TECHNICAL PAPER

BIOSECURITY NEW ZEALAND

Port of Tauranga

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

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Executive summary

- This report describes the results of a repeat port baseline survey of the Port of Tauranga undertaken in April 2005. 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 Tauranga undertaken in March 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 Tauranga, the survey used the same methodologies, occurred in the same season, 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 Tauranga. 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 Tauranga 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 304 species or higher taxa were identified in the first survey of the Port of Tauranga in March 2002. They consisted of 202 native species, 10 non-indigenous species, 51 cryptogenic species (those whose geographic origins are uncertain) and 41 species indeterminata (taxa for which there is insufficient taxonomic or systematic information available to allow identification to species level).

- During the repeat survey, 264 species or higher taxa were recorded, including 177 native species, 9 non-indigenous species, 43 cryptogenic species and 35 species indeterminata. Many species were common to both surveys. Around 41% the native species, 44% of non-indigenous species, and 50% of cryptogenic species recorded during the repeat survey were also found in the earlier survey.

- The 9 non-indigenous organisms found in the repeat survey of the Port of Tauranga included representatives of 3 major taxonomic groups. The non-indigenous species detected were: *Bugula flabellata*, *Bugula neritina*, *Electra tenella*, *Watersipora subtorquata*, *Amathia distans*, *Zoobotryon verticillatum* (Bryozoa); *Monotheca pulchella*, *Sertularia marginata* (Cnidaria); *Cliona celata* (Porifera). Five of these species – *Electra tenella*, *Amathia distans*, *Zoobotryon verticillatum*, *Monotheca pulchella*, *Sertularia marginata* – were not recorded in the earlier baseline survey of the Port of Tauranga. In addition, 5 non-indigenous species that were present in the first survey – *Polydora hoplura*, *Clytia ?linearis*, *Eudendrium capillare*, *Apocorophium acutum*, *Monocorophium acherusicum* – were not found during the repeat survey.

- Twenty three species recorded in the repeat survey had not previously been described from New Zealand waters. This included 19 species of sponge that not correspond with existing descriptions from New Zealand or overseas and may be new to science.

- None of the species recorded from the Port of Tauranga is on the New Zealand register of unwanted organisms.

- 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 44 % (4 of 9 species) of NIS in the Port of Tauranga are likely to have been introduced in hull fouling assemblages, 44 % (4 species) by hull fouling or ballast water , and 1 species (12 %) via fouling on flotsam vectors.

- The predominance of hull fouling species in the introduced biota of the Port of Tauranga (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 (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). These shipping transport mechanisms have enabled hundreds of marine species to spread worldwide and establish populations in shipping ports and coastal environments outside their natural range (Cohen and Carlton 1995; Hewitt et al. 1999; Eldredge and Carlton 2002; 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 deliberately or accidentally introduced to New Zealand, with around 90 % of these establishing permanent populations (Cranfield et al. 1998). Since that review, an an additional 441 non-indigenous species or suspected non-indigenous species (i.e. Cryptogenic type I – 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.

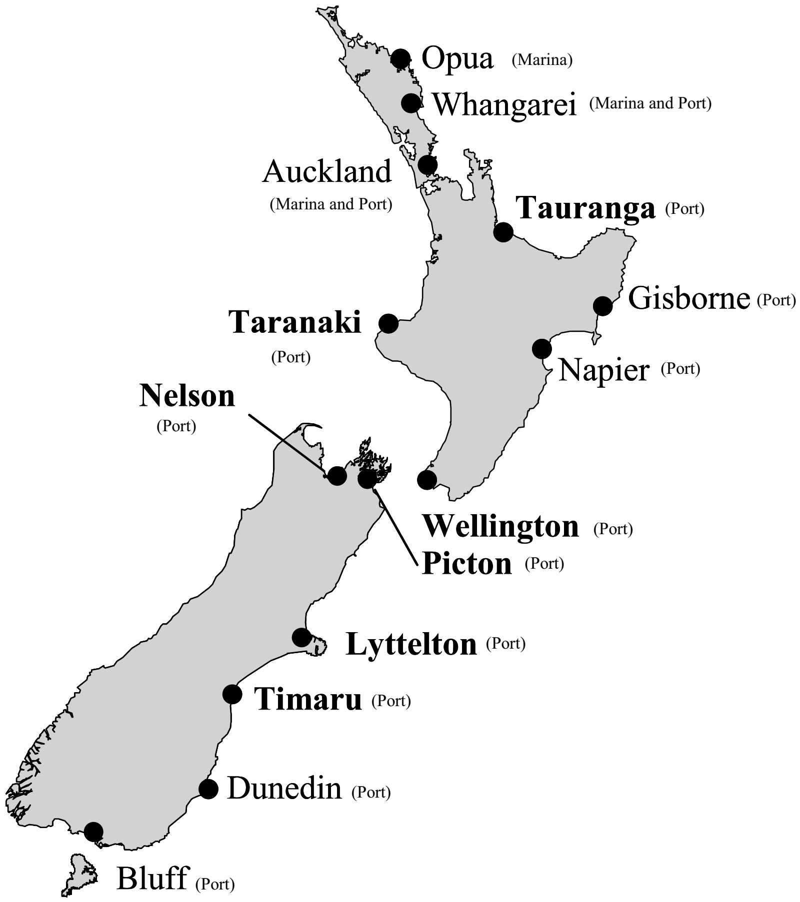

Figure 1: Commercial shipping ports in New Zealand where baseline non-indigenous species surveys have been conducted. Group 1 ports surveyed in the summer of 2001/2002 and re-surveyed in the summer of 2004/2005 are indicated in bold and Group 2 ports surveyed in the summer of 2002/2003 are indicated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

The 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)

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

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

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.

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 Tauranga undertaken in April 2005, 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 Tauranga, 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 TAURANGA

General features

Tauranga Harbour is a crescent-shaped, moderately tidal inlet on the west edge of the Bay of Plenty, on New Zealand's North Island (37° 40'S. 176° 10'E; Figure 2). The harbour is protected along its seaward side by Matakana Island and shipping traffic can enter the harbour around either the northern or southern tips of the island. Both harbour entrances are approximately 800 m across, with tidal scour ensuring that deep channels are maintained in each. The rest of the harbour is consistently shallow (Thompson 1981), typically less than 10m deep, with intertidal flats comprising approximately 66 % of its total area (201 km^2). The Port of Tauranga is located near Mount Maunganui at the southeastern end of the harbour, in an extensive mudflat area approximately 30 km long and 5 km wide (Thompson 1981).

Three main harbour basins exist, with intertidal flats separating the larger northern and southern basins. The third smaller basin includes several bays and sub-estuaries (Park 2003). Maritime marshes cover extensive areas of the harbour, playing an important role in the harbour ecosystem by providing buffer zones between the land and open water and important habitat for marine invertebrates. Mangrove marshes are also extensive in the harbour, providing sheltered habitat for a variety of fauna and flora (Barker and Larcombe 1976). The harbour also has several areas of seagrass beds (Park 2000), which are more extensive than in any other New Zealand harbour (Barker and Larcombe 1976). Tauranga harbour sediments are generally sandy mud and shell (Park 2000, 2003). Almost 120,000 tonnes of sediment washes into the harbour each year, mostly from farmland and forested areas via rivers and streams (Environment Bay of Plenty 1999). The harbour suffers from large blooms of *Ulva lactuca* (sea lettuce) that are thought to be linked to El Nino weather patterns and the high nutrient content of the harbour (Environment Bay of Plenty 1999). Hydrodynamics in the area are dominated by tidal currents and wind generated waves, and a variety of minor water movements also occur, including tidal wave surge, harbour resonance and estuarine circulation (Davies-Colley and Healy 1978).

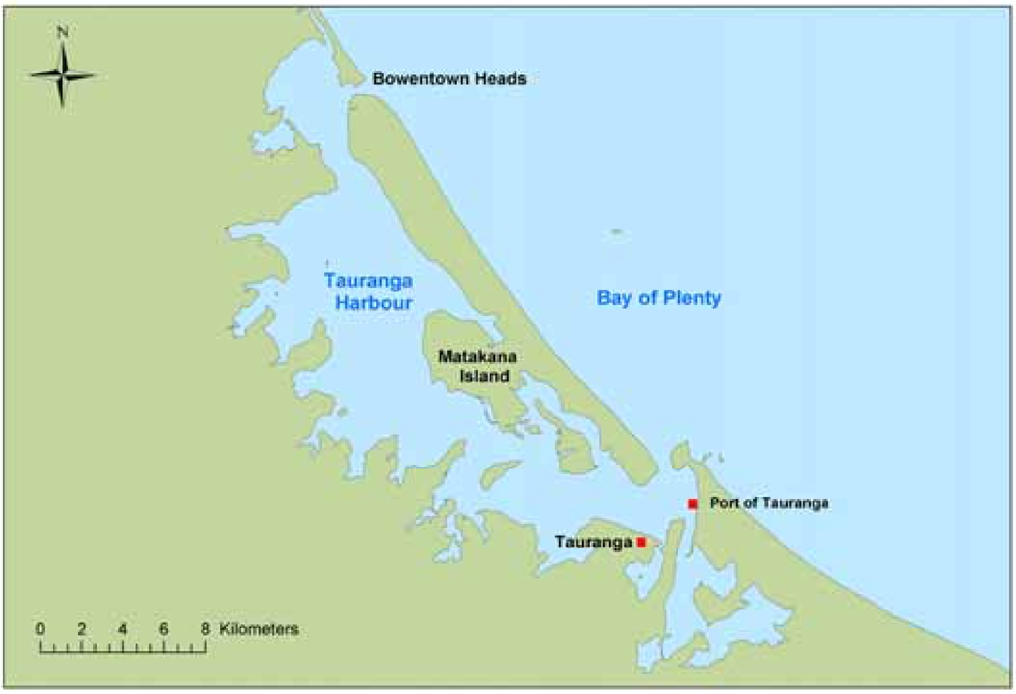

Figure 2: Tauranga Harbour and Bay of Plenty map

The Port of Tauranga was officially established in 1873. In 1927, a railway wharf at Tauranga was constructed, largely for coastal shipping use. In 1953, the first wharf structure was initiated at Mount Maunganui. In 1957, the first log shipment to Japan occurred, and in 1967 the first container was unloaded (www.port-tauranga.co.nz). In 1988, the Bay of Plenty Harbour Board was disestablished and the Port of Tauranga Ltd began operations with control over the port. In 1992 the Tauranga terminal development was completed at Sulphur Point and associated wharves opened for shipping. In 1999, the Port of Tauranga established New Zealand's first fully integrated inland port service, MetroPort Auckland, which provides for storage and transfer of cargo between Auckland and Tauranga.

Port operation, development and maintenance activities

The Port of Tauranga currently consists of two separate wharves, divided by a tidal channel in the Tauranga Harbour (Figure 3). On the Mount Maunganui side of the harbour, the Port has 2,055 m of continuous berth face, with twelve berths. Sulphur Point facilities on the western side of the channel feature 600 m of heavy-duty wharf, with three berths. Maximum draught at high water at each set of wharves is 13 m, and the maximum vessel length capability is 290 m. Berth construction is predominantly concrete deck on wood and concrete piles, with a mixture of wood and steel/wood fender piling. The original piling wood is hardwood, but replacement when required is with treated pine piles. Details of the berthing facilities available in the Port are summarised in Table 1.

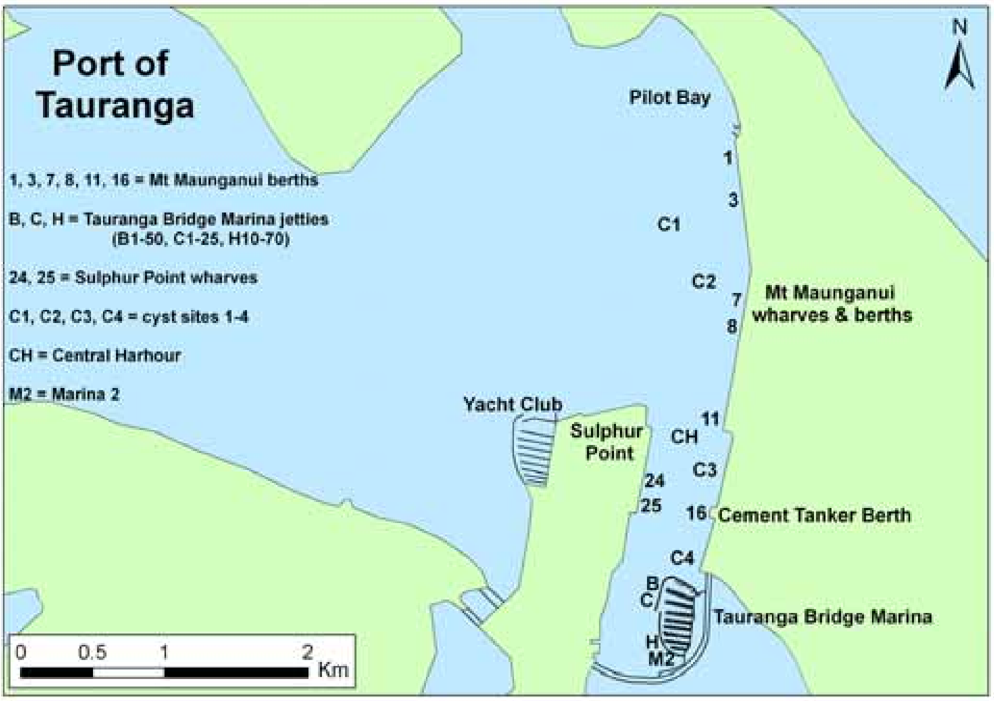

Figure 3: **Port of Tauranga map**

At the southern end of the commercial port, there is the 500-berth Tauranga Bridge marina, which has a range of floating concrete berths from 10.5 to 37 m with treated pine piling, enclosed by an oblong floating concrete breakwater (www.marina.co.nz).

Vessels unable to be berthed immediately in the port may anchor outside the port at three designated anchorages (or wherever practicable outside shipping lanes if these anchorages are full): 37°36.49'S, 176°13.71'E; 37°37.49'S, 176°15.21'E; 37°38.29'S, 176°16.91'E. Pilotage is compulsory on vessels over 100 GRT unless the Master holds a pilot exemption certificate (www.port-tauranga.co.nz).

Within the port, there is on-going maintenance dredging as required. This occurs approximately every two years (most recently in 2002, 2004 and 2006), starting around March and ending two to three months later (G. Thompson, Port of Tauranga Ltd., pers comm.). Around 300,000 m^3 is dredged each time. Half of this volume is removed from within the harbour and half from the entrance channel. Around 80,000 to 100,000 m^3 is extracted ashore at Sulphur Point and the sand sold to concrete plants and other buyers. The remaining volume is deposited in seven different deposition sites. Of the deposited material, silt and other material unsuitable for nearshore dumping is deposited in offshore dump grounds, whilst sand is mostly deposited in nearshore sites to assist beach nourishment on the Mt Maunganui ocean beaches near Rabbit Island. There has been no capital dredging conducted since 1992, but the Port has renewed their consent for capital dredging around Sulphur Point in case it becomes necessary to extend southwards (G. Thompson, pers comm.).

No new wharfs have been constructed since 1992, and no berth expansions have been completed recently, although consent for berth expansion at Sulphur Point has been renewed. Some berth deepening is currently occurring on the Mt Maunganui side of the Point. Once maintenance dredging has been completed for the year, sheet piles will be driven along the toe of the wharf to deepen the draft by approximately 2 m (G. Thompson, pers comm.).

The major recent landward capital works has been the completion of a $27 million coal import facility, to assist in the import of over one million tonnes of coal per year for use in the Huntly Power Station (G. Thompson, pers comm.).

Imports and exports

The Port of Tauranga is one of the biggest commercial enterprises in the Bay of Plenty, and New Zealand's largest combined export-import port (Healy 1994). The Port of Tauranga recorded total cargo volumes of 12,623,000 tonnes in the 2004-2005 financial year, 3.1 % higher than the previous year (Port of Tauranga 2005). In the 2004-2005 financial year, container throughput rose 11.1 % to 438,214 TEU[2] and coal tonnage through the port increased by 32.7 % to 880,000 tonnes (Port of Tauranga 2005).

We used data from Statistics New Zealand to further summarise import and export characteristics for the Port of Tauranga. We summarised total quantities of overseas cargo loaded and unloaded by weight and by value for each financial year between the 2001-2002 year and the 2004-2005 year (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). Note that the import and export data presented below only considers cargo being loaded for or unloaded from overseas and does not consider domestic cargo. This is therefore likely to sum to a lower amount than the total amount of cargo handled by the port.

Imports

The weight of overseas cargo unloaded at the Port of Tauranga has increased each year since the 2002 initial baseline survey, with 3,535,977 tonnes gross weight being unloaded in the year ended June 2005 (Statistics New Zealand 2006b). This represents an increase in weight of 27 % compared to the year ending June 2002 (Table 2). With domestic cargo included, the Port of Tauranga reported a rise in import cargo volumes over the 2004-2005 financial year of 22.6 % to 5.3 million tonnes (Port of Tauranga 2005). The value of overseas cargo unloaded declined slightly between 2002 and 2003, but increased in subsequent years to $3,520 million in 2005,

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

36 % higher than the year ended June 2002 (Statistics New Zealand 2006b). Overseas cargo unloaded at the Port of Tauranga between 2002 and 2005 accounted for 10 to 13 % by value and 12 to 19 % by weight of the total overseas cargo unloaded at New Zealand's seaports (Table 2).

The Port of Tauranga imported cargo in 97 different commodity categories between 2002 and 2005 inclusive (Statistics New Zealand 2006a). The dominant commodities by value imported at the Port of Tauranga during this time were boilers, machinery and mechanical appliances (10 %), mineral fuels, oils, and their products (10 %), paper and paperboard and articles thereof (6 %), electrical machinery and equipment (5 %) and plastics and plastic articles (5 %; Figure 4). Machinery and mineral fuels and oils ranked first or second each year. Paper and paperboard, electrical machinery and equipment, and plastics ranked between third and fifth each year except in 2003, when a higher value of vehicles was imported than electrical machinery (Statistics New Zealand 2006a). In 2005, the Port of Tauranga recorded increases in import volumes of coal, oil, cement and fertiliser (Port of Tauranga 2005).

The Port of Tauranga received imports from 169 countries of initial origin[3] between 2002 and 2005 inclusive (Statistics New Zealand 2006a). During this time, the Port of Tauranga imported most of its overseas cargo by value from Australia (34 %), the USA (15 %) and the People's Republic of China (9 %; Figure 5). Australia was ranked first every year. The USA was ranked second and China third every year except 2005, when their ranks were reversed. Japan and Singapore each ranked in the top five in three of the four years.

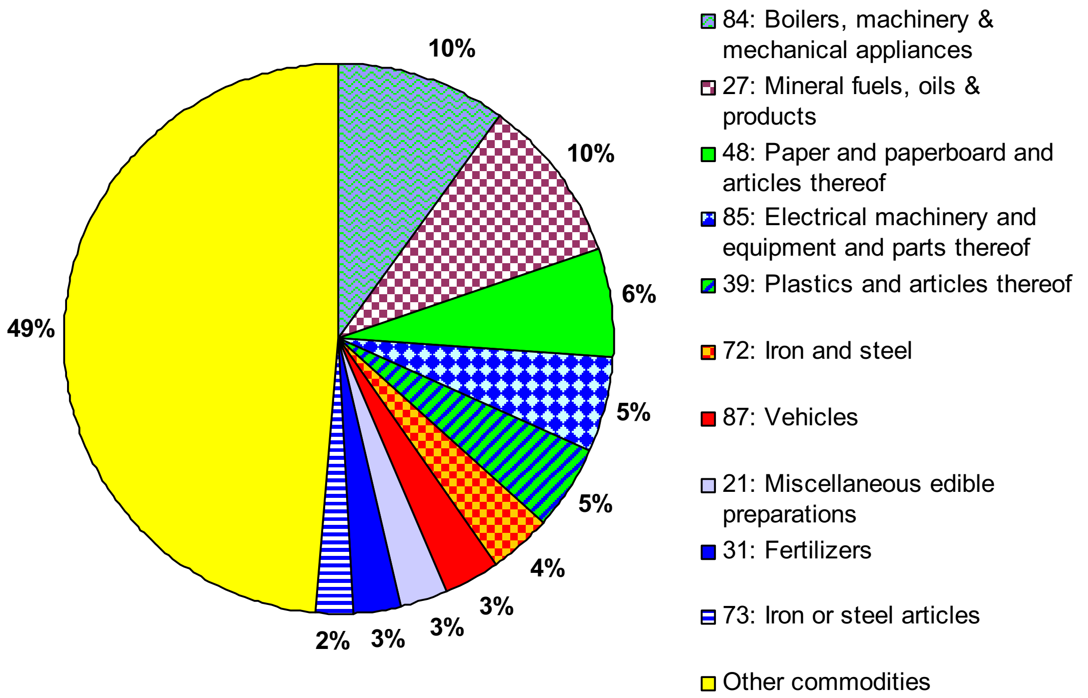

Figure 4: Top 10 commodities by value unloaded at the Port of Tauranga summed over the period January 2002 to December 2005 inclusive (data sourced from Statistics New Zealand 2006a). Commodity category descriptions have been summarised for brevity; category numbers are provided in the legend and full 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 Tauranga; for ship movements see the section on "Shipping movements and ballast discharge patterns"

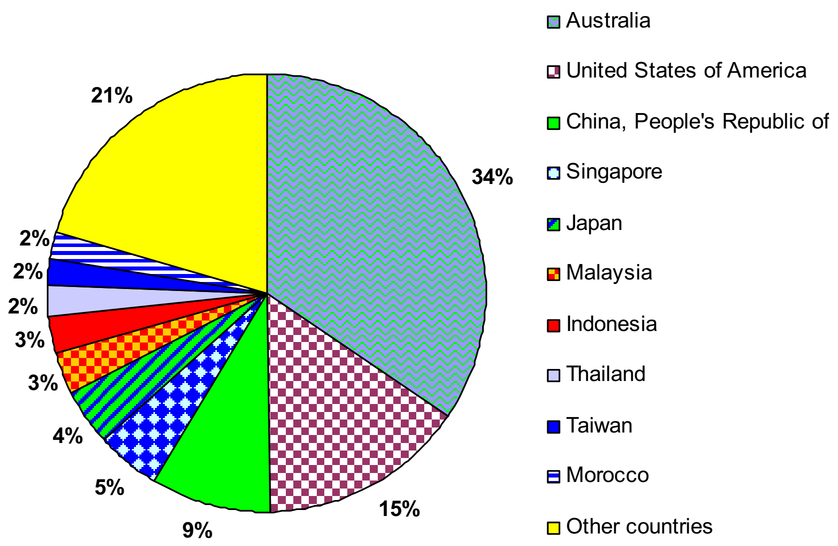

Figure 5: 10 countries of initial origin that cargo was unloaded from at the Port of Tauranga. The data are percentages of the total volume of cargo unloaded in the period January 2002 to December 2005 inclusive (data sourced from Statistics New Zealand 2006a).

Exports.

In the year ending June 2005, the Port of Tauranga loaded 6,257,042 tonnes of cargo for overseas export (Statistics New Zealand 2006b). This represented a 13 % decline compared to the more than 7 million tonnes loaded in the year ending June 2002 (Table 3). With domestic cargo included, the Port of Tauranga reported a fall in import cargo volumes over the 2004-2005 financial year of 8.6 % to 7.3 million tonnes (Port of Tauranga 2005). This was largely due to a downturn in the forestry sector, resulting in total imports (5.3 million tonnes) exceeding, for the first time in 2005, forestry exports (4.4 million tonnes). The value of cargo loaded also declined over this period, dropping almost 6 % to $7,063 million in the year ending June 2005 (Statistics New Zealand 2006b). For the financial years ending June 2002 to 2005, overseas cargo loaded at the Port of Tauranga accounted for around 29 to 31 % by weight and 25 to 27 % by value of the total overseas cargo loaded at New Zealand's seaports (Table 3).

The Port of Tauranga exported cargo in 97 different commodity categories between 2002 and 2005 inclusive (Statistics New Zealand 2006a). The dominant commodity categories by value loaded at the Port of Tauranga for export during this time were dairy produce, bird's eggs, natural honey and other edible animal products (25 %), meat and edible meat offal (12 %), wood and wooden articles (11 %) and fruit and nuts (9 %; Figure 6). Dairy ranked first each year. Meat ranked second every year except 2002, when it ranked third. Wood and fruit ranked third or fourth each year except in 2002, when wood ranked second. Albuminoidal substances ranked fifth each year. In 2005, the Port of Tauranga recorded increases in export volumes of kiwifruit, apples and milk powder (Port of Tauranga 2005).

The Port of Tauranga loaded cargo for export to 189 countries of final destination[4] between 2002 and 2005 inclusive (Statistics New Zealand 2006a). During this time, the Port of Tauranga exported most of its overseas cargo by value to the USA (20 %), Australia (17 %), Japan (10%), and China, Korea and Taiwan (5 % each; Figure 7). The USA, Australia and

[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 Tauranga; it is the final destination of the goods. For ship movements see "Shipping movements and ballast discharge patterns"

Japan ranked first, second and third respectively each year. China ranked fourth and Korea fifth each year, except in 2002 when their ranks were reversed.

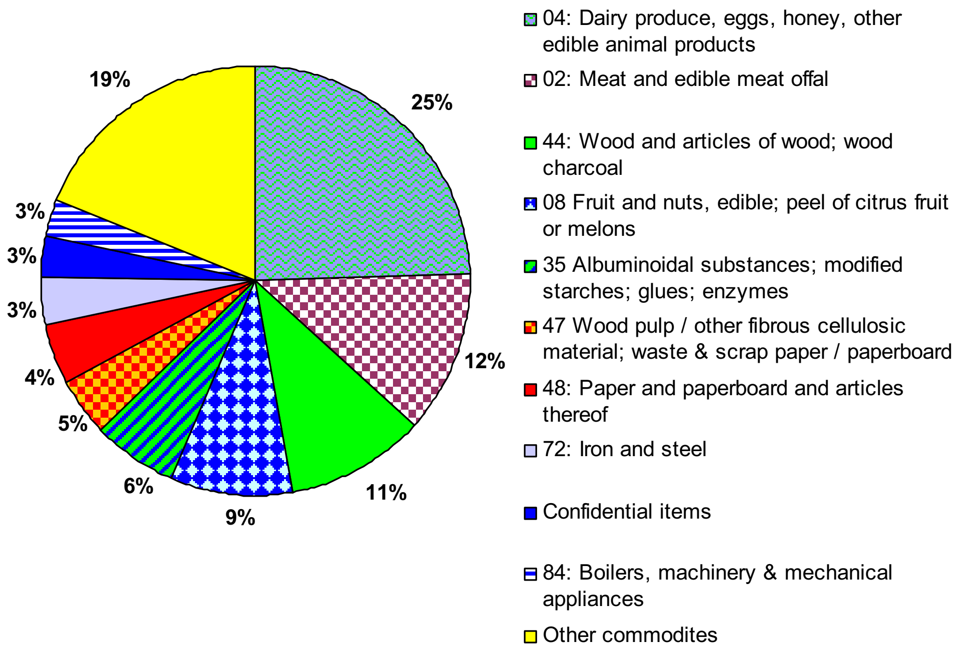

Figure 6: Top 10 commodities by value loaded at the Port of Tauranga summed over the period January 2002 to December 2005 inclusive (data sourced from Statistics New Zealand 2006a). Commodity category descriptions have been summarised for brevity; category numbers are provided in the legend and full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

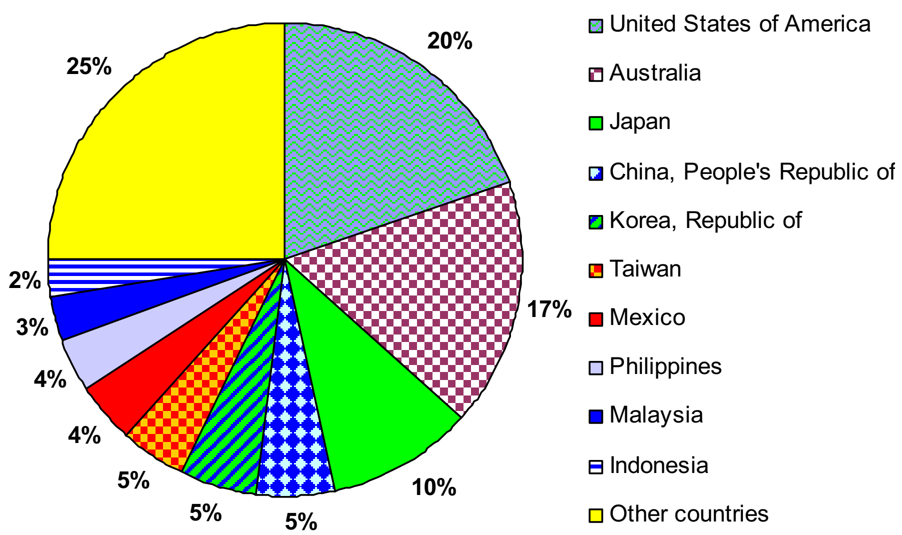

Figure 7: Top 10 countries of final destination that cargo was loaded for at the Port of Tauranga. The data are percentages of the total cargo loaded at the port for the period January 2002 to December 2005 inclusive (data sourced from Statistics New Zealand 2006a).

Shipping movements and ballast discharge patterns

According to Inglis (2001), a total volume of 335,410 m^3 of ballast water was discharged in the Port of Tauranga in 1999, with the largest country-of-origin volumes of 135,850 m^3 from Japan, 80,725 m^3 from South Korea, 27,477 m^3 from Australia, and 61,112 m^3 unspecified. Since June 2005, vessels have been required to comply with the Import Health Standard for Ships' Ballast Water from All Countries (www.biosecurity.govt.nz/imports/non-organic/standards/ballastwater.htm). 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 200m depth); demonstrating ballast water is fresh (2.5 ppt sodium chloride) or having the ballast water treated by a MAF approved treatment system.

The Port of Tauranga recorded 1,207 cargo ship departures in the 2004-2005 financial year, down from the recent peak of 1,312 in the 2002-2003 financial year (Port of Tauranga 2005). In 2004, 14 cruise ships visited Tauranga (Boreham 2005).

To gain a more detailed understanding of international and domestic vessel movements to and from the Port of Tauranga 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. However, the database does not include movement records for domestic or international ferries plying definitive scheduled routes. By contrast, cruise ships, coastal cargo vessels and all other vessels over 99 gross tonnes excluding scheduled ferry services are included in the database.

The database, therefore, gives a good indication of the movements of international and domestic vessels involved in trade, but it should be kept in mind that ferry trips are not recorded, nor are domestic fishing vessels or recreational vessels. Furthermore, a small number of vessel movement records in the database are incomplete, resulting in those movements being excluded from the analysis. As a result, the database is unlikely to include every movement that occurred at the port and therefore total movement numbers would be lower than those actually recorded by the port. 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 1,798 vessel arrivals to the Port of Tauranga from overseas ports between 2002 and 2005 inclusive (Table 4). These arrived from 41 different countries represented by most regions of the world. The greatest number of overseas arrivals during this period came from the following areas: Australia (803), Pacific Islands (266), the west coast of North America (175), Japan (167), and east Asian seas (140; Table 4). The previous ports of call for 13 of the international arrivals were not stated in the database. Vessels arriving from Australia came mostly from ports in New South Wales (345), Queensland (251 arrivals) and Victoria (152 arrivals; Table 5). Container ships and ro/ro vessels were the dominant vessel type arriving from overseas at the Port of Tauranga (907 arrivals), followed by bulk /cement carriers (473 arrivals), and general cargo vessels (288 arrivals; Table 4).

