BIOSECURITY NEW ZEALAND

Kaikoura

First baseline survey for non-indigenous marine species (Research Project ZBS2005/19)

MAF Biosecurity New Zealand Technical Paper No: 2019/06

Prepared for MAFBNZ Post-border Directorate
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NIWA
Taihoro Nukurangi

ISBN No: 978-1-98-857165-2
ISSN No: 2624-0203

June 2009

Ministry of Agriculture and Forestry
Te Manatū Ahuwhenua, Ngāherehere

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Executive summary

- This report describes the results of the first port baseline survey of Kaikoura, undertaken in May 2007. The survey provides an inventory of native, non indigenous and cryptogenic marine taxa in Kaikoura and the surrounding coastal area and compares the biota with existing marine species records from the area.

- The survey is part of a nationwide investigation of native and non-native marine biodiversity in New Zealand's shipping ports and marinas of first entry for vessels entering New Zealand from overseas.

- Sampling methods used in these surveys were based on protocols developed by the Australian Centre for Research on Introduced Marine Pests (CRIMP) for baseline surveys of non-indigenous species in ports. Some variations to these protocols were necessary for use in the marine environments of Kaikoura.

- A wide range of sampling techniques were used to collect marine organisms from habitats within Kaikoura. Fouling assemblages were scraped from hard substrata by divers, benthic assemblages were sampled using an anchor box dredge, large hand corer and diver visual transects, and a gravity corer or small hand corer was used to sample for dinoflagellate cysts. Phytoplankton and zooplankton were sampled with fine-meshed plankton nets. Mobile predators and scavengers were sampled using baited crab and shrimp traps, and fish were sampled with poison stations and beach seine netting. Beach wrack was surveyed on visual walks along selected shorelines. Sediment samples were also collected to analyse organic content and particle size.

- Sampling effort was distributed in Kaikoura and surrounding coastal environments according to priorities identified by MAF Biosecurity New Zealand. In total, 21 sites were sampled during the survey.

- Organisms collected during the survey were sent to New Zealand and international taxonomic experts for identification.

- Prior to the port baseline survey, a desktop review was conducted to compile an inventory of non-indigenous marine species that have been recorded previously from Kaikoura and surrounding areas. Eight non-indigenous species were recorded from the literature describing the Kaikoura marine flora and fauna. These include the polychaete worm *Dipolydora armata,* amphipod *Monocorophium sextonae,* salmon *Oncorhynchus tshawytscha,* hydroid *Obelia longissima,* brown algae *Punctaria latifolia*, *Sargassum verruculosum* and *Undaria pinnatifia* and the sponge *Chondropsis topsentii.* Fourteen cryptogenic category one taxa (C1: those whose identity as native or non-indigenous is ambiguous) were also recorded from the literature describing Kaikoura.

- The initial port baseline survey of Kaikoura recorded a total of 411 species or higher taxa. The collection consisted of 296 native taxa, four non-indigenous species, eight cryptogenic category one taxa, 20 cryptogenic category two taxa (species that have recently been discovered but for which there is insufficient biogeographic or taxonomic information to determine the native provenance), and zooplankton (which were screened for target non-indigenous species but otherwise not identified), with the remaining 82 taxa being indeterminate (unable to be identified to species level).

- The four non-indigenous species (NIS) recorded from the initial baseline survey of Kaikoura included the amphipod *Jassa slatteryi*, the hydroid *Pennaria disticha*, the brown alga *Undaria pinnatifida* and the sponge *Dendya clathrata*. The eight C1 taxa were represented by the polychaete worm species complex *Capitella* "*capitata*", the ascidians *Didemnum* sp., *Cystodytes dellechiajei*, *Corella eumyota* and *Botrylloides leachi*, and the sponges *Leucosolenia* cf. *discoveryi*, *Callyspongia diffusa* and *Crella incrustans*. All of these have been previously recorded in New Zealand. However, the record of the NIS sponge *Dendya clathrata* from the Kaikoura port survey represents an extension to the known range of this species in New Zealand.

- The 12 NIS and C1 taxa collected during the Kaikoura port survey were represented by 29 records. They occurred in samples collected by seven different sampling methods, in water depths ranging from the intertidal to below 20 m depth. Almost half of these records came from pile scrapings at depths of 5 m or less. Benthic sleds and diver visual surveys yielded the next greatest numbers of NIS & C1 taxon records.

- The greatest number of NIS and C1 taxa were recorded during the port survey from the Fyffe Cove slipway.

- All of the taxa recorded from the first port baseline survey of Kaikoura have been recorded previously in New Zealand.

- One of the species recorded from the Kaikoura port survey, the Asian seaweed *Undaria pinnatifida*, is currently listed on the New Zealand Register of Unwanted Organisms. It is also listed on the Australian CCIMPE Trigger List along with four other taxa recorded from the Kaikoura baseline survey - the ascidian *Didemnum* sp. (considered C1 in New Zealand) and the three diatoms *Pseudo-nitzschia australis*, *Chaetoceros concavicornis* and *C. convolutus* (all considered native in New Zealand). *Undaria pinnatifida* is also on an Australian list of 53 Australian priority domestic pests. Another species on the Australian priority domestic pest list, the mollusc *Chiton glaucus* (considered native in New Zealand), was recorded during the desktop review of existing marine species records from Kaikoura. Another three species recorded from the Kaikoura port survey, the three diatoms *Pseudo-nitzschia australis*, *Chaetoceros concavicornis* and *C. convolutus* (all considered native in New Zealand), are included on the companion Australian list of 37 priority international pests.

- Three toxin-producing species were recorded during the Kaikoura port baseline survey – the native dinoflagellates *Dinophysis acuminata* and *D. tripos* and the native diatom *Pseudo-nitzschia australis*. Cyst specimens of another dinoflagellate genus known to contain toxin-producing species, *Alexandrium* sp., were also collected during the Kaikoura port survey, but could not be identified to species level. Another two native diatoms recorded during the port survey, *Chaetoceros convolutus* and *C. concavicornis*, are considered harmful to fish due to their barbed setae, but are not directly toxic.

- Two hundred and fifty of the 328 taxa (76 %) that were identified in the port survey were not represented amongst the 510 taxa recorded during the desktop review. The port baseline survey thus represents a valuable addition to the knowledge of the flora and fauna of the Kaikoura area. The low overlap in species composition between the desktop review of existing marine species records and the records from the port baseline survey can be attributed to variation in sampling effort and technique between surveys and to the differences in time-frame over which the records were accumulated (i.e. single snap-shot survey versus accumulation of historical records).

- Most non-indigenous and C1 taxa recorded during the Kaikorua survey or desktop review are likely to have been introduced to New Zealand accidentally by international shipping, associated with fisheries or spread from other locations in New Zealand (including translocation by shipping).

- There is little shipping traffic operating in Kaikoura, and those that do operate there are generally ecotourism, fishing or recreation vessels. This lack of shipping activity significantly reduces the risk of introduction of new marine species to the area.

- The distribution of NIS and C1 taxa in the Kaikoura area appears to be centred around the three main wharf or slipway areas (Fyffe Cove slipway, the South Bay area, and the Ingles Bay area). It is suggested that regular maintenance and surveillance of these areas and the vessels using them will reduce the likelihood of NIS and C1 taxa becoming established at Kaikoura and prevent them from being translocated to other locations in New Zealand.

Introduction

Introduced (non-indigenous) plants and animals are now recognised as one of the most serious threats to the natural ecology of biological systems worldwide (Wilcove *et al.* 1998; Mack *et al.* 2000). Growing international trade and trans-continental travel mean that humans now intentionally and unintentionally transport a wide range of species outside their natural biogeographic ranges to regions where they did not previously occur. A proportion of these species are capable of causing serious harm to native biodiversity, industries and human health. Recent studies suggest that coastal marine environments may be among the most heavily invaded ecosystems, as a consequence of the long history of transport of marine species by international shipping (Carlton and Geller 1993; Grosholz 2002). Ocean-going vessels transport marine species in ballast water, in sea chests and other recesses in the hull structure, and as fouling communities attached to submerged parts of their hulls (Carlton 1985; Carlton 1999; AMOG Consulting 2002; Coutts *et al.* 2003). Transport by shipping has enabled hundreds of marine species to spread worldwide and establish populations in shipping ports and coastal environments outside their natural range (Cohen and Carlton 1995; Hewitt *et al.* 1999; Eldredge and Carlton 2002; Leppakoski *et al.* 2002).

Like many other coastal nations, New Zealand is just beginning to document the numbers, identity, distribution and impacts of non-indigenous species in its coastal waters. A review of existing records suggested that by 1998, at least 148 marine species had been recorded from New Zealand, with around 90 % of these establishing permanent populations (Cranfield *et al.* 1998). Since that review, at least another 41 non-indigenous species or suspected non-indigenous species (i.e. Cryptogenic category 1 – see "

Baseline survey methods: Definitions of biosecurity status", below) 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. The purpose of these surveys is to:

- improve knowledge of potentially harmful species and of marine biodiversity in areas most at risk from harmful species,
- provide a baseline for monitoring the rate of new incursions by non-indigenous marine species in shipping ports, and
- assist international risk profiling of problem species through the sharing of information with other shipping nations (Hewitt and Martin 2001).

Worldwide, standardised port surveys 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 10 sites throughout the Mediterranean (Raaymakers 2003).

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 port baseline surveys for non-indigenous marine species. These surveys aimed to determine the identity, prevalence and distribution of native, cryptogenic and non-indigenous species in New Zealand's major shipping ports and other high risk points of entry for vessels entering New Zealand from overseas.

