]	No specialist available as yet	[3]West University of Timisoara, Timisoara, 1900, Romania
Cnidaria	Hydrozoa	Jan Watson[4]	Jan Watson[4]	[4]Hydrozoan Research Laboratory, Clifton Springs, Victoria, Australia
Crustacea	Amphipoda	Graham Fenwick[5]	Graham Fenwick[5]	[5]NIWA Christchurch
Crustacea	Cirripedia	Graham Fenwick[5], Isla Fitridge[5] John Buckeridge[6]	Isla Fitridge[5]	[5]NIWA Christchurch and [6]Auckland University of Technology
Crustacea	Decapoda	Colin McLay[7] Graham Fenwick[5], Nick Gust[5]	Colin McLay[7]	[7]University of Canterbury and [5]NIWA Christchurch
Crustacea	Isopoda	Niel Bruce[1]	Niel Bruce[1]	[1]NIWA Greta Point
Crustacea	Mysidacea	Fukuoka Kouki[8]	Niel Bruce[1]	[1]NIWA Greta Point and [8]National Science Museum, Tokyo
Echinodermata	Asteroidea	Don McKnight[1]	Niki Davey[9]	[1]NIWA Greta Point and [9]NIWA Nelson
Echinodermata	Echinoidea	Don McKnight[1]	Niki Davey[9]	[1]NIWA Greta Point and [9]NIWA Nelson
Echinodermata	Holothuroidea	Niki Davey[9]	Niki Davey[9]	[9]NIWA Nelson
Echinodermata	Ophiuroidea	Don McKnight[1], Helen Rottman[1]	Niki Davey[9]	[1]NIWA Greta Point and [9]NIWA Nelson
Echiura	Echiuroidea	Geoff Read[1]	Geoff Read[1]	[1]NIWA Greta Point
Mollusca	Bivalvia. Cephalopoda, Gastropoda, Polyplacophora	Bruce Marshall[10]	Bruce Marshall[10]	[10]Museum of NZ Te Papa Tongarewa
Nemertea	Anopla, Enopla	Geoff Read[1]	Geoff Read[1]	[1]NIWA Greta Point
Macroalgae	Phaeophyceae, Rhodophyceae, Ulvophyceae	Wendy Nelson[1], Kate Neill[1]	Wendy Nelson[1], Kate Neill[1]	[1]NIWA Greta Point
Platyhelminthes	Turbellaria	Sean Handley[9]	Sean Handley[9]	[9]NIWA Nelson
Porifera	Demospongiae, Calcarea	Michelle Kelly-Shanks[11]	Michelle Kelly-Shanks[11]	[11]NIWA Auckland
Priapula	Priapulidae	Geoff Read[1]	Geoff Read[1]	[1]NIWA Greta Point
Dinophyta	Dinophyceae	Hoe Chang[1], Rob Stewart[1]	Hoe Chang[1], Rob Stewart[1]	[1]NIWA Greta Point
Urochordata	Ascidiacea	Mike Page[e],	Mike Page[9],	[9]NIWA Nelson and

Major taxonomic groups	Class	Specialist Survey 1 samples	Specialist Survey 2 samples	Institution
		Anna Bradley[e] Patricia Kott[12]	Anna Bradley[9]	[12]Queensland Museum
Vertebrata	Osteichthyes	Clive Roberts[10], Andrew Stewart[10]	Clive Roberts[10], Andrew Stewart[10]	[10]Museum of NZ Te Papa Tongarewa

Appendix 4: Generic descriptions of representative groups of the main marine phyla collected during sampling

Phylum Annelida

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

Phylum Arthropoda

The Arthropoda is a very large group of organisms, with well-known members including crustaceans, insects and spiders.

Crustaceans: The crustaceans (including Classes Malacostra, Cirripedia and other smaller classes) represent one of the sea's most diverse groups of organisms, including shrimps, crabs, lobsters, amphipods, tanaids and several other groups. 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.

Pycnogonids: The pycnogonids, or sea spiders, are 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.

Phyla Chlorophyta, Rhodophyta and Ochrophyta

Macroalgae: Marine macroalgae are highly diverse and are grouped under several phyla. The green algae are in Phylum Chlorophyta; red algae are in Phylum Rhodophyta, and the brown algae are in Phylum Ochrophyta. Whilst the green and red algae fall under Kingdom Plantae, the brown algae (Phylum Ochrophyta) are grouped in the Kingdom Chromista. Despite their disparate systematics, red, green and brown algae perform many similar ecological functions. 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.

Phylum Chordata

Ascidiacea: Ascidians are sometimes referred to as 'sea squirts' or 'tunicates'. 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.

Actinopterygii: The Class Actinopterygii refers to the ray-finned fishes. This is an extremely diverse group. 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. They can be classified ecologically according to depth habitat preferences; for example, fish that live on or near the sea floor are considered demersal while those living in the upper water column are termed pelagics.

Elasmobranchii: The Class Elasmobranchii are one of two classes of cartilaginous fishes, including sharks, skates and rays.

Phylum Cnidaria
Anthozoa: The Class Anthozoa includes the true corals, sea anemones and sea pens.
Hydrozoa: The Class Hydrozoa includes hydroids, fire corals and many medusae. Of these, only hydroids were recorded in the port surveys. 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.
Scyphozoa: Scyphozoans are the true jellyfish.

Phylum Dinophyta
Dinoflagellates: Dinoflagellates are a large group of unicellular algae that live in the water column or within the sediments. 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 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 Ectoprocta
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 Magnoliophyta
Seagrasses: The Magnoliophyta are the flowering plants, or angiosperms. Most of these are terrestrial, but the Magnoliophyta also include marine representatives – the seagrasses. The only Mangnoliophyte encountered in the port surveys was the seagrass *Zostera*.