According to the LMIU "Seasearcher.com" database, during the same period 2,040 vessels departed from the Port of Tauranga to 37 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 (607 movements) followed by the northwest Pacific (416), Japan (261) and the Pacific Islands (183; Table 6). The major vessel types departing to overseas ports from the Port of Tauranga were general cargo vessels (727 movements), container ships and ro/ro (682 movements) and bulk / cement carriers (556; Table 6).

Domestic vessel movements

The LMIU "Seasearcher.com" database contains movement records for 2,708 vessel arrivals to the Port of Tauranga from New Zealand ports between 2002 and 2005 inclusive. These arrived from 17 different ports in both the North and South Islands (Table 7). The greatest number of domestic arrivals during this period came from Auckland (906 arrivals), Napier (491), Whangarei (428), Nelson (246) and Lyttelton (213). The major vessel types arriving at the Port of Tauranga from New Zealand ports were general cargo vessels (881 arrivals), container ships and ro/ro's (872), and bulk / cement carriers (585; Table 7).

During the same period, the LMIU "Seasearcher.com" database contains movement records for 2,460 vessel departures from the Port of Tauranga to 18 New Zealand ports in both the North and South Islands. The most domestic movements departed the Port of Tauranga for Napier (668 movements), Auckland (505), Lyttelton (434) and Whangarei (318; Table 8). Container ships and ro/ro's dominated the vessel types leaving the Port of Tauranga on domestic voyages (1,096 movements), followed by bulk / cement carriers (500 movements) and general cargo vessels (443 movements; Table 8).

The reader is reminded that the above data do not include scheduled ferry movements, or vessels under 99 gross tonnes including fishing and recreational vessels. In 2000, there were two registered fishing vessels in the Port of Tauranga (Sinner et al. 2000).

EXISTING BIOLOGICAL INFORMATION

Environment Bay of Plenty regularly monitors the biodiversity of the Tauranga Harbour, and has undertaken many of the previous biological studies to date. Below we review biological studies conducted in the Harbour. In addition, the initial NIWA baseline survey of Tauranga Harbour (Inglis et al. 2006a) has made a valuable addition to the biological information available in the area. This is explained further in the next section. In addition, the NIWA Client Report by Inglis et al. (2006c) describes marine communties in Tauranga Harbour, with particular emphasis on surveillance for early detection of unwanted organisims in New Zealand Ports.

Hatton et al. (1975) conducted an ecological survey of Tauranga Harbour in areas where seasonal ecological variation had been noted in previous surveys. Their report is one of a series describing the ecology of harbours, estuaries, and the lower reaches of major rivers in the Bay of Plenty. They monitored density of algae and grazing gastropod molluscs at the Rereatukahia Inlet and Waikareao Inlet, and attributed fluctuations in the abundance of algae and gastropods to seasonal phenomena, such as changes in water temperatures and nutrient availability. The following year, the ecology of the Tauranga Harbour was examined by Barker and Larcombe (1976), who collated previously obtained information and provided species lists for each of eight major habitat types or zones identified in the harbour.

Roper (1990) reported on the benthos associated with an estuarine outfall discharging municipal sewage into Tauranga Harbour. Species lists were produced and 124 taxa were identified, with crustaceans being the most diverse group with 51 species present. Many mollusc species were also found, with total numbers dominated by the bivalve *Nucula hartvigiana*. The non-indigenous bivalve *Theora lubrica* was already present in the harbour at this time. The study concluded that the outfall had little effect on the distribution, numbers of taxa or total numbers of individuals present in the harbour. The composition of macro-invertebrate assemblages was unaffected by the outfall, and thought to be more closely related to natural variability in sediment particle size and sorting.

Park and Donald (1994) of Environment Bay of Plenty reviewed the general ecology of Tauranga Harbour, focussing on the extensive soft-shore benthic macrofaunal communities and algae of the harbour and the freshwater ecology of the northern harbour catchment streams. They noted that previous studies of the harbour's ecology were either descriptive or qualitative in nature (eg. Barker and Larcombe 1976), or quantitative and focused on certain components of benthic communities or confined to small areas of the harbour (eg. Hatton et al. 1975). Their investigations of the macrofauna revealed a series of communities that reflected prevailing current velocities and sediments within the harbour channels. Macrofaunal communities were similar to those described from the same types of habitat found elsewhere in northern New Zealand. Cockle-wedge shell and seagrass macrofaunal communities dominated extensive intertidal areas. Seagrasses covered 22.5 % of the entire harbour area, with the next most common alga being sea lettuce (*Ulva lactuca*). Species lists are included in their report.

Park (1996) reported on sea lettuce (*Ulva* spp.) monitoring in Tauranga and Ohiwa Harbours from July 1992 to June 1996, undertaken as part of the Environment Bay of Plenty's Coastal and Estuarine Ecology – Natural Regional Monitoring Network. At least three species of *Ulva* have been recorded from Tauranga Harbour: *Ulva laetevirens, Ulva lactuca* and *Ulva rigida*. During the period of the study, a sea lettuce bloom peaked in 1992 in Tauranga Harbour, and from 1994 biomass was very low. Abundances in the northern part of the harbour were as high as or higher than in the southern part. The behaviour of sea lettuce in Tauranga Harbour appeared to be linked to nutrient levels, coastal water temperatures, available sunlight and possibly changes in wind climate. The blooms coincided with El Nino weather patterns but statistical links could not be tested. Scholes (2005) reported that sea lettuce blooms have been less prolific in recent years.

Healy (1994) reviewed some of the major environmental concerns relating to the dredging programme operating in the Port of Tauranga, which were raised in a previous environmental impact assessment. The main biological concerns related to erosion of some beaches and the migration of dumped dredge spoil onto others. This movement of sediments was highlighted by the presence of bivalve shells of estuarine origin on the ocean beach. Further biological concerns were discussed in relation to the placement of the dredge mound and the effects this may have on emergent reefs and their ecology. It was concluded that transport rates were insufficient to affect the ecology of these habitats, but that ongoing monitoring would be necessary to ensure that the dumped dredge spoil is not having an unacceptable adverse effect.

Environment Bay of Plenty surveys yearly for the presence of dinoflagellate cysts in Tauranga harbour. Park (Park 1988) reported on the monitoring program in the Port for the period 1993 to 1998. The samples were collected in areas of reduced current velocities (where settlement of fine suspended particles is more likely to occur) using a box core, taken to a depth of 2cm. All the dinoflagellate cysts collected were found to be types commonly observed in New Zealand coastal sediments. Species lists were produced. Taylor & MacKenzie (Taylor and MacKenzie 2001) also tested the Port of Tauaranga for the presence of the toxic blooming dinoflagellate *Gymnodinium catenatum*, and did not detect any resting cysts (sediment samples) or motile cells (phytoplankton samples).

Fifteen estuarine sites are regularly assessed by Environment Bay of Plenty to determine the variety and numbers of benthic macrofauna present. Park (2000) reported on the results of the programme over a ten-year period (1990 – 2000). The results suggested that the harbour environment provided habitat of a good quality. Species richness was found to be stable. The report focused on general species richness and did not include species lists.

Cole et al. (2000) surveyed infaunal bivalve molluscs in December 1994 and May 1995 on Centre Bank, the flood tidal delta adjacent to the Port of Tauranga. They identified 31 bivalve taxa from 27 sites, with extremely high densities of bivalves encountered at several sites. A list of bivalve species and their abundances was produced. There were no non-indigenous species recorded. The three dominant species were *Paphies australis, Tawera spissa* and *Ruditapes largillierti*.

Ellis et al. (2000) sampled the benthic marine fauna of the Wairoa Arm of Tauranga Harbour, to the west of the Port of Tauranga, as part of an assessment of the potential environmental impacts from the proposed construction of the Te Tawa Quays marina. Sampling in fifteen intertidal and subtidal sites in December 1998 revealed high species richness and a diverse array of habitat types, including seagrass beds, sandflats and extensive cockle (*Austrovenus stutchburyi*) and pipi (*Paphies australis*) beds. The only non-indigenous species recorded in the survey was the Pacific oyster *Crassostrea gigas*, recorded only from one site in the middle part of the Tilby Channel with an average of 9.7 individuals per 0.25 m^2 quadrat. The sea anemone *Anthopleura aureoradiata* was the only cryptogenic species recorded; it was found in low densities in a muddy sandflat site on the western side of Tilby Channel (average of 3 individuals per quadrat) and in the lower Tilby Channel (average of 4.3 individuals per quadrat) and in high densities at the mouth of the Tilby Channel (average of 352.3 individuals per quadrat). The report provides a summary table of the mean, minimum and maximum abundance of each species at each site, and identified six distinctive areas of the embayment based on their macrofaunal community compositions.

Stevens et al. (2002) used bed-load and suspended-load traps to sample amphipods in Waimapu Estuary, 8km south of the Port of Tauranga at monthly intervals from October 1999 to October 2000. Morphological and molecular analyses of their samples identified four corophiid amphipod species. Two of the species, *Paracorophium lucasi* and *P. excavatum* were New Zealand endemics, and the other two species had not previously been recorded from New Zealand. One, *P. brisbanensis*, had previously been recorded only from the east coast of Australia, and the other, an unidentified species of *Corophium*, did not correspond to any of the three known *Corophium* species reported from New Zealand. The presence of reproductive females and juvenile *P. brisbanensis* suggested a viable breeding population in Tauranga Harbour, likely to have been introduced to New Zealand possibly through ballast water. The port baseline surveys for non-indigenous marine species subsequently reported *P. brisbanensis* from the Whangarei Town Basin marina (Inglis et al. 2006b).

Changes in the extent of seagrass and mangroves have also been studied in Tauranga Harbour. Park (1999) reported on changes in the abundance of seagrass beds throughout the Tauranga harbour between 1959 and 1996. Thirty-four percent of seagrass beds were thought to have been lost in the harbour over this 37-year period. Subtidal areas suffered the highest loss with 90 % reduction in this habitat over the entire harbour. Evidence points to sediment and nutrient runoff as the main factor in these losses, with the magnitude of loss representing a potentially serious impact on harbour ecology. The report includes maps of the harbour showing seagrass changes between 1959 and 1996.

In contrast to the reduction in seagrass beds, the extent of mangroves in Tauranga Harbour increased exponentially between 1943 and 2001 at all sites investigated by Park (2004). Mangrove cover was strongly correlated with the mud content of estuaries, with estuaries on the western margin of the harbour having higher mud content and mangrove cover. Increased sedimentation in the harbour's estuaries due to land clearance and development appears to be accelerating the spread of mangroves.

An extensive survey of marine sediments and contaminants was conducted in Tauranga Harbour from 2001-2003 (Park 2003). The survey sampled sediment particle size, nutrients and total organic content, metals, total petroleum hydrocarbons, pesticides, polycyclic aromatic hydrocarbons, and polychlorinated biphenyls. Maps of mud content were produced and can be used as an indicator of where sediment nutrient and total organic content levels are high. Concentrations of all contaminants were below ANZECC (2000) guidelines.

Environment Bay of Plenty conducts water quality monitoring in Tauranga Harbour and other Bay of Plenty Estuaries as part of the Environment Bay of Plenty's Natural Environmental Regional Monitoring programme (NERMN). Twenty-one sites in the Bay of Plenty are monitored every two months to observe trends in water clarity, nutrient levels, suspended sediments, pathogens and phytoplankton. Scholes (2005) found that the Town Basin sites, located near the Port of Tauranga, have good water quality and water quality classifications were being met.

Recently, isolated populations of the Asian date mussel, *Musculista senhousia*, and the Asian kelp, *Undaria pinnatifida*, have been discovered within Tauranga Harbour (J. Mather, Environment Bay of Plenty, pers. comm.). *M. senhousia* is widely distributed in northeastern New Zealand, from the Bay of Islands to the Firth of Thames. *U. pinnitifida* 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. It was not recorded in the first baseline survey of the Port of Tauranga.

RESULTS OF THE FIRST BASELINE SURVEY

An initial baseline survey of the Port of Tauranga was completed in March 2002 (Inglis et al. 2006a). A total of 316 species or higher taxa were identified from the Tauranga port survey. They consisted of 203 native species, 11 non-indigenous species, 40 cryptogenic species (those whose geographic origins are uncertain) and 62 species indeterminata (taxa for which there is insufficient taxonomic or systematic information available to allow identification to species level). Twenty-one species collected from the Port of Tauranga had not previously been described from New Zealand waters. Seventeen of these were species of sponge that were thought to be new to science. The other first records for New Zealand were a cryptogenic ascidian (*Microcosmus squamiger*) and amphipod (*Meridiolembos* sp. aff. *acherontis*), and two non-indigenous species of hydroids: *Clytia ?linearis* and *Eudendrium capillare*.

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, a spionid polychaete worm that was identified from the Port of Tauranga as the introduced species *Dipolydora flava*, has subsequently been re-identified as *Dipolydora dorsomaculata*, a species whose type specimen is from Dunedin (Rainer 1973). All specimens given this name, therefore, are now considered native to New Zealand. *D. dorsomaculata* is the preferred name, as the concept of a widely distributed *D. flava* is currently/now regarded as suspect. The revised summary statistics for the Port of Tauranga following re-classification were a total of 304 species or higher taxa, including 202 native species, 10 non-indigenous species, 51 cryptogenic species and 41 species indeterminata.

These revisions have been incorporated into the comparison of data from the two surveys below.

The 10 non-indigenous organisms described from the Port of Tauranga included representatives of six major taxonomic groups. The non-indigenous species detected were: *Polydora hoplura* (Annelida); *Bugula flabellata, Bugula neritina, Watersipora subtorquata* (Bryozoa); *Clytia ?linearis* and *Eudendrium capillare* (Cnidaria); *Apocorophium acutum, Monocorophium acherusicum* (Crustacea)*; Codium fragile* subsp. *tomentosoides?* (Macroalgae) and *Cliona celata* (Porifera). There were no species on the New Zealand register of unwanted marine organisms found in the Port of Tauranga initial baseline survey. Approximately 73 % (8 of 12 species) of non-indigenous species recorded in the Port of Tauranga initial baseline survey were likely to have been introduced in hull fouling assemblages and 27 % could have been introduced by either ballast water or hull fouling vectors.

Methods

SURVEY METHOD DEVELOPMENT

The sampling methods used in this survey were based on the CSIRO Centre for Research on Introduced Marine Pests (CRIMP) protocols developed for baseline port surveys in Australia (Hewitt and Martin 1996; 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 second baseline survey of the Port of Tauranga. The survey was undertaken between April 4th and 8th, 2005.

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.

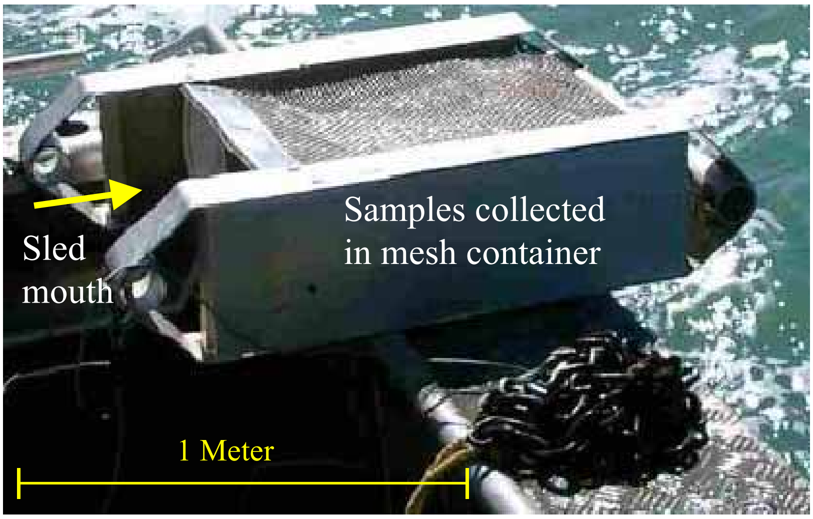

Figure 10: Benthic sled

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.

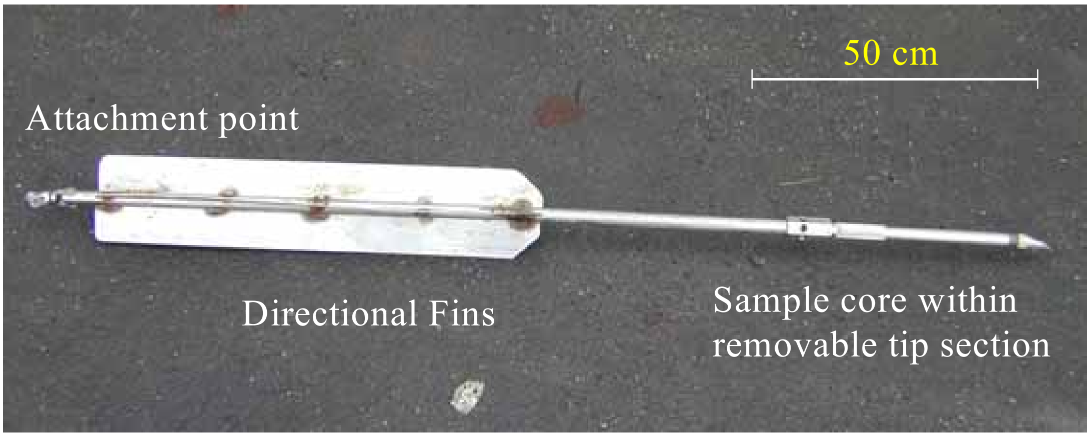

Figure 11: Javelin corer

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.

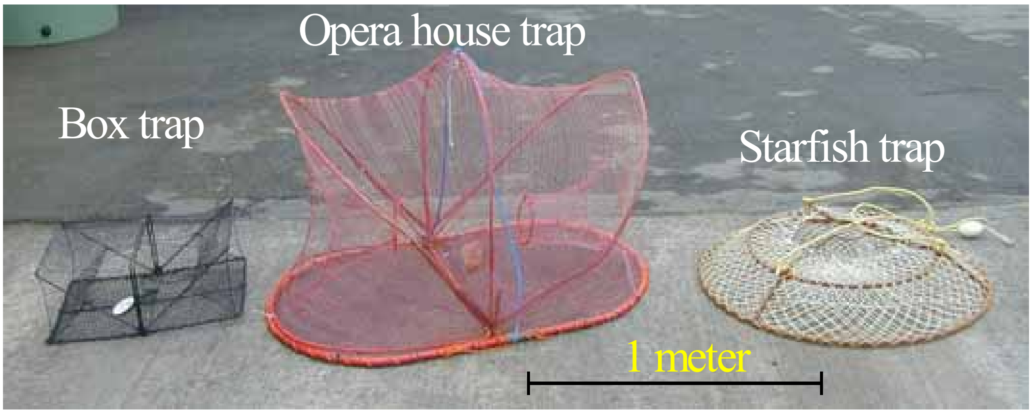

Figure 12: Trap types deployed in the port.

VISUAL SEARCHES

Opportunistic visual searches of three jetties in the Tauranga Marina were conducted from above water. Observers searched for non-indigenous organisms fouling jetty pilings and associated structures.

SAMPLING EFFORT

A summary of sampling effort during the second baseline survey of the Port of Tauranga is provided in Table 10, and exact locations of each sample site are provided in Appendix 2. Most sampling was concentrated on six main berths: Wharf berths 1, 3, 7, 11, 16 and 24. Additional trapping and opportunistic sampling was conducted at 15 other locations within the Port of Tauranga (Table 10). We particularly focused sampling effort on hard substrata within ports (such as pier piles and wharves) where invasive species are likely to be found (Hewitt and Martin 2001), and increased the number of quadrats sampled on each pile relative to the CRIMP protocols, as well as sampling both shaded and unshaded piles. The distribution of effort within ports aimed to maximise spatial coverage and represent the diversity of active berthing sites within the area. Total sampling effort was constrained by the costs of processing and identifying specimens obtained during the survey.

The spatial distribution of sampling effort for each of the sample methods in the Port of Tauranga 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), javelin cyst coring (Figure 18) and above-water visual surveys (Figure 19).

SORTING AND IDENTIFICATION OF SPECIMENS

Each sample collected in the diver pile scrapings, benthic sleds, box, starfish and shrimp traps, opera house fish traps, shipek grabs and javelin cores was allocated a unique code on waterproof labels and transported to a nearby field laboratory where it was sorted by a team into broad taxonomic groups (e.g. ascidians, barnacles, sponges etc.). These groups were then preserved and individually labelled. Details of the preservation techniques varied for many of the major taxonomic groups collected, and the protocols adopted and preservative solutions used are indicated in Table 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