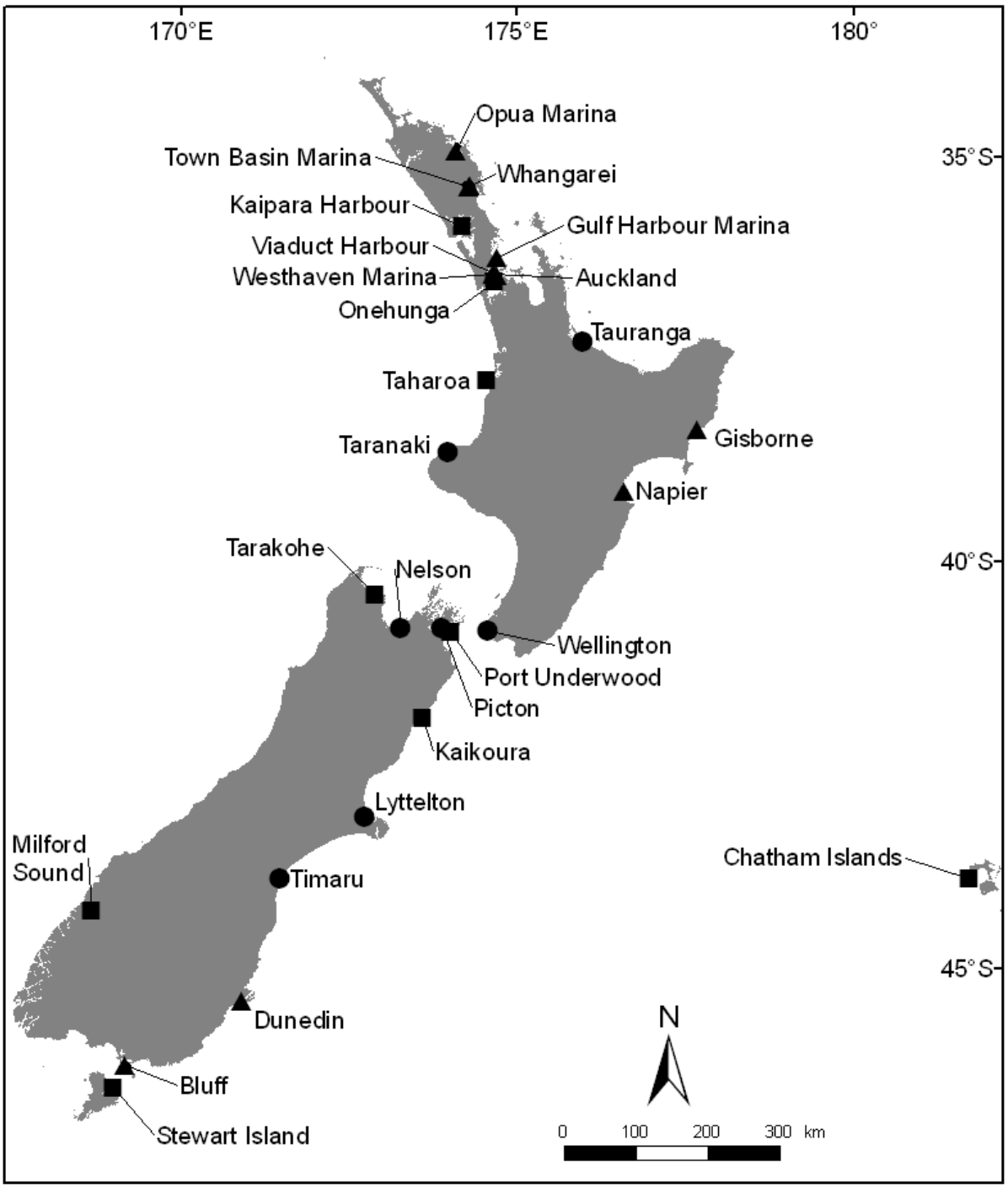

Figure 1: **Commercial shipping ports in New Zealand where baseline non-indigenous species surveys have been conducted. Group 1 ports (circles) were surveyed in the summer of 2001/2002 and re-surveyed in the summer of 2004/2005, Group 2 ports (triangles) were surveyed in the summer of 2002/2003 and re-surveyed in the summer of 2005/2006 (except for Viaduct and Westhaven marinas, which were surveyed for the first time during the 2005/2006 summer), and Group 3 ports (squares) were surveyed between May 2006 and December 2007.**

Initial surveys were completed during the summers of 2001/2002 and 2002/2003 in 13 major shipping ports and three marinas of first entry for vessels entering New Zealand (Figure 1). The surveys recorded almost 1300 taxa; 126 of which were known or suspected to have been introduced to New Zealand. At least 18 of the non-indigenous species were recorded for the first time in New Zealand in the port baseline surveys. In addition, 106 species that are potentially new to science were discovered. These 16 locations were subsequently re-surveyed in the summers of 2004/05 and 2005/06 to establish changes in the number and identity of non-indigenous species present. The repeat surveys again recorded almost 1300 taxa, 124 of which were known or suspected to be introduced. Together, both surveys recorded over 155 taxa known or suspected to be introduced. Almost 40 taxa recorded in the first survey were not recorded in the second survey and almost 45 taxa recorded in the second survey were not recorded in the first survey.

In 2005, MAF Biosecurity New Zealand extended the national port baseline surveys to a range of secondary, domestic and international ports and marinas within New Zealand to increase our knowledge of the non-indigenous marine species present in regional nodes for shipping. Biological baseline surveys were contracted for the following locations:

- Taharoa Iron Sands Terminal
- Port of Onehunga (Manukau Harbour) & marinas
- Kaikoura
- Kaipara Harbour & marinas
- Golden Bay Marina (Takaka)
- Kaikoura / Port Underwood
- Stewart Island
- Chatham Islands

This report summarises the results of the first port baseline survey of Kaikoura and provides an inventory of species detected in the survey and in a review of existing biological records for the area. It identifies and categorises native, non-indigenous and cryptogenic species. Organisms that could not be identified to species level are also listed as indeterminate taxa (see “

Baseline survey methods: Definitions of biosecurity status", below).

DESCRIPTION OF KAIKOURA

General features

The Kaikoura coastline on the east coast of the South Island of New Zealand covers an 80 km coastal strip between the Clarence and Conway Rivers. The Kaikoura marine environment has a large diversity of land forms characterised by rock platforms, rocky outcrops, large bouder beaches, gravel and mixed gravel/sand beaches (Figure 2). It has a relatively small tidal range of 1.8 m and intense periods of wave action are common on exposed coastlines. Water temperatures range from around 8.5 ºC to 19 ºC. The Kaikoura canyon, north-east of Goose Bay, traps and diverts sediment, directing it northwards on the Southland current (Marsden and Schiel 2007).

History of settlement and use

Maori were drawn to the Kaikoura area more than 900 years ago by the abundance of food in the area. Two tribes lived in the area until the 'Ngati Kuri' sub tribe of Ngai Tahu arrived in the area and eventually claimed land rights. Kaikoura's earliest known European settler, Robert Fyffe, established the first shore whaling station in about 1845 near his house located close to the old wharf. Sheep and goats were introduced to the area around the 1850's and the area north of Kaikoura extended itself to become more of a farming district. Other whaling stations were set up around the peninsula and over one hundred men were employed in this industry (McAloon *et al.* 1998). From 1850 onwards whale numbers steadily declined and their exploitation became uneconomical. However, whaling continued sporadically until New Zealand's last whaling operations ceased in 1964. The port was the town's link to the outside world for many years, but eventually access by land improved and in 1931 the port was closed. After the economic downturn of the late 1980's tourism became more prominent and commercial whale, dolphin and seal watching began (McAloon *et al.* 1998).

Kaikoura is now a very popular tourist destination in New Zealand, offering many marine watching and interactive tours, walking and recreational diving. In the decade from 1987 to 1996, tourist numbers grew from 3400 to over 200,000, supporting the establishment of 30 new tourist accommodation businesses and 45 new tourism service businesses (Buckley 2003). In 1998 the ecotourism company Whale Watch Kaikoura recorded over 60,000 visitors and in the 2005/2006 season a total of 95,000 whale watchers (Carter 2007).

Under section 186b of the *Fisheries Act* (1996) a temporary closure, known as a rahui, was placed on the Waiopuka reef area of the Kaikoura Peninsula in 2002. It was proposed by the Te Runanga o Kaikoura and the Kaikoura Marine and Coastal Protection Society as a response to the fishing pressure from recreational, commercial and customary harvesters in the area. This rahui has been twice renewed and came up for review again in August 2008 (Te Korowai o Te Tai o Marokura (Kaikoura Coastal Marine Guardians) 2007).