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

Phylum 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.

Appendix 5 Criteria for assigning non-indigenous status to species sampled from the Port of Nelson in the second survey.

List of Chapman and Carlton's (1994) nine criteria (C1 – C9) for assigning non-indigenous species status that were met by the non-indigenous species sampled in the Port of Nelson in the second survey. Criteria that apply to each species are indicated by (+). Cranfield et al's (1998) analysis was used for species previously known from New Zealand waters. For non-indigenous species that were first detected during the present study, criteria were assigned using advice from the taxonomists that identified them. Refer to footnote for a full description of C1 – C9.

Major taxonomic groups and Species	C1	C2	C3	C4	C5	C6	C7	C8	C9
Annelida									
Hydroides elegans	+	+	+	+	+	+	+	+	+
Bryozoa									
Bugula flabellata	+	+	+		+	+	+	+	+
Cryptosula pallasiana	+	+	+		+	+	+	+	+
Electra tenella	+		+		+	+	+	+	
Watersipora subtorquata	+	+	+		+	+	+	+	+
Celleporaria nodulosa	+		+		+		+	+	+
Cnidaria									
Filellum serpens	+		+		+		+	+	
Synthecium campylocarpum	+		+		+		+	+	
Synthecium subventricosum	+		+		+		+	+	
Lafoeina amirantensis	+		+		+		+	+	
Mollusca									
Crassostrea gigas	+	+	+			+	+	+	+
Theora lubrica	+	+			+	+	+	+	+
Macroalgae									
Undaria pinnatifida	+	+	+		+	+	+	+	+

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 6a. Results from the pile scraping quadrats

Appendix 6a. Results from the diver collections and pile scrapings.

						Site code	Kingsford Quay														Lay-Up & Repair Facility														Main Wharf															McGlashen Quay														Superyacht													
						Pile replicate	1							2							1							2							1							2								1							2							1								2					
						Pile position	IN			OUT				IN			OUT				IN			OUT				IN			OUT				IN			OUT				IN				OUT				IN			OUT				IN			OUT				IN				OUT				IN		OUT			
Phylum	class	order	family	genus	species	*class_code	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4	2	3	1	2	3	4
				Clava	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	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Eunicida	Dorvilleidae	Dorvillea	australiensis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Glyceridae	Glycera	benhami	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0
Annelida	Polychaeta	Phyllodocida	Nereididae	Neanthes	kerguelensis	N	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	1	0	0	0	0	1	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Nereididae	Nereididae	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Nereididae	Nereis	falcaria	N	0	0	0	0	0	1	0	0	0	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	1	0	0	0	0	0	0	1	0	0	0	1	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
Annelida	Polychaeta	Phyllodocida	Nereididae	Perinereis	amblyodonta	N	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Annelida	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Nereididae	Perinereis	Perinereis-A	C2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Nereididae	Perinereis	pseudocamiguina	N	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Nereididae	Platynereis	Platynereis_australis_group	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Annelida	Polychaeta	Phyllodocida	Phyllodocidae	Eulalia	bilineata	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Phyllodocidae	Eulalia	microphylla	N	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	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	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe	macrolepidota	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Polynoidae	Lepidonotus	polychromus	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	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	1	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Polynoidae	Ophiodromus	angustifrons	N	0	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	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	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Syllidae	Eusyllis	Eusyllis-A	C2	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Syllidae	Eusyllis	Eusyllis-B	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Annelida	Polychaeta	Phyllodocida	Syllidae	Syllidae	Indet	SI	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Sabellida	Sabellidae	Megalomma	suspiciens	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Sabellida	Sabellidae	Pseudopotamilla	laciniosa	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0
Annelida	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	1	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	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	0	0	0	0
Annelida	Polychaeta	Sabellida	Serpulidae	Hydroides	elegans	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Scolecida	Opheliidae	Armandia	maculata	N	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Scolecida	Scalibregmatidae	Hyboscolex	longiseta	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	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	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Annelida	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	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0
Annelida	Polychaeta	Spionida	Spionidae	Boccardia	syrtis	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Spionida	Spionidae	Paraprionospio	Paraprionospio-A [pinnata]	C2	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Terebellida	Acrocirridae	Acrocirrus	trisectus	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Terebellida	Cirratulidae	Protocirrineris	nuchalis	N	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	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	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0
Annelida	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	1	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	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	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Terebellida	Terebellidae	Lanassa	Lanassa-A	C2	0	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	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	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Annelida	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0
Annelida	Polychaeta	Terebellida	Terebellidae	Pseudopista	rostrata	N	0	0	0	0	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	0	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	0	0	0	0	0	0	1	0	0	0	0
Annelida	Polychaeta	Terebellida	Terebellidae	Streblosoma	toddae	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	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	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Annelida	Polychaeta	Terebellida	Terebellidae	Terebella	Terebella-B	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0
Ectoprocta						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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Aeteidae	Aetea	truncata	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	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta	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	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	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Beaniidae	Beania	sp.	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1
Ectoprocta	Gymnolaemata	Cheilostomata	Bugulidae	Bugula	flabellata	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	1	0	0	0	1
Ectoprocta	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	1	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Electridae	Electra	tenella	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Eurystomellidae	Eurystomella	foraminigera	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Lepraliellidae	Celleporaria	nodulosa	A	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	0	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	0	0	1	0	0	0	1	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Microporellidae	Microporella	speculum	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Phidoloporidae	Rhynchozoon	larreyi	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Romancheinidae	Escharoides	angela	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Watersiporidae	Watersipora	subtorquata	A	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0
Cnidaria	Hydrozoa	Hydroida	Bougainvilliidae	Bougainvillia	muscus	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0
Cnidaria	Hydrozoa	Hydroida	Campanulariidae	Clytia	elongata	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cnidaria	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Cnidaria	Hydrozoa	Hydroida	Campanulariidae	Obelia	dichotoma	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Cnidaria	Hydrozoa	Hydroida	Campanulinidae	Lafoeina	amirantensis	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cnidaria	Hydrozoa	Hydroida	Campanulinidae	Phialella	quadrata	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	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	1	0
Cnidaria	Hydrozoa	Hydroida	Haleciidae	Halecium	delicatulum	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cnidaria	Hydrozoa	Hydroida	Lafoeidae	Filellum	serpens?	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cnidaria	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cnidaria	Hydrozoa	Hydroida	Sertulariidae	Amphisbetia	bispinosa	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cnidaria	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cnidaria	Hydrozoa	Hydroida	Syntheciidae	Synthecium	campylocarpum	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	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0
Cnidaria	Hydrozoa	Hydroida	Syntheciidae	Synthecium	subventricosum	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	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Cirripedia	Thoracica	Balanidae	Austrominius	modestus	N	0	1	0	1	1	0	0	0	1	0	1	1	0	1	1	1	1	1	1	0	0	1	1	0	1	1	1	0	1	1	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	1	0	0	0	1	1	1	0	0	0	0	1	1	0	0	0	1	0	0	1	1	1	1	1	0
Arthropoda	Malacostraca	Amphipoda	Aoridae	Aora	typica	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	0	0	0	0	0	0	0	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	0	0	0	0	0	0	1	0
Arthropoda	Malacostraca	Amphipoda	Aoridae	Haplocheira	barbimana	N	0	0	1	0	0	1	1	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	0	0	1	1
Arthropoda	Malacostraca	Amphipoda	Dexaminidae	Paradexamine	pacifica	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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