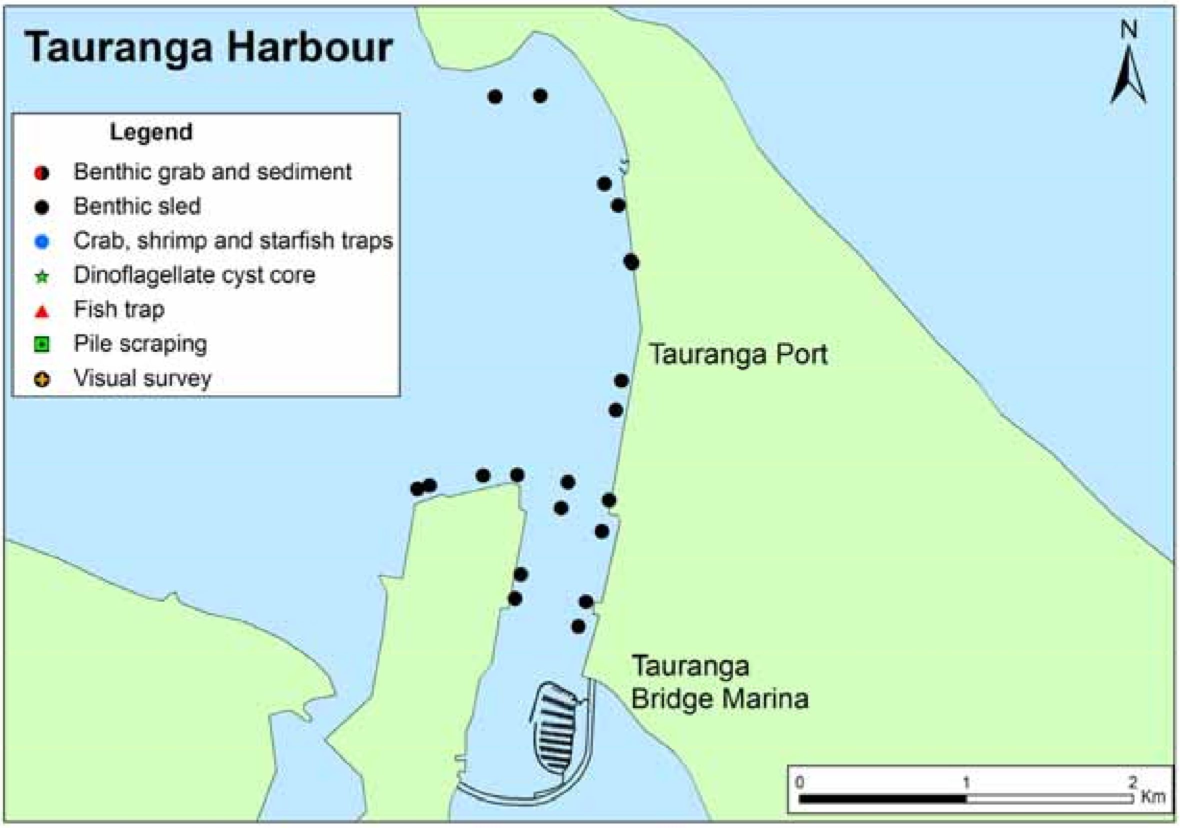

Figure 14: Benthic sled sites

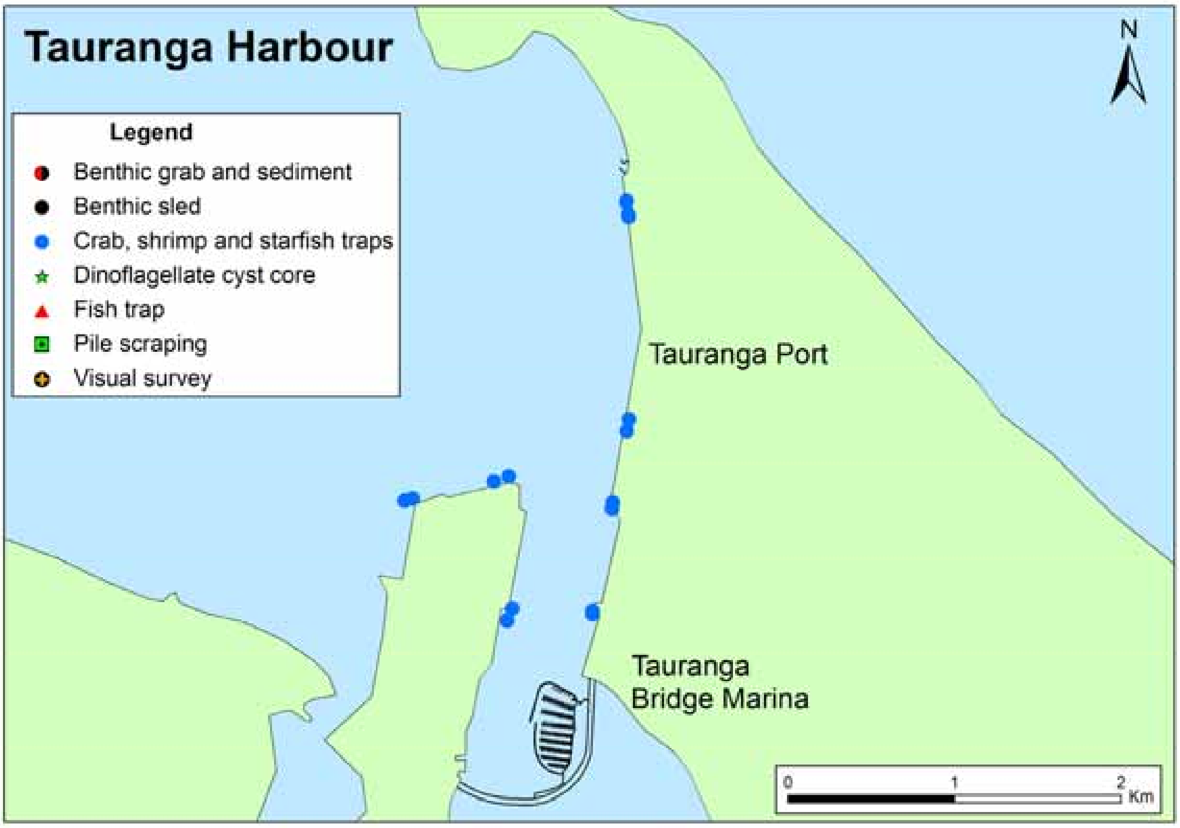

Figure 15: Sites trapped using box (crab), shrimp and starfish traps

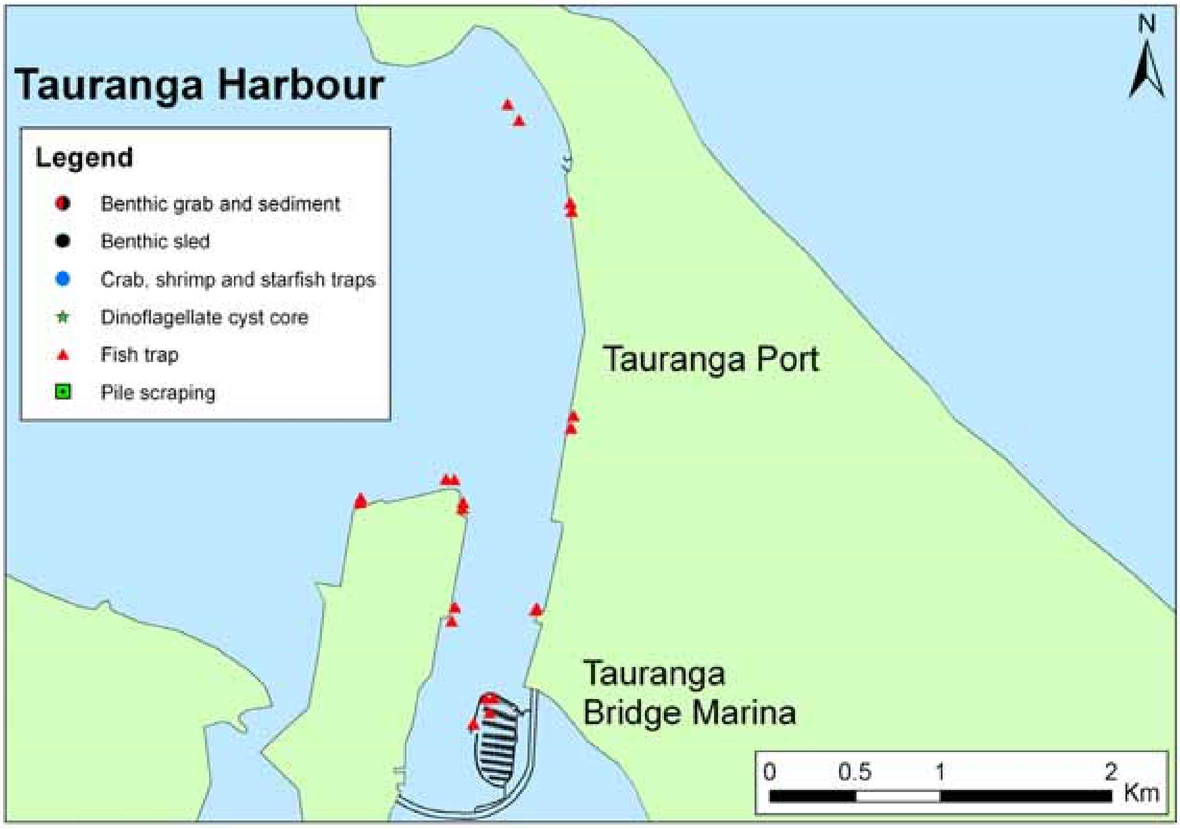

Figure 16: Opera house (fish) trapping sites

Figure 17: Shipek benthic grab sites

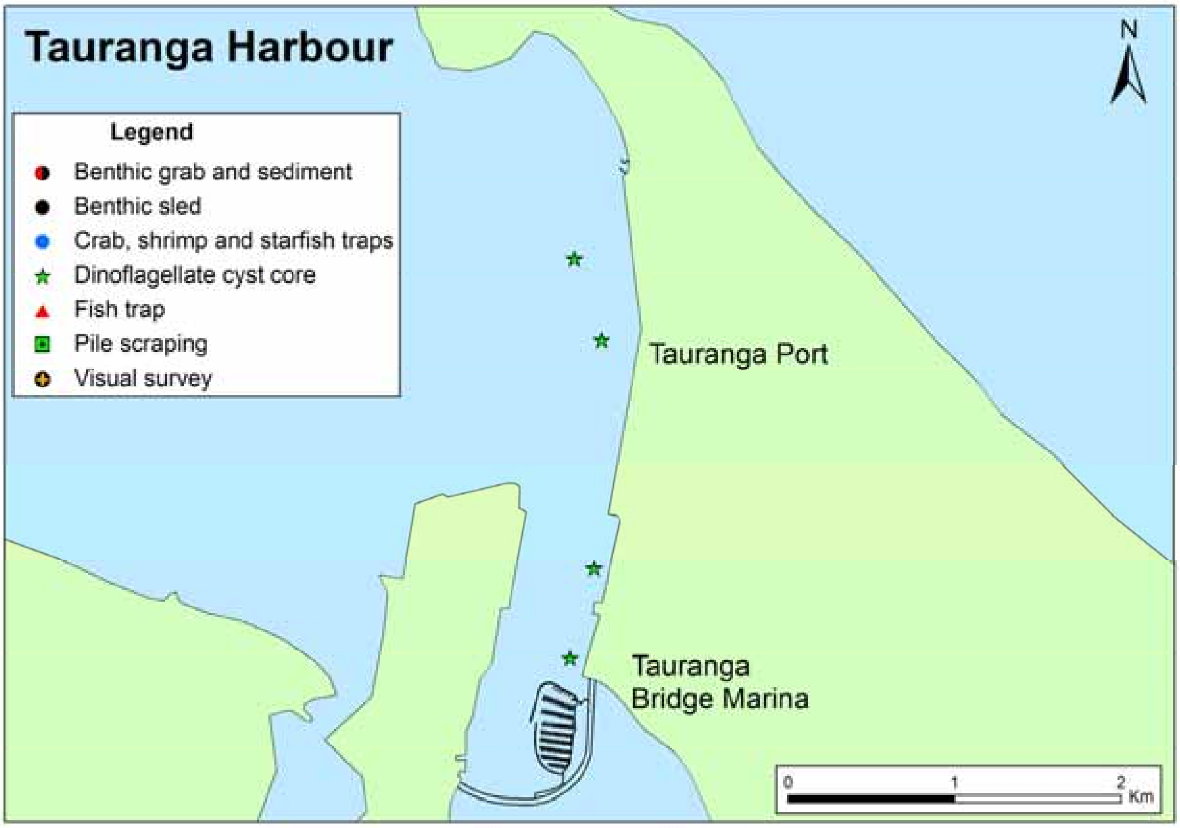

Figure 18: Javelin core sites

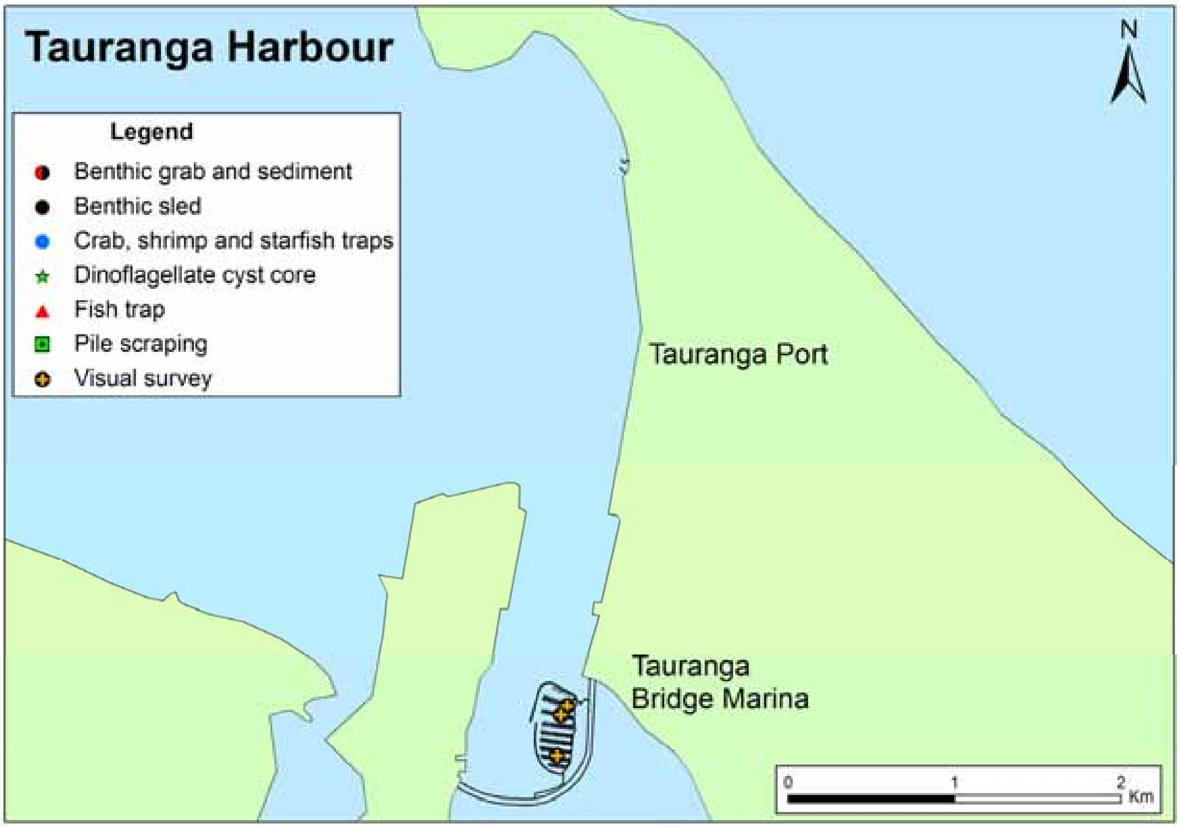

Figure 19: Above-water visual survey sites

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 Tauranga, completed in 2002 (Inglis et al. 2006a) .

Summary statistics were compiled on the total number of species and major taxonomic groups 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 Tauranga.

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). For each similarity index, values range from zero (completely different) to one (identical).

Survey results

A total of 264 species or higher taxa were identified from the re-survey of the Port of Tauranga. This collection consisted of 177 native (Table 14), 43 cryptogenic (Table 15), and 9 non-indigenous species (Table 16), with the remaining 35 taxa being made up of species indeterminata. By comparison, 304 taxa were recorded from the initial survey of the port, comprising 202 native species, 51 cryptogenic, 10 non-indigenous and 41 species indeterminata.

The biota in the re-survey included a diverse array of organisms from 13 major taxonomic groups (Figure 21). 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.

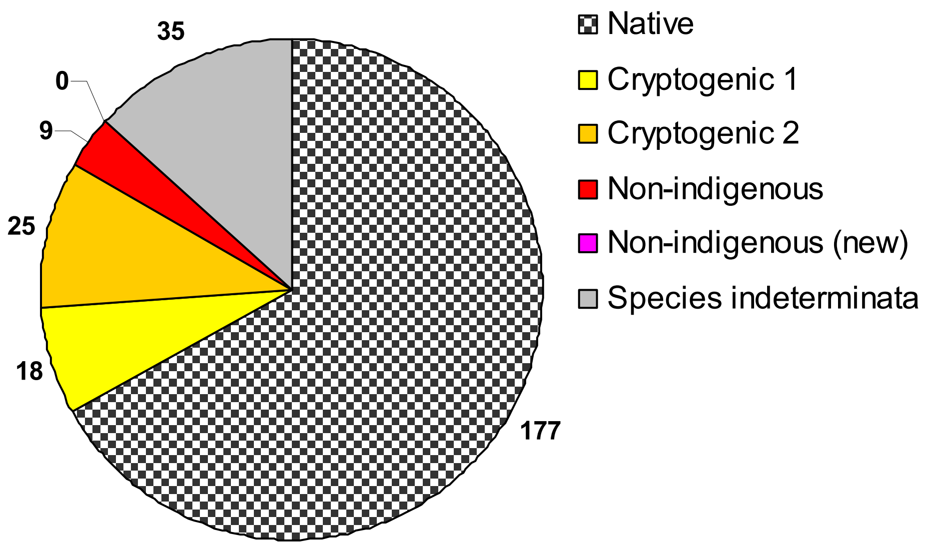

Figure 20: Diversity of marine species sampled in the Port of Tauranga. Values indicate the number of taxa in each category.

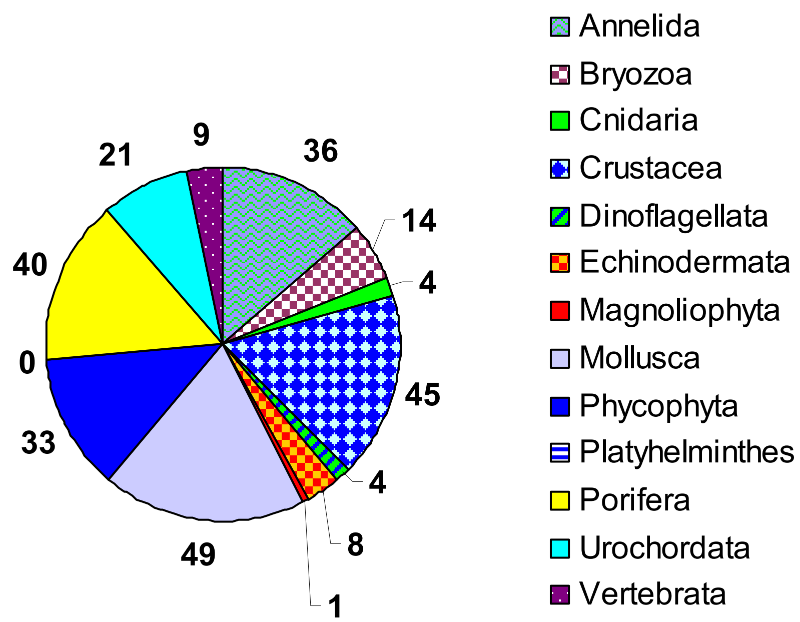

Figure 21: Major taxonomic groups sampled in the Port of Tauranga. Values indicate the number of taxa in each of the major taxonomic groups.

NATIVE SPECIES

The 177 native species (Table 14) recorded during the resurvey of the Port of Tauranga represented 67 % of all species identified from this location and included diverse assemblages of molluscs (46 species), crustaceans (35 species), annelids (29 species), porifera (17 species), algae (16 species), and urochordates (10 species). A number of other less diverse major taxonomic groups including echinoderms, vertebrates, bryozoans, dinoflagellates and cnidarians were also recorded from the Port (Table 14).

CRYPTOGENIC SPECIES

Cryptogenic species (n = 43) represented 16 % of all species or higher taxa identified from the Port. The cryptogenic organisms identified included 18 Category 1 and 25 Category 2 species or species groups as defined in "Definitions of species categories" above. These organisms included 6 annelids, 1 bryozoan, 1 cnidarian, 6 crustaceans, 1 dinoflagellate, 21 sponges and 7 ascidian species or species groups (Table 15). Three of the Category 1 cryptogenic species (the dinoflagellate *Alexandrium tamarense* and the sponges *Chelonaplysilla cf. violacea* and *Darwinella cf. gardineri*) were not recorded in the initial baseline survey of the port. Eight of the 24 Category 1 species recorded in the initial baseline survey of the Port of Tauranga were not found during the re-survey (the hydroids *Corynactis australis, Bougainvillia muscus, Clytia hemisphaerica, Obelia dichotoma* and *Halecium delicatulum*; the sponge *Lissodendoryx isodictyalis*; and the ascidians *Microcosmus australis* and *Styela plicata*). Several of the Category 1 cryptogenic species (e.g the hydroid *Plumularia setacea*, the red rock crab *Plagusia chabrus,* and the ascidians *Aplidium phortax*, *Corella eumyota, Botrylloides leachii* and *Astereocarpa cerea*) 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 first baseline of the Port of Tauranga. *D. 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, approximately 90 km north of Tauranga (Kott 2002). It has subsequently been reported from several other port environments in the Bay of Plenty and upper South Island (Port Nelson and Shakespeare Bay, Picton) and a local control programme was trialled in the Marlborough Sounds to prevent its spread to aquaculture sites (Coutts 2002). The appearance of *D. vexillum* in New Zealand was followed closely by reports of other nuisance species in this genus from the Atlantic coast of the USA, Mediterranean, North Sea and English Channel, but these now appear to be different species (Kott 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 with few distinguishing characters (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 Tauranga, *D. vexillum* occurred in pile scrapes taken from Berths 3 and 16 at the Mount Maunganui port and Berth 24 at Sulphur Point. *D. incanum* was recorded in a single pile scrape sample from berth 16 and unidentified specimens of Didemnidae (specimens that did not fit the morphological charcters for *D. vexillum* or *D. incanum*) were recorded from Berths 11, 16, 24, and 3. In the repeat survey of the Port of Tauranga, species in the *Didemnum* group were recorded in pile scrape samples taken from Berths 1, 3, 7, 11, and 16.

The large tube-building polychaete *Chaetopterus* sp. A was also present in Tauranga. This species came to the attention of New Zealand scientists in 1997 when commercial scallop fishers reported dense tube mats that appeared suddenly in scallop grounds in the Hauraki Gulf.

It subsequently spread rapidly to other coastal areas of northeastern New Zealand from Bream Head, in the north, to the Motiti Islands in the South (Tricklebank et al. 2001). There is also some uncertainty about the taxonomy of this species, since museum specimens and holotypes are often poorly preserved making comparisons with other species difficult. In the Port of Tauranga, *Chaetopterus* sp. A was a dominant component of fouling assemblages on wharf piles. During the first baseline survey it occurred in pile scrapes from Berths 1, 2, 11, 16 and 24 and in a sled sample from near berth 24. In the repeat baseline survey, it was recorded in pile scrape samples taken from Berths 11, 16, and 24, and in a benthic sled sample taken near berth 25.

NON-INDIGENOUS SPECIES

Nine non-indigenous species (NIS) were recorded in the re-survey of the Port of Tauranga (Table 16). They included 6 bryozoans, 2 hydroids and 1 sponge. Ten non-indigenous species were found during the initial March 2002 survey, but only four of these were also recorded in the re-survey (the bryozoans *Bugula flabellata, B. neritina, Watersipora subtorquata* and the sponge *Cliona celata*). Both the hydroids (*Monotheca pulchella* and *Sertularia marginata*) and three of the bryozoa (*Electra tenella, Amathia distans and Zoobotryon verticillatum*) found in the re-survey were not found in the initial survey. The five species recorded from the initial survey but not in the re-survey consisted of the polychaete worm *Polydora hoplura,* the amphipods *Monocorophium acherusicum* and *Apocorophium acutum*, the hydroids *Clytia ?linearis* and *Eudendrium capillare*, and the alga, *Codium fragile* subsp. *tomentosoides*?. The two hydroid species were new records in New Zealand during the initial port baseline survey, and their absence from samples in the re-survey suggests that populations of these species may not have succeeded in establishing in the Port of Tauranga. None of the nine non-indigenous species recorded in the re-survey are new to New Zealand. 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 major taxonomic groups in the same order as Table 16.

Bugula flabellata (Thompson in Gray, 1847)

Image and information: NIMPIS (2002b)

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. 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). In the Port of Tauranga it was recorded from Berths 1, 3, 7, 11 and 24 during the initial port baseline survey (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. During the second baseline survey of the Port of Tauranga *B. flabellata* occurred in pile scrape samples taken from Berths 1, 3, 11, 16 and 24 (Figure 23).

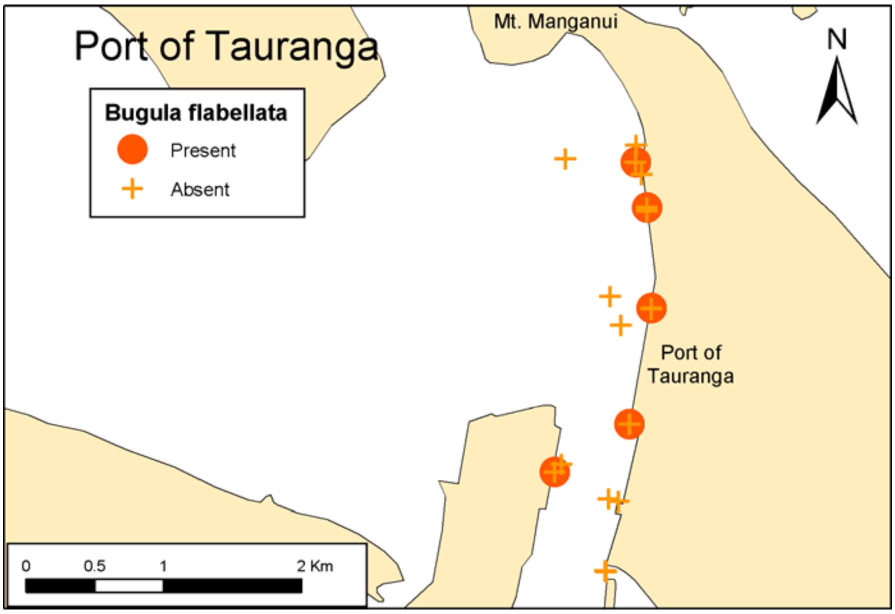

Figure 22: ***Bugula flabellata* distribution in the initial baseline survey of the Port of Tauranga (March 2002).**

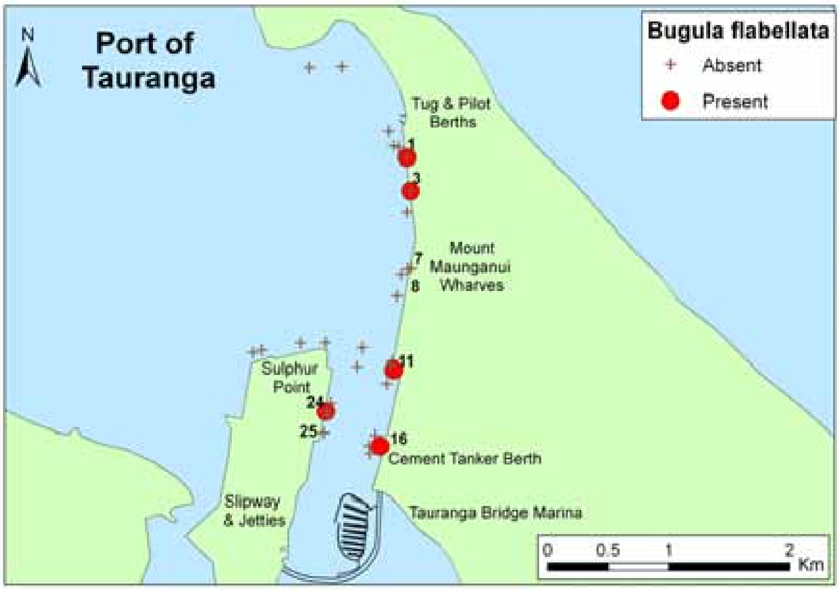

Figure 23: *Bugula flabellata* distribution in the re-survey of the Port of Tauranga (April 2005).

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

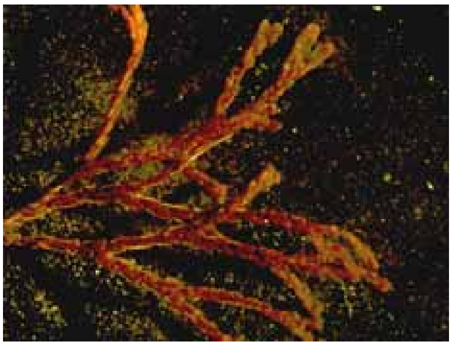

Image and information: NIMPIS (2002c)

Bugula neritina is an erect, bushy, red-purple-brown bryozoan. Branching is dichotomous (in series of two) and zooids alternate in two rows on the branches. Unlike all other species of *Bugula*, *B. neritina* has no avicularia (defensive structures) or spines, but there is a single pointed tip on the outer corner of zooids. Ovicells (reproductive structures) are large, globular and white. They often appear in such high numbers that they resemble small snails or beads. *Bugula neritina* is native to the Mediterranean Sea. It has been introduced to most of North America, Hawaii, India, the Japanese and China Seas, Australia and New Zealand. It is cryptogenic in the British Isles. *Bugula neritina* is one of the most abundant bryozoans in ports and harbours and an important member of the fouling community. The species colonises any available substratum and can form extensive monospecific growths. It grows well on pier piles, vessel hulls, buoys and similar submerged surfaces. It even grows heavily in ships' intake pipes and condenser chambers. In North America, *B. neritina* occurs on rocky reefs and seagrass leaves. In Australia, it occurs primarily on artificial substrata. *B. neritina* occurs in all New Zealand ports (Gordon & Matawari 1992). During the initial port baseline surveys it was recorded from the Opua and Gulf Harbour marinas, Whangarei Harbour (Marsden Point, Whangarei Port and Town Basin marina), and the ports of Tauranga, Taranaki, Napier, Gisborne, Lyttelton, Timaru and Dunedin (Table 18). In the Port of Tauranga it was recorded from Berths 11, 16 and 24 during the intial port baseline survey (Figure 24). In the second baseline surveys of Group 1 ports it was recorded from the ports of Tauranga, Taranaki, Picton, Lyttelton and Timaru. During the second baseline survey of the Port of Tauranga it occurred in pile scrape samples taken from Berths 3, 11 and 24 (Figure 25).

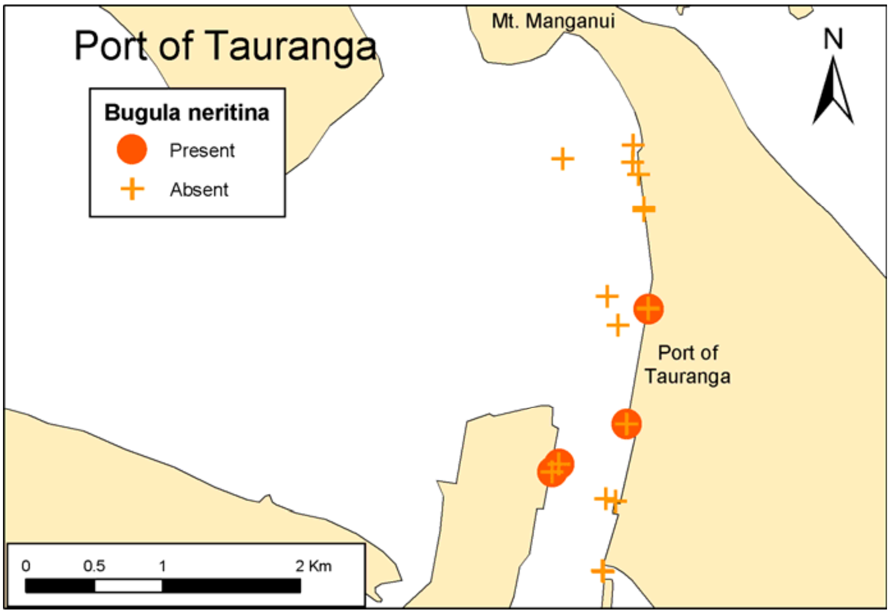

Figure 24: ***Bugula neritina*** **distribution in the initial baseline survey of the Port of Tauranga (March 2002).**

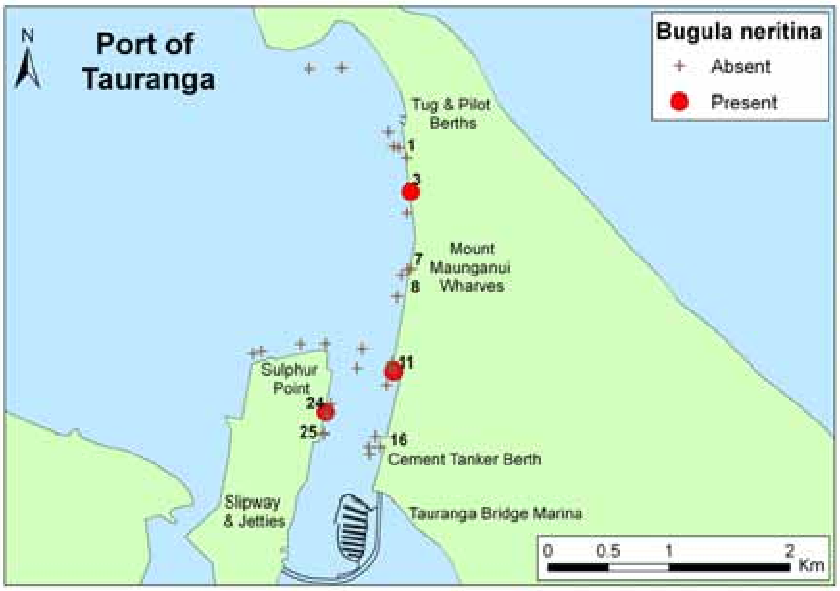

Figure 25: ***Bugula neritina*** **distribution in the re-survey of the Port of Tauranga (April 2005).**

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, NIWA, 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. In the Port of Tauranga it occurred in a benthic sled sample from berth 25 (Figure 26).

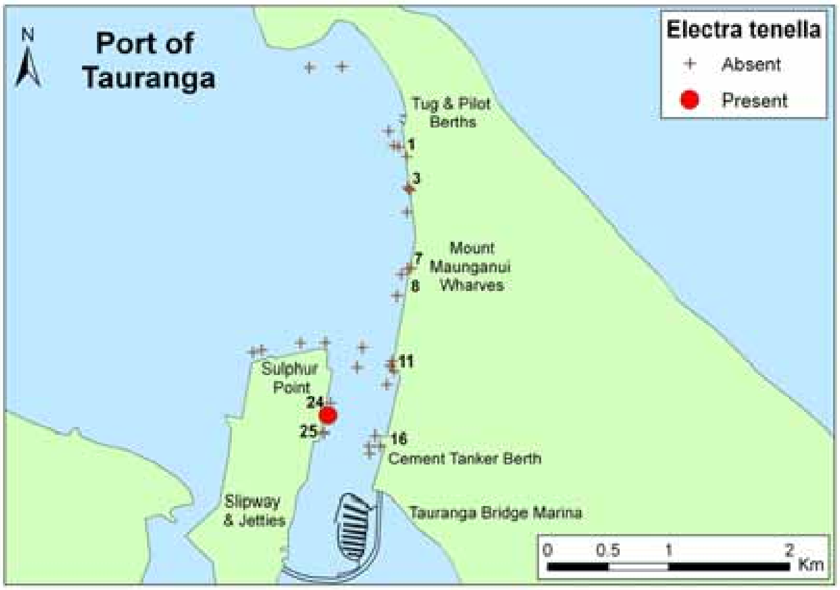

Figure 26: *Electra tenella* distribution in the re-survey of the Port of Tauranga (April 2005).

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

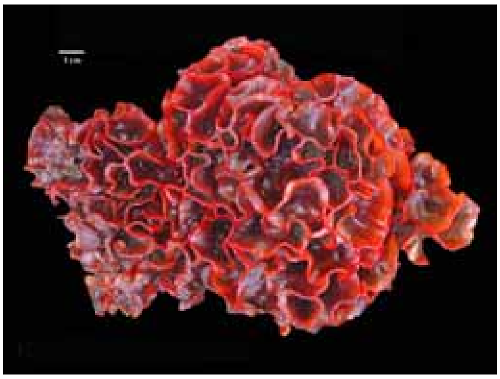

Image: Cohen (2005)
Information: Gordon and Matawari (1992)

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. *Watersipora subtorquata* has no spines, avicularia or ovicells. The native range of the species is unknown, but is thought to include the wider Caribbean and South Atlantic. The type specimen was described from Rio de Janeiro, Brazil (Gordon and Mawatari 1992). It also occurs in the northwest Pacific, Torres Strait and northeastern and southern Australia.

W. 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. *Watersipora subtorquata* is also an abundant fouling organism and is resistant to a range of antifouling toxins. It can therefore spread rapidly on vessel hulls and provide an area for other species to settle onto which can adversely impact on vessel maintenance and speed, as fouling assemblages can build up on the hull.

W. subtorquata has been present in New Zealand since at least 1982 and is now present in most ports from Opua to Bluff (Gordon and Mawatari 1992). 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 Tauranga it was recorded from Berths 3, 7, 11 and 24 during the initial port baseline survey (Figure 27). 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. During the second baseline survey of the Port of Tauranga it occurred in pile scrape samples taken from Berths 1, 7, 11 and 24 (Figure 28).

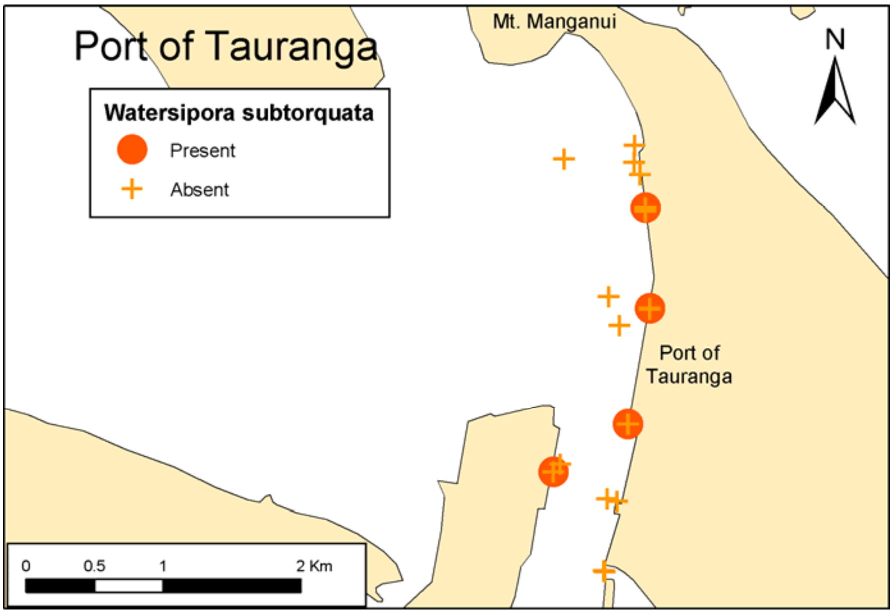

Figure 27: ***Watersipora subtorquata*** **distribution in the initial baseline survey of the Port of Tauranga (March 2002).**

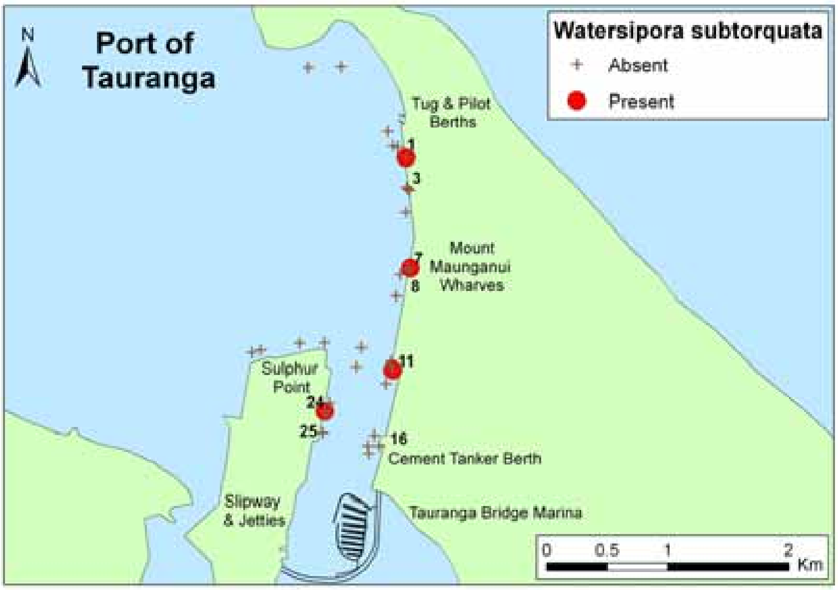

Figure 28: ***Watersipora subtorquata*** **distribution in the re-survey of the Port of Tauranga (April 2005).**

Amathia distans Busk, 1886

Image: Eldredge and Smith (2001)
Information: NIMPIS (NIMPIS 2002a)

Amathia distans is an erect bryozoan in the Family Vesiculariidae. The type locality is Bahia, Brazil and it is regarded as native to the Caribbean and the west coast of North and South America (NIMPIS 2002a). It is considered cryptogenic on the west African coast, and has been introduced to the west coast of North America, Hawaii, the Mediterranean, Red Sea, India, Java (Indonesia), Japan, Australia and New Zealand (Auckland Harbour, Gordon and Mawatari 1992). *A. distans* forms fragile, dichotomously branching colonies with semi-transparent zooids arranged in short spirals on the branches. Colonies usually grow to 4 or 5 cm high and have a yellow appearance. *A. distans* is a suspension feeder, collecting plankton and organic matter from the water column. There are no known impacts of this fouling organism, and no known predators, although nudibranchs commonly feed on bryozoans. Suitable substrata where *A. distans* can settle include rocks, seagrasses, algae (including the native brown alga *Sargassum sinclairii*), other bryozoans (eg. *Zoobotryon verticillatum*), oysters, polychaete worm tubes, docks, pilings, breakwaters and man-made debris. *Amathia distans* 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 only from the Port of Tauranga (Table 18). The finding of *A. distans* in the Port of Tauranga may represent an extension of its known range in New Zealand, as prior to the 1992 comprehensive review by Gordon and Matawari (1992) it was only known from Auckland Harbour. In the Port of Tauranga it occurred in a benthic sled sample taken from Berth 25 (Figure 29).