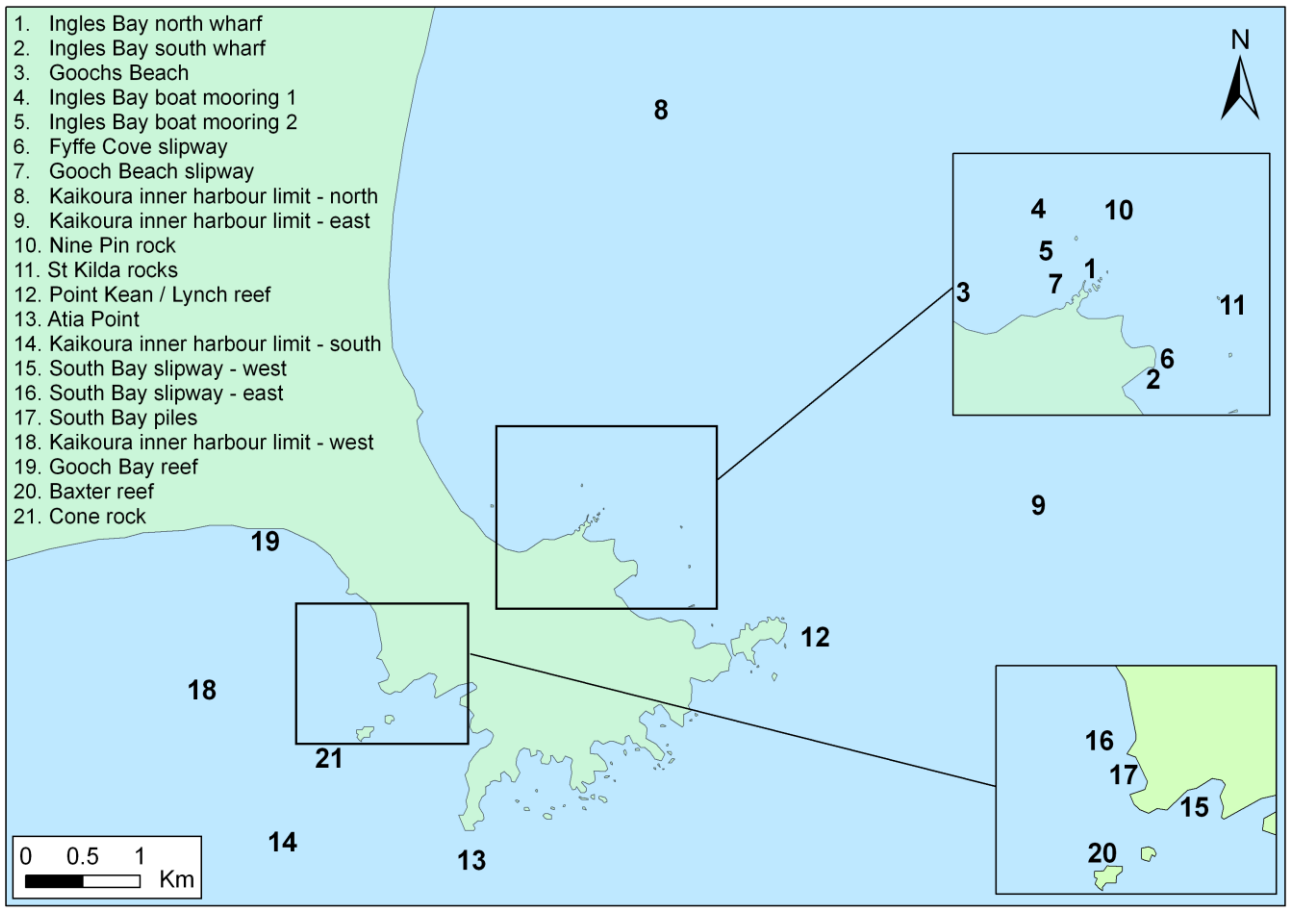

Figure 2: Map of the Kaikoura Peninsula and surrounding harbour, showing numbered field sampling sites.

Port operation, development and maintenance activities

Shipping and boating facilities in Kaikoura work out of three main areas on the Kaikoura Peninsula – the areas known locally as the "new" and "old" wharves on the northern side, and South Bay on the southern side. The "new wharf" (at site 1 in Figure 2) is home to the formerly busy but now unoccupied Pacifica fish factory. It has been in a state of disrepair for a substantial period of time and is planned to be replaced by a new wharf in June 2009 (G. Saidy, Asset Manager Kaikoura District Council, pers. comm.). Ajacent to the new wharf is the Gooch beach slipway, used by the Kaikoura boat club. Many recreational fishermen and local tourist operators launch from Armers Beach, directly south of the "Old Wharf" (at site 2 in Figure 2). This is a calm sandy beach surrounded by large rocky intertidal shelves. These two main wharves on the northern side of the Peninsula are used very infrequently by commercial fishers because of their poor condition. As a result the main facilities for commercial tourist operations in Kaikoura are run out of South Bay. This facility was purpose-built for Whale Watch Kaikoura and includes a small marina, seawall, slipway, fuel facility, and boat washdown area (Whale Watch Kaikoura 2006). This area is cleaned every few years and additional limestone has recently been laid on top of the breakwall for extra protection. The area has recently been inspected above and below the water line to highlight any additional maintenace required and it has been suggested that dredging may be necessary in years to come because of sediment build up around the marina entrance (K. Ngapora 2009, Chief Operating Officer Whale Watch Kaikoura, pers. comm.). Encounter Kaikoura (another major ecotourism company that also uses the South Bay facilities) inspects their jetty annually but no major work has been required for several years. If major work is required on any

vessels they have been piloted to Picton in the past, but this has only occurred every 5-6 years (A. Thompson Business Developer, Encounter Kaikoura 2009, pers. comm.). This area falls into the Kaikoura district council's Marine Facilities Zone which extends from the former limestone quarry at the eastern end of the South Bay Parade around to an area west of the Coastguard in South Bay (Kaikoura District Council 2007).

Shipping movements and ballast discharge patterns

Kaikoura is a major tourist attraction and most of the vessel traffic in the area consists of tourist enterprises, fishing charters, commercial fishermen, some private vessels and infrequent cruise ship arrivals. However, cruise ship numbers are expected to increase with the planned creation of new more adequate wharf structures (G. Saidy, Asset manager Kaikoura District Council 2009, pers. comm.).

Whale Watch Kaikoura, the first major marine eco-tourism company in Kaikoura, operate four mammal watching tour vessels with up to four trips a day. All vessels are held in their purpose built South Bay marina during the day and trailered on shore at night (Whale Watch Kaikoura 2006). The dolphin swimming company Encounter Kaikoura operate three vessels, two catamarans and one stabi craft. The largest catamaran is 14 metres long and can take up to 30 passengers. All dolphin encounter vessels are also trailered when not in use (Encounter Kaikoura 2009). The Department of Conservation has issued a 10 year moratorium on marine mammal watching permits, thereby limiting the number of commercial tourist vessels that are able to operate marine mammal watching tours in Kaikoura.

Vessels operated from Kaikoura are typically fast and highly maneuoverable, ranging from 6 to 13 metres in length. There are 46 registered fishing vessels in Kaikoura, but the storage of these vessels has been dictated by the lack of in-water overnight mooring facilities and because of the exposed and changeable nature of the Kaikoura coast. There are approximately only 20 local regularly used commercial fishing boats. Most fishing boats are local, so are moored here, or taken out of the water following use. Occasionaly bigger trawlers and squid boats are seen off the Kaikoura coast in deeper waters (R. Vaughn 2009, District Planner Kaikoura District Council, pers. comm Baxter 1993; Dodgshun *et al.* 2004; Hayden *et al.* 2008). Commercial fishing vessels do not require a coastal permit to operate in Kaikoura (Ministry for the Environment 2004).

Crayfishing vessel numbers have fluctuated greatly over the past several years, according to data published by the NZ marine department covering 1945-2004. The largest number of registered commercial crayfishing vessels was in 1977, with a total of 140 vessels harvesting 190 tonnes of crayfish. Since then there has been a steady decline in the number of crayfishing vessels with 15 commerical crayfishing vessels being recorded in the Kaikoura coastal and marine statistical area 917 in 2004 (Te Korowai o Te Tai o Marokura (Kaikoura Coastal Marine Guardians) 2007)

Large international cruise ships rarely enter Kaikoura waters because of the inadequate facilites. However, one smaller cruise ship, the 'Clipper Odyssey', is a 120 berth luxury expedition vessel that is small enough to enter many ports that other cruise ships would be unable to reach. It generally circumnavigates the South Island of New Zealand, obtaining its passengers from the port of Lyttelton before heading south to Dunedin, the sub-Antarctic Campbell, Auckland and Snares Islands before bearing north up the west coast of the South Island, stopping in Fiordland and various wildlife areas. It then voyages through the Cook Strait towards Lyttelton via Kaikoura. The vessel also occasionally visits most ports in the North Island, and during other parts of the year it visits Asia, Australia, Latin America and the Galapagos as well as North America (Abercrombie & Kent Inc 2008).

Since June 2005, vessels in New Zealand have been required to comply with the Import Health Standard for Ships' Ballast Water from all Countries (Biosecurity New Zealand 2005). No ballast water is allowed to be discharged without the express permission of a Ministry of Agriculture and Forestry (MAF) inspector. To allow discharge, vessel 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. Ballast water loaded in Tasmania and Port Philip Bay in Victoria (Australia) may not be discharged into New Zealand water under any circumstances, due to the presence of several high-risk non-indigenous species in those areas (Biosecurity New Zealand 2005).

EXISTING BIOLOGICAL INFORMATION

A large number of historical records and local indigenous knowledge have centered on the marine environment along the Kaikoura coastline. For more than a century it has been the focus of research by archaeologists, geologists, geographers and biologists. The Edward Percival Fieldstation run by the Univesity of Canterbury has been the base of considerable scientific research on the marine enviroment since its establishement in 1960. Previous quantitative studies of the Kaikoura Peninsula have recorded 123 macrofaunal species and 45 algal species, with species diversity increasing to seawards and with increased habitat heterogeneity ((Marsden 1981, 1985). Eight key intertidal species were identified in Marsden's (1981; 1985) reports: *Austrolittorina cincta, Austrolittorina antipodum, Melagraphia aethiops, Turbo smaragdus, Cellana denticulata, Epopella plicata, Hormosira banksii,* and *Carpophyllum maschalocarpum.* All of these key intertidal species have been studied by Canterbury University undergraduate students on marine field courses as well as by students studying towards their post-graduate degrees (Chamberlain 1970; Robinson 1992; Walters 1994; Guerry *et al.* 2009).

Two well known fisheries in Kaikoura, the crayfish *Jasus edwardsii* and the paua *Haliotis iris*, fisheries have been observed in the area. Relatively little settlement of puerulus stage *J. edwardsii* larvae is known to occur in Kaikoura and very little research has been undertaken on juvenile and adult rock lobster ecology in the area. However, the commercial and recreational rock lobster fishery has been studied by two post-graduate students in the 1980's (Slark (1985) and Cairns (1985) in Marsden and Schiel 2007). In contrast the paua fishery has been studied by several scientists in the past with research topics covering facets such as general biology, feeding, growth, movement, population ecology, reproduction and (Marsden and Schiel 2007).

Since the 1980's the major drawcard of Kaikoura to the tourism community has been the interaction people can have with the large marine mammal population. Up to 25 species of marine mammal have been recorded from the Kaikoura and Canterbury coastline (Marsden and Schiel 2007). The Southland current and the depths associated with the Kaikoura Canyon, continental shelf and Hikurangi Trough are all believed to draw these large mammals in such close vicinity of the coastline. For this reason marine mammal research in the area has also been abundant with researchers trying to understand aspects of their breeding and migration, the potential impact tourism can play, abundance, acoustic behaviour, population dynamics, diet, and parasites. (Marsden and Schiel 2007).