Appendix 6a. Results from the diver collections and pile scrapings.

						Site code	Kingsford Quay														Lay-Up & Repair Facility														Main Wharf															McGlashen Quay														Superyacht													
						Pile replicate	1							2							1							2							1							2								1							2							1								2					
						Pile position	IN			OUT				IN			OUT				IN			OUT				IN			OUT				IN			OUT				IN				OUT				IN			OUT				IN			OUT				IN				OUT				IN		OUT			
Arthropoda	Malacostraca	Amphipoda	Hyalidae	Hyale	sp.	SI	1	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	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Amphipoda	Isaeidae	Gammaropsis	indet sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	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	0	0	0	0	0	0	1	1	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	1	0	0	0	0	0	0	0	0	0	1
Arthropoda	Malacostraca	Amphipoda	Leucothoidae	Paraleucothoe	sp. A	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Parawaldeckia	angusta	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Parawaldeckia	sp. aff. P. stephenseni	C2	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Parawaldeckia	stephenseni	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Parawaldeckia	vesca	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Amphipoda	Phtisicidae	Caprellina	longicollis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Amphipoda	Talitridae	Parorchestia	tenuis	N	0	0	0	1	1	0	0	0	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	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	1	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Anomura	Diogenidae	Paguristes	setosus	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	0	0	0	0	0	1	0	0	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	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Anomura	Paguridae	Pagurus	traversi	N	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	1	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Anomura	Porcellanidae	Petrolisthes	elongatus	N	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	1	1	0	1	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	0	0	0	0	1	0	1	0	1	0	1	0	1	1	0	0	0	1	0	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Anomura	Porcellanidae	Petrolisthes	novaezelandiae	N	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	1	1	0	0	1	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Hymenosomatidae	Halicarcinus	innominatus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Hymenosomatidae	Halicarcinus	varius	N	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	1	0	1	1	1	0	0	0	0	0	1	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	1	0	1	0	0	1	0
Arthropoda	Malacostraca	Brachyura	Hymenosomatidae	Neohymenicus	pubescens	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	1	1	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	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Majidae	Notomithrax	minor	N	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	1	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Pinnotheridae	Pinnotheres	novaezelandiae	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Arthropoda	Malacostraca	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	1	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Xanthidae	Pilumnus	novaezealandiae	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	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	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Arthropoda	Malacostraca	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	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	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Caridea	Palemonidae	Periclimenes	yaldwyni	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0
Arthropoda	Malacostraca	Tanaidacea		Tanaidacea	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Isopoda	Sphaeromatidae	Cilicaea	caniculata	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Isopoda	Sphaeromatidae	Pseudosphaeroma	campbellensis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Arthropoda	Pycnogonida					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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echinodermata	Asteroidea	Valvatida	Asterinidae	Meridiastra	mortenseni	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echinodermata	Asteroidea	Valvatida	Asterinidae	Patiriella	regularis	N	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Magnoliophyta	Alismatidae	Najadales	Zosteraceae	Zostera	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Bivalvia	Myoida	Hiatellidae	Hiatella	arctica	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Bivalvia	Mytiloida	Mytilidae	Modiolarca	impacta	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	0	0	0	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	0	0	0	0	0	1	0	0	0	0
Mollusca	Bivalvia	Mytiloida	Mytilidae	Modiolus	areolatus	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Bivalvia	Mytiloida	Mytilidae	Perna	canaliculus	N	0	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	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Mollusca	Bivalvia	Mytiloida	Mytilidae	Xenostrobus	pulex	N	0	1	0	0	1	0	0	0	0	0	0	1	1	0	1	1	1	0	1	0	1	1	1	0	1	0	0	0	1	1	0	0	1	0	0	1	1	0	0	0	1	0	0	1	1	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	1
Mollusca	Bivalvia	Ostreoida	Ostreidae	Crassostrea	gigas	A	0	0	0	0	1	1	0	0	0	0	0	1	1	1	0	0	1	0	1	0	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Mollusca	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	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	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	0	0
Mollusca	Bivalvia	Pterioida	Anomiidae	Pododesmus	zelandicus	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Bivalvia	Pterioida	Pectinidae	Talochlamys	zelandiae	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	1	0	0	1	1	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	0	1	0	0	0	0	0	0	0	0	1	0
Mollusca	Bivalvia	Veneroida	Cardiidae	Pratulum	pulchellum	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Mollusca	Bivalvia	Veneroida	Kelliidae	Kellia	cycladiformis	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Bivalvia	Veneroida	Lasaeidae	Lasaea	hinemoa	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Bivalvia	Veneroida	Semelidae	Leptomya	retiaria	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Basommatophora	Ellobiidae	Leuconopsis	obsoleta	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	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Littorinimorpha	Littorinidae	Austrolittorina	antipodum	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Mollusca	Gastropoda	Littorinimorpha	Littorinidae	Risellopsis	varia	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	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	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Cominella	glandiformis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Neogastropoda	Muricidae	Xymene	plebeius	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Neotaenioglossa	Velutinidae	Lamellaria	ophione	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Notaspidea	Pleurobranchidae	Pleurobranchaea	maculata	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	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	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Nudibranchia	Dorididae	Alloiodoris	lanuginata	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Nudibranchia	Dorididae	Archidoris	wellingtonensis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Systellomatophora	Onchidiidae	Onchidella	nigricans	N	0	0	0	0	1	0	0	0	0	0	0	0	0	1	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	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Mollusca	Gastropoda	Vetigastropoda	Fissurellidae	Scutus	breviculus	N	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Vetigastropoda	Turbinidae	Turbo	smaragdus	N	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Polyplacophora	Acanthochitonina	Acanthochitonidae	Acanthochitona	violacea	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Polyplacophora	Acanthochitonina	Acanthochitonidae	Cryptoconchus	porosus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Polyplacophora	Ischnochitonina	Chitonidae	Sypharochiton	pelliserpentis	N	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	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	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
Mollusca	Polyplacophora	Ischnochitonina	Chitonidae	Sypharochiton	sinclairi	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae					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	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Rhodophyta	Florideophyceae	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Rhodophyta	Florideophyceae	Ceramiales	Ceramiaceae	Ceramium	apiculatum	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Dasyaceae	Dasya	collabens	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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