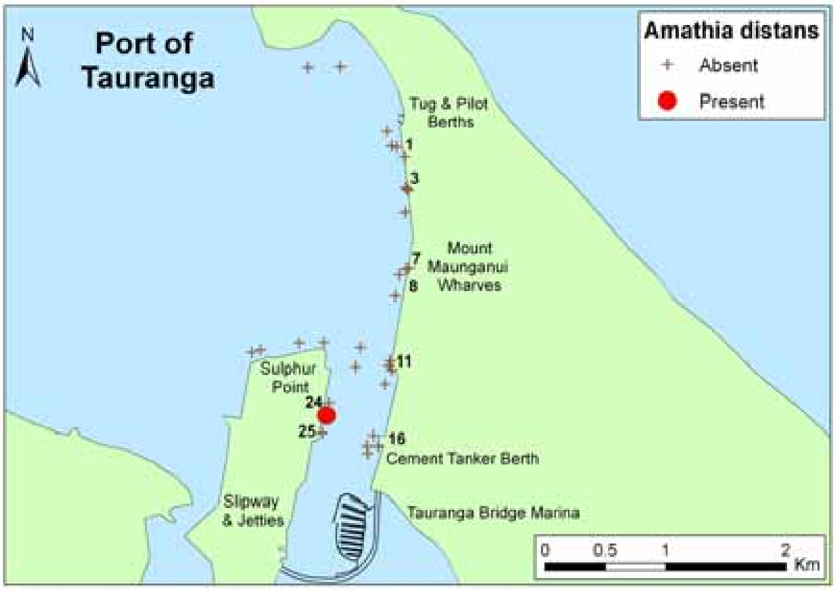

Figure 29: ***Amathia distans*** **distribution in the re-survey of the Port of Tauranga (April 2005).**

Zoobotryon verticillatum **(della Chiaje, 1828)**
No image available.

Zoobotryon verticillatum is a bryozoan that grows into large, repeatedly branching, bushy colonies up to 50 cm long (Gordon and Mawatari 1992). They often appear like thin, stringy, gelatinous noodles. The young colonies are usually transparent, while older and larger ones have a dirty white appearance. In contrast to most other bryozoans, calcium carbonate is absent in exoskeletons of this species. *Zoobotryon verticillatum* is a subtidal species and mostly occurs on hard surfaces such as rocks, pontoons, pilings or boat hulls, or as an epibiont on shells or carapaces (Gordon and Mawatari 1992).

The type locality of *Z. verticillatum* is Naples, Italy, although the species is now widely distributed in tropical and subtropical seas, including the Caribbean, Indian Ocean, northwest and northeast Pacific, Hawaii, New Caledonia and Australia. It has been present in New Zealand, in the Waitemata and Manukau Harbours, since at least the 1960's (Gordon and Mawatari 1992). Under optimal conditions *Z. verticillatum* can form large aggregations that can clog fishing nets and potentially exclude other sessile organisms. Large bushes are formed only when water warms to 22°C and above, although the colonies can overwinter during colder periods. Elevated temperature and salinity has been suggested to enhance outbreaks of this bryozoan. During the initial port baseline surveys, *Z. verticillatum* was recorded only from the Gulf Harbour marina. During the second baseline surveys of Group 1 ports it was recorded only from the Port of Tauranga, where it occurred in benthic sled samples taken from the central harbour and near Berth 25 (Table 18, Figure 30).

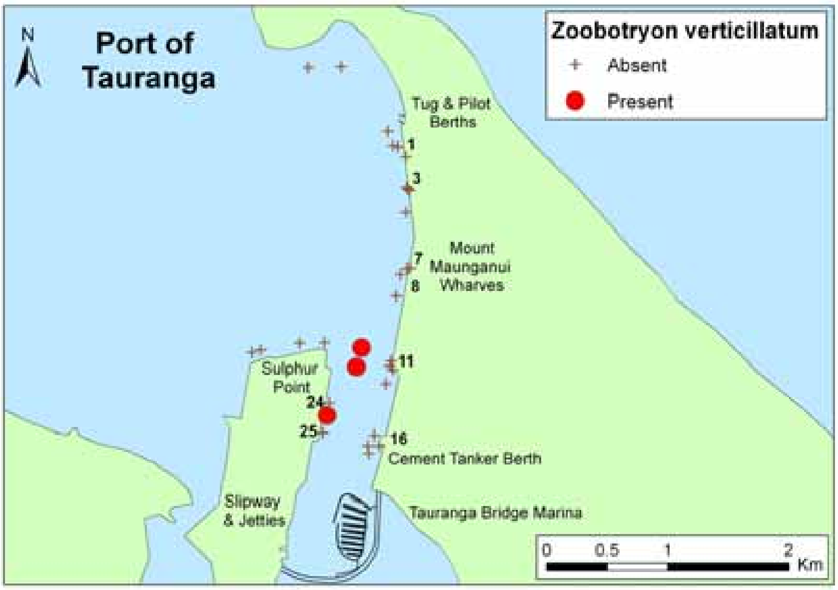

Figure 30: *Zoobotryon verticillatum* distribution in the re-survey of the Port of Tauranga (April 2005).

***Monotheca pulchella* (Bale, 1882)**

No image available.

Monotheca pulchella is a hydroid in the family Plumulariidae. Its forms fine, flexible, monosiphonic, occasionally branched colonies 10 to 15 mm high, rising from tubular stolons (Vervoort and Watson 2003). It attaches to algae, bryozoans and other hydroids. The type locality is Queenscliff, Victoria, Australia. Its distribution is in temperate and subtropical parts of eastern and western Atlantic including the Mediterranean, South African coastal waters, coastal waters of southern Australia and eastern coastal waters of New Zealand (Vervoort and Watson 2003). It was first recorded in New Zealand from Bluff in 1928 (see Vervoort and Watson 2003). *Monotheca pulchella* was not recorded during the initial port baseline surveys. During the second baseline surveys of Group 1 ports it was recorded from the ports of Tauranga, Taranaki, Wellington, Lyttelton and Timaru (Table 18). None of these records are extensions to the known range of the species in New Zealand. In the Port of Tauranga, *M. pulchella* occurred in a pile scrape sample taken from Berth 7 (Figure 31).

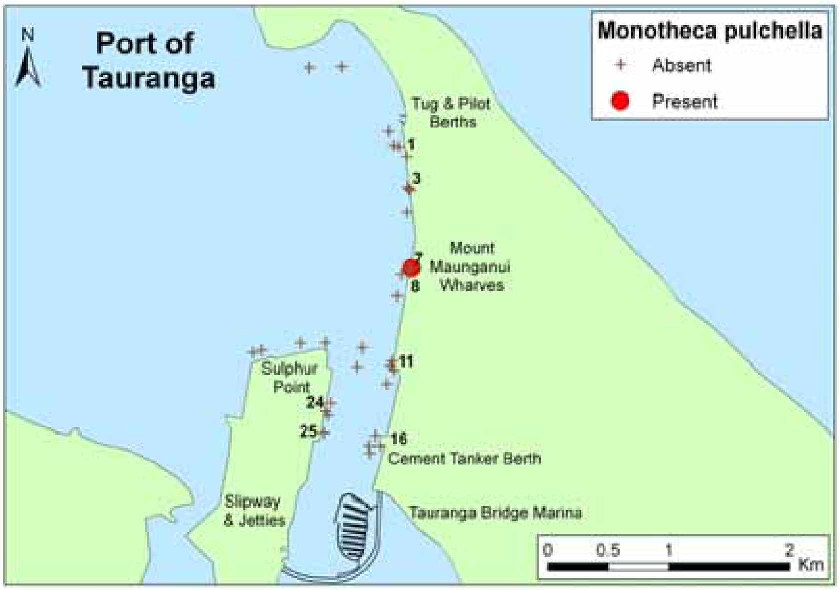

Figure 31: *Monotheca pulchella* distribution in the re-survey of the Port of Tauranga (April 2005).

Sertularia marginata (Kirchenpauer, 1864)

Medusoid of *Sertularia marginata* being liberated from gonotheca

Image: Migotto (1998)
Information: Vervoort and Watson (2003)

Sertularia marginata is a hydroid in the family Sertulariidae. Stems are pinnate, monosiphonic and rise to 30 mm high from creeping stolons. The species has a circumglobal distribution in tropical and subtropical seas, including the western and eastern Atlantic Ocean, Indian Ocean, and the western and eastern Pacific (Medel and Vervoort 1998, in Vervoort and Watson 2003). There are few records from New Zealand, but they include North Cape (from 1930), Poor Knights Islands, Russell, Bay of Islands, Auckland, the Tasman Sea near Lord Howe Island, the Pacific off South Island, and Doubtful Sound. *Sertularia marginata* was not recorded during the initial baseline surveys. During the second baseline surveys of Group 1 ports it was recorded from the ports of Tauranga and Wellington (Table 18). These records are probably extensions to the known range of this species in New Zealand (J. Watson, Hydrozoan Research Laboratory, pers. comm.). In the Port of Tauranga, *S. marginata* occurred in a benthic sled sample from Berth 3 (Figure 32).

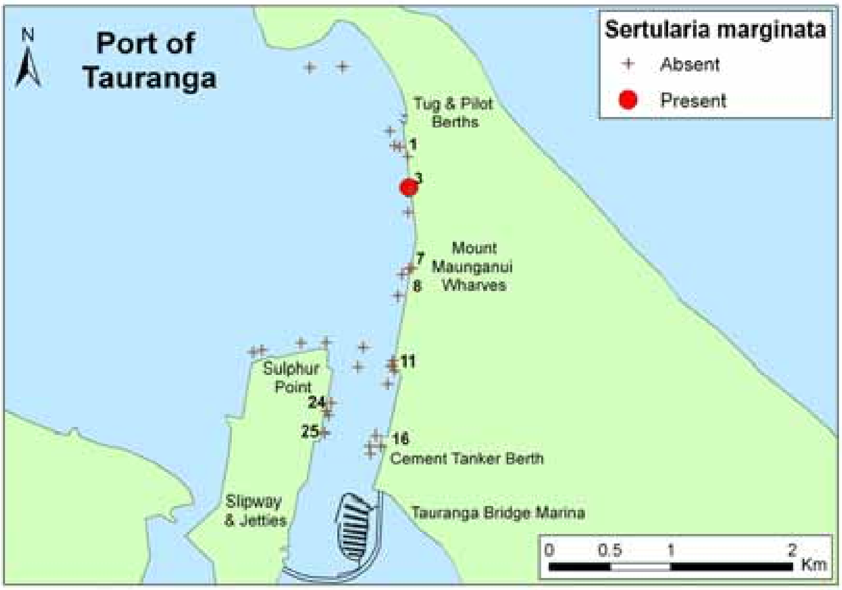

Figure 32: ***Sertularia marginata* distribution in the re-survey of the Port of Tauranga (April 2005).**

Cliona celata Grant, 1826

Image: Picton and Morrow (2005)
Information: Bower and McGladdery (2004), Picton and Morrow (2005)

Cliona celata is a bright yellow boring sponge that excavates tunnels in calcareous material such as the shells of bivalves and other molluscs. This may result in energetically costly damage to affected molluscs, through fungal and bacterial infections from other organisms settling inside the sponge tunnels, or through reduced feeding ability (and possible mortality) if the sponge perforates the adductor muscle attachment. Lesions in soft tissue may also render commercial bivalves unmarketable. The exposed part of colonies can reach 20 cm in diameter. Shell damage is most easily prevented by growing molluscs off the bottom, on hanging cultures. *Cliona celata* is common around the Arctic, Atlantic coast of Europe and North America, West Indies, Indian Ocean, the Red Sea, Malaya, Australia and New Guinea. It is present throughout New Zealand coastal waters and was recorded from Whangarei (Marsden Point) and Tauranga during the initial port baseline surveys (Table 18). In the Port of Tauranga it was recorded from berth 3 during the initial port baseline survey (Figure 33). During the second baseline surveys of Group 1 ports it was recorded only from the Port of Tauranga, where it occurred in a pile scrape sample taken from Berth 16 (cement tanker berth; Figure 34).

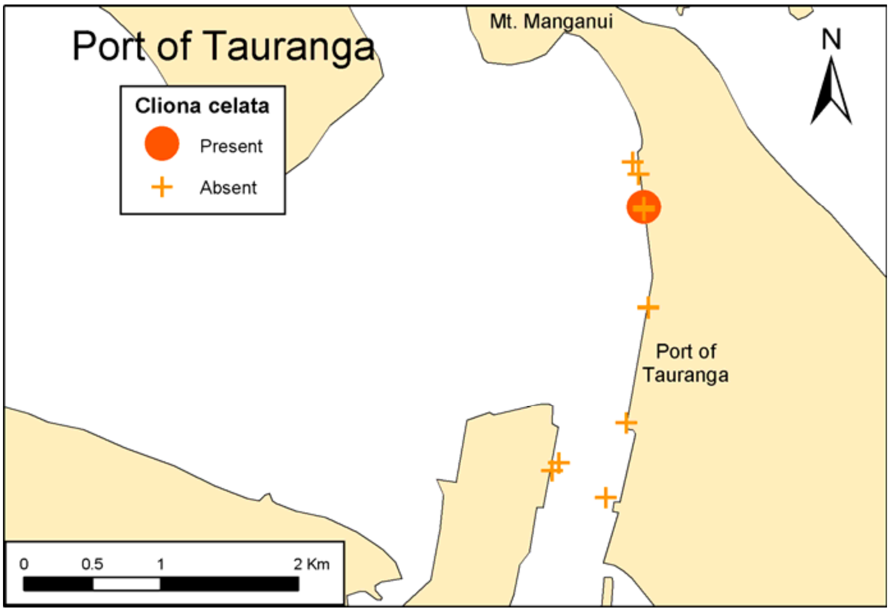

Figure 33: *Cliona celata* **distribution in the initial baseline survey of the Port of Tauranga (March 2002).**

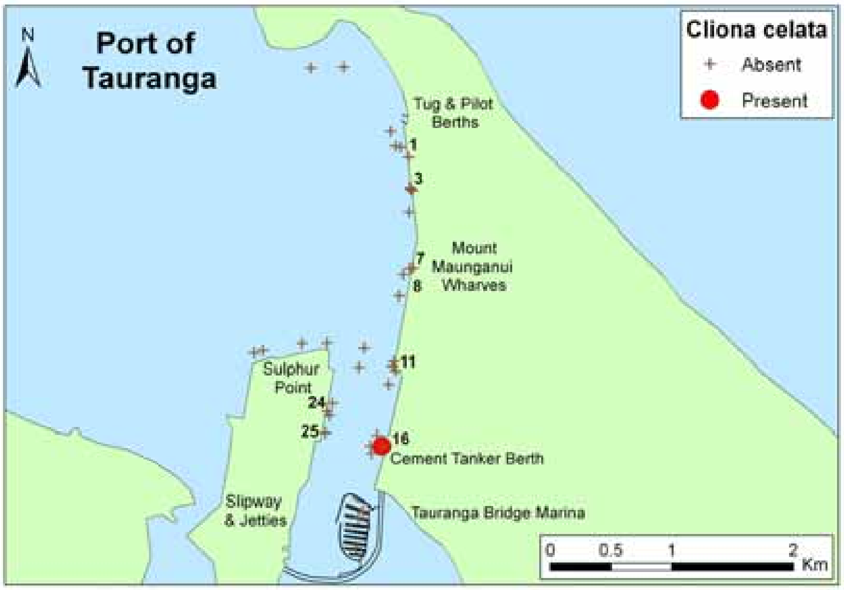

Figure 34: *Cliona celata* **distribution in the re-survey of the Port of Tauranga (April 2005).**

SPECIES INDETERMINATA

Thirty-five organisms from the Port of Tauranga were classified as species indeterminata (Figure 20). If each of these organisms is considered a species of unresolved identity, then together they represent 13.6 % of all species collected from this survey. Species indeterminata from the Port of Tauranga included 17 phycophytes, four ascidians, four crustaceans, three molluscs, two fish, and one each of annelid, bryozoan, dinoflagellate, sponge and seagrass (Table 17).

NOTIFIABLE AND UNWANTED SPECIES

None of the species recorded from the re-survey of the Port of Tauranga are currently listed on the New Zealand register of unwanted organisms (Table 12). The Asian kelp, *Undaria pinnatifida*, is one of the species listed on the New Zealand register. Isolated specimens of *U. pinnatifid*a have recently been found near the entrance to Tauranga Harbour (J. Mather, Environment Bay of Plenty, pers. comm.) but it does not appear to have established yet within the port. A dinoflagellate species recorded in the baseline re-survey of the Port of Tauranga, *Alexandrium tamarense*, is listed on the Australian Ballast Water Management Advisory Council's schedule of non-indigenous pest species (Table 13). This species is discussed further under "Cyst-forming species", below.

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 Biosecurity NZ. Eight of the 53 Australian priority domestic pests are known to be present in the Port of Tauranga. These are listed in descending order of the impact potential ranking attributed to them by Hayes et al. (2004): *Crassostrea gigas*, *Bugula neritina*, *Codium fragile* subsp. *tomentosoides*, *Bugula flabellata*, *Undaria pinnatifida*, *Musculista senhousia*, *Watersipora subtorquata, Zoobotryon verticillatum, Bougainvillia muscus, Apocorophium acutum, and Monocorophium acherusicum*. None of the 37 priority international pests identified by Hayes et al. (2004) was present in the Port of Tauranga.

PREVIOUSLY UNDESCRIBED SPECIES IN NEW ZEALAND

Five species recorded from the re-survey of the Port of Tauranga are new records from New Zealand waters. These are all sponges: *Halichondria* new sp. 3, *Haliclona* new sp. 3 (also recorded during the recent re-survey of the Port of Wellington), *Haliclona* new sp. 4 (also recorded during the recent re-surveys of the ports of Lyttelton, Picton and Taranaki), *Haliclona* new sp. 5 and *Haliclona* new sp. 6 (also recorded during the recent re-surveys of the ports of Picton and Lyttelton). A further 17 species from the present survey were described for the first time during the initial port baseline surveys. These were the amphipods *Leucothoe* sp. 1 and *Stomacontion* sp. aff. *S. pungpunga,* the ascidian *Microcosmus squamiger* and the sponges *Adocia* new sp. 2, *Chalinopsilla* new sp. 1, *Clathria* new sp. 1, *Dysidea* new sp. 1, *Esperiopsis* new sp. 1, *Euryspongia* cf. *arenaria, Euryspongia* new sp. 2, *Euryspongia* new sp. 3, *Halichondria* new sp. 1, *Ophlitospongia* new sp. 1, *Paraesperella* new sp. 1 (macrosigma), *Phorbas* cf. *anchorata*, *Phorbas* new sp. 1 and *Suberitidae* new g. new sp. 1. Ten of these species - *Microcosmus squamiger, Adocia* new sp. 2, *Clathria* new sp. 1, *Dysidea* new sp. 1, *Esperiopsis* new sp. 1, *Euryspongia* new sp. 3, *Halichondria* new sp. 1, *Ophlitospongia* new sp. 1, *Phorbas* cf. *anchorata* and *Phorbas* new sp. 1 - were recorded during the earlier port baseline survey of the Port of Tauranga. The remainder represent new records for this location.

CYST-FORMING SPECIES

Cysts of four species of dinoflagellate were collected during this survey. These included two native species (*Lingulodinium polyedrum* and *Scrippsiella trochoidea*), one cryptogenic category one species (*Alexandrium tamarense*) and one species indeterminata (*Protoperidinium sp.*). Species in the genera *Protoperidinium* and *Scrippsiella* are not known to be harmful (Hay et al. 2000; Faust and Gulledge 2002; New Zealand Food Safety Authority 2003). However, some strains of *Alexandrium tamarense* are known to produce marine biotoxins and *Lingulodinium polyedrum* has also been linked to a marine biotoxin.

Alexandrium tamarense is a widely distributed coastal and estuarine planktonic marine dinoflagellate that is associated with toxic Paralytic Shellfish Poisoning blooms (Hay et al. 2000; Faust and Gulledge 2002). It produces very potent PSP neurotoxins which can affect humans, other mammals, fish and birds (Larsen and Moestrup 1989, in Faust and Gulledge 2002). Human illnesses and deaths have been recorded after consumption of infected shellfish, and bloom events have also been linked to several massive fish kills. However, not all strains of *A. tamarense* are toxic, and strains in Australia, the Gulf of Thailand and some other locations are non-toxic (see Faust and Gulledge 2002). Hay et al. (2000) reported on the specific toxicity of strains of several *Alexandrium* species found in New Zealand, but the toxicity of *Alexandrium tamarense* (from Tasman Bay) was reported as "unknown".

Lingulodinium polyedrum is a widely distributed species in warm temperate and subtropical coastal waters, and is considered native in New Zealand. It can form blooms known as "red tides" which have been associated with fish and shellfish mortality events (Faust and Gulledge 2002). The presence of a paralytic shellfish poison (PSP) toxin, saxitoxin, has also been reported in water samples taken during a bloom of *L. polyedrum* (Bruno 1990, in Faust and Gulledge 2002). However, it is not listed as producing marine biotoxins by either of the recent reviews of the non-commercial marine biotoxin monitoring programme in New Zealand (Hay et al. 2000; New Zealand Food Safety Authority 2003).

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

Pile scrape samples

Native species

Rarefaction curves and estimates of total species richness in pile scrape samples taken from the two baseline surveys of the Port of Tauranga are presented in Figure 35a. Curves for the native species assemblage from the first and second surveys exhibited similar rates of species accumulation relative to sampling effort, with slightly greater density of species in the first baseline survey, highlighted by a slightly steeper rate of increase and a larger number of observed species for the same level of sample effort. In each case, the observed richness increased steadily as more samples were taken and did not approach an asymptote. Estimates of total species richness in each survey also continued to increase with sample size at much the same rate as the rarefaction curves and did not plateau or converge with observed richness. This indicates that, as sample size increased, more unique species (i.e. those that occurred in only one sample) were added to the survey. These 'rare' species comprised large proportions of the sampled assemblages. Forty five percent and 37% of the native species observed in each survey, respectively, occurred in just a single sample (Table 19). The large number of uniques had a strong influence on the estimated number of unsampled species in the assemblage, which varied between 28% in the first survey (ie. 39 unsampled species out of 137 observed) and 37% in the re-survey (ie. 43 unsampled species of 117 observed; Figure 35a).

Despite the correspondence between the rarefaction curves for the two surveys, the species composition of the assemblages in each survey was quite different. Only 78 species (44% of the total number) were recorded in both surveys (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 only moderate similarity between the assemblages recorded in the initial and repeat baseline surveys of Tauranga (0.443 and 0.614, respectively). The new Chao similarity indices, however, which adjust for the effects of non-detection of rare species, suggest much closer resemblance between the two samples (Chao bias-adjusted Jaccard = 0.820; Chao bias-adjusted Sorenson = 0.901; Table 19).

Cryptogenic category 2 species

The observed richness of cryptogenic category two species also showed very similar patterns of species accumulation in each of the baseline surveys, with similar total numbers of observed species (Table 19). Rarefaction curves did not reach an asymptote in either survey, but continued to increase at about the same rate as the estimated total richness for this group as more samples were added (Figure 35b). This indicates that, as more samples were taken in each survey, more 'rare' cryptogenic category 2 species continued to be added to the inventory. In each survey, the observed number of species accounted for between 81% (survey 1) and 84% (survey 2) of the estimated species richness (Figure 35b).

There was comparatively high turn-over in species composition between the two surveys. Only 11 of the 35 species in this category (31%) were common to both surveys (Table 19). This is reflected in the moderate similarity between the assemblages, even when adjustment is made for undetected rare species (Chao bias-adjusted Jaccard = 0.504; Chao bias-adjusted Sorenson = 0.67; Table 19).

Non-indigenous and cryptogenic category 1 species

Fewer non-indigenous and cryptogenic category 1 species were recorded in the re-survey of the Port of Tauranga (n = 22 species) than in the initial baseline survey (n = 29 species), despite similar survey effort (Table 19). In the initial survey, the observed species density in this group had converged with the estimated total richness at an asymptote of around 31 species (Figure 35c), suggesting a relatively complete inventory with a small proportion of uniques (10%) and, therefore, few undetected species. The observed density of non-indigenous and cryptogenic category 1 species was much lower in the repeat survey, increased at a much slower rate with sample size, and did not converge with the estimated richness of the assemblage which, again, appeared to plateau at around 30 species (Figure 35c). Thus, despite similar survey effort, there appears to be a much larger number of species that remained undetected in the repeat survey, than in the first survey. Indeed, 11 of the species recorded during the first survey were not found in the repeat survey (Table 19). When these undetected species were taken into account, the species assemblages sampled on each occasion were very similar (Chao bias-adjusted Jaccard = 0.857; Chao bias-adjusted Sorenson = 0.923; Table 19).

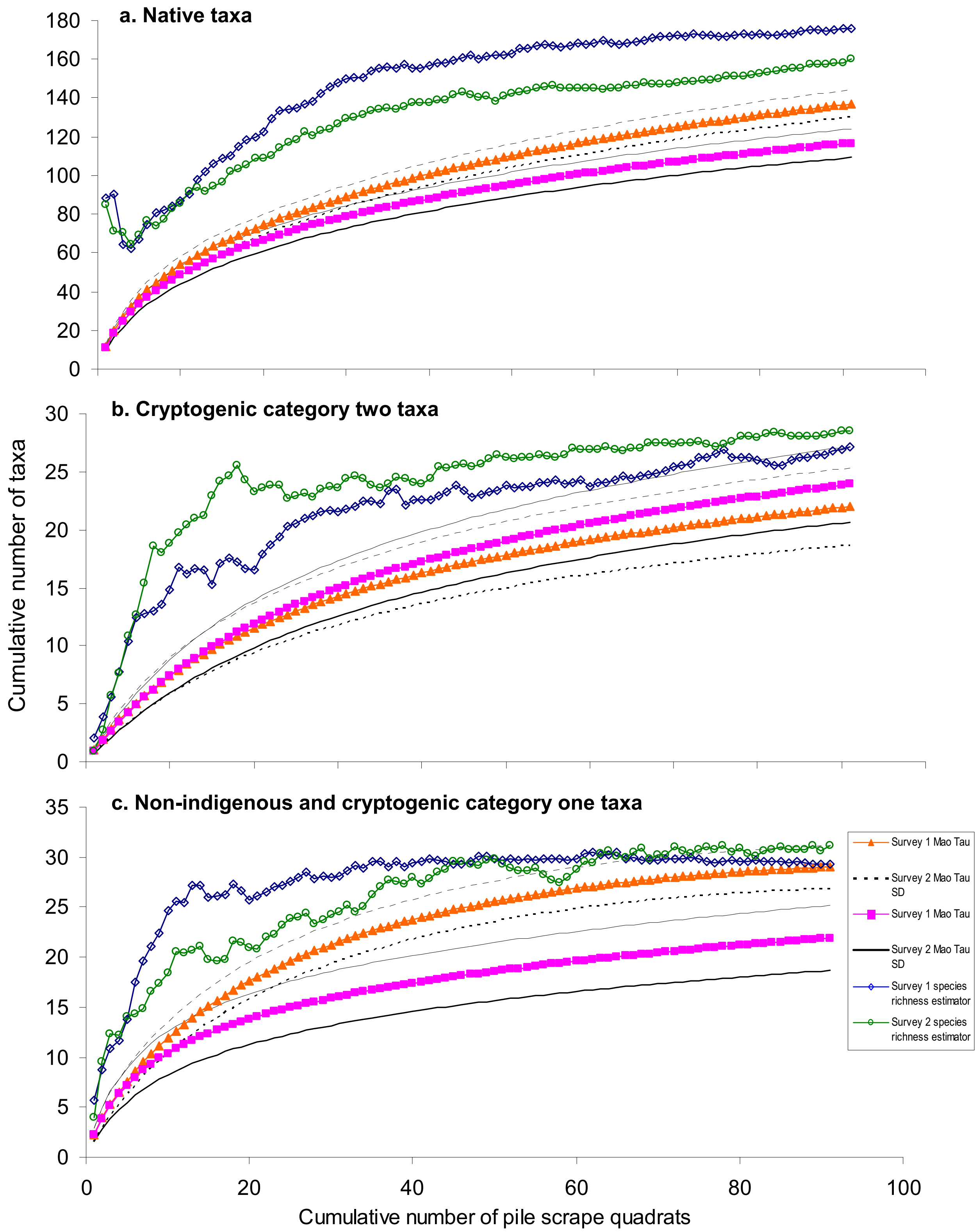

Figure 35: Rarefaction curves (Mao Tau) for native (top), cryptogenic category two (middle) and non-indigenous and cryptogenic category one (bottom) taxa from pile scrape quadrats for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). Species richness estimators are also shown for the first survey (empty diamonds) and second survey (empty circles); the Chao 2 classic formula was used for native taxa and NIS & C1 taxa in the second survey; the Chao 2 bias-corrected formula was used in all other instances.

Benthic sled samples

Native species

Samples taken with the benthic sled recovered similar total numbers of epibenthic native species in each survey (Table 19). In the initial survey, benthic sled samples were dominated by uniques (52% of species), resulting in a comparatively large and unstable estimate of total species richness that was almost double the number of observed species (S_{obs} = 67 species, ICE richness estimate = 129 species; Figure 36a). A smaller proportion of the sample was comprised of uniques in the second survey (43%; Table 19) and, as a result, the ICE estimate of total richness approached an asymptote at around 92 species (Figure 36a). Nevertheless, in both surveys the rarefaction curves increased only slowly with sample size and, at the observed rate of species accumulation, sample effort would need to more than double (i.e. >40 sled samples in total) for the observed species density to approach the total estimate of richness in the repeat survey. Only 23 of the 61 species recorded in the second survey (38%) were also recorded in the initial survey, with moderate similarity between the two samples (Chao bias-adjusted Jaccard = 0.468; Chao bias-adjusted Sorenson = 0.637; Table 19).