A compilation of marine macroalgae species records from the Kaikoura region includes three species of non-indigenous algae (*Punctaria latifolia, Undaria pinnatifida* and *Sargassum*

verruculosum) (Nelson 1999). *Punctaria latifolia* was first recorded at Stewart Island pre-1947. Its native range includes a large proportion of Europe, South Australia to Victoria, and north and eastern Tasmania. Since its arrival in Stewart Island its New Zealand range has spread to include Otago and Wellington Harbours as well as Kaikoura. *Sargassum verruculosum*, native to western and southern Australia, New South Wales and Tasmania, has been recorded in Fiordland from Bligh, Thompson, Doubtful, Breaksea and Dusky Sounds and Chalky/Preservation Inlet, and from elsewhere in New Zealand at Stewart Island, Akaroa Harbour and Kaikoura. These two species were all possibly introduced through early whaling and sealing operations in the late 18th and early 19th centuries, but none of them are considered to present a serious threat to native biodiversity (Nelson *et al.* 2002). The distribution of the brown alga *Undaria pinnatifida* has been a focus of considerable research since its arrival into Wellington pre-1947 (Nelson 1999). It is known as an aggressive species in Australia and Europe and its presence was recorded in Kaikoura in 2002 (Stuart 2004).

Environment Canterbury, the government agency responsible for environmental matters in the region that encompasses Kaikoura, has incorporated marine biosecurity issues within its New Zealand Coastal Policy Statements and fisheries policy and plans (ECAN 2005). In all other circumstances MAFBNZ's list of unwanted marine species and legislation controlling this area apply. There are six species on this unwanted register. These species are the seaweed *Caulerpa taxifolia*, the Chinese mitten crab *Eriochier sinensis*, the European shore crab *Carcinus maenas*, the Mediterranean fanworm *Sabella spallanzanii*, the Northern pacific seastar *Asterias amurensis* and the Asian clam *Potamocorbula amurensis (*MAFBNZ unwated register).

Francis (1979) recorded a total of 179 fish species from the Kaikoura area, with representatives from 94 families from a diverse range of habitats. The current number of fish species recorded from the Kaikoura coast stands at 203 (Marsden and Schiel 2007). The diversity of fish in the Kaikoura region has been attributed to the wide range of habitats and the hydrological conditions. Seasonal migrants from the north also pass the Kaikoura peninsula these inlcude kingfish, jack mackerel, trevally and snapper. Deep sea fishes have also been recorded off the Kaikoura coast, like the hatchetfish *Lampanictodes hectoris.* None of the recorded species are non-indigenous to Kaikoura (Marsden and Schiel 2007).

Cranfield *et al.* (1998) reviewed the published literature and classified 159 species as being adventive in New Zealand. Those relevant to the Kaikoura area include the marine macroalga *Sargassum verruculosum*, mentioned above, and the Chinook Salmon *Oncorhynchus tshawytscha*, which is known to spawn in many South Island rivers and was a successful deliberate introduction to New Zealand (Cranfield *et al.* 1998).

Baseline survey methods

REVIEW OF MARINE SPECIES RECORDS FROM KAIKOURA

Prior to undertaking the Kaikoura baseline survey, we conducted a desktop review of biological records (including historical) of marine species previously recorded from Kaikoura. We conducted this review by searching the Southwestern Pacific Regional OBIS Node (SW-PRON) database (NIWA 2008) and relevant published literature.

The SW_PRON database is a work in progress, comprising a growing number of datasets containing marine biodiversity data from the Southwestern Pacific region (NIWA 2008). At the time of our review (mid-2006) it contained two datasets – a "fish" dataset and a "bryozoan" dataset. The "fish" dataset contains mostly fish records as well as some invertebrate records that are derived from various trawl surveys conducted on behalf of New Zealand's Ministry of Fisheries in the Southwest Pacific Ocean between 14/03/1961 and 07/07/2005. The "bryozoan" dataset contains bryozoan species presence data derived from various trips in and around the New Zealand Exclusive Economic Zone between 14/07/1874 and 19/04/2002. These datasets are available for public access on the SW-PRON website (NIWA 2008).

During our desktop review, we compiled a list of all species records that we encountered from the Kaikoura coast, but focused particularly on obtaining a complete inventory of non-indigenous (NIS) and cryptogenic category 1 (C1) species. After compiling our initial species lists we sent the lists for each taxonomic group to relevant experts for them to review species names, reliability of the records and biosecurity status. We also asked the experts to add any NIS or C1 species records that we had missed, and to provide information on the New Zealand and global distribution for the NIS and C1 species. The distribution information was then mapped and species information sheets prepared for each NIS and C1 species.

PORT BASELINE SURVEY OF KAIKOURA

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. We surveyed a variety of these habitat types at sites specified by MAF Biosecurity New Zealand within, and around Kaikoura, from May 14th to 18th 2007.

A variety of sampling techniques was used for the survey of Kaikoura. These sampling methods, specified by MAF Biosecurity New Zealand in the tender documents, are derived from the CSIRO Centre for Research on Introduced Marine Pests (CRIMP) protocols developed for port baseline 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). The methods include small cores for dinoflagellate cysts, large cores and box dredge samples for benthic invertebrates, 20 µm and 100µm plankton nets, crab and shrimp traps, qualitative visual searches, quadrat scraping, photo stills and video, poison stations, beach seines and beach walks (Appendix 1). Due to the exposed nature of the coastline around Kaikoura and the presence of the Kaikoura-Wakatu Quay matatai reserve or Waiopuka closure, some of the sampling methods and sites were varied in agreement with MAF Biosecurity New Zealand. The sites and methods employed during the survey of Kaikoura are detailed below.

SAMPLING EFFORT

Sampling sites and the methods to be employed at each site were specified by MAF Biosecurity New Zealand. A summary of the sampling completed during the first baseline survey of Kaikoura is provided in Table 1, and the spatial distribution for each of the sample methods is shown in Figure 11 to Figure 22. The exact geographic locations of sample sites are given in Appendix 2. Planned sampling that was not conducted, and the reasons for this, are given in Appendix 3.

FOULING COMMUNITIES

Fouling assemblages at piling and hard substrate sites were surveyed using photographic stills and video as well as qualitative visual surveys and/or scraping samples.

Divers recorded video transects continuously from the surface to 10 m depth (where possible). Following the video transects, quadrats (25 cm x 40 cm) were secured to the hard surfaces at depths of 0.5 m, 3.0 m and 7.0 m depth (where water depths allowed this), and still images were taken with a high-resolution digital camera. Four overlapping photographic stills were taken in each quadrat to cover the area. At sites where scraping was possible and permitted, once the first diver had obtained the photographic images, a second diver then removed fouling organisms by scraping the organisms inside each quadrat into a 1 mm mesh collection bag, attached to the base of the quadrat. Once scraping was completed, the sample bag was sealed and returned to the boat for processing. The divers also made a visual search of the area for known harmful invasive species and collected samples of large conspicuous organisms not represented in quadrats.

Figure 3: Diver sampling organisms by quadrat scraping.

BENTHIC INFAUNA

Benthic infauna were collected by sieving sediment collected using a large hand corer or an anchor box dredge (Figure 4). The large hand corer is 150 mm in diameter and 400 mm long. It is inserted 200 mm into the sediment, resulting in a sediment sample 150 mm in diameter by 200 mm length. The large hand corer was used at all sites except site 22 (Poison Bay), where an equivalent sample was collected remotely using an anchor box dredge. The anchor box dredge consists of a solid metal box (38 cm x 35 cm x 20.5 cm) that attaches to a long

chain. The dredge is dropped from a boat or wharf to the seafloor where it sinks down into the sediment. It is then hauled back onto the boat and the retrieved sediment sieved to capture benthic infauna. At each site, triplicate samples were taken 50 m out from the pile and hard structure site (where applicable).

Figure 4: Large hand corer (left) and anchor box dredge (right) for sampling

DINOFLAGETLLATE CYST-FORMING SPECIES

Triplicate samples were collected for dinoflagellate cysts at planned pile and hard substrate sites, with triplicate samples 50 m out from the pile and hard structure site (depth permitting). At sites with suitable benthos (sites 1, 2 and 22) samples for dinoflagellate cysts were taken with a TFO gravity corer, but sites with stoney/cobble benthos (sites 3, 6, 7, 8, 10, 11, 12, 16 and 21) required divers to manually take the samples using a small hand core (Figure 5). Sediment samples were kept on ice and refrigerated prior to dispatch to the specialist taxonomist.

The TFO gravity corer consists of a 1 m long x 1.5 cm diameter hollow stainless steel shaft with a detachable 0.5-m long head (total length = 1.5 m; Figure 6). Directional fins on the shaft ensure that the corer travels vertically through the water so that the point of the sampler makes first contact with the seafloor. The detachable tip of the corer 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 effectively preserves the vertical structure of the sediments and fine flocculant material on the sediment surface. The TFO corer is deployed and retrieved from a small research vessel.

The small hand core used by divers is a 20 cm long tube with 2 cm internal diameter. Tubes are forced into the substrate then capped at each end with a rubber bung to provide an airtight seal.

Figure 5: Diver manually taking a small core sediment sample for dinoflagellate cyst-forming species.

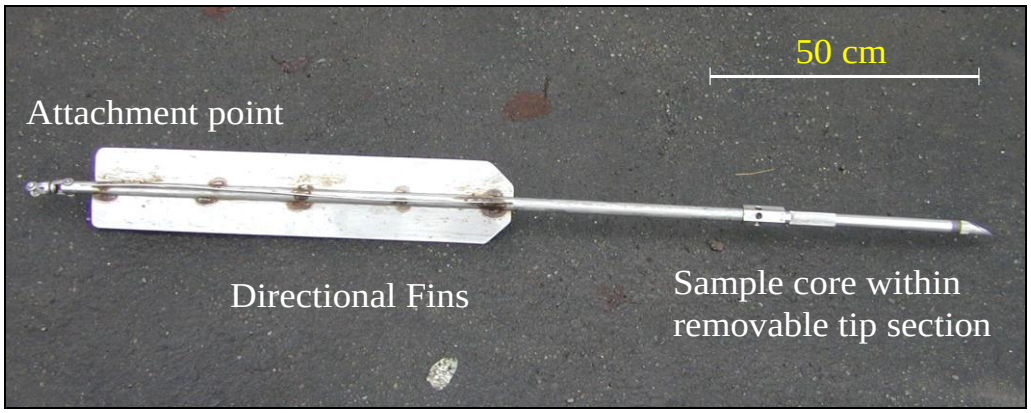

Figure 6: Javelin corer

DINOFLAGETLLATES, PHYTOPLANKTON AND ZOOPLANKTON IN THE WATER COLUMN

A 100 µm net with a diameter of 70 cm was used to sample zooplankton in the water column. The net dropped vertically to approximately 1 metre from the substrate. Following the vertical drop the net was retrieved and carefully sprayed down to collect all the sample which was then placed in containers and preserved. A 20 µm net with a diameter of 25 cm was used to sample dinoflagellates and phytoplankton species. This net was towed just below the water surface behind the charter vessel at slow speed for 1 minute then retrieved, washed down, placed in sample containers and labelled for laboratory analysis.