Appendix 6a. Results from the diver collections and pile scrapings.

						Site code	Kingsford Quay														Lay-Up & Repair Facility														Main Wharf															McGlashen Quay														Superyacht													
						Pile replicate	1							2							1							2							1							2								1							2							1								2					
						Pile position	IN			OUT				IN			OUT				IN			OUT				IN			OUT				IN			OUT				IN				OUT				IN			OUT				IN			OUT				IN				OUT				IN		OUT			
Rhodophyta	Florideophyceae	Ceramiales	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	1	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	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
Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae	Caloglossa	leprieurii	N	0	0	0	1	1	0	0	1	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	1	0	0	0	1	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	0	1	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae	Schizoseris	dichotoma	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae	Bostrychia	harveyi	N	0	0	0	0	0	0	0	1	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	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	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae	Bostrychia	moritziana	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	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	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae	Stictosiphonia	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Rhodymeniales	Rhodomeniaceae	Rhodymenia	aff. dichotoma	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chlorophyta	Ulvophyceae	Ulvales	Ulvaceae	Enteromorpha	sp.	SI	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chlorophyta	Ulvophyceae	Ulvales	Ulvaceae	Ulva	sp.	SI	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	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Halichondrida	Halichondriidae	Hymeniacidon	new sp. 1	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Callyspongiidae	Dactylia	new sp. 1	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Adocia	new sp. 1	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Adocia	new sp. 2	C2	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	1	0	0	1	0	0	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	0	0	1	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Haliclona	cf. punctata	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Haliclona	new sp. 1	C2	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	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	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	0
Porifera	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	0	0	1	0	0	0	1	0	0	1	1	0	0	0	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	0	0
Porifera	Demospongiae	Poecilosclerida	Tedaniidae	Tedania	battershilli	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Aplousobranchia	Didemnidae			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	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Aplousobranchia	Didemnidae	Didemnum	sp.	C1	0	0	1	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
Chordata	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	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Aplousobranchia	Holozoidae	Distaplia	sp.	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Aplousobranchia	Polyclinidae	Aplidium	adamsi	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	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	0	0	0	0	0	0	1	1	0	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	0	0	0	0	0	0	1
Chordata	Ascidiacea	Phlebobranchia	Rhodosomatidae	Corella	eumyota	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	1	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Botryllinae	Botrylliodes	leachii	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Molgulidae	Molgula	mortenseni	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Pyuridae	Microcosmus	squamiger	C1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	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	0	0	0	0	0	0	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
Chordata	Ascidiacea	Stolidobranchia	Pyuridae	Pyura	cancellata	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	1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Pyuridae	Pyura	carnea	N	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Pyuridae	Pyura	pulla	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Pyuridae	Pyura	sp.	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Pyuridae	Pyura	subuculata	N	0	0	0	0	0	0	1	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	1	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	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Styelidae	Asterocarpa	cerea	C1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	1	0	1	1	1	0	0	1	1	0	0	0	0	0	1	0	0	1	1
Chordata	Ascidiacea	Stolidobranchia	Styelidae	Cnemidocarpa	bicornuta	N	0	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Styelidae	Cnemidocarpa	nisiotus	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0

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

Appendix 6b. Results from the benthic grab samples.

Appendix 6b. Results from the benthic grab samples.