Cryptogenic category 2 species

Comparative few cryptogenic category 2 species were recovered in the benthic sled samples in each survey (Table 19). In the first baseline survey, almost all of the species (6 of 8 species) were each recorded from just a single sled sample. A consequence was a rapidly rising ICE estimate of total species richness (Figure 36b), as each additional sled sample added to the number of uniques in the survey. In contrast, the ICE estimate for the second survey remained relatively low and stable at around ~9 species (Figure 36). None of the 13 cryptogenic category 2 species found in the sled samples occurred in both surveys (Table 19).

Non-indigenous and cryptogenic category 1 species

Rarefaction curves and estimates of total richness for the combined non-indigenous and cryptogenic category 1 species are depicted in Figure 36c. Similar numbers of species were observed in each baseline survey (Survey 1 S_{obs} = 10 species; Survey 2, S_{obs} = 9 species), with each sample containing a large proportion of uniques (70% and 78%, respectively; Table 19). As a result, neither rarefaction curve converged with its corresponding richness estimator (Figure 36c). Only 4 of the 15 non-indigenous and cryptogenic category 1 species recorded from benthic sled samples occurred in both surveys (Table 19).

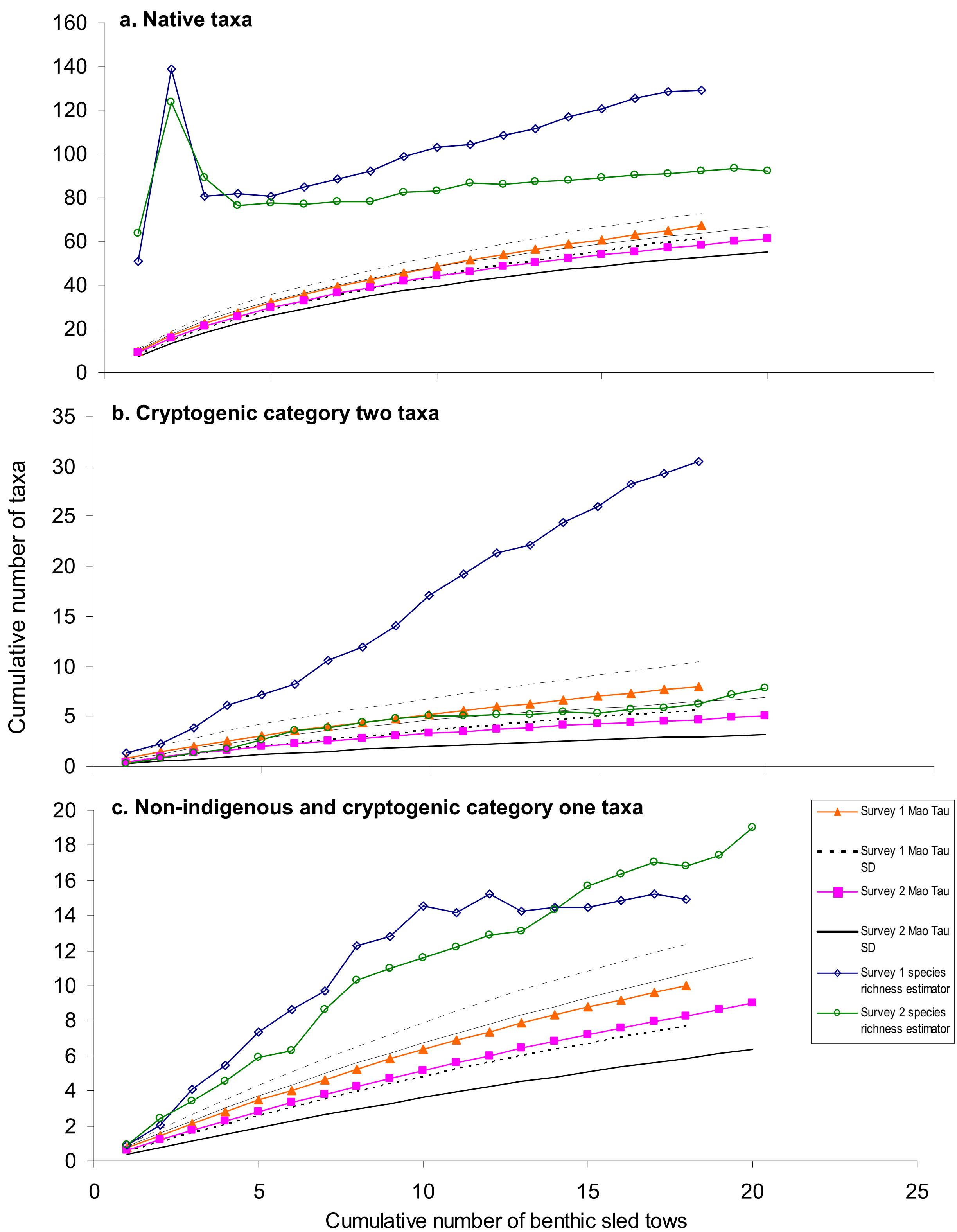

Figure 36: **Rarefaction curves (Mao Tau) for native (top), cryptogenic category two (middle) and non-indigenous and cryptogenic category one (bottom) taxa from benthic sled tows for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). Species richness estimators are also shown for the first survey (empty diamonds) and second survey (empty circles); the ICE formula was used for native taxa in both surveys and for crypotogenic category 2 taxa in the first survey. The Chao 2 bias-corrected formula was used in all other instances.**

Benthic grab samples

Samples taken with the benthic grab contained relatively few non-indigenous and cryptogenic category 1 species (2 species in total) or cryptogenic category 2 species (1 species) in either survey (Table 19). For this reason, analysis was done on the pooled species assemblage (Figure 37).

The shape of rarefaction curves generated from the benthic grab samples was similar in each survey (Figure 37), with approximately equal numbers of species recovered for equivalent survey effort (Survey 1, $n_{18 \text{ samples}}$ = 22 species; Survey 2, $n_{18 \text{ samples}}$ = 19 species). In both surveys, the samples were characterised by comparatively slow rates of species accumulation as more benthic grabs were taken, with neither curve reaching an asymptote. Large proportions of the observed species in each survey occurred in only a single sample (Survey 1, 62%; Survey 2, 58%), so that estimates of the total richness of the assemblages were large and unstable reflecting a large number of potentially undetected species (Figure 37). There was also little overlap in species composition between the surveys. Only 8 of the 40 species recorded from the benthic grab samples (20%) were present in both surveys, resulting in low similarity of the two assemblages (Chao bias-adjusted Jaccard = 0.336; Chao bias-adjusted Sorenson = 0.503; Table 19). This suggests considerable undersampling of the assemblage, but the slow rate of accumulation of species (fewer than 9 new species for every additional 10 samples) means that sampling effort would need to more than double again (~56 samples in total) to approach the estimated richness (66 species; Figure 37).

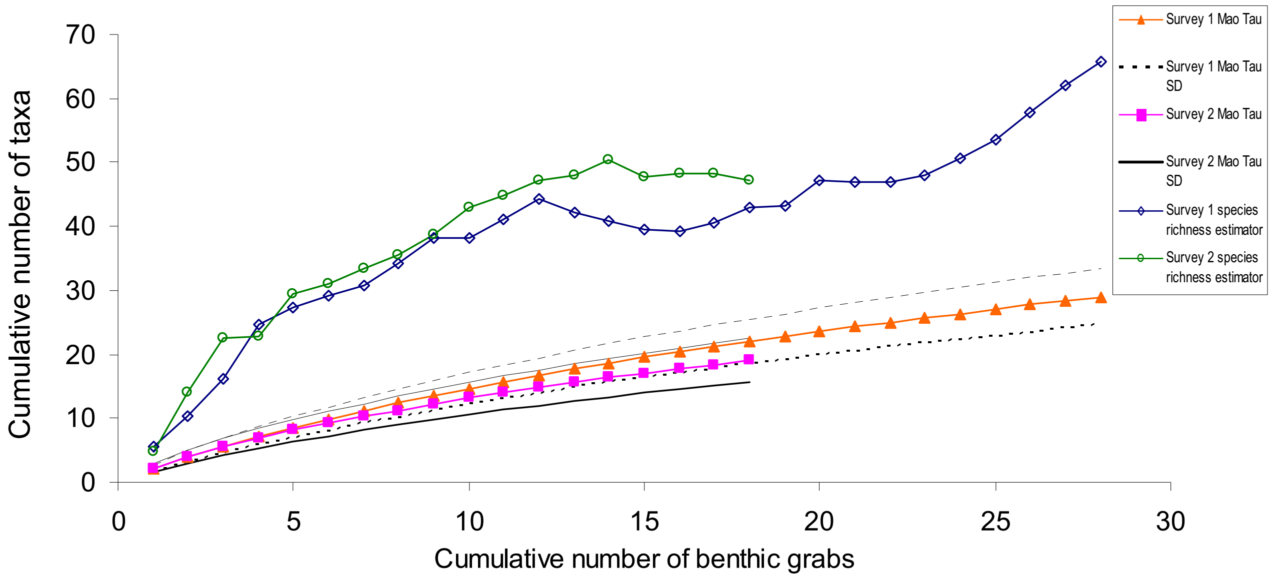

Figure 37: Rarefaction curves (Mao Tau) for native, cryptogenic and non-indigenous taxa combined from benthic grabs for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). Species richness estimators are also shown for the first survey (empty diamonds, Chao 2 bias-corrected formula) and second survey (empty circles, ICE formula).

Crab trap samples

No non-indigenous or cryptogenic category 2 species were captured in the crab traps in either survey and only a single cryptogenic category 1 species was recorded using this survey method (Table 19). Because of this, analysis of survey completeness and similarity between the two surveys was done using the pooled assemblage. Species density in the samples was markedly lower in the repeat baseline survey (Mean + S.E. = 1.28 + 0.16 species per trap) than in the initial March 2002 survey (Mean + S.E. = 3.12 + 0.27 species per trap). Despite identical survey effort, less than half the number of species was recorded (Table 19), resulting in quite different rates of species accumulation (Figure 38). In the first survey, the rarefaction curve continued to increase as more samples were taken and did not plateau or converge with the estimated richness of the assemblage, which was unstable and increased steeply with survey effort (Figure 38). In the repeat survey, however, the observed species density appeared to converge with the richness estimate, indicating a more complete inventory of a much depleted assemblage (Figure 38). Because of the large difference in the numbers of observed species, only 4 of the 20 species recorded from the crab traps were common to both surveys (Table 19). Nevertheless, the measures of species turnover suggested moderately similar assemblages were sampled on each occasion, reflecting the large estimated number of species that remained undetected in the first baseline survey (Chao bias-adjusted Jaccard = 0.544; Chao bias-adjusted Sorenson = 0.705; Table 19).

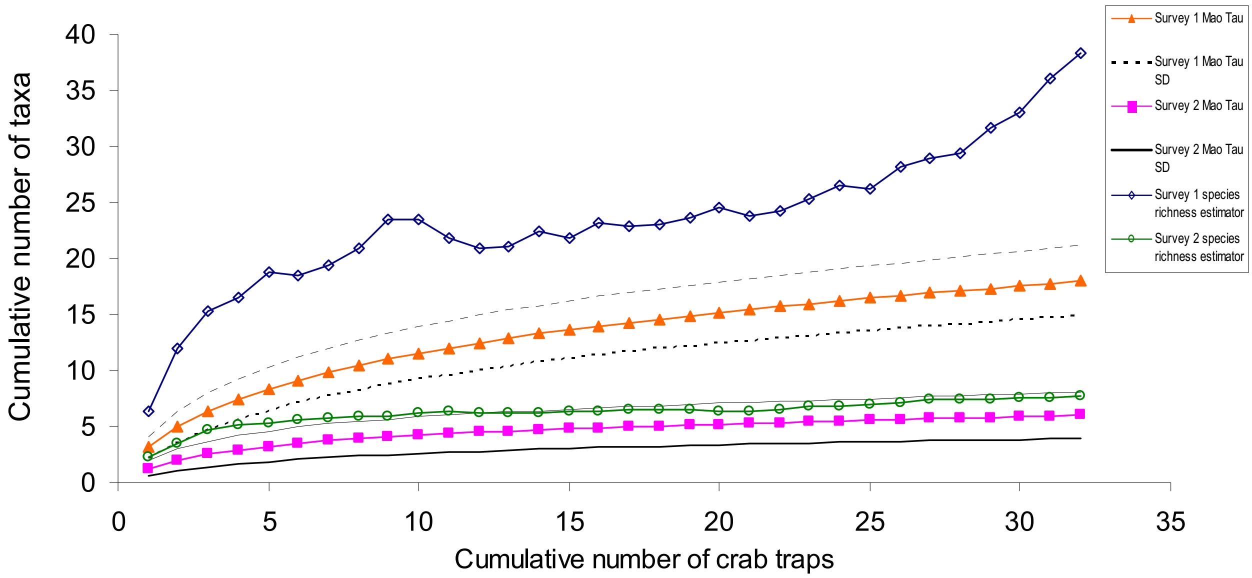

Figure 38: Rarefaction curves (Mao Tau) for native and cryptogenic category one taxa combined from crab traps for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). No NIS or cryptogenic category two taxa were encountered in either survey. Species richness estimators are also shown for the first survey (empty diamonds, Chao 2 classic formula) and second survey (empty circles, ICE formula).

Fish trap samples

Only 14 species in total were captured in the fish traps, with most (12 species) being native species (Table 19). Despite greater sample effort in the second survey (39 samples compared with 24 samples in the first survey) almost identical numbers of species were observed in the first and second baseline surveys (Table 19). This was associated with a greater average density of species in samples from the first survey. Concomitantly, the rate of species accumulation in the first survey occurred more quickly initially as more samples were added, slowed faster than in the second survey, and converged with the estimated richness, indicating that most of the species sampled were relatively common (Figure 39). Proportionately more uniques occurred in the second survey (Table 19) and both the rarefaction curve and estimated richness continued to increase with survey effort. Nevertheless, in both surveys the observed species density accounted for > 77% of the estimated richness, suggesting relatively few undetected species in the assemblage. As a result, the species composition of samples taken during each survey was quite similar (Chao bias-adjusted Jaccard = 0.646; Chao bias-adjusted Sorenson = 0.785; Table 19).

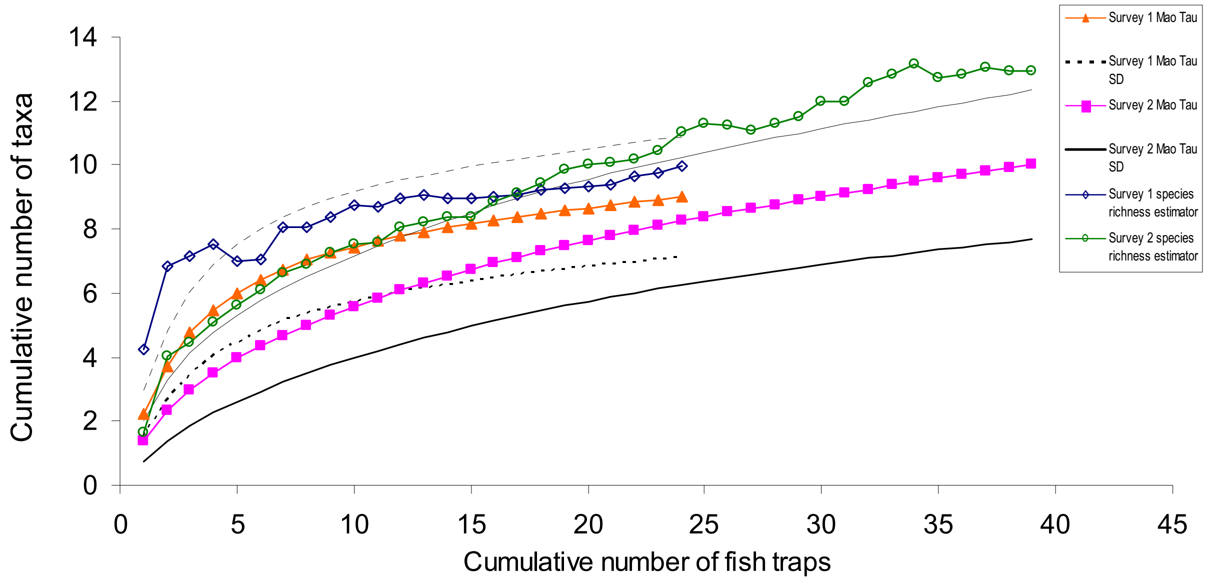

Figure 39: Rarefaction curves (Mao Tau) for native and cryptogenic taxa combined from fish traps for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). No NIS taxa were encountered in either survey. Species richness estimators are also shown for the first survey (empty diamonds) and second survey (empty circles); the Chao 2 bias-corrected formula was used for both surveys.

Starfish trap samples

Twelve species in total were recorded from the starfish traps in the two surveys (Table 19). All 12 species were native. Again, catch rates differed between the two surveys with greater density and a larger number of species were observed in the first survey (Figure 40). Almost twice as many species were encountered for the same survey effort. Estimates of total richness were unstable in each survey and continued to increase with sample size, reflecting comparatively large proportions of undetected species in each survey (Figure 40). Once these were corrected for, however, the assemblages sampled by each survey were very similar (Chao bias-adjusted Jaccard = 0.913; Chao bias-adjusted Sorenson = 0.954; Table 19).

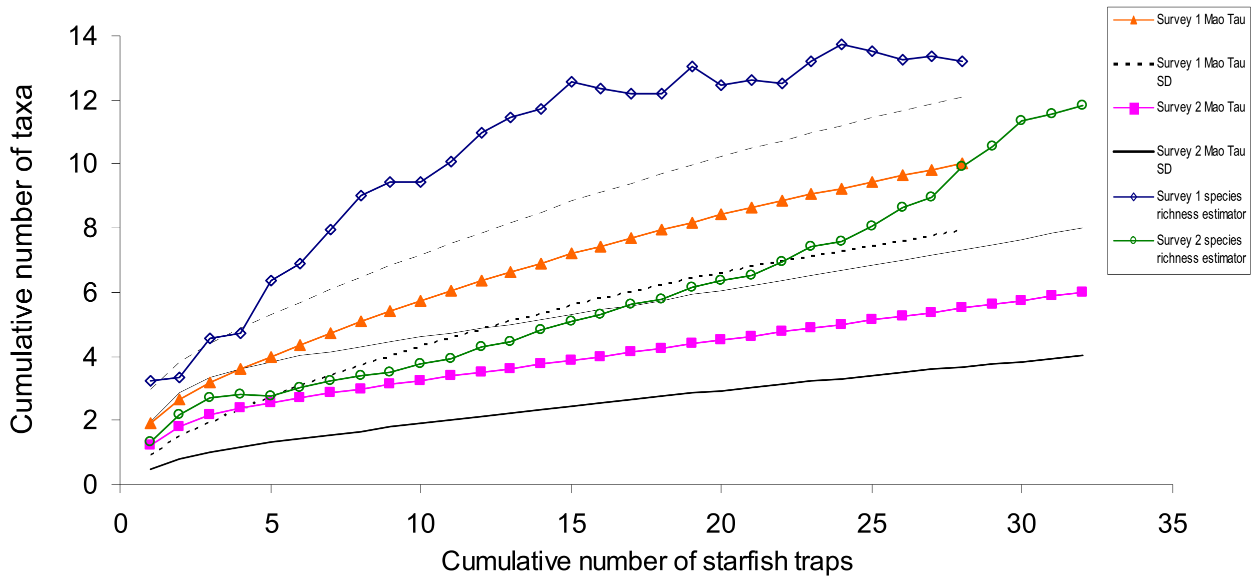

Figure 40: Rarefaction curves (Mao Tau) for native taxa from starfish traps for the first survey (full triangles, ± SD (dashed lines)) and second survey (full squares, ± SD (solid lines)). No NIS or cryptogenic taxa were encountered in either survey. Species richness estimators are also shown for the first survey (empty diamonds, Chao 2 bias-corrected formula) and second survey (empty circles, Chao 2 classic formula).

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

The non-indigenous species located in the Port of Tauranga are thought to have arrived in New Zealand via international shipping. They may have reached the Port of Tauranga 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 Tauranga during the baseline port surveys. Likely vectors of introduction are largely derived from Cranfield et al. (1998) and expert opinion. They suggest that four species (44 %) were most likely to be associated with hull fouling and of the remaining species; another four species could have arrived via either hull fouling or ballast water, and one species via plastic flotsam.

Assessment of the risk of new introductions to the port

Many NIS introduced to New Zealand ports, through hull fouling, ships' sea chests, or ballast water discharge, do not survive to establish self-sustaining local populations. Those that do often come from coastlines that have similar marine environments to New Zealand. For example, approximately 80% of the marine NIS known to be present within New Zealand are native to temperate coastlines of Europe, the northwest Pacific, and southern Australia (Cranfield et al. 1998).

Between 2002 and 2005, there were 1,798 vessel arrivals from overseas to the Port of Tauranga. The greatest number of these came from: Australia (803, including 527 from southeast Australia), Pacific Islands (266), the west coast of North America (175) Japan (167), east Asian seas (140) and the northwest Pacific (131; Table 4). With the exception of the Pacific Islands and east Asian seas, most of this trade is with ports from other temperate regions that have coastal environments similar to New Zealand's. Moreover, most of the trade between the Port of Tauranga and the Pacific Islands is of general and container cargo; these vessels typically discharge relatively small volumes of ballast water. Bulk carriers and tankers that arrive empty carry the largest volumes of ballast water. Between 2002 and 2005 bulk carriers and tankers arriving in the Port of Tauranga came predominantly from the northwest Pacific (118 visits), Japan (132 visits), and Australia (131 visits; Table 4). The Port of Tauranga is New Zealand's largest export port and consequently receives many empty vessels which need to discharge ballast water before loading. A relatively high volume of ballast water is thus discharged in the Port of Tauranga. According to Inglis (2001), a total volume of 335,410 m^3 of ballast water was discharged in the Port of Tauranga in 1999, with the largest country-of-origin volumes of 135,850 m^3 from Japan, 80,725 m^3 from South Korea, and 27,477 m^3 from Australia, and 61,112 m^3 unspecified. Shipping from these regions presents an on-going risk of introduction of new NIS to the Port of Tauranga.

Smaller, slower moving vessels, such as barges and fishing boats, tend to carry a greater density of fouling organisms than faster cargo vessels. However, there were very few visits by these types of vessels to the Port of Tauranga recorded by the LMIU, and there appear to be few fishing vessels registered in the Port of Tauranga (2 in the year 2000, Sinner et al. 2000).

Shipping from southern Australia, the west coast of North America, Japan and the northwest Pacific present the greatest risk of introducing new non-indigenous species to the Port of Tauranga. Because of the relatively short transit time, shipping originating in southern Australia (particularly Victoria and Tasmania) carries, perhaps, the greatest overall risk since six of the eight marine pests on the New Zealand Register of Unwanted Organisms are already present there (*Carcinus maenas*, *Asterias amurensis*, *Undaria pinnatifida*, *Sabella spallanzanii*, *Caulerpa taxifolia*, and *Styela clava*). The native range of the 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

Vessels departing from the Port of Tauranga after having spent time at berth within the port may pose a significant risk of spreading the non-indigenous species present in the Port of Tauranga to other ports within New Zealand that remain uninfested with these species. Between 2002 and 2005, vessels departing from the Port of Tauranga travelled to 17 ports throughout New Zealand. Napier, Auckland, Lyttelton, Whangarei, Wellington and Nelson were the next ports of call for the most domestic vessel movements from Tauranga (Table 8). Although many of the non-indigenous species found in the re-survey of the Port of Tauranga have been recorded in other locations throughout New Zealand (Table 18), they are not universally present in the other ports. There is, therefore, a risk that species established in the Port of Tauranga could be spread to other New Zealand locations.

Perhaps of greatest concern is the dinoflagellate *Alexandrium tamarense,* which is listed on the Australian Ballast Water Management Advisory Council's schedule of non-indigenous pest species (Table 13) and strains of which produce potentially deadly marine biotoxins (see "Cyst-forming species", above). Whilst *A. tamarense* has been recorded in New Zealand previously (in Tasman Bay, see Hay et al. 2000), it was not recorded from any other port during the initial or second port baseline surveys. Between 2002 and 2005, there were 2,460 vessel departures from the Port of Tauranga for other New Zealand ports (Table 8), and there is therefore a risk that this species, and others, could be spread to other ports in New Zealand by shipping from Tauranga.

Several other species recorded during the baseline re-survey of the Port of Tauranga have relatively restricted distributions nationwide and could, therefore, be spread from Tauranga to other locations. These include the bryozoans *Electra tenella, Amathia distans* and *Zoobotryon verticillatum* and the hydroid *Sertularia marginata.* Furthermore, the presence of all these species except *Z. verticillatum* in the Port of Tauranga represents extensions of their known geographic ranges in New Zealand. This may have occurred through natural transport (eg. on ocean currents), or may have resulted from transport by shipping vectors. Their presence in the Port of Tauranga may provide a stepping stone for further translocation to other, currently uninfested, parts of New Zealand. Information on the ecology of these species is limited, but none is known to have potential for significant impacts.

Five non-indigenous species recorded from Tauranga during the initial baseline survey were not found during the re-survey. These were the polychaete worm *Polydora hoplura,* the amphipods *Monocorophium acherusicum* and *Apocorophium acutum*, and the hydroids *Clytia ?linearis* and *Eudendrium capillare* (Table 18). *Polydora hoplura, Monocorophium acherusicum* and *Apocorophium acutum* were each recorded during the initial port baseline surveys in just a single sample from Tauranga but were recorded from several other New Zealand ports in both the initial and second surveys. *Eudendrium capillare* was also recorded in only a single sample from Tauranga and in several samples from other New Zealand ports during the initial baseline survey but was not recorded from any Group 1 port in the re-survey. Similarly, *Clytia ?linearis* was not recorded from Tauranga or any other Group 1 port in the re-survey, and was recorded only from Tauranga in the intial port baseline survey (the first record of its presence in New Zealand). At this stage it is unclear whether the absence of these five species from samples taken during the re-survey of the Port of Tauranga is due to sampling error as a consequence of very small population densities in each port, or because the initial populations that were discovered were not viable. All these species have cosmopolitan or subcosmopolitan distributions, reducing the likelihood that local extinction has occurred or that the species will not re-establish themselves in Tauranga. However, both of the hydroids represented new records to New Zealand (J. Watson, Hydrozoan Research Laboratory, pers. comm.), and neither of the amphipods had been recorded previously from Tauranga (G. Fenwick, NIWA, pers. comm.), suggesting that populations of these species were not yet well established in Tauranga when they were encountered in the first survey. In contrast, *Polydora hoplura* is a very successful species and it is unlikely that this species is not present in Tauranga (G. Read, NIWA, pers. comm.).

The cryptogenic ascidian *Didemnum vexillum* is also a concern for domestic translocation from the Port of Tauranga. This species has the potential to be a significant fouling pest of aquaculture (particularly longline mussel culture and seafloor scallop enhancement). It may be spread as fouling on poorly maintained commercial or recreational vessels, on fouled ropes and buoys, or other submerged marine structures.

Management of existing non-indigenous species in the port

Four of the nine NIS detected in this survey appear to be well established in the port (*Bugula flabellata, B. neritina, W. subtorquata* and *Z. verticillatum*), whilst the remaining five are less prevalent. *Electra tenella, Amathia distans, Monotheca pulchella, Sertularia marginata* and *Cliona celata* were all recorded from only one sample each in the re-survey of the Port of Tauranga, suggesting that populations of these species are not very widespread in the port. Furthermore, several of these species appear to have limited distributions nationwide. During the port baseline surveys *E. tenella* and *Sertularia marginata* were each recorded from only one other port (Nelson, and Wellington, respectively), *A. distans* was not recorded in any other port, but is known from Auckland Harbour (Gordon and Matawari 1992).

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 Tauranga, but may be worth considering for species with very restricted distributions. It 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. Although none of the species present in the Port of Tauranga are currently on the New Zealand register of unwanted species, several species discussed above have exhibited invasive behaviour (e.g. rapid spread and high abundance), are restricted in their current New Zealand distribution, and may be capable of causing impacts to natural ecosystems and valued fisheries. Managing the risk of spreading these species to other ports will require better understanding of the frequency of movements by vessels of different types from the Port of Tauranga to other domestic and international locations and improved procedures for hull maintenance and domestic ballast transfer by vessels leaving this port, particularly for slow moving vessels that have been moored for some time within the port or harbour area.

Prevention of new introductions

Interception of unwanted species transported by shipping is best achieved offshore, through control and treatment of ships destined for Tauranga 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 . 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 being introduced to New Zealand waters by shipping, especially considering the limited management options for hull fouling introductions. There is a need for continued monitoring of marine NIS in port environments to allow for (1) early detection and control of harmful or potentially harmful non-indigenous species, (2) to provide on-going evaluation of the efficacy of management activities, and (3) to allow trading partners to be notified of species that may be potentially harmful. Baseline inventories, like this one, facilitate the second and third of these two purposes. They become outdated when new introductions occur and, therefore, should be repeated on a regular basis to ensure they remain current. Hewitt and Martin (2001) recommend an interval of three to five years between repeat surveys.

The repeat survey of the Port of Tauranga recorded 264 species or higher taxa, including 9 non-indigenous species. Although many species also occurred in the initial, March 2002 baseline survey of the port, the degree of overlap was not high. Around 39% of the native species, 55% of non-indigenous species, and 37% 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 for some groups and survey methods. In the initial baseline survey, for example, 5 of the 10 non-indigenous species (50%) were each found in just a single sample. Similarly, 5 of the 9 non-indigenous species that were detected in the second survey (55%) 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. Further, the absence of the polychaete worm, *Polydora hoplura*, the amphipods, *Monocorophium acherusicum* and *Apocorophium acutum*, and the hydroids, *Clytia ?linearis* and *Eudendrium capillare* in the second survey could be explained either by sampling error or local extinction since the initial baseline survey.

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. 2006; 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 new 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).