Figure 7: Zooplankton net commencing its vertical drop.

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 8). 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.

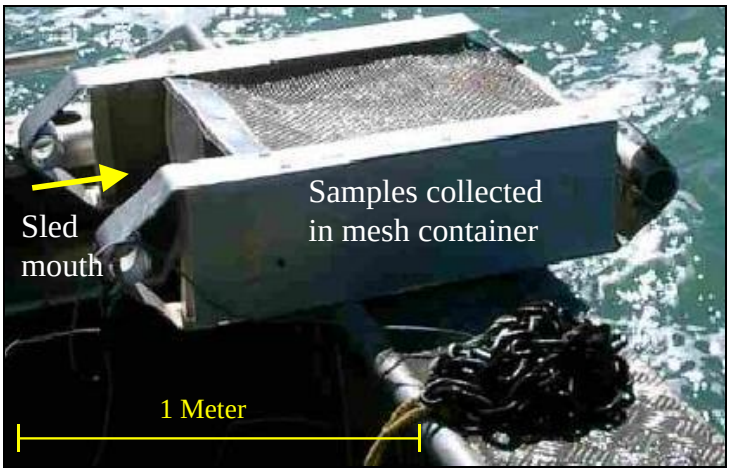

Figure 8: Benthic sled

Qualitative visual surveys

At planned sites a qualitative visual survey dive was conducted over suitable substrata. Three replicate 10 m transects were recorded on video at each qualitative visual survey site. Representative fauna and flora were collected for subsequent identification. Large, conspicuous marcofauna and flora were identified from the video records.

Traps

Crab box traps (63 cm x 42 cm x 20 cm; Figure 9) with a 1.3 cm mesh netting were used to sample mobile crabs and other small epibenthic scavengers. 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 three box traps, were set on the sea floor at each site and left to soak overnight before retrieval.

Shrimp traps (Figure 9) 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 is fitted. The funnel has a 5 cm entrance that tapers in diameter to 1 cm. The entrance is 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 three shrimp traps, were set on the sea floor at each site and left to soak overnight before retrieval.

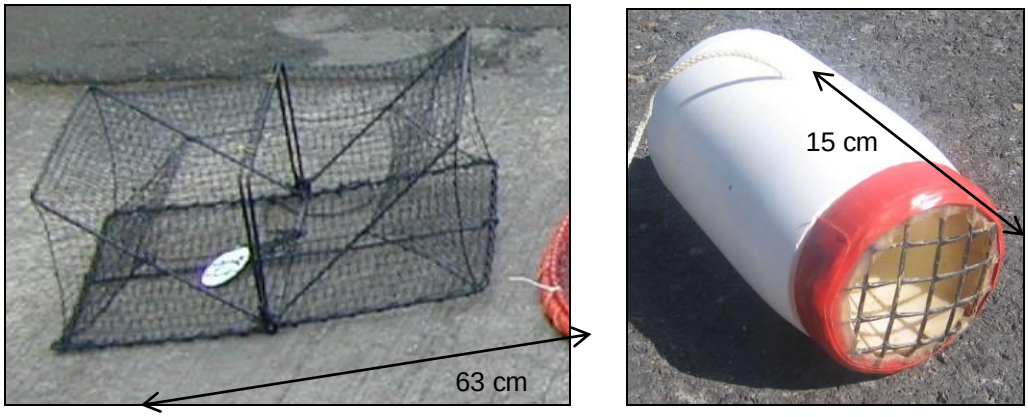

Figure 9: Crab box trap (left) and shrimp trap (right)

Fishes

Fishes were sampled using poison stations and beach seine netting.

Poison stations were sampled over hard substrata using clove oil at three sites (sites 3, 7 and 22). An area with suitable contours was selected and draped with a collection net. Clove oil was then applied to the area paying particular attention to potential hiding places for fish species. As the fish in the selected area became anesthetised they were collected using small aquarium dip nets and placed in a sealed bag. This was then returned to the charter boat for processing and labelling before being frozen.

Beach seine nets (Figure 10) were used to sample fish species at one river mouth (site 3) and one beach (site 22). The net is 11 m wide, has a headline height of around 1 m and a 4 m cod end of 9 mm mesh. The net was dragged from a suitable starting position onto the beach where the catch was bagged, labelled and placed on ice for freezing at the first opportunity.

Figure 10: A beach seine net being dragged out before hauling in

Beach wrack

Qualitative visual surveys of beach wrack were conducted at specified sites to collect crab exuviae, target macroalgae or other target organisms. Beach wrack surveys are designed for surveyors to walk parallel to the water's edge 2 m from the shore, 5 m from the shore and 10 m from the shore. However, at Kaikoura the shore was only wide enough to allow surveys at 2 m from the water's edge. At site 22 (Poison Bay), two beach wrack walks - one on each side of the creek - were conducted at 2 m from the water's edge. Collected organisms were bagged and labelled.

ENVIRONMENTAL DATA

Water temperature, salinity and sea state

Field measurements of water temperature and salinity were taken at each site. Turbidity measurements (measured as Secchi depth) were taken at each site using a 150 mm diameter Secchi disk. Observations were also made of daily sea state (Beaufort scale).

Sediment analysis

Sediment samples were taken for analysis of grain size and organic content from each site that was sampled for benthic infauna, where possible (some sites had stoney substrates with very little sediment, which prohibited the collection of one or both sediment samples). A ~100 g wet weight sample was collected from each of two replicate anchor box dredge or large hand core samples at each site, and frozen prior to analysis. A ~30 g sub-sample was removed for analysis of organic content, while the remainder was used to determine the particle size distribution of the sample using a laser grain size analyser.

The organic content of the sediments was estimated using the common method of loss on ignition (LOI). For each sample, the wet sample was well mixed and a representative subsample (approximately 30 g) placed into a pre-weighed crucible. The sample was put into a 104 ^{o}C oven until completely dry. It was then transferred to a desiccator to cool before being weighed to the nearest 0.001 g. The sample was then ashed in a muffle furnace at 500 ^{o}C for four hours. When cool enough it was transferred to a desiccator to cool further before being weighed to the nearest 0.001 g. The difference between nett dry and nett ash-free dry weights

was then calculated. This difference or weight loss, expressed as a percentage (LOI %), is closely correlated with the organic content (combustible carbon) of the sediment sample (Heiri *et al.* 2001).

The distribution of particle sizes at each port was measured using the standard procedures and equipment of nested sieves to sort the larger particles (down to 0.5 mm) and a laser grain size analyser to sort particles below this size, as follows:

1. Samples were wet sieved using sieves of mesh sizes 8 mm, 5.6 mm, 4 mm, 2.8 mm, 2 mm, 1 mm and 0.5 mm.
2. Sediments retained on each sieve were dried and weighed.
3. The remaining fraction (< 0.5 mm) was prepared for laser analysis: the < 0.5 mm fraction was made up to 1 L in a cylinder fitted with an extraction tap. The sample was homogenised by continuous agitation with a plunger up and down in the cylinder for 20 seconds. With agitation continuing during extraction, approximately 100 ml was drawn off for drying and weighing and a second 100 ml was drawn off for laser particle analysis.
4. The first 100 ml was measured to obtain a percent of the whole sample, then dried, weighed and scaled up to 100 % to return the < 0.5 mm gross dry weight.
5. The laser analysis returns percent distributions of volume in any chosen size ranges. These percents are then applied to the < 0.5 mm gross dry weight.
6. Laser analysis was conducted using a Galai CIS-100 "time-of-transition" (TOT) stream-scanning laser particle sizer. Particles sized between 2 µm and 600 µm were measured by the laser particle sizer. Typically, 250,000 to 500,000 particles were counted per sample.
7. The proportion of particles in each of five size categories (ranging from clay to small pebbles) was then calculated as a percent of the total net dry weight.

SORTING AND IDENTIFICATION OF SPECIMENS

Each sample collected in the survey was allocated a unique code on waterproof labels and transported to a field laboratory onboard the research vessel, 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 2. Specimens were subsequently sent to approximately 20 taxonomic experts 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 3) and the Australian Trigger List produced by the Consultative Committee on Introduced Marine Pest Emergencies (Table 4).

Because of the difficulty of identifying all species from the zooplankton samples, an alternative approach was taken, in consultation with MAF Biosecurity New Zealand, whereby the samples were only screened for target non-indigenous species. The species looked for were larvae that were or were suspected to be the Chinese mitten crab *Eriocheir sinensis* (or other members of this genus), the European green crab *Carcinus maenas*, the northern Pacific seastar *Asterias amurensis* and the ascidian *Styela clava*. Identifications were not made for organisms other than these species in the samples. Experts were not available to examine platyhelminths or sipunculids, so these taxa could only be recorded as "indeterminate taxa" (see "

Baseline survey methods: Definitions of biosecurity status", below).