						Site code	Amatel			Kingsford Quay			Lay-Up & Repair Facility			Main Wharf			Marina			McGlashen Quay			Nelsonhaven_N			Nelsonhaven_S			The Cut		
phylum	**class**	**order**	**family**	**genus**	**species**	***class_code**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**
Annelida	Polychaeta	Eunicida	Lumbrineridae	Lumbrineris	sphaerocephala	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
Annelida	Polychaeta	Phyllodocida	Glyceridae	Glycera	lamelliformis	N	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
Annelida	Polychaeta	Phyllodocida	Glyceridae	Hemipodus	simplex	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
Annelida	Polychaeta	Phyllodocida	Nephtyidae	Aglaophamus	verrilli	N	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	1	0
Annelida	Polychaeta	Phyllodocida	Polynoidae	Harmothoe	macrolepidota	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Sigalionidae	Labiosthenolepis	laevis	N	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Annelida	Polychaeta	Sabellida	Oweniidae	Owenia	petersenae	N	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Annelida	Polychaeta	Sabellida	Sabellidae	Euchone	sp_undet	SI	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
Annelida	Polychaeta	Spionida	Spionidae	Paraprionospio	Paraprionospio-A [pinnata]	C2	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
Annelida	Polychaeta	Terebellida	Pectinariidae	Pectinaria	australis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Annelida	Polychaeta	Terebellida	Terebellidae	Pista	pegma	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
Ectoprocta						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
Ectoprocta	Gymnolaemata	Cheilostomata	Celleporidae	Celleporina	sinuata	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
Cnidaria	Hydrozoa	Hydroida	Campanulariidae	Obelia	dichotoma	C1	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
Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca	chiltoni	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
Arthropoda	Malacostraca	Amphipoda	Phoxocephalidae	Torridoharpinia	hurleyi	N	0	0	1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0
Arthropoda	Malacostraca	Anomura	Paguridae	Pagurus	novizealandiae	N	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	0
Arthropoda	Malacostraca	Brachyura	Hymenosomatidae	Halicarcinus	varius	N	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Majidae	Notomithrax	minor	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
Arthropoda	Malacostraca	Brachyura	Ocypodidae	Macrophthalmus	hirtipes	N	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	1	0	0	0	0	0
Arthropoda	Malacostraca	Isopoda	Cirolanidae	Natatolana	rossi	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
Echinodermata	Echinoidea	Spatangoida	Loveniidae	Echinocardium	cordatum	N	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
Mollusca	Bivalvia	Nuculoida	Nuculidae	Nucula	hartvigiana	N	1	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	1
Mollusca	Bivalvia	Veneroida	Lasaeidae	Arthritica	bifurca	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
Mollusca	Bivalvia	Veneroida	Psammobiidae	Gari	stangeri	N	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
Mollusca	Bivalvia	Veneroida	Semelidae	Leptomya	retiaria	N	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Mollusca	Bivalvia	Veneroida	Semelidae	Theora	lubrica	A	1	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1
Mollusca	Bivalvia	Veneroida	Tellinidae	Macomona	liliana	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
Mollusca	Bivalvia	Veneroida	Veneridae	Austrovenus	stutchburyi	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Bivalvia	Veneroida	Veneridae	Ruditapes	largillierti	N	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
Mollusca	Gastropoda	Littorinimorpha	Iravadiidae	Nozeba	emarginata	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
Mollusca	Gastropoda	Neogastropoda	Muricidae	Xymene	plebeius	N	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Rhodophyta	Florideophyceae					SI	0	0	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
Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae	Aphanocladia	delicatula	N	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	0
Rhodophyta	Florideophyceae	Corallinales	Corallinaceae			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
Chlorophyta	Ulvophyceae	Ulvales	Ulvaceae	Ulva	sp.	SI	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Polyzoinae	Polyzoa	opuntia	N	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

*class_code: A = non-indigenous (highlighted by shading), C1 = cryptogenic category 1, C2 = cryptogenic category 2, N = native, SI = indeterminate species.

Appendix 6c. Results from the benthic sled samples.

Appendix 6c. Results from the benthic sled samples.