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Tables

Table 1: Berthage facilities in the Port of Tauranga

Berth	Berth No.	Purpose	Construction	Length of Berth (m)	Depth (m)
Mt Maunganui Wharves	1	General, containers	Concrete deck/wood piles + wood fenders	170	10.4
	2		Concrete deck/wood piles + wood fenders	170	10.4
	3		Concrete deck/wood piles + wood fenders	170	12.5
	4		Concrete deck/wood piles + wood fenders	170	9.5-12.5
	5		Concrete deck/wood piles + wood fenders	228	9.5
	6		Concrete deck/wood piles + wood fenders	150	10.4
	7	General, containers, bulk cargoes	Concrete deck/wood piles + wood fenders	160	10.4
	8		Concrete deck/wood piles + wood fenders	180	12.5
	9	Logs, bulk cargoes	Concrete deck/wood piles + wood fenders	180	11.6
	10		Concrete deck/wood piles + wood fenders	200	11.6
	11		Concrete deck/wood piles + wood fenders	223	12.5
	16 (Cement/ Tankers)	Petrochemicals, cement, woodchips	Concrete deck/wood piles + wood fenders	-	13
Sulphur Point	23	General, containers	Concrete deck/concrete piles + steel fenders with wood faces	200	14.5
	24		Concrete deck/concrete piles + steel fenders with wood faces	200	14.5
	25		Concrete deck/concrete piles + steel fenders with wood faces	200	14.5

Table 2: Weight and value of overseas cargo unloaded at the Port of Tauranga 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	1,837,933		2,588		12.0	10.6
2003	1,864,193	1.4	2,392	-7.6	11.6	9.7
2004	2,780,611	49.2	2,505	4.7	15.8	9.9
2005[P]	3,535,977	27.2	3,520	40.5	18.6	12.7
Change from 2002 to 2005	1,698,044	92.4	932	36.0		

[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 Tauranga 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^1) ($million)	% value change from previous year	Proportion by weight of all NZ Seaports	Proportion by value of all NZ Seaports
2002	7,194,175		7,504		29.3	26.7
2003	7,865,360	9.3	6,415	-14.5	31.2	25.2
2004	6,694,584	-14.9	6,691	4.3	29.8	26.1
2005[P]	6,257,042	-6.5	7,063	5.6	28.7	27.0
Change from 2002 to 2005	-937,133	-13.0	-441	-5.9		

[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 Tauranga 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 (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	104				84		6			1	27	580	1	803
Pacific Islands	4				111		8	2			2	139		266
West coast North America inc USA, Canada & Alaska	18				16						1	140		175
Japan	120	1			34						11	1		167
East Asian seas	81	1			9		1				14	34		140
Northwest Pacific	81			3	9						37	1		131
North African coast	34													34
Gulf of Mexico	8				4						8			20
Unknown (not stated in database)	1							1			1	10		13
South America Atlantic coast	10				1						1			12
U.S, Atlantic coast including part of Canada					8									8
Red Sea coast inc up to the Persian Gulf					4						2	1		7
North European Atlantic coast	5				1									6
Gulf States	1				3				1					5
Spain / Portugal including Atlantic Islands	5													5
South America Pacific coast	1				2							1		4
Central America including Mexico to Panama					1									1
South & East African coasts					1									1
Total	473	2	0	3	288	0	15	3	1	1	104	907	1	1798

Table 5: Number of vessel arrivals to the Port of Tauranga from Australia 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 carrier	Dredge	Fishing	General cargo	LPG/ LNG	Passeng er/ vehicle/ livestock	Other (inc pontoons, barges, mining & supply ships, etc)	Passenger ro/ro	Research	Tanker (inc chemical/ oil and ashphalt)	Containe r/ unitised carrier and ro/ro	Tug	Total
New South Wales	17				31						3	293	1	345
Queensland	18				28		6				9	190		251
Victoria	39				18					1	2	92		152
South Australia	22				4									26
Western Australia	6				1						13	5		25
Tasmania	2				2									4
Total	104	0	0	0	84	0	6	0	0	1	27	580	1	803

Table 6: Number of vessel departures from the Port of Tauranga 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 (pontoons, barges, mining/supply ships, etc)	Passenger ro/ro	Research	Tanker (chemical/ oil/ ashphalt)	Container /unitised carrier and ro/ro	Tug	Total
Australia	87			1	174		1		1		38	301	4	607
Northwest Pacific	287				102		1				4	22		416
Japan	95				131						1	34		261
Pacific Islands	1				63		3	1			1	114		183
East Asian seas	58	1			40		1				12	27		139
West coast North America inc USA, Canada & Alaska	20				64							51		135
Central America inc Mexico to Panama					4							128		132
North European Atlantic coast					81									81
European Mediterranean coast	1				34							1		36
U.S, Atlantic coast including part of Canada	1				20							3		24
South America Pacific coast	2			3						1				6
Gulf of Mexico					6									6
Caribbean Islands					2							1		3
Central Indian Ocean	2													2
South America Atlantic coast					1		1							2
Spain / Portugal including Atlantic Islands					2									2
North African coast					1									1
United Kingdom inc Eire					1									1
Gulf States	1													1

Geographical area of next port of call	Bulk/ cement carrier	Bulk/ oil carrier	Dredge	Fishing	General cargo	LPG/ LNG	Passenge r/ vehicle/ livestock	Other (pontoons, barges, mining/suppl y ships, etc)	Passenger ro/ro	Research	Tanker (chemical/ oil/ ashphalt)	Container /unitised carrier and ro/ro	Tug	Total
South & East African coasts	1													1
Scandinavia inc Baltic, Greenland, Iceland etc					1									1
Total	556	1	0	4	727	0	7	1	1	1	56	682	4	2040

Table 7: Number of vessel arrivals from New Zealand ports to the Port of Tauranga 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	Passenge r/ 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
Auckland	67			3	291		98	3			63	381		906
Napier	90				147		16				9	229		491
Whangarei	224				111						90	3		428
Nelson	69			1	89						6	76	5	246
Lyttelton	16				122		5				5	65		213
Timaru	11		1		18						24	83		137
Wellington	10				35		3			2	8	32	1	91
Gisborne	65				9									74
Bluff	13				24						3			40
New Plymouth	11				13						5	2		31
Dunedin	3				16		1				3			23
Tauranga				3	5		1	6			1			16
Picton	3						2							5
Westport	2													2
Mount Maunganui					1							1		2
Bay of Islands							2							2
Onehunga	1													1
Total	585	0	1	7	881	0	128	9	0	2	217	872	6	2708

Table 8: Number of vessel departures from the Port of Tauranga 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)	Passenger ro/ro	Research	Tanker (including chemical/ oil and ashphalt)	Container/ unitised carrier and ro/ro	Tug	Total
Napier	75	1			48		83			1	25	434	1	668
Auckland	28			2	151		23	3		1	29	268		505
Lyttelton	15				47		7				42	323		434
Whangarei	235				61						21	1		318
Wellington	25				58		17				83	14		197
Nelson	52				45						6	25	1	129
Timaru	17		1		3		1				40	13		75
Dunedin	3				7						3	18		31
New Plymouth	2				13						13			28
Bluff	20				3						1			24
Gisborne	17				1									18
Tauranga				3	5		1	6			1			16
Picton	8													8
Westport	3													3
Bay of Islands							2							2
Opua							2							2
Onehunga					1									1
Mount Maunganui											1			1
Total	500	1	1	5	443	0	136	9	0	2	265	1096	2	2460

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	
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

	CRIMP Protocol		NIWA Method		
Taxa sampled	**Survey method**	**Sample procedure**	**Survey method**	**Sample procedure**	**Notes**
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 Tauranga. 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		Qual. visual searches#		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**
Tauranga Port																				
Breakwall (south of Berth 11)	4				4		4													
Central Harbour												2								
Channel									6		1									
Cyst Site 1																				2
Cyst Site 2																				2
Cyst Site 3																				2
Cyst Site 4																				2
Pilot Bay				3								2								
site a																			2	
site b																			2	
site c																			2	
site d																			2	
Sorting Shed Wharf*	4																			
Sulphur Point		4		8		2		4				2								
Berth 1	4	4	4	4	4	2	4	4	4	3	2	2	14	15	14	15	4	4		
Berth 3	4	4	4		4	3	4	4	4	3	3	2	15	16	15	16	4	4		
Berth 7	4		4		4		4		2	3	3	2	14	13	14	13	4	4		
Berth 8		4		4		2		4												
Berth 11	4	4	4		4	3	4	4	4	3	3	2	16	16	16	16	4	4		
Berth 16	4	4	4	4	4	1	4	4	4	3	3	2	16	16	16	16	4	4		
Berth 24	4		4		4		4		4	3	3		16	16	16	16	4	4		
Berth 25		4		4		2		4				2								
Tauranga Marina																				
Marina 2				4																
Marina - Bridge				4																
Jetty B1-50																		1		
Jetty C1-25																		1		
Jetty H10-70																		1		
Yacht Club		4		4		1		4				2								
Total	32	32	24	39	28	16	28	32	28	18	18	20	91	92	91	92	24	27	8	8

Visual searches were conducted by divers on pile scrapings at Berths, 1, 3, 7, 11, 16 and 24; and by above-water observation at the Tauranga Marina jetties
* Small wharf alongside the building used to sort samples; located at the southern end of the Mt Maunganui wharves, just north of the Tauranga Bridge Marina

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 Tauranga 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*	0	1
Polychaeta	Eunicida	Eunicidae	*Eunice australis*	0	1
Polychaeta	Eunicida	Eunicidae	*Lysidice ninetta*	0	1
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris sphaerocephala*	1	1
Polychaeta	Phyllodocida	Goniadidae	*Glycinde trifida*	0	1
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus macroura*	0	1
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus verrilli*	1	0
Polychaeta	Phyllodocida	Nereididae	*Neanthes cricognatha*	0	1
Polychaeta	Phyllodocida	Nereididae	*Neanthes kerguelensis*	1	1
Polychaeta	Phyllodocida	Nereididae	*Nereis falcaria*	1	1
Polychaeta	Phyllodocida	Nereididae	*Perinereis amblyodonta*	0	1
Polychaeta	Phyllodocida	Nereididae	*Perinereis camiguinoides*	1	1
Polychaeta	Phyllodocida	Nereididae	*Perinereis pseudocamiguina*	1	0
Polychaeta	Phyllodocida	Nereididae	*Platynereis Platynereis_australis_group*	1	1
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia capensis*	1	1
Polychaeta	Phyllodocida	Phyllodocidae	*Nereiphylla cf. castanea*	1	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidastheniella comma*	1	1
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus jacksoni*	1	1
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus polychromus*	1	1
Polychaeta	Phyllodocida	Polynoidae	*Ophiodromus angustifrons*	1	0
Polychaeta	Phyllodocida	Sigalionidae	*Sigalion oviger*	1	0
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis gigantea*	1	1
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis zebra*	1	1
Polychaeta	Phyllodocida	Syllidae	*Typosyllis prolifera*	1	0
Polychaeta	Sabellida	Sabellidae	*Demonax aberrans*	1	0
Polychaeta	Sabellida	Sabellidae	*Megalomma suspiciens*	1	1
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla laciniosa*	0	1
Polychaeta	Sabellida	Serpulidae	*Galeolaria hystrix*	1	1
Polychaeta	Scolecida	Maldanidae	*Macroclymenella stewartensis*	0	1
Polychaeta	Scolecida	Opheliidae	*Armandia maculata*	1	0
Polychaeta	Scolecida	Scalibregmatidae	*Hyboscolex longiseta*	1	0
Polychaeta	Spionida	Spionidae	*Boccardia otakouica*	1	0
Polychaeta	Spionida	Spionidae	*Dipolydora dorsomaculata*	1	0
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris nuchalis*	1	0
Polychaeta	Terebellida	Cirratulidae	*Timarete anchylochaetus*	1	1
Polychaeta	Terebellida	Flabelligeridae	*Flabelligera affinis*	1	1
Polychaeta	Terebellida	Flabelligeridae	*Pherusa parmata*	1	1
Polychaeta	Terebellida	Pectinariidae	*Pectinaria australis*	1	1
Polychaeta	Terebellida	Terebellidae	*Nicolea armilla*	1	1
Polychaeta	Terebellida	Terebellidae	*Pista pegma*	1	0
Polychaeta	Terebellida	Terebellidae	*Pseudopista rostrata*	1	1
Polychaeta	Terebellida	Terebellidae	*Streblosoma toddae*	1	1
Polychaeta	Terebellida	Terebellidae	*Terebella plagiostoma*	1	0
Bryozoa					
Gymnolaemata	Cheilostomata	Beaniidae	*Beania discodermiae*	1	1

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
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	Bitectiporidae	*Schizosmittina cinctipora*	0	1
Gymnolaemata	Cheilostomata	Bugulidae	*Bicellariella ciliata*	1	0
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperia granulosa*	1	0
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperiopsis rubida*	0	1
Gymnolaemata	Cheilostomata	Lacernidae	*Rogicka biserialis*	0	1
Cnidaria					
Hydrozoa	Hydroida	Plumulariidae	*Plumularia setaceoides*	1	0
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia bispinosa*	1	0
Hydrozoa	Hydroida	Sertulariidae	*Sertularella robusta*	1	0
Hydrozoa	Hydroida	Sertulariidae	*Stereotheca elongata*	1	0
Hydrozoa	Hydroida	Solanderiidae	*Solanderia ericopsis*	1	1
Hydrozoa	Hydroida	Syntheciidae	*Synthecium elegans*	1	0
Crustacea					
Cirripedia	Thoracica	Balanidae	*Austrominius modestus*	1	1
Cirripedia	Thoracica	Balanidae	*Notobalanus vestitus*	1	0
Cirripedia	Thoracica	Balanidae	*Notomegabalanus decorus*	1	0
Cirripedia	Thoracica	Chthamalidae	*Chaemosipho columna*	1	0
Cirripedia	Thoracica	Pachylasmidae	*Epopella plicata*	1	0
Malacostraca	Amphipoda	Aoridae	*Haplocheira barbimana*	1	1
Malacostraca	Amphipoda	Caprellidae	*Caprella equilibra*	1	0
Malacostraca	Amphipoda	Colomastigidae	*Colomastix magnirama*	1	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis thomsoni*	1	0
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe trailli*	1	0
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia akaroica*	1	1
Malacostraca	Amphipoda	Lysianassidae	*Orchomene aahu*	1	1
Malacostraca	Amphipoda	Melitidae	*Melita festiva*	1	1
Malacostraca	Amphipoda	Podoceridae	*Podocerus cristatus*	0	1
Malacostraca	Amphipoda	Podoceridae	*Podocerus karu*	1	0
Malacostraca	Amphipoda	Stenothoidae	*Stenothoe moe*	1	0
Malacostraca	Anomura	Diogenidae	*Paguristes pilosus*	0	1
Malacostraca	Anomura	Diogenidae	*Paguristes setosus*	1	0
Malacostraca	Anomura	Paguridae	*Diacanthurus spinulimanus*	1	0
Malacostraca	Anomura	Paguridae	*Lophopagurus (Australeremus) kirkii*	0	1
Malacostraca	Anomura	Paguridae	*Lophopagurus (L.) lacertosus*	1	1
Malacostraca	Anomura	Paguridae	*Lophopagurus (Lophopagurus) pumilus*	0	1
Malacostraca	Anomura	Paguridae	*Pagurixus hectori*	0	1
Malacostraca	Anomura	Paguridae	*Pagurus novizealandiae*	1	1
Malacostraca	Anomura	Paguridae	*Pagurus traversi*	1	1
Malacostraca	Anomura	Porcellanidae	*Petrolisthes elongatus*	1	1
Malacostraca	Anomura	Porcellanidae	*Petrolisthes novaezelandiae*	1	1
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus cookii*	1	1
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus innominatus*	1	1
Malacostraca	Brachyura	Hymenosomatidae	*Halicarcinus varius*	1	1
Malacostraca	Brachyura	Majidae	*Eurynolambrus australis*	0	1
Malacostraca	Brachyura	Majidae	*Leptomithrax longimanus*	0	1

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Malacostraca	Brachyura	Majidae	*Notomithrax minor*	1	1
Malacostraca	Brachyura	Majidae	*Notomithrax peronii*	1	0
Malacostraca	Brachyura	Majidae	*Notomithrax ursus*	1	1
Malacostraca	Brachyura	Majidae	*Thacanophrys filholi*	1	0
Malacostraca	Brachyura	Ocypodidae	*Macrophthalmus hirtipes*	1	1
Malacostraca	Brachyura	Portunidae	*Liocarcinus corrugatus*	1	0
Malacostraca	Brachyura	Portunidae	*Nectocarcinus antarcticus*	0	1
Malacostraca	Brachyura	Portunidae	*Ovalipes catharus*	0	1
Malacostraca	Brachyura	Xanthidae	*Pilumnus lumpinus*	0	1
Malacostraca	Brachyura	Xanthidae	*Pilumnus novaezealandiae*	1	1
Malacostraca	Caridea	Alpheidae	*Alpheus novaezealandiae*	1	1
Malacostraca	Caridea	Alpheidae	*Alpheus socialis*	1	0
Malacostraca	Caridea	Crangonidae	*Pontophilus australis*	0	1
Malacostraca	Caridea	Crangonidae	*Pontophilus chiltoni*	1	1
Malacostraca	Caridea	Crangonidae	*Pontophilus hamiltoni*	0	1
Malacostraca	Caridea	Palemonidae	*Palaemon affinis*	1	1
Malacostraca	Caridea	Palemonidae	*Periclimenes yaldwyni*	1	1
Malacostraca	Isopoda	Cirolanidae	*Natatolana narica*	0	1
Malacostraca	Isopoda	Pseudojaniridae	*Schottea cf. taupoensis*	1	0
Malacostraca	Isopoda	Pseudojaniridae	*Schottea sp.*	1	0
Malacostraca	Isopoda	Sphaeromatidae	*Exosphaeroma montis*	1	0
Malacostraca	Isopoda	Sphaeromatidae	*Isocladus dulciculus*	0	1
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma campbellensis*	1	0
Echinodermata					
Asteroidea	Forcipulata	Asteriidae	*Allostichaster polyplax*	1	1
Asteroidea	Forcipulata	Asteriidae	*Coscinasterias muricata*	1	1
Asteroidea	Valvatida	Asterinidae	*Meridiastra mortenseni*	0	1
Asteroidea	Valvatida	Asterinidae	*Patiriella regularis*	1	1
Echinoidea	Clypeasteroidea	Arachnoididae	*Fellaster zelandiae*	0	1
Echinoidea	Spatangoida	Loveniidae	*Echinocardium cordatum*	1	1
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus mollis*	1	0
Ophiuroidea	Ophiurida	Amphiuridae	*Ophiocentrus novaezealandiae*	1	0
Ophiuroidea	Ophiurida	Ophiactidae	*Ophiactis resiliens*	1	0
Ophiuroidea	Ophiurida	Ophiocomidae	*Ophiopteris antipodum*	0	1
Ophiuroidea	Ophiurida	Ophionereididae	*Ophionereis fasciata*	0	1
Mollusca					
Bivalvia	Myoida	Corbulidae	*Corbula zelandica*	1	0
Bivalvia	Myoida	Hiatellidae	*Hiatella arctica*	1	1
Bivalvia	Mytiloida	Mytilidae	*Modiolarca impacta*	1	1
Bivalvia	Mytiloida	Mytilidae	*Perna canaliculus*	1	1
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus pulex*	1	0
Bivalvia	Nuculoida	Nuculidae	*Nucula hartvigiana*	1	1
Bivalvia	Nuculoida	Nuculidae	*Nucula nitidula*	1	1
Bivalvia	Ostreoida	Ostreidae	*Ostrea chilensis*	1	1
Bivalvia	Pholadomyoida	Myochamidae	*Myadora striata*	0	1
Bivalvia	Pterioida	Anomiidae	*Pododesmus zelandicus*	1	1
Bivalvia	Pterioida	Pectinidae	*Talochlamys zelandiae*	1	1
Bivalvia	Solemyoida	Solemyidae	*Solemya parkinsonii*	1	0

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Bivalvia	Veneroida	Kelliidae	*Kellia cycladiformis*	1	1
Bivalvia	Veneroida	Lasaeidae	*Lasaea hinemoa*	1	0
Bivalvia	Veneroida	Laseidae	*Myllitella vivens*	0	1
Bivalvia	Veneroida	Mactridae	*Scalpomactra scalpellum*	1	1
Bivalvia	Veneroida	Mesodesmatidae	*Paphies australis*	0	1
Bivalvia	Veneroida	Psammobiidae	*Gari stangeri*	1	0
Bivalvia	Veneroida	Semelidae	*Leptomya retiaria*	1	1
Bivalvia	Veneroida	Veneridae	*Irus reflexus*	1	1
Bivalvia	Veneroida	Veneridae	*Ruditapes largillierti*	0	1
Bivalvia	Veneroida	Veneridae	*Tawera spissa*	1	1
Cephalopoda	Octopoda	Octopodidae	*Octopus maorum*	1	1
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria australis*	1	0
Gastropoda	Caenogastropoda	Turritellidae	*Maoricolpus roseus*	1	0
Gastropoda	Cephalaspidea	Aglajidae	*Philinopsis taronga*	0	1
Gastropoda	Littorinimorpha	Calyptraeidae	*Maoricrypta costata*	1	1
Gastropoda	Littorinimorpha	Calyptraeidae	*Maoricrypta sodalis*	1	0
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella novaezelandiae*	1	1
Gastropoda	Littorinimorpha	Calyptraeidae	*Sigapatella tenuis*	1	1
Gastropoda	Littorinimorpha	Littorinidae	*Risellopsis varia*	1	0
Gastropoda	Littorinimorpha	Ranellidae	*Cabestana spengleri*	1	1
Gastropoda	Littorinimorpha	Ranellidae	*Ranella australasia*	1	0
Gastropoda	Neogastropoda	Buccinidae	*Buccinulum linea*	1	1
Gastropoda	Neogastropoda	Buccinidae	*Buccinulum vittatum*	0	1
Gastropoda	Neogastropoda	Buccinidae	*Cominella adspersa*	1	1
Gastropoda	Neogastropoda	Buccinidae	*Cominella maculosa*	1	0
Gastropoda	Neogastropoda	Buccinidae	*Cominella virgata*	1	0
Gastropoda	Neogastropoda	Muricidae	*Dicithais orbita*	1	1
Gastropoda	Neogastropoda	Muricidae	*Xymene ambiguus*	0	1
Gastropoda	Neogastropoda	Muricidae	*Xymene huttoni*	1	1
Gastropoda	Neogastropoda	Muricidae	*Xymene pusillus*	1	0
Gastropoda	Neogastropoda	Muricidae	*Xymene traversi*	1	0
Gastropoda	Neogastropoda	Olividae	*Amalda australis*	0	1
Gastropoda	Neotaenioglossa	Velutinidae	*Lamellaria ophione*	0	1
Gastropoda	Notaspidea	Pleurobranchidae	*Berthella medietas*	0	1
Gastropoda	Notaspidea	Pleurobranchidae	*Berthella ornata*	0	1
Gastropoda	Notaspidea	Pleurobranchidae	*Pleurobranchaea maculata*	1	1
Gastropoda	Nudibranchia	Aeolidiidae	*Anteaeolidiella indica*	0	1
Gastropoda	Nudibranchia	Chromodorididae	*Cadlina willani*	1	0
Gastropoda	Nudibranchia	Chromodorididae	*Chromodoris aureomarginata*	1	0
Gastropoda	Nudibranchia	Dendrodorididae	*Dendrodoris citrina*	1	1
Gastropoda	Nudibranchia	Discodorididae	*Hoplodoris nodulosa*	0	1
Gastropoda	Nudibranchia	Dorididae	*Alloiodoris lanuginata*	0	1
Gastropoda	Nudibranchia	Dorididae	*Aphelodoris luctuosa*	0	1
Gastropoda	Nudibranchia	Dorididae	*Rostanga muscula*	1	0
Gastropoda	Patellogastropoda	Lottiidae	*Notoacmea helmsi*	0	1
Gastropoda	Patellogastropoda	Lottiidae	*Patelloida corticata*	1	0
Gastropoda	Vetigastropoda	Fissurellidae	*Scutus breviculus*	1	0
Gastropoda	Vetigastropoda	Fissurellidae	*Tugali suteri*	1	1
Gastropoda	Vetigastropoda	Trochidae	*Micrelenchus rufozonus*	1	0
Gastropoda	Vetigastropoda	Trochidae	*Trochus tiaratus*	1	1

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona violacea*	1	1
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona zelandica*	0	1
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus porosus*	1	1
Polyplacophora	Ischnochitonina	Chitonidae	*Rhyssoplax canaliculata*	0	1
Macroalgae					
Florideophyceae	Ceramiales	Ceramiaceae	*Ceramium rubrum*	0	1
Florideophyceae	Ceramiales	Ceramiaceae	*Spyridia filamentosa*	0	1
Florideophyceae	Ceramiales	Dasyaceae	*Dasya subtilis*	0	1
Florideophyceae	Ceramiales	Delesseriaceae	*Hymenena variolosa*	1	1
Florideophyceae	Ceramiales	Delesseriaceae	*Myriogramme denticulata*	0	1
Florideophyceae	Ceramiales	Rhodomelaceae	*Cladhymenia lyalli*	1	1
Florideophyceae	Ceramiales	Rhodomelaceae	*Cladhymenia oblongifolia*	0	1
Florideophyceae	Gigartinales	Caulacanthaceae	*Catenella nipae*	1	0
Florideophyceae	Gigartinales	Gigartinaceae	*Chondracanthus chapmanii*	0	1
Florideophyceae	Gigartinales	Gigartinaceae	*Gigartina atropurpurea*	1	1
Florideophyceae	Gigartinales	Phyllophoraceae	*Stenogramme interrupta*	1	1
Florideophyceae	Gigartinales	Sarcodiaceae	*Trematocarpus aciculare*	1	0
Florideophyceae	Gracilariales	Gracilariaceae	*Gracilaria truncata*	1	0
Florideophyceae	Halymeniales	Halymeniaceae	*Cryptonemia latissima*	1	0
Florideophyceae	Halymeniales	Halymeniaceae	*Grateloupia urvilleana*	0	1
Florideophyceae	Plocamiales	Plocamiaceae	*Plocamium angustum*	1	1
Florideophyceae	Plocamiales	Plocamiaceae	*Plocamium cirrhosum*	0	1
Florideophyceae	Rhodymeniales	Champiaceae	*Champia novae-zelandiae*	0	1
Phaeophyceae	Dictyotales	Dictyotaceae	*Dictyota dichotoma var. intricata*	1	0
Phaeophyceae	Fucales	Hormosiraceae	*Hormosira banksii*	1	1
Phaeophyceae	Laminariales	Alariaceae	*Ecklonia radiata*	0	1
Ulvophyceae	Bryopsidales	Codiaceae	*Codium fragile*	1	0
Ulvophyceae	Bryopsidales	Codiaceae	*Codium fragile subsp. novae-zelandiae*	1	0
Porifera					
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia cf. arenaria*	0	1
Demospongiae	Hadromerida	Tethyidae	*Tethya burtoni*	1	0
Demospongiae	Haplosclerida	Chalinidae	*Adocia cf. parietalioides*	1	1
Demospongiae	Haplosclerida	Chalinidae	*Adocia cf. venustina*	1	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona cf. isodictyale*	0	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona cf. tenacior*	1	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona glabra*	1	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona maxima*	1	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona stelliderma*	1	1
Demospongiae	Poecilosclerida	Crellidae	*Crella (Pytheas) affinis*	0	1
Demospongiae	Poecilosclerida	Desmacellidae	*Desmacella ambigua*	1	0
Demospongiae	Poecilosclerida	Hymedesmiidae	*Hymedesmia anisostrongyloxea*	0	1
Demospongiae	Poecilosclerida	Hymedesmiidae	*Hymedesmia (Stylopus) (lissostyla*	0	1
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas cf. anchorata*	1	1
Demospongiae	Poecilosclerida	Microcionidae	*Clathria cf. lissosclera*	1	1
Demospongiae	Poecilosclerida	Microcionidae	*Clathria cf. terraenovae*	1	1
Demospongiae	Poecilosclerida	Microcionidae	*Clathria (Microciona) coccinea*	1	1
Demospongiae	Poecilosclerida	Microcionidae	*Plocamia novizelanicum*	1	0
Demospongiae	Poecilosclerida	Tedaniidae	*Tedania battershilli*	1	1

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Demospongiae	Poecilosclerida	Tedaniidae	*Tedania spinostylota*	1	1
Dinophyta					
Dinophyceae	Peridinales	Peridiniaceae	*Lingulodinium polyedrum*	1	1
Dinophyceae	Peridinales	Peridiniaceae	*Protoperidinium conicum*	1	0
Dinophyceae	Peridinales	Peridiniaceae	*Protoperidinium conicum cf. conicoides*	1	0
Dinophyceae	Peridinales	Peridiniaceae	*Scrippsiella trochoidea*	1	1
Urochordata					
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium adamsi*	1	1
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula amokurae*	1	0
Ascidiacea	Stolidobranchia	Molgulidae	*Molgula mortenseni*	1	1
Ascidiacea	Stolidobranchia	Polyzoinae	*Polyzoa reticulata*	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura cancellata*	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura carnea*	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura pachydermatina*	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura picta*	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura pulla*	1	0
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura rugata*	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura subuculata*	1	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura suteri*	0	1
Ascidiacea	Stolidobranchia	Pyuridae	*Pyura trita*	1	0
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa coerulea*	1	0
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa bicornuta*	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa nisiotus*	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Cnemidocarpa regalis*	1	0
Vertebrata					
Actinopterygii	Anguilliformes	Congridae	*Conger wilsoni*	1	0
Actinopterygii	Gadiformes	Moridae	*Lotella rhacinum*	0	1
Actinopterygii	Gadiformes	Moridae	*Pseudophycis breviuscula*	1	0
Actinopterygii	Gasterosteiformes	Syngnathidae	*Hippocampus abdominalis*	0	1
Actinopterygii	Gasterosteiformes	Syngnathidae	*Leptonotus elevatus*	1	0
Actinopterygii	Gasterosteiformes	Syngnathidae	*Lissocampus filum*	1	0
Actinopterygii	Perciformes	Arripidae	*Arripis trutta*	0	1
Actinopterygii	Perciformes	Blenniidae	*Parablennius laticlavius*	1	0
Actinopterygii	Perciformes	Carangidae	*Trachurus novaezelandiae*	1	0
Actinopterygii	Perciformes	Labridae	*Notolabrus celidotus*	1	1
Actinopterygii	Perciformes	Mullidae	*Upeneichthys lineatus*	1	1
Actinopterygii	Perciformes	Scorpidinae	*Helicolenus percoides*	1	0
Actinopterygii	Perciformes	Scorpidinae	*Scorpis lineolata*	1	0
Actinopterygii	Perciformes	Sparidae	*Pagrus auratus*	1	1
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina capito*	1	0
Actinopterygii	Perciformes	Trypterigiidae	*Grahamina gymnota*	1	0
Actinopterygii	Pleuronectiformes	Bothidae	*Lophonectes gallus*	0	1