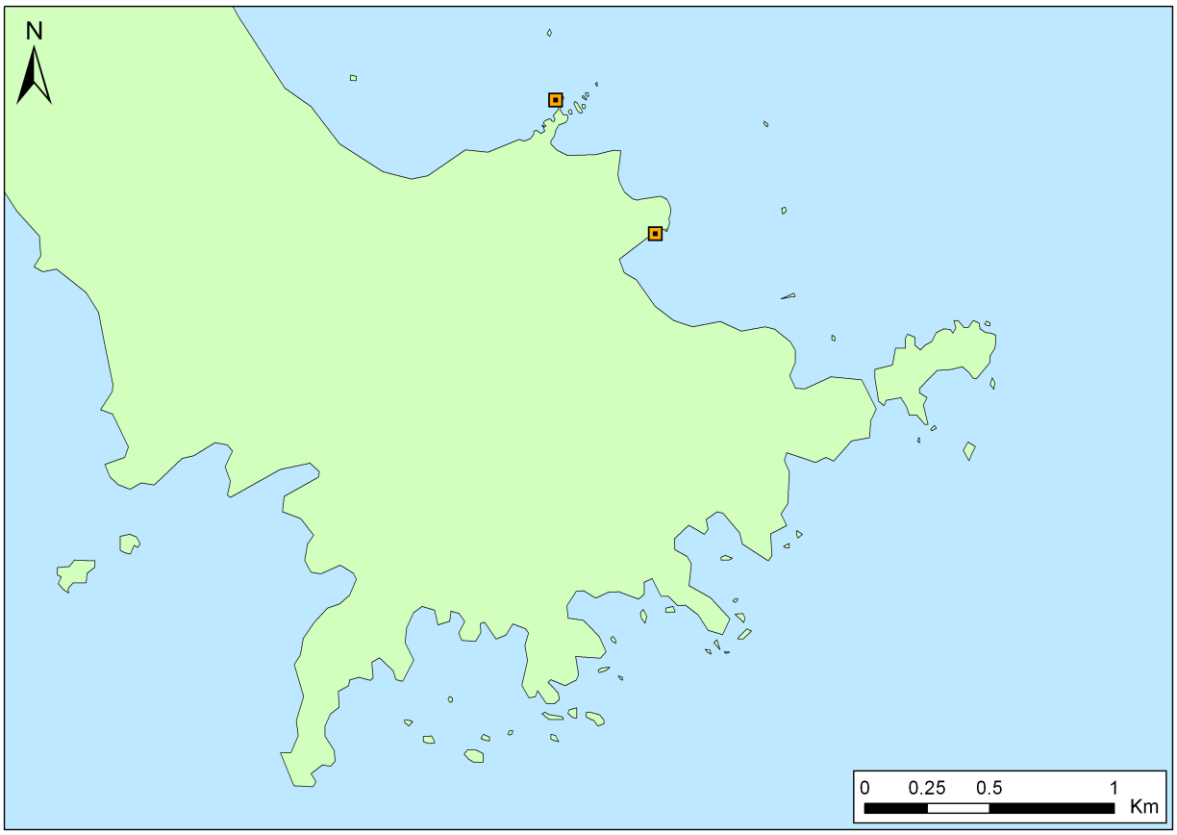

Figure 11: Quadrat scraping sites

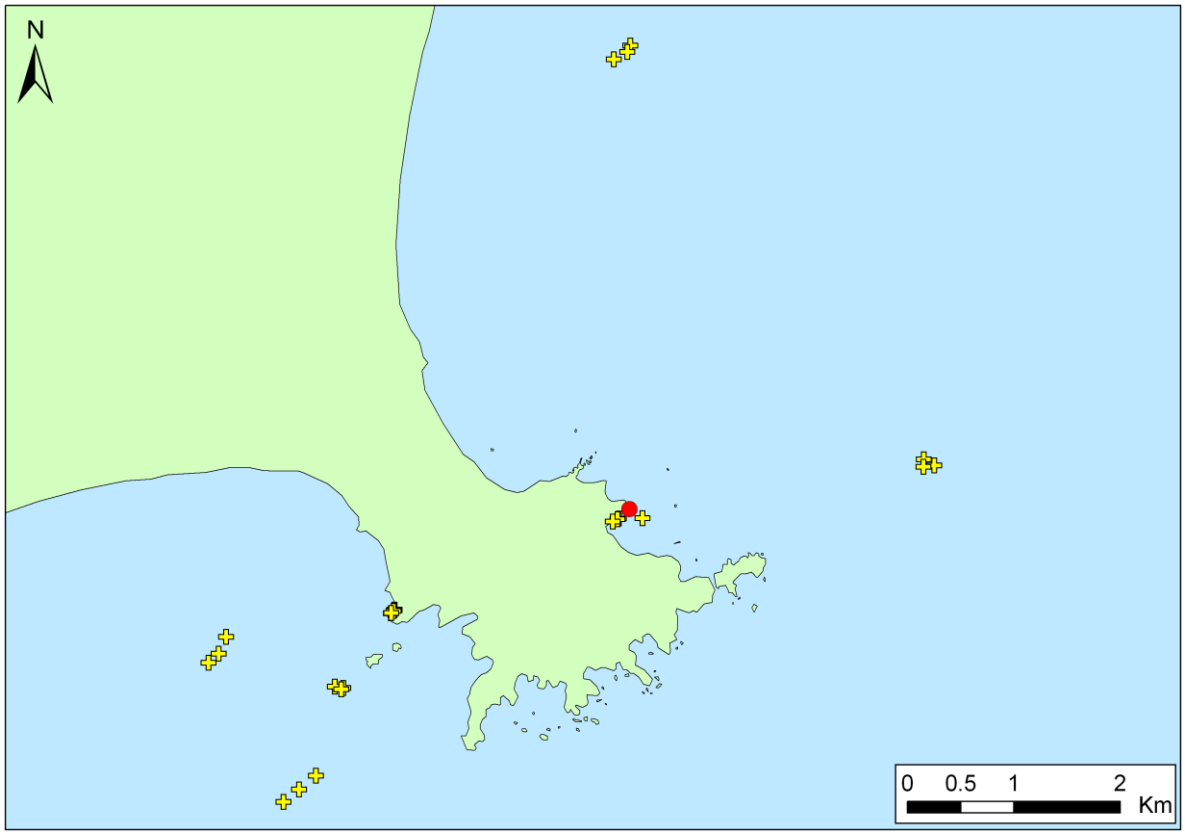

Figure 12: Anchor box dredge (yellow cross) and large benthic core (red circle) sampling sites