					Site code	Amatel		Kingsford Quay		Lay-Up & Repair Facility		Main Wharf		Marina		McGlashen Quay		Nelsonhaven_N		Nelsonhaven_S		The Cut	
class	**order**	**family**	**genus**	**species**	***class_code**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Polychaeta	Eunicida	Dorvilleidae	Dorvillea	australiensis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Polychaeta	Phyllodocida	Nephtyidae	Aglaophamus	verrilli	N	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Nereididae	Platynereis	Platynereis_australis_group	N	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Sigalionidae	Labiosthenolepis	laevis	N	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Polychaeta	Phyllodocida	Syllidae	Eusyllis	Eusyllis-B	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Sabellida	Sabellidae	Megalomma	suspiciens	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Scolecida	Opheliidae	Armandia	maculata	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Polychaeta	Terebellida	Pectinariidae	Pectinaria	australis	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polychaeta	Terebellida	Terebellidae	Nicolea	maxima	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polychaeta	Terebellida	Terebellidae	Streblosoma	toddae	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
					SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Beaniidae	Beania	sp.	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Gymnolaemata	Cheilostomata	Celleporidae	Celleporina	sinuata	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Gymnolaemata	Cheilostomata	Hippothoidae	Celleporella	tongima	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Hydrozoa	Hydroida	Sertulariidae	Dictyocladium	reticulatum	N	0	0	0	0	0	1	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	1	0	0	0	0	0
Hydrozoa	Hydroida	Syntheciidae	Synthecium	campylocarpum	A	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Malacostraca	Amphipoda				SI	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Amphipoda	Ampeliscidae	Ampelisca	chiltoni	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Malacostraca	Amphipoda	Dexaminidae	Paradexamine	pacifica	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Malacostraca	Amphipoda	Phoxocephalidae	Protophoxus	australis	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Malacostraca	Amphipoda	Phoxocephalidae	Torridoharpinia	hurleyi	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Anomura	Diogenidae	Paguristes	setosus	N	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Malacostraca	Anomura	Paguridae	Lophopagurus (L.)	thompsoni	N	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0
Malacostraca	Anomura	Paguridae	Pagurus	novizealandiae	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Malacostraca	Anomura	Paguridae	Pagurus	traversi	N	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
Malacostraca	Anomura	Porcellanidae	Petrolisthes	elongatus	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0
Malacostraca	Anomura	Porcellanidae	Petrolisthes	novaezelandiae	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Malacostraca	Brachyura	Hymenosomatidae	Halicarcinus	varius	N	1	0	0	0	1	1	0	0	0	1	0	0	1	1	1	1	1	1
Malacostraca	Brachyura	Majidae	Notomithrax	minor	N	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1
Malacostraca	Brachyura	Ocypodidae	Macrophthalmus	hirtipes	N	1	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	1	1
Malacostraca	Brachyura	Portunidae	Nectocarcinus	sp.	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Malacostraca	Caridea	Crangonidae	Pontophilus	australis	N	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1	0	0
Malacostraca	Caridea	Hippolytidae	Hippolyte	bifidirostris	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Malacostraca	Caridea	Palemonidae	Periclimenes	yaldwyni	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Malacostraca	Isopoda	Sphaeromatidae	Cilicaea	caniculata	N	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1
Asteroidea	Forcipulata	Asteriidae	Coscinasterias	muricata	N	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0
Asteroidea	Valvatida	Asterinidae	Meridiastra	mortenseni	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Asteroidea	Valvatida	Asterinidae	Patiriella	regularis	N	1	0	0	0	1	1	0	0	1	1	0	0	1	0	1	1	1	1
Echinoidea	Spatangoida	Loveniidae	Echinocardium	cordatum	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Alismatidae	Najadales	Zosteraceae	Zostera	sp.	SI	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1
Bivalvia	Mytiloida	Mytilidae	Perna	canaliculus	N	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
Bivalvia	Nuculoida	Nuculidae	Nucula	hartvigiana	N	1	1	0	1	0	1	0	0	1	0	1	0	0	0	0	1	0	0
Bivalvia	Nuculoida	Nuculidae	Nucula	nitidula	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Bivalvia	Nuculoida	Nuculidae	Nucula	sp.	SI	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Mactridae	Cyclomactra	ovata	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Semelidae	Leptomya	retiaria	N	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0
Bivalvia	Veneroida	Semelidae	Theora	lubrica	A	1	1	1	1	0	0	1	0	1	0	1	0	0	1	0	0	1	0
Bivalvia	Veneroida	Tellinidae	Macomona	liliana	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	Austrovenus	stutchburyi	N	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Bivalvia	Veneroida	Veneridae	Ruditapes	largillierti	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Bivalvia	Veneroida	Veneridae	Tawera	spissa	N	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0
Gastropoda	Caenogastropoda	Turritellidae	Maoricolpus	roseus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Gastropoda	Neogastropoda	Buccinidae	Cominella	adspersa	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Gastropoda	Neogastropoda	Muricidae	Xymene	plebeius	N	1	0	0	1	0	0	1	0	1	0	0	0	1	1	0	0	0	0
Gastropoda	Notaspidea	Pleurobranchidae	Pleurobranchaea	maculata	N	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1
Gastropoda	Nudibranchia	Dorididae	Aphelodoris	luctuosa	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Gastropoda	Vetigastropoda	Trochidae	Micrelenchus	huttonii	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Gastropoda	Vetigastropoda	Trochidae	Trochus	tiaratus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Gastropoda	Vetigastropoda	Turbinidae	Cookia	sulcata	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Polyplacophora	Ischnochitonina	Chitonidae	Rhyssoplax	aerea	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Florideophyceae					SI	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Florideophyceae	Ceramiales	Ceramiaceae	Antithamnionella	adnata	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Florideophyceae	Ceramiales	Ceramiaceae	Callithamnion	sp.	SI	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Florideophyceae	Ceramiales	Ceramiaceae	Ceramium	apiculatum	N	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1
Florideophyceae	Ceramiales	Ceramiaceae	Ceramium	flaccidum	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Florideophyceae	Ceramiales	Dasyaceae	Dasya	collabens	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Florideophyceae	Ceramiales	Dasyaceae	Heterosiphonia	squarrosa	N	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0
Florideophyceae	Ceramiales	Delesseriaceae			SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1
Florideophyceae	Ceramiales	Delesseriaceae	Erythroglossum	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Florideophyceae	Ceramiales	Delesseriaceae	Erythroglossum	undulatissimum	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Florideophyceae	Ceramiales	Delesseriaceae	Hymenena	variolosa	N	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Florideophyceae	Ceramiales	Delesseriaceae	Myriogramme	denticulata	N	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0

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

Appendix 6c. Results from the benthic sled samples.

					Site code	Amatel		Kingsford Quay		Lay-Up & Repair Facility		Main Wharf		Marina		McGlashen Quay		Nelsonhaven_N		Nelsonhaven_S		The Cut	
Florideophyceae	Ceramiales	Delesseriaceae	Schizoseris	sp.	SI	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Florideophyceae	Ceramiales	Rhodomelaceae	Aphanocladia	delicatula	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Florideophyceae	Corallinales	Corallinaceae			SI	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Florideophyceae	Gelidiales	Gelidiaceae	Gelidium	caulacantheum	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Florideophyceae	Gigartinales	Gigartinaceae	Gigartina	atropurpurea	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Florideophyceae	Gigartinales	Phyllophoraceae	Stenogramme	interrupta	N	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	0
Florideophyceae	Rhodymeniales	Rhodomeniaceae	Rhodymenia	novazelandica	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0
Florideophyceae	Rhodymeniales	Rhodomeniaceae	Rhodymenia	sp.	SI	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1
Phaeophyceae	Fucales	Sargassaceae	Carpophyllum	maschalocarpum	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Phaeophyceae	Laminariales	Alariaceae	Undaria	pinnatifida	A	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1
Ulvophyceae	Ulvales	Ulvaceae	Ulva	sp.	SI	0	1	0	1	1	0	0	0	0	0	1	0	1	1	0	1	0	1
Demospongiae	Haplosclerida	Chalinidae	Haliclona	glabra	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Demospongiae	Haplosclerida	Chalinidae	Haliclona	new sp. 1	C2	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Ascidiacea	Stolidobranchia	Styelidae	Asterocarpa	cerea	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ascidiacea	Stolidobranchia	Styelidae	Cnemidocarpa	bicornuta	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

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

Appendix 6d. Results from the dinoflagellate cyst core samples.