* 1 = Present, 0 = Absent

Table 15: Cryptogenic marine species recorded from the Port of Tauranga 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	Eunicida	Dorvilleidae	*Dorvillea Dorvillea-A*	C2	1	0
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia Eulalia-NIWA-2*	C2	1	1
Polychaeta	Phyllodocida	Phyllodocidae	*Mystides Mystides-B*	C2	0	1
Polychaeta	Phyllodocida	Phyllodocidae	*Pirakia Pirakia-A*	C2	1	1
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotin Lepidonotin-A*	C2	1	1
Polychaeta	Phyllodocida	Syllidae	*Eusyllin-unknown Eusyllin-unknown-A*	C2	1	1
Polychaeta	Phyllodocida	Syllidae	*Eusyllis Eusyllis-C*	C2	1	0
Polychaeta	Phyllodocida	Syllidae	*Typosyllis Typosyllis-A*	C2	1	0
Polychaeta	Spionida	Chaetopteridae	*Chaetopterus Chaetopterus-A*	C1	1	1
Polychaeta	Spionida	Chaetopteridae	*Phyllochaetopterus Phyllochaetopterus-A*	C2	1	0
Polychaeta	Terebellida	Ampharetidae	*Amphicteis Amphicteis-A*	C2	1	0
Polychaeta	Terebellida	Terebellidae	*Lanice Lanice-01 [conchilega / aoteoroae]*	C2	1	0
Polychaeta	Terebellida	Terebellidae	*Pseudopista Pseudopista-01 [Glasby unpub as marangai]*	C2	1	0
Bryozoa						
Gymnolaemata	Cheilostomata	Scrupariidae	*Scruparia ambigua*	C1	1	1
Cnidaria						
Anthozoa	Corallimorpharia	Corallimorphidae	*Corynactis australis*	C1	1	0
Hydrozoa	Hydroida	Bougainvilliidae	*Bougainvillia muscus*	C1	1	0
Hydrozoa	Hydroida	Campanulariidae	*Clytia hemisphaerica*	C1	1	0
Hydrozoa	Hydroida	Campanulariidae	*Obelia dichotoma*	C1	1	0
Hydrozoa	Hydroida	Haleciidae	*Halecium delicatulum*	C1	1	0
Hydrozoa	Hydroida	Plumulariidae	*Plumularia setacea*	C1	1	1
Crustacea						
Cirripedia	Thoracica	Balanidae	*Balanus trigonus*	C1	1	1
Malacostraca	Amphipoda	Corophiidae	*Meridiolembos sp. aff. acherontis*	C2	1	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis sp. 2*	C2	1	0
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis sp. 3*	C2	1	0
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa sp. 2*	C2	1	0
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe sp. 1*	C2	0	1
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia sp.*	C2	1	0
Malacostraca	Amphipoda	Lysianassidae	*Stomacontion sp. aff. S. pungpunga*	C2	0	1
Malacostraca	Brachyura	Dromiidae	*Dromia wilsoni*	C1	1	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*
Porifera						
Demospongiae	Dendroceratida	Darwinellidae	*Chelonaplysilla cf. violacea*	C1	0	1
Demospongiae	Dendroceratida	Darwinellidae	*Darwinella cf. gardineri*	C1	0	1
Demospongiae	Dictyoceratida	Dysideidae	*Dysidea new sp. 1*	C2	1	1
Demospongiae	Dictyoceratida	Dysideidae	*Dysidea new sp. 2*	C2	1	0
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia new sp. 2*	C2	0	1
Demospongiae	Dictyoceratida	Dysideidae	*Euryspongia new sp. 3*	C2	1	1
Demospongiae	Hadromerida	Suberitidae	*new g. new sp. 1*	C2	0	1
Demospongiae	Halichondrida	Halichondriidae	*Halichondria new sp. 1*	C2	1	1
Demospongiae	Halichondrida	Halichondriidae	*Halichondria new sp. 3*	C2	0	1
Demospongiae	Halichondrida	Halichondriidae	*Halichondria panicea*	C1	1	1
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia ramosa*	C1	1	1
Demospongiae	Haplosclerida	Callyspongiidae	*Chalinopsilla new sp. 1*	C2	0	1
Demospongiae	Haplosclerida	Chalinidae	*Adocia new sp. 2*	C2	1	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona new sp. 3*	C2	0	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona new sp. 4*	C2	0	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona new sp. 5*	C2	0	1
Demospongiae	Haplosclerida	Chalinidae	*Haliclona new sp. 6*	C2	0	1
Demospongiae	Poecilosclerida	Coelosphaeridae	*Lissodendoryx isodictyalis*	C1	1	0
Demospongiae	Poecilosclerida	Esperiopsidae	*Esperiopsis new sp. 1*	C2	1	1
Demospongiae	Poecilosclerida	Hymedesmiidae	*Phorbas new sp. 1*	C2	1	1
Demospongiae	Poecilosclerida	Microcionidae	*Clathria new sp. 1*	C2	1	1
Demospongiae	Poecilosclerida	Microcionidae	*Clathria new sp. 2*	C2	1	0
Demospongiae	Poecilosclerida	Microcionidae	*Clathria new sp. 3*	C2	1	0
Demospongiae	Poecilosclerida	Microcionidae	*Ophlitospongia new sp. 1*	C2	1	1
Demospongiae	Poecilosclerida	Mycalidae	*Paraesperella new sp. 1 (macrosigma)*	C2	0	1
Dinophyta						
Dinophyceae	Gonyaulacales	Goniodomataceae	*Alexandrium tamarense*	C1	0	1
Urochordata						
Ascidiacea	Aplousobranchia	Didemnidae	*Didemnum* species group (includes *D.vexillum, D. incanum,* and other *Didemnum* species)	C1	1	1#
Ascidiacea	Aplousobranchia	Didemnidae	*Diplosoma listerianum*	C1	1	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	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Asterocarpa cerea*	C1	1	1
Ascidiacea	Stolidobranchia	Styelidae	*Styela plicata*	C1	1	0
Vertebrata						
Actinopterygii	Perciformes	Gobiesocidae	*Trachelochismus new sp.*	C2	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 Tauranga 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	Spionida	Spionidae	*Polydora hoplura*	1	0	H	Unknown[1]
Bryozoa							
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula flabellata*	1	1	H	Pre-1949
Gymnolaemata	Cheilostomata	Bugulidae	*Bugula neritina*	1	1	H	1949
Gymnolaemata	Cheilostomata	Electridae	*Electra tenella*	0	1	Drift plastic	1977
Gymnolaemata	Cheilostomata	Watersiporidae	*Watersipora subtorquata*	1	1	H or B	Pre-1982
Gymnolaemata	Ctenostomata	Vesiculariidae	*Amathia distans*	0	1	H or B	Pre-1960
Gymnolaemata	Ctenostomata	Vesiculariidae	*Zoobotryon verticillatum*	0	1	H or B	1960
Cnidaria							
Hydrozoa	Hydroida	Campanulariidae	*Clytia ?linearis* **(NR)***	1	0	H	Mar 2002[d]

Major taxonomic groups, Class	Order	Family	Genus and species	T1	T2	Probable means of introduction	Date of introduction or detection (d)
Hydrozoa	Hydroida	Eudendriidae	*Eudendrium capillare* ***(NR)***	1	0	H	Nov 2001[d]
Hydrozoa	Hydroida	Plumulariidae	*Monotheca pulchella*	0	1	H	1928
Hydrozoa	Hydroida	Sertulariidae	*Sertularia marginata*	0	1	H	1930
Crustacea							
Malacostraca	Amphipoda	Corophiidae	*Apocorophium acutum*	1	0	H	Pre-1921
Malacostraca	Amphipoda	Corophiidae	*Monocorophium acherusicum*	1	0	H	Pre-1921
Macroalgae							
Ulvophyceae	Bryopsidales	Codiaceae	*Codium fragile* subsp. *tomentosoides?**	1	0	H	1973
Porifera							
Demospongiae	Hadromerida	Clionaidae	*Cliona celata*	1	1	H or B	Unknown[1]

[1] Date of introduction currently unknown but species had been encountered in New Zealand prior to the present survey.
* Identification is uncertain for this species

Table 17: Species indeterminata recorded from the Port of Tauranga 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	Phyllodocidae	*Phyllodocidae Indet*	1	0
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotinae Indet*	1	0
Polychaeta	Phyllodocida	Polynoidae	*Polynoidae indet*	1	0
Polychaeta	Phyllodocida	Syllidae	*Syllidae Indet*	1	0
Polychaeta	Sabellida	Sabellidae	*Sabellidae Indet*	1	0
Polychaeta	Sabellida	Serpulidae	*Serpulidae Indet*	1	0
Polychaeta	Spionida	Chaetopteridae	*Chaetopteridae Indet*	1	1
Polychaeta	Terebellida	Cirratulidae	*Cirratulidae Indet*	1	0
Polychaeta	Terebellida	Terebellidae	*Terebellidae Indet*	1	0
Bryozoa					
			Unidentified Bryozoa	0	1
Cnidaria					
Anthozoa	Actiniaria		*Acontiaria sp.*	1	0
Anthozoa	Actiniaria		*Actiniaria sp.*	1	0
Anthozoa	Corallimorpharia	Corallimorphidae	*Corynactis sp.*	1	0
Anthozoa	Zoanthidea	Zoanthidae	*Zoanthidea sp.*	1	0
Hydrozoa	Hydroida	Corynidae	*Sarsia sp.*	1	0
Hydrozoa	Hydroida	Haleciidae	*Halecium ?corrrugatissimum*	1	0
Crustacea					
Malacostraca	Amphipoda	Corophiidae	*Meridiolembos sp.*	1	0
Malacostraca	Amphipoda	Ischyroceridae	*?Ventojassa sp.*	1	0
Malacostraca	Amphipoda	Ischyroceridae	*Ericthonius sp. indet.*	0	1
Malacostraca	Amphipoda	Leucothoidae	*Paraleucothoe sp. A*	0	1
Malacostraca	Anomura	Paguridae	*Pagurixus ?hectori*	0	1
Malacostraca	Anomura	Paguridae	*Pagurus sp.*	0	1
Malacostraca	Brachyura	Majidae	*Notomithrax sp.*	1	0
Malacostraca	Isopoda	Anthuridae	*Mesanthura sp.*	1	0
Malacostraca	Isopoda	Janiridae	*Iathrippa sp.*	1	0
Malacostraca	Isopoda	Sphaeromatidae	*Pseudosphaeroma sp.*	1	0
Malacostraca	Tanaidacea	Nototanaidae	*Teleotanais sp.*	1	0
Malacostraca	Tanaidacea	Tanaidae	*Zeuxoides sp.*	1	0
Echinodermata					
Asteroidea			*Unidentified Asteroidea*	1	0
Asteroidea	Valvatida	Asterinidae	*Patiriella ?oliveri*	1	0
Asteroidea	Valvatida	Asterinidae	*Patiriella sp.*	1	0
Magnoliophyta					
Liliopsida	Najadales	Zosteraceae	*Zostera sp.*	1	1
Mollusca					

Major taxonomic groups, Class	Order	Family	Genus and species	T1*	T2*
Bivalvia	Nuculoida	Nuculidae	*Linucula sp.*	1	0
Gastropoda			*Opisthobranchia sp. indet*	0	1
Gastropoda	Neogastropoda	Buccinidae	*Cominella sp.*	0	1
Gastropoda	Neogastropoda	Turridae	*Neoguraleus sp.*	0	1
Macroalgae					
			Unidentified Phycophyta	1	1
Florideophyceae			*Unidentified Rhodophyceae*	1	1
Florideophyceae	Ceramiales	Ceramiaceae	*Ceramium sp.*	1	1
Florideophyceae	Ceramiales	Ceramiaceae	*Griffithsia sp.*	1	1
Florideophyceae	Ceramiales	Delesseriaceae	*Unidentified Delesseriaceae*	0	1
Florideophyceae	Ceramiales	Delesseriaceae	*Hymenena sp.*	0	1
Florideophyceae	Ceramiales	Rhodomelaceae	*Chondria?*	0	1
Florideophyceae	Ceramiales	Rhodomelaceae	*Cladhymenia sp.*	0	1
Florideophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia sp.*	1	1
Florideophyceae	Corallinales	Corallinaceae	*Unidentified Corallinaceae*	0	1
Florideophyceae	Gigartinales	Cystocloniaceae	*Rhodophyllis sp.*	0	1
Florideophyceae	Gigartinales	Hypnaceae	*Hypnea sp.*	1	0
Florideophyceae	Gigartinales	Kallymeniaceae	*Callophyllis sp.*	0	1
Florideophyceae	Plocamiales	Plocamiaceae	*Plocamium sp.*	0	1
Florideophyceae	Rhodymeniales	Lomentariaceae	*Lomentaria sp.*	1	0
Florideophyceae	Rhodymeniales	Rhodomeniaceae	*Rhodymenia sp.*	1	1
Phaeophyceae	Ectocarpales	Scytosiphonaceae	*Colpomenia sp.*	0	1
Ulvophyceae	Ulvales	Ulvaceae	*Enteromorpha sp.*	1	1
Ulvophyceae	Ulvales	Ulvaceae	*Ulva sp.*	1	1
Platyhelminthes					
Turbellaria	Polycladida		*Unidentified Polycladida*	1	0
Turbellaria	Polycladida	Stylochidae	*Enterogonia sp.*	1	0
Porifera					
			Unidentified Porifera	0	1
Dinophyta					
Dinophyceae	Peridinales	Peridiniaceae	*Protoperidinium sp.*	1	1
Urochordata					
Ascidiacea	Aplousobranchia	Polyclinidae	*Aplidium sp.*	0	1
Ascidiacea	Aplousobranchia	Polyclinidae	*Synoicum sp.*	0	1
Ascidiacea	Stolidobranchia	Polyzoinae	*Polyzoa sp.*	0	1
Ascidiacea	Stolidobranchia	Styelidae	*Alloeocarpa sp.*	0	1
Vertebrata					
Actinopterygii	Gadiformes	Moridae	*Pseudophycis sp.*	0	1
Actinopterygii	Perciformes	Carangidae	*Trachurus sp.*	0	1

* 1 = Present, 0 = Absent

Table 18: Non-indigenous marine organisms recorded from the Port of Tauranga 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 Tauranga	Locations detected in the Port of Tauranga		Detected in other locations surveyed in ZBS2000_04
		Time 1	Time 2	
Annelida				
Polydora hoplura	Pile visual	Berth 1		Dunedin, Lyttelton, Nelson, Picton, Timaru, Wellington, Whangarei
Bryozoa				
Bugula flabellata	Benthic sled, pile scrape	Berth 1, Berth 3, Berth 7, Berth 11, Berth 24 (See Figure 22)	Berth 1, Berth 3, Berth 11, Berth 16, Berth 24 (See Figure 23)	Auckland, Bluff, Dunedin, Lyttelton, Napier, Nelson, New Plymouth, Opua, Picton, Timaru, Wellington, Whangarei
Bugula neritina	Benthic sled, pile scrape	Berth 11, Berth 16, Berth 24 (See Figure 24)	Berth 3, Berth 11, Berth 24 (See Figure 25)	Auckland, Dunedin, Gisborne, Lyttelton, Napier, New Plymouth, Opua, Picton, Timaru, Whangarei
Electra tenella	Benthic sled		Berth 25 (See Figure 26)	Nelson
Watersipora subtorquata	Pile scrape	Berth 3, Berth 7, Berth 11, Berth 24 (See Figure 27)	Berth 1, Berth 11, Berth 7, Berth 24 (See Figure 28)	Auckland, Bluff, Dunedin, Gisborne, Lyttelton, Napier, Nelson, New Plymouth, Opua, Picton, Timaru, Wellington, Whangarei
Amathia distans	Benthic sled		Berth 25 (See Figure 29)	
Zoobotryon verticillatum	Benthic sled		Central Harbour, Berth 25 (See Figure 30)	Auckland
Cnidaria				
*Clytia ?linearis**	Pile scrape	Berth 24		
Eudendrium capillare	Pile scrape	Berth 1		New Plymouth, Wellington
Monotheca pulchella	Pile scrape		Berth 7 (See Figure 31)	Lyttelton, New Plymouth, Timaru, Wellington
Sertularia marginata	Benthic sled		Berth 3 (See Figure 32)	Wellington
Crustacea				
Apocorophium acutum	Pile scrape	Berth 11		Auckland, Dunedin, Lyttelton, Opua, Timaru
Monocorophium acherusicum	Pile scrape	Berth 16		Dunedin, Gisborne, Lyttelton, Timaru, Wellington, Whangarei
Porifera				
Cliona celata	Pile scrape, pile visual	Berth 3 (See Figure 33)	Berth 16 (See Figure 34)	Whangarei

* Identification is uncertain for this species

Table 19: Summary statistics for taxon assemblages collected in the Port of Tauranga 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	91	92	137	117	78 (44%)	59	39	45 (33%)	37 (32%)	117.95	0.443	0.614	0.82	0.901
C2	91	92	22	24	11 (31%)	11	13	7 (32%)	8 (33%)	14.313	0.314	0.478	0.504	0.67
NIS & C1	91	92	29	22	18 (55%)	11	4	3 (10%)	6 (27%)	19.306	0.545	0.706	0.857	0.923
Benthic sleds														
Native	18	20	67	61	23 (22%)	44	38	35 (52%)	26 (43%)	34.727	0.219	0.359	0.468	0.637
C2	18	20	8	5	0 (0%)	8	5	6 (75%)	3 (60%)	0	0	0	0	0
NIS & C1	18	20	10	9	4 (27%)	6	5	7 (70%)	7 (78%)	10.25	0.267	0.421	0.535	0.697
Benthic grabs														
Native	28	18	26	19	8 (22%)	18	11	15 (58%)	11 (58%)	See analysis for all taxa combined				
C2	28	18	1	0	0 (0%)	1	0	1 (100%)	0 (0%)	Not enough taxa encountered for a meaningful analysis				
C1 (no NIS were encountered)	28	18	2	0	0 (0%)	2	0	2 (100%)	0 (0%)	Not enough taxa encountered for a meaningful analysis				
Native, C2, NIS & C1 taxa combined	28	18	29	19	8 (20%)	21	11	18 (62%)	11 (58%)	10.536	0.2	0.333	0.336	0.503

	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
Crab traps														
Native	32	32	17	6	4 (21%)	13	2	7 (41%)	2 (33%)	See analysis for all taxa combined				
C2	32	32	0	0	0 (0%)	0	0	0 (0%)	0 (0%)	No taxa encountered				
C1 (no NIS were encountered)	32	32	1	0	0	1	0	0 (0%)	0 (0%)	Not enough taxa encountered for meaningful analysis				
Native and C1 taxa combined	32	32	18	6	4 (20%)	14	2	7 (39%)	2 (33%)	4	0.2	0.333	0.544	0.705
Fish traps														
Native	24	39	9	8	5 (42%)	4	3	2 (22%)	2 (25%)	See analysis for all taxa combined				
C2	24	39	0	1	0 (0%)	0	1	0 (0%)	1 (100%)	Not enough taxa encountered for meaningful analysis				
C1 (no NIS were encountered)	24	39	0	1	0 (0%)	0	1	0 (0%)	1 (100%)	Not enough taxa encountered for meaningful analysis				
Native, C2, and C1 taxa combined	24	39	9	10	5 (36%)	4	5	2 (22%)	4 (40%)	5.354	0.357	0.526	0.646	0.785
Starfish traps														
Native	28	32	10	6	4 (33%)	6	2	5 (50%)	4 (67%)	5	0.333	0.5	0.913	0.954
C2	28	32	0	0	0 (0%)	0	0	0 (0%)	0 (0%)	No taxa encountered				
NIS & C1	28	32	0	0	0 (0%)	0	0	0 (0%)	0 (0%)	No taxa encountered				

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 Is)
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

Geographical area	Countries/locations included
Eastern Mediterranean inc Cyprus, Turkey	Turkey
European Mediterranean coast	France
	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

Geographical area	Countries/locations included
	Pitcairn Islands
	Solomon Islands
	Tokelau Islands
	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
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

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	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
	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

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
	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
	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 Tauranga second baseline survey (NZGD49)

Site	Easting	Northing	Survey Method	Number of sample units
Central Harbour	2790557	6388707	BSLD	1
Central Harbour	2790599	6388865	BSLD	1
Cyst Site 1	2790634	6390209	CYST	2
Cyst Site 2	2790796	6389719	CYST	2
Cyst Site 3	2790753	6388345	CYST	2
Cyst Site 4	2790608	6387805	CYST	2
Jetty B1-50	2790591	6387513	VISS	1
Jetty C1-25	2790554	6387459	VISS	1
Jetty H10-70	2790532	6387215	VISS	1
Marina 2	2790480	6387542	FSHTP	2
Marina 2	2790385	6387476	FSHTP	2
Marina-Bridge	2790459	6387624	FSHTP	2
Marina-Bridge	2790503	6387626	FSHTP	2
Pilot Bay	2790161	6391183	BSLD	1
Pilot Bay	2790430	6391191	BSLD	1
Pilot Bay	2790586	6391118	FSHTP	1
Pilot Bay	2790651	6391023	FSHTP	2
Sulphur Point	2790089	6388904	BSLD	1
Sulphur Point	2790294	6388908	BSLD	1
Sulphur Point	2790154	6388868	CRBTP	2
Sulphur Point	2790242	6388899	CRBTP	2
Sulphur Point	2790224	6388915	FSHTP	2
Sulphur Point	2790273	6388913	FSHTP	2
Sulphur Point	2790321	6388744	FSHTP	2
Sulphur Point	2790325	6388779	FSHTP	2
Sulphur Point	2790154	6388868	SHRTP	1
Sulphur Point	2790242	6388899	SHRTP	1
Sulphur Point	2790154	6388868	STFTP	2
Sulphur Point	2790242	6388899	STFTP	2
Berth 1	2790858	6390537	BGRB	3
Berth 1	2790818	6390659	BSLD	1
Berth 1	2790900	6390527	BSLD	1
Berth 1	2790948	6390546	CRBTP	2
Berth 1	2790951	6390558	CRBTP	2

Site	Easting	Northing	Survey Method	Number of sample units
Berth 1	2790953	6390537	FSHTP	2
Berth 1	2790961	6390488	FSHTP	2
Berth 1	2790967	6390441	PSC	15
Berth 1	2790948	6390546	SHRTP	1
Berth 1	2790951	6390558	SHRTP	1
Berth 1	2790948	6390546	STFTP	2
Berth 1	2790951	6390558	STFTP	2
Berth 11	2790833	6388716	BGRB	3
Berth 11	2790802	6388566	BSLD	1
Berth 11	2790844	6388755	BSLD	1
Berth 11	2790862	6388703	CRBTP	2
Berth 11	2790865	6388742	CRBTP	2
Berth 11	2790858	6388681	PSC	16
Berth 11	2790862	6388703	SHRTP	1
Berth 11	2790865	6388742	SHRTP	2
Berth 11	2790862	6388703	STFTP	2
Berth 11	2790865	6388742	STFTP	2
Berth 16	2790652	6388054	BGRB	3
Berth 16	2790661	6387991	BSLD	1
Berth 16	2790705	6388141	BSLD	1
Berth 16	2790744	6388070	CRBTP	2
Berth 16	2790745	6388088	CRBTP	2
Berth 16	2790750	6388143	FSHTP	2
Berth 16	2790756	6388154	FSHTP	2
Berth 16	2790745	6388052	PSC	16
Berth 16	2790744	6388070	SHRTP	1
Berth 16	2790744	6388070	STFTP	2
Berth 16	2790745	6388088	STFTP	2
Berth 24	2790336	6388409	BGRB	3
Berth 24	2790297	6388339	PSC	16
Berth 25	2790280	6388162	BSLD	1
Berth 25	2790315	6388305	BSLD	1
Berth 25	2790232	6388031	CRBTP	2
Berth 25	2790263	6388104	CRBTP	2
Berth 25	2790257	6388079	FSHTP	2
Berth 25	2790277	6388162	FSHTP	2
Berth 25	2790232	6388031	SHRTP	1

Site	Easting	Northing	Survey Method	Number of sample units
Berth 25	2790263	6388104	SHRTP	1
Berth 25	2790232	6388031	STFTP	2
Berth 25	2790263	6388104	STFTP	2
Berth 3	2790970	6389986	BGRB	3
Berth 3	2790975	6390194	BSLD	1
Berth 3	2790984	6390181	BSLD	1
Berth 3	2790961	6390477	CRBTP	2
Berth 3	2790963	6390460	CRBTP	2
Berth 3	2790998	6390166	PSC	16
Berth 3	2790961	6390477	SHRTP	1
Berth 3	2790963	6390460	SHRTP	2
Berth 3	2790961	6390477	STFTP	2
Berth 3	2790963	6390460	STFTP	2
Berth 7	2790978	6389521	BGRB	3
Berth 7	2790886	6389296	BSLD	1
Berth 7	2790920	6389474	BSLD	1
Berth 7	2791003	6389527	PSC	13
Berth 8	2790950	6389171	CRBTP	2
Berth 8	2790965	6389242	CRBTP	2
Berth 8	2790957	6389214	FSHTP	2
Berth 8	2790972	6389287	FSHTP	2
Berth 8	2790950	6389171	SHRTP	1
Berth 8	2790965	6389242	SHRTP	1
Berth 8	2790950	6389171	STFTP	2
Berth 8	2790965	6389242	STFTP	2
Yacht Club	2789694	6388824	BSLD	1
Yacht Club	2789766	6388844	BSLD	1
Yacht Club	2789616	6388753	CRBTP	2
Yacht Club	2789665	6388766	CRBTP	2
Yacht Club	2789719	6388781	FSHTP	2
Yacht Club	2789725	6388805	FSHTP	2
Yacht Club	2789616	6388753	SHRTP	1
Yacht Club	2789616	6388753	STFTP	2
Yacht Club	2789665	6388766	STFTP	2

*Survey methods: PSC = pile scrape and diver observations on wharf pilings, BSLD = benthic sled, BGRB = benthic grab, CYST = dinoflagellate cyst core, CRBTP = crab trap, FSHTP = fish trap, STFTP = starfish trap, SHRTP = shrimp trap, VISS = above-water qualitative visual surveys.

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
Dinoophyta	Dinophyceae	Hoe Chang[1], Rob Stewart[1]	Hoe Chang[1], Rob Stewart[1]	[1]NIWA Greta Point
Urochordata	Ascidiacea	Mike Page[e], Anna Bradley[e] Patricia Kott[12]	Mike Page[9], Anna Bradley[9]	[9]NIWA Nelson and [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 Tauranga 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 Tauranga 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
Bryozoa									
Bugula flabellata	+	+	+		+	+	+	+	+
Bugula neritina	+				+	+	+	+	+
Electra tenella	+		+		+	+	+	+	
Watersipora subtorquata	+	+	+		+	+	+	+	+
Amathia distans	+			+	+	+	+	+	
Zoobotryon verticillatum	+	+			+	+	+	+	+
Cnidaria									
Monotheca pulchella	+		+		+		+	+	
Sertularia marginata	+		+		+		+	+	
Porifera									
Cliona celata			+				+	+	

Criterion 1: Has the species suddenly appeared locally where it has not been found before?
Criterion 2: Has the species spread subsequently?
Criterion 3: Is the species' distribution associated with human mechanisms of dispersal?
Criterion 4: Is the species associated with, or dependent on, other introduced species?
Criterion 5: Is the species prevalent in, or restricted to, new or artificial environments?
Criterion 6: Is the species' distribution restricted compared to natives?
Criterion 7: Does the species have a disjunct worldwide distribution?
Criterion 8: Are dispersal mechanisms of the species inadequate to reach New Zealand, and is passive dispersal in ocean currents unlikely to bridge ocean gaps to reach New Zealand?
Criterion 9: Is the species isolated from the genetically and morphologically most similar species elsewhere in the world?