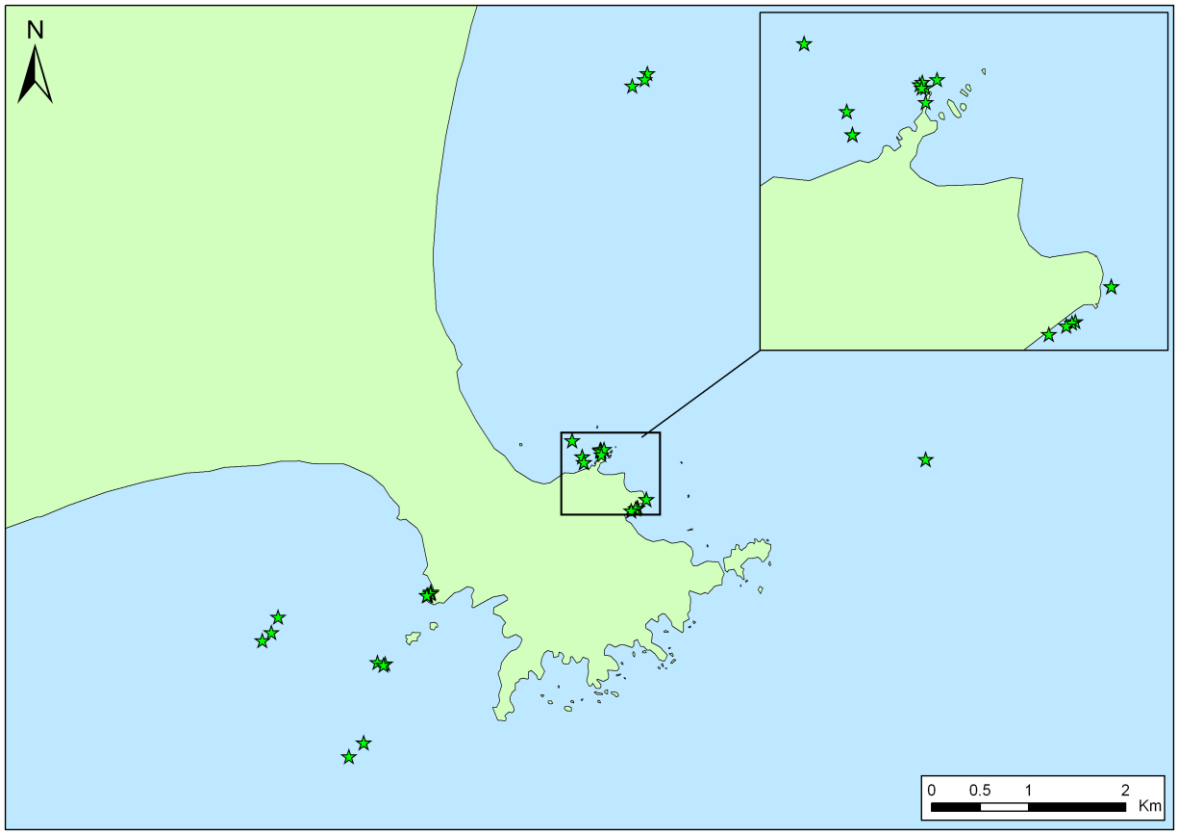

Figure 13: Cyst sampling sites

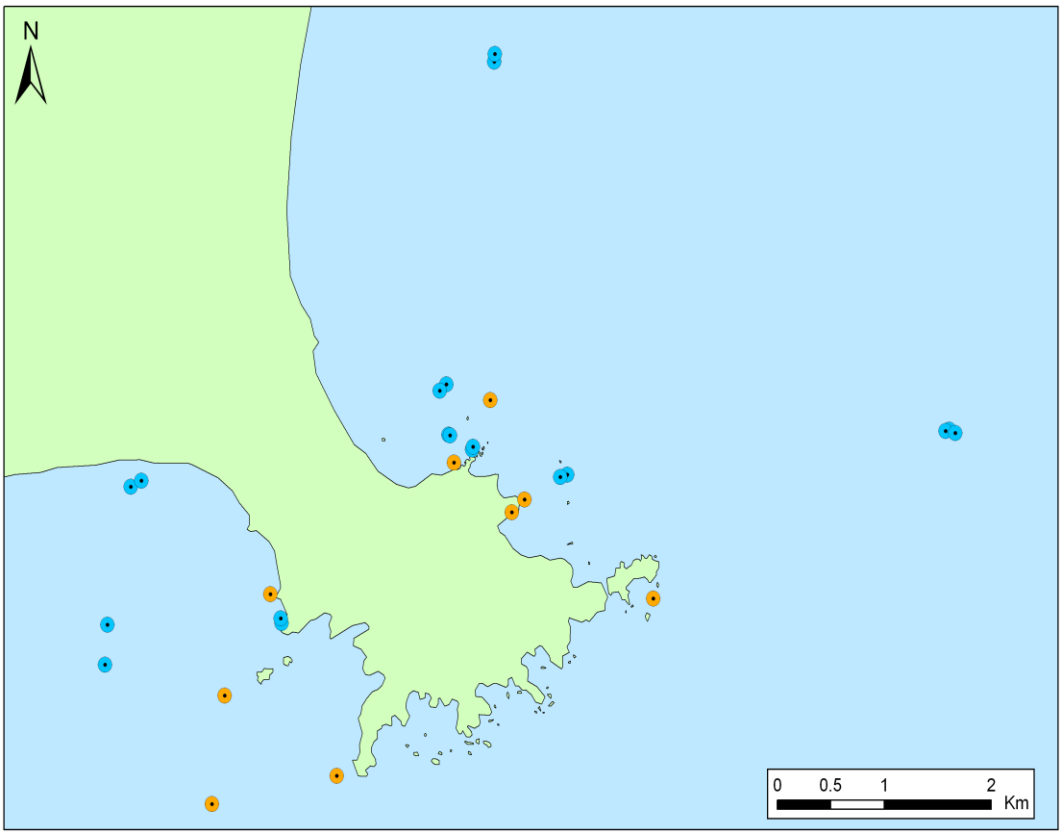

Figure 14: Diver visual transect and benthic sleds sites

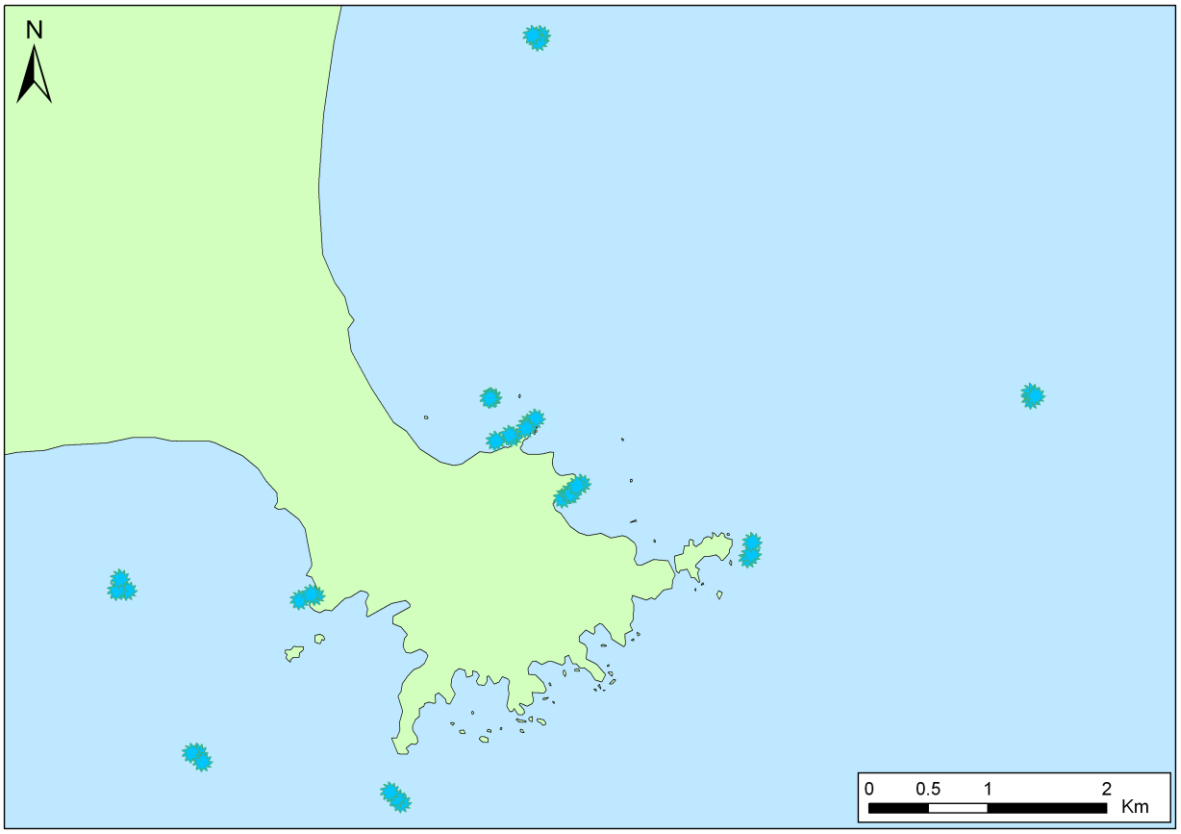

Figure 15: Water column sampling sites for phytoplankton and dinoflagellates

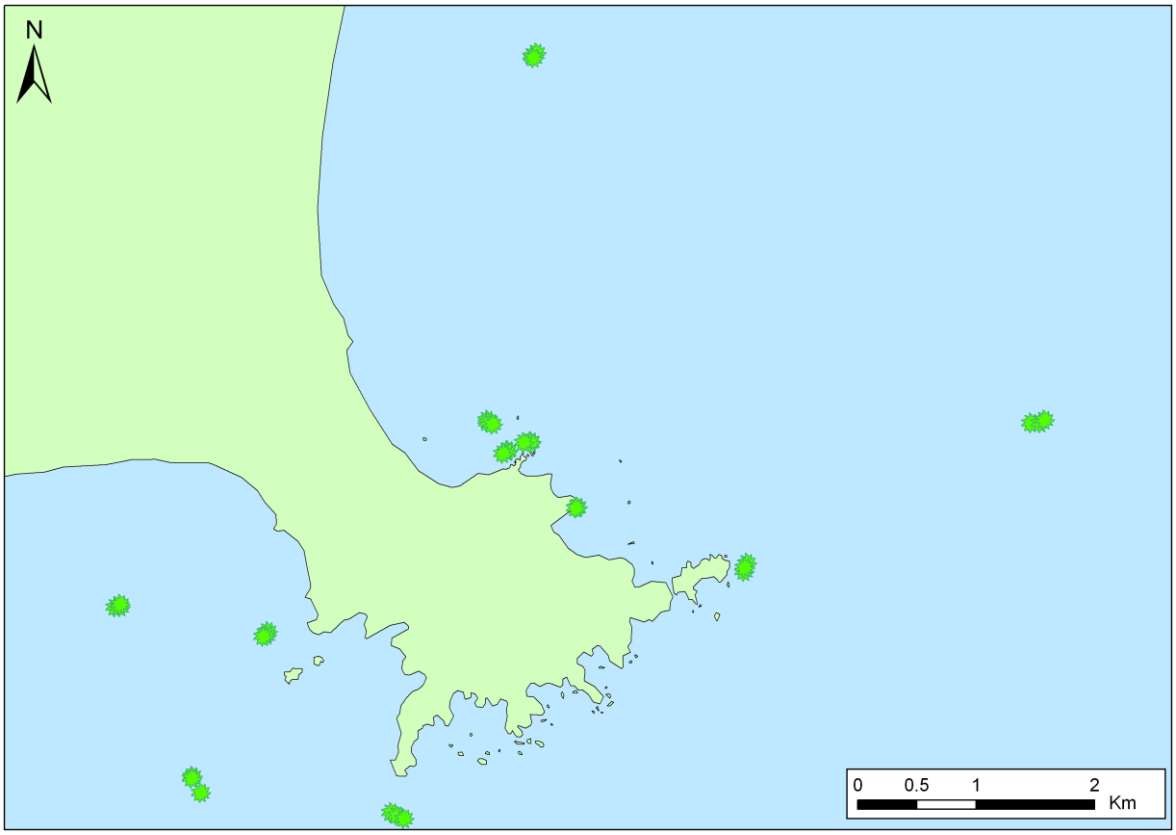

Figure 16: Water column sampling sites for zooplankton