Appendic 6d. Results from the dinoflagellate cyst samples.

							Amatel		Basin		Lay-Up & Repair Facility		Main Wharf		Marina		McGlashen Quay	
phylum	**class**	**order**	**family**	**genus**	**species**	**class_code**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Dinoflagellata	Dinophyceae	Peridinales	Peridiniaceae	Protoperidinium	sp.	SI	0	1	1	0	1	0	0	0	1	0	0	0
Echinodermata	Asteroidea	Forcipulata	Asteriidae	Coscinasterias	muricata	N	0	0	0	0	0	0	0	1	0	0	0	0

*class_code: A = nonindigenous (highlighted by shading), C1 = cryptogenic category 1, C2 = cryptogenic category 2, N = native, SI = indeterminate species. See text for details.

Appendix 6e. Results from the fish trap samples.

Appendix 6e. Results from the fish trap samples.

						Site code	Boulder Bank (Opp Marina)				Kingsford Quay				y-Up & Repair Facil				Main Wharf				Marina				McGlashen Quay				Of Fisherie		Nelsonhaven				Superyacht				The Cut							
						Trap line	1		2		1		2		1		2		1		2		1		2		1		2		1				2		1		2		1		2		3		4	
phylum	class	order	family	genus	species	*class_code	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Chordata	Chondrichthyes	Carcharhiniformes	Scyliorhinidae	Cephaloscyllium	isabellum	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	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Grapsidae	Plagusia	chabrus	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Portunidae	Nectocarcinus	sp.	C2	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echinodermata	Asteroidea	Valvatida	Asterinidae	Patiriella	regularis	N	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	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Mollusca	Gastropoda	Notaspidea	Pleurobranchidae	Pleurobranchaea	maculata	N	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Haliclona	glabra	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Anguilliformes	Congridae	Conger	verreauxi	N	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Gasterosteiformes	Syngnathidae	Hippocampus	abdominalis	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Mugiliformes	Mugilidae	Aldrichetta	forsteri	N	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Perciformes	Cheilodactylidae	Nemadactylus	macropterus	N	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Perciformes	Labridae	Notolabrus	celidotus	N	1	0	0	0	1	0	1	1	1	1	1	0	0	1	0	0	0	1	0	0	1	1	0	0	0	1	0	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0
Vertebrata	Actinopterygii	Perciformes	Sparidae	Pagrus	auratus	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Perciformes	Tripterygiidae	Tripterygiidae	sp.	SI	0	0	0	0	0	0	0	0	0	0	1	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	0	0	0	0

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

Appendix 6f. Results from the crab trap samples.

Appendix 6f. Results from the crab trap samples.

						Site code	oulder Bank (Opp Marin				Kingsford Quay				ay-Up & Repair Facili				Main Wharf				Marina				McGlashen Quay				MFish Wharf		Nelsonhaven						Superyacht			
						Trap line	1		2		1		2		1		2		1		2		1		2		1		2				1		2		3		1		2	
phylum	class	order	family	genus	species	*class_code	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Chordata	Chondrichthyes	Carcharhiniformes	Scyliorhinidae	Cephaloscyllium	isabellum	N	0	0	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	0	0	0	0	0	1
Cnidaria	Hydrozoa	Hydroida	Plumulariidae	Plumularia	setacea	C1	0	0	0	0	0	0	0	0	0	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	0
Cnidaria	Hydrozoa	Hydroida	Sertulariidae	Sertularella	robusta	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	0	0	0	0	0	0	0	0
Cnidaria	Hydrozoa	Hydroida	Syntheciidae	Synthecium	campylocarpum	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	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Anomura	Paguridae	Pagurus	novizealandiae	N	0	0	0	0	0	0	0	0	0	0	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
Arthropoda	Malacostraca	Anomura	Paguridae	Pagurus	sp.	SI	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	1
Arthropoda	Malacostraca	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	1	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Majidae	Notomithrax	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	0	0	0	0	0	0	0	0
Echinodermata	Asteroidea	Forcipulata	Asteriidae	Coscinasterias	muricata	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	0	0	0	0	0	0	0	0
Echinodermata	Asteroidea	Valvatida	Asterinidae	Patiriella	regularis	N	1	1	1	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1
Magnoliophyta	Alismatidae	Najadales	Zosteraceae	Zostera	sp.	SI	0	0	0	0	0	0	0	0	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	0
Mollusca	Gastropoda	Caenogastropoda	Turritellidae	Zeacolpus	sp.	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Littorinimorpha	Littorinidae	Austrolittorina	antipodum	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Cominella	sp.	SI	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
Mollusca	Gastropoda	Notaspidea	Pleurobranchidae	Pleurobranchaea	maculata	N	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	0	0	0	0	0	0	0	0	1	1	0
Rhodophyta	Florideophyceae	Ceramiales	Ceramiaceae	Antithamnionella	adnata	N	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	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Ceramiaceae	Ceramium	apiculatum	N	0	0	0	0	0	0	0	0	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	0
Rhodophyta	Florideophyceae	Ceramiales	Dasyaceae	Dasya	collabens	N	0	0	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	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Dasyaceae	Dasya	subtilis	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	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae			SI	0	0	0	0	0	0	0	0	1	1	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
Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae	Myriogramme	denticulata	N	0	0	0	0	0	0	0	0	0	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	0
Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae	Schizoseris	dichotoma	N	0	0	0	0	0	0	0	0	1	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
Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae	Schizoseris	sp.	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	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae	Aphanocladia	delicatula	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	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae	Symphyocladia	marchantioides	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	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Gigartinales	Kallymeniaceae	?Thamnophyllis?		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	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Gigartinales	Phyllophoraceae	Stenogramme	interrupta	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	0	0	0	0	0	0	0	0
Chlorophyta	Ulvophyceae	Ulvales	Ulvaceae	Ulva	sp.	SI	0	0	0	0	0	0	0	0	1	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
Chordata	Ascidiacea	Phlebobranchia	Rhodosomatidae	Corella	eumyota	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	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Botryllinae	Botrylliodes	leachii	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Gasterosteiformes	Syngnathidae	Hippocampus	abdominalis	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	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Mugiliformes	Mugilidae	Aldrichetta	forsteri	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	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Perciformes	Tripterygiidae	Tripterygiidae	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0