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

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

						Site code	Berth 1															Berth 11																Berth 16																Berth 24																Berth 3																Berth 7												
						Pile replicate	1								2							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				IN		OUT				IN			OUT			
phylum	class	order	family	genus	species	*class_code	1	2	3	4	1	2	3	4	1	2	3	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	1	2	3	4	1	2	3	1	2	3	4
Annelida	Polychaeta	Eunicida	Dorvilleidae	Dorvillea	australiensis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Annelida	Polychaeta	Eunicida	Eunicidae	Eunice	australis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0
Annelida	Polychaeta	Eunicida	Eunicidae	Lysidice	ninetta	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Eunicida	Lumbrineridae	Lumbrineris	sphaerocephala	N	1	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	1	0	1	0	0	0	1	1	1	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	1	0	0	0	1	1	0	1	1	1	1	1	0	0	0	1	1	1	1	1	0	1	0	1	0	0	0	0	0	0	1	1	0	0	1	0	0	1	1	1	1	0	0	0	1	1	0	0
Annelida	Polychaeta	Phyllodocida	Nereididae	Neanthes	cricognatha	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Annelida	Polychaeta	Phyllodocida	Nereididae	Neanthes	kerguelensis	N	1	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	1	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	1	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
Annelida	Polychaeta	Phyllodocida	Nereididae	Nereis	falcaria	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	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	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
Annelida	Polychaeta	Phyllodocida	Nereididae	Perinereis	amblyodonta	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	camiguinoides	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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	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	Phyllodocidae	Eulalia	capensis	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	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
Annelida	Polychaeta	Phyllodocida	Phyllodocidae	Eulalia	Eulalia-NIWA-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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Annelida	Polychaeta	Phyllodocida	Phyllodocidae	Mystides	Mystides-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	0	1	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	Pirakia	Pirakia-A	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	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	1	0	0	1	0	0
Annelida	Polychaeta	Phyllodocida	Polynoidae	Lepidastheniella	comma	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Annelida	Polychaeta	Phyllodocida	Polynoidae	Lepidonotin	Lepidonotin-A	C2	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	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	jacksoni	N	0	0	0	0	0	0	0	0	0	0	0	0	1	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	1	0	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	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Polynoidae	Lepidonotus	polychromus	N	0	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	1	1	0	0	0	0	1	0	0	0	0	0	1	1	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	1	0
Annelida	Polychaeta	Phyllodocida	Syllidae	Eusyllin-unknown	Eusyllin-unknown-A	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	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annelida	Polychaeta	Phyllodocida	Syllidae	Trypanosyllis	gigantea	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	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	Trypanosyllis	zebra	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	1	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	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
Annelida	Polychaeta	Sabellida	Sabellidae	Megalomma	suspiciens	N	0	0	0	0	0	0	0	1	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	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	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
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	0	0	0	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	Sabellida	Serpulidae	Galeolaria	hystrix	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	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	1	0	1	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
Annelida	Polychaeta	Spionida	Chaetopteridae	Chaetopterus	Chaetopterus-A	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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	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	Terebellida	Flabelligeridae	Flabelligera	affinis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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
Annelida	Polychaeta	Terebellida	Flabelligeridae	Pherusa	parmata	N	0	1	0	1	0	0	0	0	0	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	0	1	1	0	1	0	1	1	1	0	1	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0
Annelida	Polychaeta	Terebellida	Terebellidae	Nicolea	armilla	N	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	1	1	1	0	0	0	0	1	0	0	0	1	0	1	1	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	1	1	0	0	0	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	1	1	0
Annelida	Polychaeta	Terebellida	Terebellidae	Pseudopista	rostrata	N	0	1	0	1	0	1	1	0	0	0	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0	1	0	0	1	1	1	0	0	1	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	1	0	0	0	1	0	1	0	0	0	0	1	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	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	1	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
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	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
Ectoprocta	Gymnolaemata	Cheilostomata	Beaniidae	Beania	discodermiae	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	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
Ectoprocta	Gymnolaemata	Cheilostomata	Beaniidae	Beania	plurispinosa	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	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
Ectoprocta	Gymnolaemata	Cheilostomata	Beaniidae	Beania	sp.	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Bugulidae	Bugula	flabellata	A	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	1	1	1	1	1	0	0	1	1	0	0	0	1	1	1	0	1	0	0	0	0	0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Bugulidae	Bugula	neritina	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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
Ectoprocta	Gymnolaemata	Cheilostomata	Lacernidae	Rogicka	biserialis	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Ectoprocta	Gymnolaemata	Cheilostomata	Scrupariidae	Scruparia	ambigua	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	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
Ectoprocta	Gymnolaemata	Cheilostomata	Watersiporidae	Watersipora	subtorquata	A	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	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	0	0	0	0	0	0
Cnidaria	Hydrozoa	Hydroida	Plumulariidae	Monotheca	pulchella	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	0	0	0	0	0	0	0	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
Cnidaria	Hydrozoa	Hydroida	Plumulariidae	Plumularia	setacea	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Cnidaria	Hydrozoa	Hydroida	Solanderiidae	Solanderia	ericopsis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Cirripedia	Thoracica	Balanidae	Austrominius	modestus	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	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	0	0	0	0	0	0	0
Arthropoda	Cirripedia	Thoracica	Balanidae	Balanus	trigonus	C1	1	0	0	0	0	1	1	1	0	1	0	0	0	1	0	0	1	1	0	1	1	1	1	0	0	0	0	1	1	1	1	0	0	1	1	1	0	0	1	1	1	0	1	0	1	1	1	1	1	1	0	0	0	1	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	1	1	1	1	0	0	0	0	1	1	0	1	1	1	1	0	0	0	0	1	0	0	1
Arthropoda	Malacostraca	Amphipoda	Aoridae	Haplocheira	barbimana	N	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	1	1	1	1	0	0	1	1	0	1	1	0	1	0	0	1	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	1	1	0	0	1	0	0	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	1	1	1	0	1
Arthropoda	Malacostraca	Amphipoda	Ischyroceridae	Ericthonius	sp. indet.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	sp. 1	C2	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	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	0	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	1	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Liljeborgiidae	Liljeborgia	akaroica	N	0	0	1	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	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	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	1
Arthropoda	Malacostraca	Amphipoda	Lysianassidae	Orchomene	aahu	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	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	Stomacontion	sp. aff. S. pungpunga	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	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	Amphipoda	Melitidae	Melita	festiva	N	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	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	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	Amphipoda	Podoceridae	Podocerus	cristatus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Anomura	Paguridae	Lophopagurus (L.)	lacertosus	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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 (Lophopagurus)	pumilus	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Anomura	Paguridae	Pagurixus	?hectori	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	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	Pagurixus	hectori	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	0	0	0	0	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	1	0	0	0	0
Arthropoda	Malacostraca	Anomura	Paguridae	Pagurus	traversi	N	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	1	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	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Arthropoda	Malacostraca	Anomura	Porcellanidae	Petrolisthes	elongatus	N	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	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	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
Arthropoda	Malacostraca	Anomura	Porcellanidae	Petrolisthes	novaezelandiae	N	0	1	1	1	0	0	1	1	0	0	1	1	1	1	1	0	1	0	1	1	0	1	0	0	0	0	1	1	1	1	0	1	1	1	1	0	1	1	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	1	1	0	1	1	0	0	0	1	0	1	0	1	0	1	1	1	0	0	0	0	0	1	1	1	0	0	0	1	1	1	1
Arthropoda	Malacostraca	Brachyura	Dromiidae	Dromia	wilsoni	C1	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	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	Grapsidae	Plagusia	chabrus	C1	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	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	varius	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	1	0	1	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	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
Arthropoda	Malacostraca	Brachyura	Majidae	Eurynolambrus	australis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Arthropoda	Malacostraca	Brachyura	Majidae	Leptomithrax	longimanus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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
Arthropoda	Malacostraca	Brachyura	Majidae	Notomithrax	minor	N	0	0	1	0	0	0	1	1	0	1	1	1	1	0	0	0	1	1	0	0	0	1	1	0	0	0	0	1	0	1	1	0	0	0	0	0	1	1	1	0	0	0	1	1	0	0	1	0	0	1	0	0	1	1	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	1	0	0	0	1	0	0	1	1	0	1	1	0	0	0	0	0	1	0	1	0	0	1
Arthropoda	Malacostraca	Brachyura	Majidae	Notomithrax	ursus	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	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	1	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Xanthidae	Pilumnus	lumpinus	N	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Xanthidae	Pilumnus	novaezealandiae	N	1	1	1	0	0	1	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	0	1	0	0	0	1	1	0	0	0	0	0	0	1	1	1	0	0	0	1	0	0
Arthropoda	Malacostraca	Caridea	Alpheidae	Alpheus	novaezealandiae	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Arthropoda	Malacostraca	Caridea	Palemonidae	Periclimenes	yaldwyni	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Echinodermata	Asteroidea	Forcipulata	Asteriidae	Allostichaster	polyplax	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0	0	0
Echinodermata	Asteroidea	Forcipulata	Asteriidae	Coscinasterias	muricata	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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	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	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
Echinodermata	Asteroidea	Valvatida	Asterinidae	Patiriella	regularis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Ophiuroidea	Ophiurida	Ophiocomidae	Ophiopteris	antipodum	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Ophiuroidea	Ophiurida	Ophionereididae	Ophionereis	fasciata	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	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	1	0	1	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
Mollusca	Bivalvia	Myoida	Hiatellidae	Hiatella	arctica	N	0	1	0	0	0	1	1	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	1	0	0	1	1	0	0	0	0	1	1	0	1	0	0	1	1	0	1	1	0	0	1	0	0	0	1	1	1	1	0	1	1	1	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1
Mollusca	Bivalvia	Mytiloida	Mytilidae	Modiolarca	impacta	N	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	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	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	1	0	0	0	0	0	1
Mollusca	Bivalvia	Mytiloida	Mytilidae	Perna	canaliculus	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	0	0	0	0	0	0	0	0	0	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
Mollusca	Bivalvia	Ostreoida	Ostreidae	Ostrea	chilensis	N	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1	0	0	1	1	1	1	0	1	0	0	1	1	0	1	1	0	0	1	0	0	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	1	1	1	0	0	0	1	1	0	1	0	1	1	1	0	0	0	0	0	0	0	0	1	1	0	1	0	1	1	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	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	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	Bivalvia	Pterioida	Pectinidae	Talochlamys	zelandiae	N	1	0	1	0	0	0	0	1	1	0	1	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	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Mollusca	Bivalvia	Veneroida	Kelliidae	Kellia	cycladiformis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	1	0	0	0	0
Mollusca	Bivalvia	Veneroida	Mesodesmatidae	Paphies	australis	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Mollusca	Bivalvia	Veneroida	Semelidae	Leptomya	retiaria	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	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

*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	Berth 1															Berth 11																Berth 16																Berth 24																Berth 3																Berth 7												
						Pile replicate	1								2							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				IN		OUT				IN			OUT			
Mollusca	Bivalvia	Veneroida	Veneridae	Irus	reflexus	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Mollusca	Bivalvia	Veneroida	Veneridae	Tawera	spissa	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Littorinimorpha	Calyptraeidae	Maoricrypta	costata	N	1	0	1	0	1	0	0	1	1	1	1	1	0	0	0	0	1	1	0	0	0	1	0	1	1	1	0	1	0	0	1	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	0	0	1	1	0	1	0	1	0	0	1	1	1	0	1	0	1	0	1	0	1	1	1
Mollusca	Gastropoda	Littorinimorpha	Calyptraeidae	Sigapatella	novaezelandiae	N	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	1	1	1	0	0	0	0	0	1	1	0	0	0	1	0	1	0	1	0	0	0	1	0	0	0	1	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
Mollusca	Gastropoda	Littorinimorpha	Ranellidae	Cabestana	spengleri	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	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
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Buccinulum	linea	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	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	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	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Neogastropoda	Muricidae	Dicithais	orbita	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Mollusca	Gastropoda	Neogastropoda	Muricidae	Xymene	huttoni	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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	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
Mollusca	Gastropoda	Notaspidea	Pleurobranchidae	Berthella	medietas	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Mollusca	Gastropoda	Notaspidea	Pleurobranchidae	Berthella	ornata	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	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Nudibranchia	Aeolidiidae	Anteaeolidiella	indica	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Nudibranchia	Dendrodorididae	Dendrodoris	citrina	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	0	0	0	0	0	0	0	0	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
Mollusca	Gastropoda	Nudibranchia	Discodorididae	Hoplodoris	nodulosa	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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	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
Mollusca	Gastropoda	Nudibranchia	Dorididae	Aphelodoris	luctuosa	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Fissurellidae	Tugali	suteri	N	0	1	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	1	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	1	1	0	0	0	0	0	0	1	1	0	1	1	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	1	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	0	0	0	0	0	0	0	0	0	0	0	0	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	Polyplacophora	Acanthochitonina	Acanthochitonidae	Acanthochitona	zelandica	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	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	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	1	0	0	0	0	0	1	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	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
Rhodophyta	Florideophyceae	Ceramiales	Ceramiaceae	Griffithsia	sp.	SI	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	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	Polysiphonia	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Plocamiales	Plocamiaceae	Plocamium	angustum	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	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Rhodymeniales	Rhodomeniaceae	Rhodymenia	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Ochrophyta	Phaeophyceae	Ectocarpales	Scytosiphonaceae	Colpomenia	sp.	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ochrophyta	Phaeophyceae	Laminariales	Alariaceae	Ecklonia	radiata	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	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	Dendroceratida	Darwinellidae	Chelonaplysilla	cf. violacea	C1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Dendroceratida	Darwinellidae	Darwinella	cf. gardineri	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Dictyoceratida	Dysideidae	Dysidea	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	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	0	0	1	0
Porifera	Demospongiae	Dictyoceratida	Dysideidae	Euryspongia	cf. arenaria	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Dictyoceratida	Dysideidae	Euryspongia	new sp. 2	C2	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	1	0	0	0	0	0	1	0	0	0	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	1	0	0	0	0	0	0
Porifera	Demospongiae	Dictyoceratida	Dysideidae	Euryspongia	new sp. 3	C2	0	0	1	0	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	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	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Porifera	Demospongiae	Hadromerida	Clionaidae	Cliona	celata	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Porifera	Demospongiae	Hadromerida	Suberitidae	new g.	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	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
Porifera	Demospongiae	Halichondrida	Halichondriidae	Halichondria	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	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	1	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Halichondrida	Halichondriidae	Halichondria	new sp. 3	C2	0	1	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Halichondrida	Halichondriidae	Halichondria	panicea	C1	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	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	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
Porifera	Demospongiae	Haplosclerida	Callyspongiidae	Callyspongia	ramosa	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	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
Porifera	Demospongiae	Haplosclerida	Callyspongiidae	Chalinopsilla	new sp. 1	C2	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	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	cf. parietalioides	N	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	1	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	1	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	1	0	0	1	0	0	0	0	1	0	1	1	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Adocia	cf. venustina	N	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	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Adocia	new sp. 2	C2	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	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	1	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Haliclona	cf. isodictyale	N	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	1	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	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Haliclona	cf. tenacior	N	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	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	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	0	0	0	0	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	Haliclona	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	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	Haliclona	new sp. 3	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	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	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Haliclona	new sp. 4	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	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Haliclona	new sp. 5	C2	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	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	Haliclona	new sp. 6	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	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Haliclona	stelliderma	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	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
Porifera	Demospongiae	Poecilosclerida	Crellidae	Crella (Pytheas)	affinis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Porifera	Demospongiae	Poecilosclerida	Esperiopsidae	Esperiopsis	new sp. 1	C2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	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	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Poecilosclerida	Hymedesmiidae	Hymedesmia	anisostrongyloxea	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	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
Porifera	Demospongiae	Poecilosclerida	Hymedesmiidae	Hymedesmia (Stylopus)	(lissostyla	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	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
Porifera	Demospongiae	Poecilosclerida	Hymedesmiidae	Phorbas	cf. anchorata	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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
Porifera	Demospongiae	Poecilosclerida	Hymedesmiidae	Phorbas	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	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	1	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
Porifera	Demospongiae	Poecilosclerida	Microcionidae	Clathria	cf. lissosclera	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	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
Porifera	Demospongiae	Poecilosclerida	Microcionidae	Clathria	cf. terraenovae	N	0	0	1	0	0	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	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	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	0	0	0	1	0
Porifera	Demospongiae	Poecilosclerida	Microcionidae	Clathria	new sp. 1	C2	0	0	0	1	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	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	1	1	0	0	0	0
Porifera	Demospongiae	Poecilosclerida	Microcionidae	Clathria (Microciona)	coccinea	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1
Porifera	Demospongiae	Poecilosclerida	Microcionidae	Ophlitospongia	new sp. 1	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Poecilosclerida	Mycalidae	Paraesperella	new sp. 1 (macrosigma)	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	0	1	0	0	0	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	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	1	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	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Porifera	Demospongiae	Poecilosclerida	Tedaniidae	Tedania	spinostylota	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	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	1	0	0
Porifera	Porifera					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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Chordata	Ascidiacea	Aplousobranchia	Didemnidae	Didemnum	sp.	C1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	1	0	1	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	1	0	1	0	0	0	0	1	1	1	0	0	0	1	0	0	0	0	0	1	1	0	1	0
Chordata	Ascidiacea	Aplousobranchia	Didemnidae	Diplosoma	listerianum	C1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0
Chordata	Ascidiacea	Aplousobranchia	Polyclinidae	Aplidium	adamsi	N	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	1	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	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	1	0	0	0	1	0	1	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	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	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Chordata	Ascidiacea	Aplousobranchia	Polyclinidae	Aplidium	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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	Synoicum	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	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
Chordata	Ascidiacea	Phlebobranchia	Rhodosomatidae	Corella	eumyota	C1	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	1	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	1	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Botryllinae	Botrylliodes	leachii	C1	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	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Molgulidae	Molgula	mortenseni	N	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	0	1	0	0	0	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	0	0	0	1	0	0	1	1	0	0	1	0	1	1	0	1	1	1	1	1	1
Chordata	Ascidiacea	Stolidobranchia	Polyzoinae	Polyzoa	sp.	SI	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	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	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Chordata	Ascidiacea	Stolidobranchia	Pyuridae	Microcosmus	squamiger	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	1	0	0	1	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	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
Chordata	Ascidiacea	Stolidobranchia	Pyuridae	Pyura	cancellata	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	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
Chordata	Ascidiacea	Stolidobranchia	Pyuridae	Pyura	carnea	N	0	0	1	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	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	picta	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	0	1	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	1	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	1	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Pyuridae	Pyura	subuculata	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	1	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Pyuridae	Pyura	suteri	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	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	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
Chordata	Ascidiacea	Stolidobranchia	Styelidae	Asterocarpa	cerea	C1	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	1	1	1	1	0	1	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1	1	1	0	1	1	1	1	0	0
Chordata	Ascidiacea	Stolidobranchia	Styelidae	Cnemidocarpa	bicornuta	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	1	1	0	0	0	1	1	1	1	1	1	1	0	1	0	0	1	1	0	1	1	1	1	0	1	1	1	1	1	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	1	1	0	1	0	1	0	1
Chordata	Ascidiacea	Stolidobranchia	Styelidae	Cnemidocarpa	nisiotus	N	1	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	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	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 6b. Results from the benthic grab samples.

Appendix 6b. Results from the benthic grab samples.

						Site code	Berth 1			Berth 11			Berth 16			Berth 24			Berth 3			Berth 7		
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**
Annelida	Polychaeta	Phyllodocida	Goniadidae	Glycinde	trifida	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Annelida	Polychaeta	Scolecida	Maldanidae	Macroclymenella	stewartensis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Annelida	Polychaeta	Terebellida	Pectinariidae	Pectinaria	australis	N	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Anomura	Diogenidae	Paguristes	pilosus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
Arthropoda	Malacostraca	Anomura	Paguridae	Lophopagurus (Australeremus)	kirkii	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0
Arthropoda	Malacostraca	Brachyura	Ocypodidae	Macrophthalmus	hirtipes	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Portunidae	Nectocarcinus	antarcticus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Arthropoda	Malacostraca	Isopoda	Cirolanidae	Natatolana	narica	N	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Echinodermata	Echinoidea	Spatangoida	Loveniidae	Echinocardium	cordatum	N	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0	0	0	0
Mollusca	Bivalvia	Nuculoida	Nuculidae	Nucula	hartvigiana	N	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Mollusca	Bivalvia	Nuculoida	Nuculidae	Nucula	nitidula	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
Mollusca	Bivalvia	Veneroida	Mesodesmatidae	Paphies	australis	N	1	1	1	0	0	1	0	0	0	1	1	0	1	1	0	0	1	1
Mollusca	Bivalvia	Veneroida	Semelidae	Leptomya	retiaria	N	0	0	0	0	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	0	0	0	0	0	0	0	1
Mollusca	Bivalvia	Veneroida	Veneridae	Tawera	spissa	N	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Cominella	adspersa	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
Mollusca	Gastropoda	Neogastropoda	Muricidae	Xymene	ambiguus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Mollusca	Gastropoda	Neogastropoda	Turridae	Neoguraleus	sp.	SI	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae					SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Plocamiales	Plocamiaceae	Plocamium	angustum	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Plocamiales	Plocamiaceae	Plocamium	cirrhosum	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Phycophyta	Ulvophyceae	Ulvales	Ulvaceae	Ulva	sp.	SI	0	0	0	0	0	0	1	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	Central Harbour		Pilot Bay		Sulphur Point		Berth 1		Berth 11		Berth 16		Berth 25		Berth 3		Berth 7		Yacht Club	
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
Annelida	Polychaeta	Phyllodocida	Nephtyidae	Aglaophamus	macroura	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Annelida	Polychaeta	Spionida	Chaetopteridae	Chaetopterus	Chaetopterus-A	C1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ectoprocta						SI	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Beaniidae	Beania	discodermiae	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Bitectiporidae	Schizosmittina	cinctipora	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Chaperiidae	Chaperiopsis	rubida	N	0	0	0	0	0	0	0	0	0	0	0	0	1	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	1	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Lacernidae	Rogicka	biserialis	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Cheilostomata	Scrupariidae	Scruparia	ambigua	C1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Ctenostomata	Vesiculariidae	Amathia	distans	A	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Ectoprocta	Gymnolaemata	Ctenostomata	Vesiculariidae	Zoobotryon	verticillatum	A	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Cnidaria	Hydrozoa	Hydroida	Sertulariidae	Sertularia	marginata	A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Crustacea	Cirripedia	Thoracica	Balanidae	Balanus	trigonus	C1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Amphipoda	Aoridae	Haplocheira	barbimana	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Anomura	Diogenidae	Paguristes	pilosus	N	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0
Arthropoda	Malacostraca	Anomura	Paguridae	Lophopagurus (Australeremus)	kirkii	N	1	1	1	0	1	0	1	1	0	0	0	1	1	1	1	0	1	0	0	0
Arthropoda	Malacostraca	Anomura	Paguridae	Lophopagurus (L.)	lacertosus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Arthropoda	Malacostraca	Anomura	Paguridae	Lophopagurus (Lophopagurus)	pumilus	N	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Anomura	Paguridae	Pagurus	novizealandiae	N	0	1	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	1	1
Arthropoda	Malacostraca	Anomura	Porcellanidae	Petrolisthes	elongatus	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Arthropoda	Malacostraca	Anomura	Porcellanidae	Petrolisthes	novaezelandiae	N	0	0	0	0	1	0	0	0	0	0	0	0	1	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	0	0	0	0	0	1
Arthropoda	Malacostraca	Brachyura	Hymenosomatidae	Halicarcinus	cookii	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Arthropoda	Malacostraca	Brachyura	Hymenosomatidae	Halicarcinus	varius	N	1	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	1	0
Arthropoda	Malacostraca	Brachyura	Majidae	Notomithrax	minor	N	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0
Arthropoda	Malacostraca	Brachyura	Ocypodidae	Macrophthalmus	hirtipes	N	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Portunidae	Nectocarcinus	antarcticus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Arthropoda	Malacostraca	Brachyura	Portunidae	Nectocarcinus	sp.	C2	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Arthropoda	Malacostraca	Caridea	Crangonidae	Pontophilus	australis	N	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
Arthropoda	Malacostraca	Caridea	Crangonidae	Pontophilus	chiltoni	N	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Caridea	Crangonidae	Pontophilus	hamiltoni	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Caridea	Palemonidae	Palaemon	affinis	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Caridea	Palemonidae	Periclimenes	yaldwyni	N	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Arthropoda	Malacostraca	Isopoda	Sphaeromatidae	Isocladus	dulciculus	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Echinodermata	Asteroidea	Forcipulata	Asteriidae	Coscinasterias	muricata	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Echinodermata	Asteroidea	Valvatida	Asterinidae	Meridiastra	mortenseni	N	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
Echinodermata	Asteroidea	Valvatida	Asterinidae	Patiriella	regularis	N	1	1	0	0	1	1	0	1	0	0	0	0	1	1	1	1	1	0	0	1
Echinodermata	Echinoidea	Clypeasteroidea	Arachnoididae	Fellaster	zelandiae	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Magnoliophyta	Alismatidae	Najadales	Zosteraceae	Zostera	sp.	SI	1	0	0	0	0	1	0	0	1	1	1	1	0	0	1	1	1	0	0	0
Mollusca	Bivalvia	Mytiloida	Mytilidae	Perna	canaliculus	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
Mollusca	Bivalvia	Pholadomyoida	Myochamidae	Myadora	striata	N	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Bivalvia	Veneroida	Laseidae	Myllitella	vivens	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	Bivalvia	Veneroida	Mactridae	Scalpomactra	scalpellum	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Mollusca	Bivalvia	Veneroida	Mesodesmatidae	Paphies	australis	N	1	1	0	0	1	0	1	1	0	0	0	0	1	1	0	0	0	1	1	1
Mollusca	Bivalvia	Veneroida	Veneridae	Tawera	spissa	N	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	1	0	0	1
Mollusca	Gastropoda	Cephalaspidea	Aglajidae	Philinopsis	taronga	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	Gastropoda	Littorinimorpha	Calyptraeidae	Sigapatella	tenuis	N	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	adspersa	N	0	0	0	0	1	0	1	1	0	0	0	0	1	0	1	0	0	1	0	1
Mollusca	Gastropoda	Neogastropoda	Muricidae	Xymene	ambiguus	N	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0
Mollusca	Gastropoda	Neogastropoda	Olividae	Amalda	australis	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Mollusca	Gastropoda	Notaspidea	Pleurobranchidae	Pleurobranchaea	maculata	N	0	0	0	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0
Mollusca	Gastropoda	Patellogastropoda	Lottiidae	Notoacmea	helmsi	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Mollusca	Gastropoda	Vetigastropoda	Trochidae	Trochus	tiaratus	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Mollusca	Polyplacophora	Ischnochitonina	Chitonidae	Rhyssoplax	canaliculata	N	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Algae (Unidentified)						SI	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae					SI	0	1	0	0	0	0	0	1	0	1	1	0	1	0	0	1	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Ceramiaceae	Ceramium	rubrum	N	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Ceramiaceae	Ceramium	sp.	SI	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Ceramiaceae	Spyridia	filamentosa	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Rhodophyta	Florideophyceae	Ceramiales	Dasyaceae	Dasya	subtilis	N	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae			SI	0	0	1	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	1
Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae	Hymenena	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Delesseriaceae	Hymenena	variolosa	N	0	0	0	1	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	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae	Chondria?		SI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae	Cladhymenia	lyalli	N	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae	Cladhymenia	oblongifolia	N	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Ceramiales	Rhodomelaceae	Cladhymenia	sp.	SI	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Corallinales	Corallinaceae			SI	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Gigartinales	Cystocloniaceae	Rhodophyllis	sp.	SI	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Gigartinales	Gigartinaceae	Chondracanthus	chapmanii	N	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Rhodophyta	Florideophyceae	Gigartinales	Gigartinaceae	Gigartina	atropurpurea	N	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	1	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 6c. Results from the benthic sled samples.

						Site code	Central Harbour		Pilot Bay		Sulphur Point		Berth 1		Berth 11		Berth 16		Berth 25		Berth 3		Berth 7		Yacht Club	
Rhodophyta	Florideophyceae	Gigartinales	Kallymeniaceae	Callophyllis	sp.	SI	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Gigartinales	Phyllophoraceae	Stenogramme	interrupta	N	1	1	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	0
Rhodophyta	Florideophyceae	Halymeniales	Halymeniaceae	Grateloupia	urvilleana	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Rhodophyta	Florideophyceae	Plocamiales	Plocamiaceae	Plocamium	angustum	N	1	1	0	0	0	0	0	0	1	1	0	1	0	1	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Plocamiales	Plocamiaceae	Plocamium	cirrhosum	N	1	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0
Rhodophyta	Florideophyceae	Plocamiales	Plocamiaceae	Plocamium	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Rhodymeniales	Champiaceae	Champia	novae-zelandiae	N	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Rhodophyta	Florideophyceae	Rhodymeniales	Rhodomeniaceae	Rhodymenia	sp.	SI	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Ochrophyta	Phaeophyceae	Fucales	Hormosiraceae	Hormosira	banksii	N	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Ochrophyta	Phaeophyceae	Laminariales	Alariaceae	Ecklonia	radiata	N	0	0	0	0	0	0	1	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	0	0	0	0	0	0	0	0	0	1
Chlorophyta	Ulvophyceae	Ulvales	Ulvaceae	Ulva	sp.	SI	1	1	0	0	0	1	1	0	1	1	1	1	1	1	1	0	0	0	0	0
Porifera	Demospongiae	Dictyoceratida	Dysideidae	Euryspongia	new sp. 2	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Porifera	Demospongiae	Dictyoceratida	Dysideidae	Euryspongia	new sp. 3	C2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Adocia	new sp. 2	C2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Porifera	Demospongiae	Haplosclerida	Chalinidae	Haliclona	new sp. 4	C2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Porifera	Demospongiae	Poecilosclerida	Microcionidae	Clathria	cf. terraenovae	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Porifera	Porifera					SI	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Styelidae	Alloeocarpa	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Chordata	Ascidiacea	Stolidobranchia	Styelidae	Asterocarpa	cerea	C1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Pleuronectiformes	Bothidae	Lophonectes	gallus	N	1	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 6d. Results from the dinoflagellate cyst core samples.

Appendic 6d. Results from the dinoflagellate cyst samples.

							Cyst Site 1		Cyst Site 2		Cyst Site 3		Cyst Site 4	
phylum	**class**	**order**	**family**	**genus**	**species**	**class_code**	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**
Dinophyta	Dinophyceae	Gonyaulacales	Goniodomataceae	Alexandrium	tamarense	C1	0	0	1	0	0	0	0	0
Dinophyta	Dinophyceae	Peridinales	Peridiniaceae	Lingulodinium	polyedrum	N	0	0	0	0	1	0	0	0
Dinophyta	Dinophyceae	Peridinales	Peridiniaceae	Protoperidinium	sp.	SI	0	0	0	0	1	0	1	0
Dinophyta	Dinophyceae	Peridinales	Peridiniaceae	Scrippsiella	trochoidea	N	0	0	1	0	1	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	Marina 2				Marina-Bridge				Pilot Bay			Sulphur Point								Berth 1				Berth 16				Berth 25				Berth 8				Yacht Club			
						Trap line	1		2		1		2		1		2	1		2		3		4		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**	**1**	**2**	**1**	**2**	**1**	**2**
Arthropoda	Malacostraca	Anomura	Paguridae	Pagurus	sp.	SI	0	0	0	0	0	1	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	0	0	0	0	0
Arthropoda	Malacostraca	Brachyura	Grapsidae	Plagusia	chabrus	C1	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	Portunidae	Nectocarcinus	sp.	C2	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
Echinodermata	Asteroidea	Forcipulata	Asteriidae	Coscinasterias	muricata	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0
Echinodermata	Asteroidea	Valvatida	Asterinidae	Patiriella	regularis	N	1	1	0	1	1	1	1	1	1	0	0	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1
Mollusca	Cephalopoda	Octopoda	Octopodidae	Octopus	maorum	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
Mollusca	Gastropoda	Notaspidea	Pleurobranchidae	Pleurobranchaea	maculata	N	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	0	0
Vertebrata	Actinopterygii	Perciformes	Arripidae	Arripis	trutta	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	1	1	1	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Perciformes	Carangidae	Trachurus	sp.	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Perciformes	Labridae	Notolabrus	celidotus	N	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	1	1	0	0	1	0	1	1	1	1	0	1	1	1	0	1	0	0	0	0
Vertebrata	Actinopterygii	Perciformes	Mullidae	Upeneichthys	lineatus	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
Vertebrata	Actinopterygii	Perciformes	Sparidae	Pagrus	auratus	N	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	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	Sulphur Point				Berth 1				Berth 11				Berth 16				Berth 25				Berth 3				Berth 8				Yacht Club			
						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	Anomura	Paguridae	Pagurus	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
Arthropoda	Malacostraca	Brachyura	Portunidae	Ovalipes	catharus	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
Echinodermata	Asteroidea	Forcipulata	Asteriidae	Coscinasterias	muricata	N	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	1	1	0	1	0	0	0	0	0
Echinodermata	Asteroidea	Valvatida	Asterinidae	Patiriella	regularis	N	1	1	1	1	0	0	0	0	0	1	1	1	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1
Mollusca	Gastropoda			Opisthobranchia	sp. indet	SI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Cominella	sp.	SI	0	0	1	1	0	0	0	0	1	1	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1
Vertebrata	Actinopterygii	Gadiformes	Moridae	Lotella	rhacinum	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Gadiformes	Moridae	Pseudophycis	sp.	SI	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
Vertebrata	Actinopterygii	Perciformes	Labridae	Notolabrus	celidotus	N	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	0	0	0	0
Vertebrata	Actinopterygii	Perciformes	Mullidae	Upeneichthys	lineatus	N	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	1	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	Sulphur Point				Berth 1				Berth 11				Berth 16				Berth 25				Berth 3				Berth 8				Yacht Club			
						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**
Annelida	Polychaeta	Spionida	Chaetopteridae	Chaetopteridae	Indet	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	0	0	0	0	0
Echinodermata	Asteroidea	Forcipulata	Asteriidae	Coscinasterias	muricata	N	1	1	1	0	0	1	1	0	0	1	0	0	0	0	0	1	0	1	0	0	1	1	1	1	0	0	1	0	0	0	0	0
Echinodermata	Asteroidea	Valvatida	Asterinidae	Patiriella	regularis	N	1	1	1	1	0	0	0	0	0	1	0	1	0	0	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1
Mollusca	Cephalopoda	Octopoda	Octopodidae	Octopus	maorum	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Cominella	adspersa	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
Mollusca	Gastropoda	Neogastropoda	Buccinidae	Cominella	sp.	SI	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	1	1	1	1
Mollusca	Gastropoda	Notaspidea	Pleurobranchidae	Pleurobranchaea	maculata	N	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vertebrata	Actinopterygii	Gasterosteiformes	Syngnathidae	Hippocampus	abdominalis	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

*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	Sulphur Point		Berth 1		Berth 11			Berth 1	Berth 25		Berth 3			Berth 8		Yacht Club
						Trap line	**1**	**2**	**1**	**2**	**1**		**2**	**2**	**1**	**2**	**1**		**2**	**1**	**2**	**2**
phylum	**class**	**order**	**family**	**genus**	**species**	***class_code**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**1**	**1**	**1**
Vertebrata	Actinopterygii	Perciformes	Mullidae	Upeneichthys	lineatus	N	0	0	0	0	0	0	0	0	0	1	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 6i. Results from the above-water visual surveys

Appendix 6i. Results from the opportunistic visual surveys.

phylum	class	order	family	genus	species	*class_code	Jetty B1-50	Jetty C1-25	Jetty H10-70
No taxa recorded									

*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 two that were 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. During the second baseline survey of the Port of Tauranga it was recorded in pile scrape samples from berth 11. The other amphipod, *Meridiolembos* sp., appears to be different to the other species in this genus, but as the genus is endemic to New Zealand, it can be safely regarded as a native species that is a new record for New Zealand. This taxon was recorded from the first baseline survey of the Port of Tauranga but not in the re-survey.

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