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

Appendix 6g. Results from the starfish trap samples.

Appendix 6g. Results from the starfish trap samples.

						Site code	Boulder Bank (Opp Marina)				Kingsford Quay				Lay-Up & Repair Facility				Main Wharf				Marina				McGlashen Quay				M.Of F	Nelsonhaven				Superyacht			
						Trap line	1		2		1		2		1		2		1		2		1		2		1		2			1		2		1		2	
phylum	**class**	**order**	**family**	**genus**	**species**	***class_code**	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2		1	2	1	2	1	2	1	2
Arthropoda	Malacostraca	Brachyura	Portunidae	Nectocarcinus	sp.	C2	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	0	0	0	0	0
Arthropoda	Malacostraca	Isopoda		Isopoda	sp.	SI	0	0	0	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	0	0	0	0
Arthropoda	Malacostraca	Isopoda	Cirolanidae	Natatolana	rossi	N	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	0	0	0	0	0	0
Arthropoda	Malacostraca	Isopoda	Sphaeromatidae	Pseudosphaeroma	campbellensis	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	0	0	0	0	0
Echinodermata	Asteroidea	Forcipulata	Asteriidae	Coscinasterias	muricata	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	1	0	0	0	0	0	0
Echinodermata	Asteroidea	Valvatida	Asterinidae	Patiriella	regularis	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	1	1	1	1	0
Mollusca	Gastropoda	Littorinimorpha	Littorinidae	Austrolittorina	antipodum	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Cominella	sp.	SI	1	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	0	0	0	0
Mollusca	Gastropoda	Notaspidea	Pleurobranchidae	Pleurobranchaea	maculata	N	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	0	0	0	0	1	1	1	0
Rhodophyta	Florideophyceae	Ceramiales	Ceramiaceae	Antithamnionella	adnata	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	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Ceramiaceae	Ceramium	rubrum	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	0	0	0	0	0
Rhodophyta	Florideophyceae	Gigartinales	Gigartinaceae	Gigartina	atropurpurea	N	0	0	0	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	0	0	0	0
Rhodophyta	Florideophyceae	Rhodymeniales	Rhodomeniaceae	Rhodymenia	novazelandica	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	0	0	0	0	0
Ochrophyta	Phaeophyceae	Laminariales	Alariaceae	Undaria	pinnatifida	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	1	0	0	0	0	0	0	0	0
Chlorophyta	Ulvophyceae	Ulvales	Ulvaceae	Ulva	sp.	SI	0	0	0	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	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Callyspongiidae	Dactylia	new sp. 1	C2	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	0	0	0	0	0
Vertebrata	Actinopterygii	Gasterosteiformes	Syngnathidae	Hippocampus	abdominalis	N	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	0	0	0	0	0	0

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

Appendix 6h. Results from the shrimp trap samples.

Appendix 6h. Results from the starfish trap samples.

						Site code	Boulder Bank (Opp Marina)				Kingsford Quay				Lay-Up & Repair Facility				Main Wharf				Marina				McGlashen Quay				Nelsonhaven				Superyacht			
						Trap line	**1**		**2**		**1**		**2**		**1**		**2**		**1**		**2**		**1**		**2**		**1**		**2**		**1**		**2**		**1**		**2**	
phylum	**class**	**order**	**family**	**genus**	**species**	***class_code**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Arthropoda	Malacostraca	Isopoda		Isopoda	sp.	SI	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	1	0	1	1	1	1	0	0	1	1	0	1	1	0	1	0
Arthropoda	Malacostraca	Isopoda	Cirolanidae	Natatolana	rossi	N	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	0	0	0	0	0	0
Arthropoda	Malacostraca	Isopoda	Sphaeromatidae	Pseudosphaeroma	campbellensis	N	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Perciformes	Tripterygiidae	Tripterygiidae	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

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

Addendum

Recent revision by one of the authors (G.F.) of the status of amphipods identified in this survey has lead to a change in status of one species classed as species indeterminata in this report. *Paraleucothoe* sp. A should instead be considered cryptogenic category two, on the basis that only one other species of *Paraleucothoe* has been described world-wide (from Australia) and *Paraleucothoe* sp. A does not match its description. *Paraleucothoe* sp. A has not previously been recorded in New Zealand. It was recorded in the repeat survey of Nelson from the Superyacht berth.

KEEPING WATCH
BIOSECURITY NEW ZEALAND

www.biosecurity.govt.nz