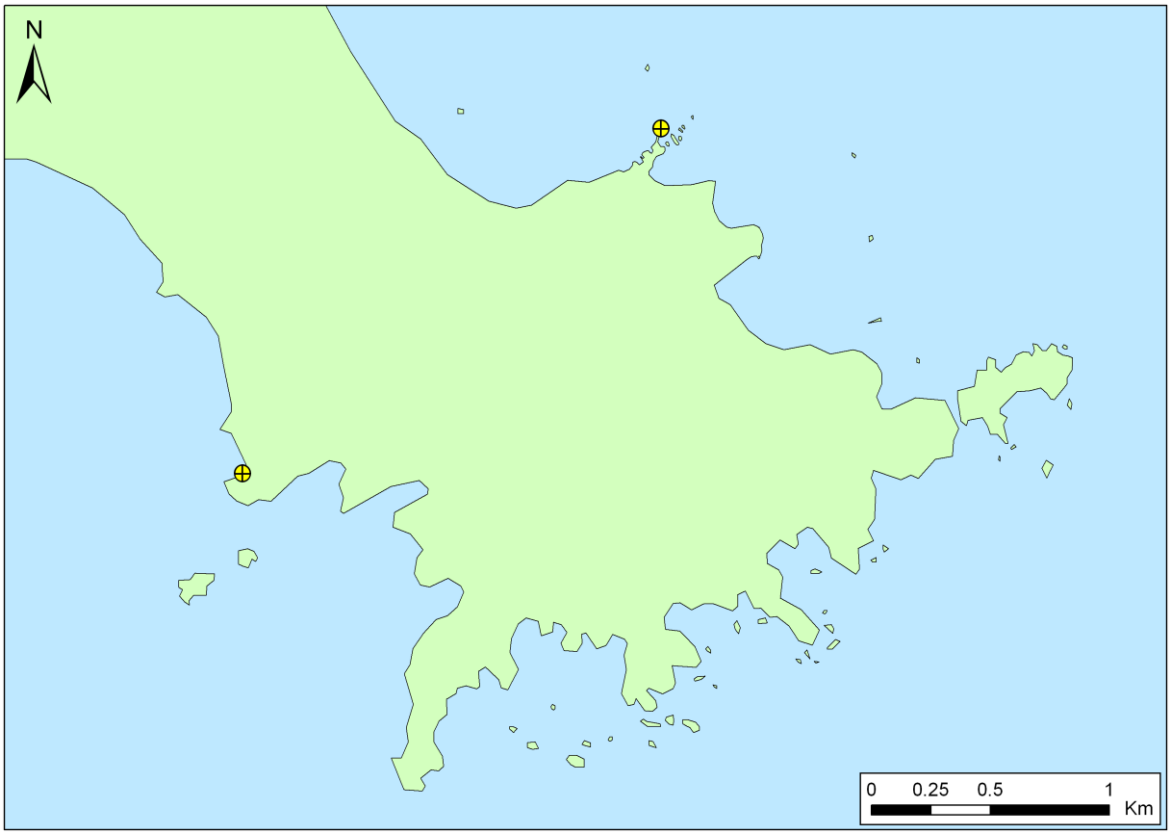

Figure 17: Above water oportunistic visual transect sites

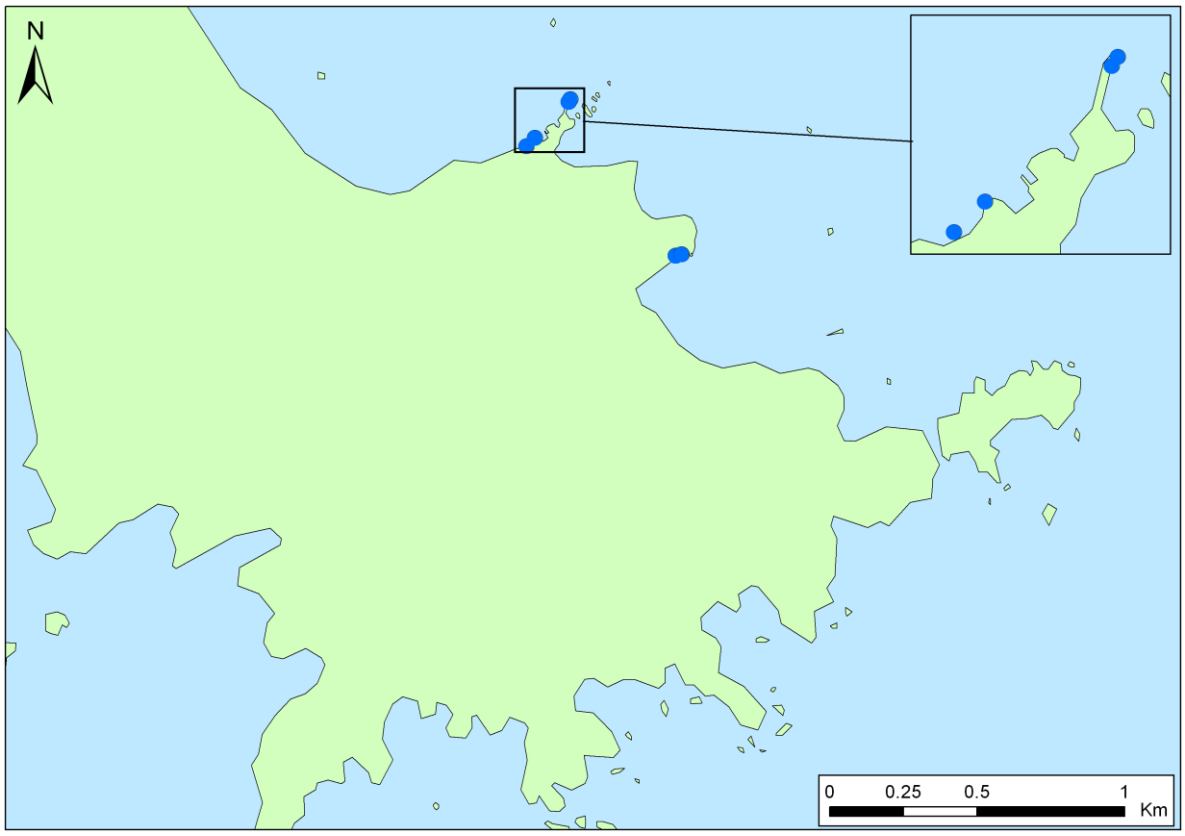

Figure 18: Crab and shrimp trapping sites

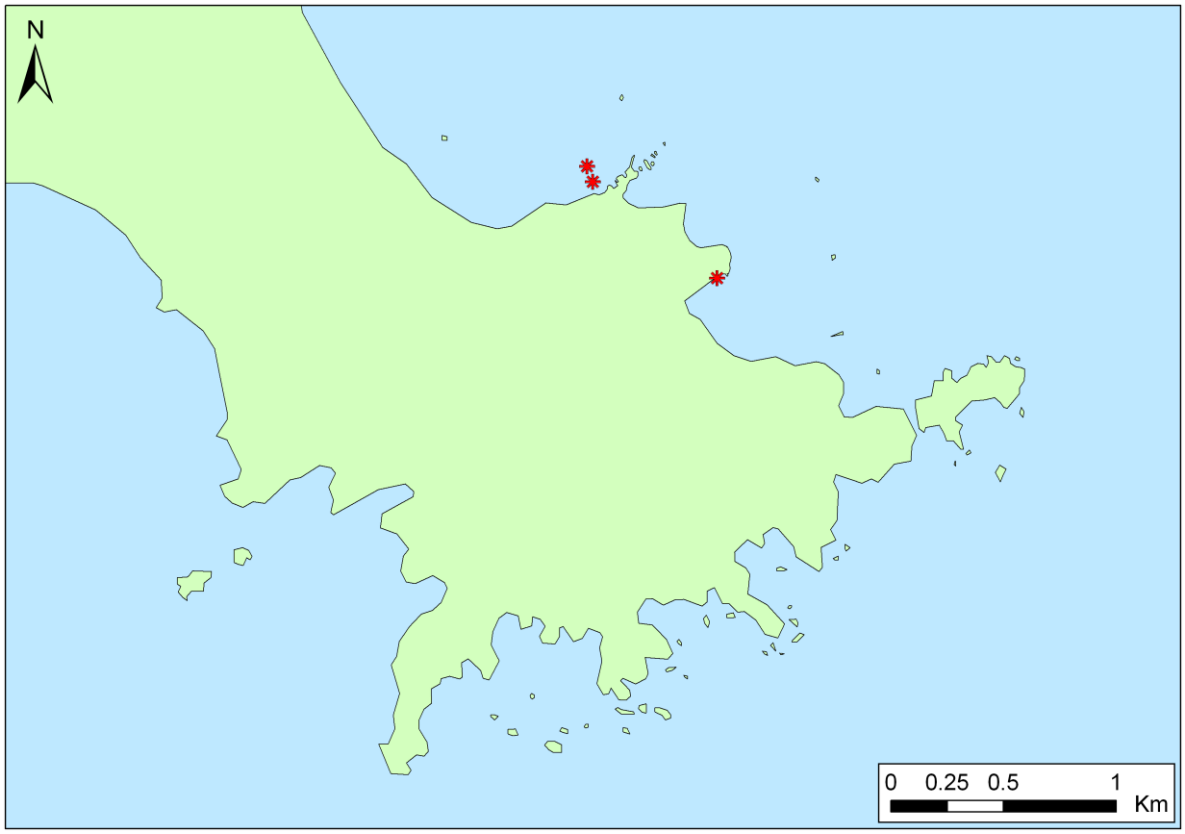

Figure 19: Poison station sampling sites

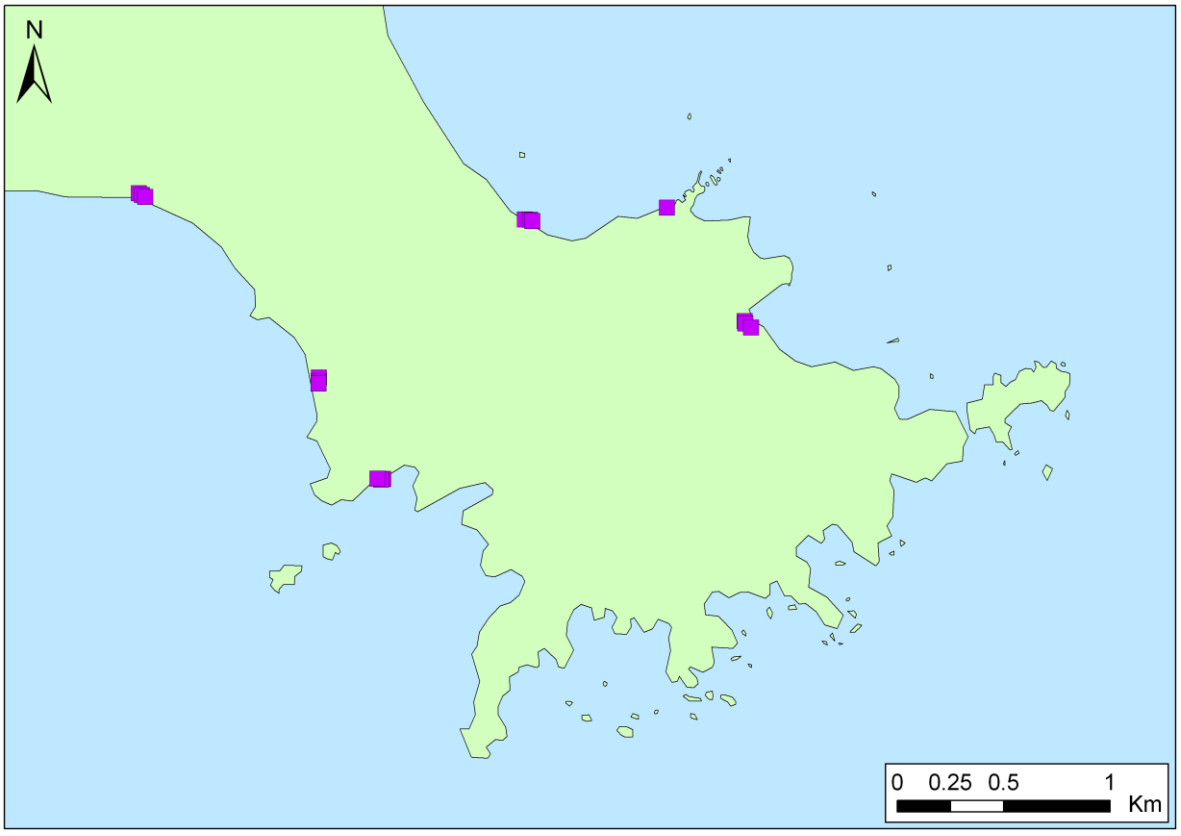

Figure 20: Beach seine sampling sites

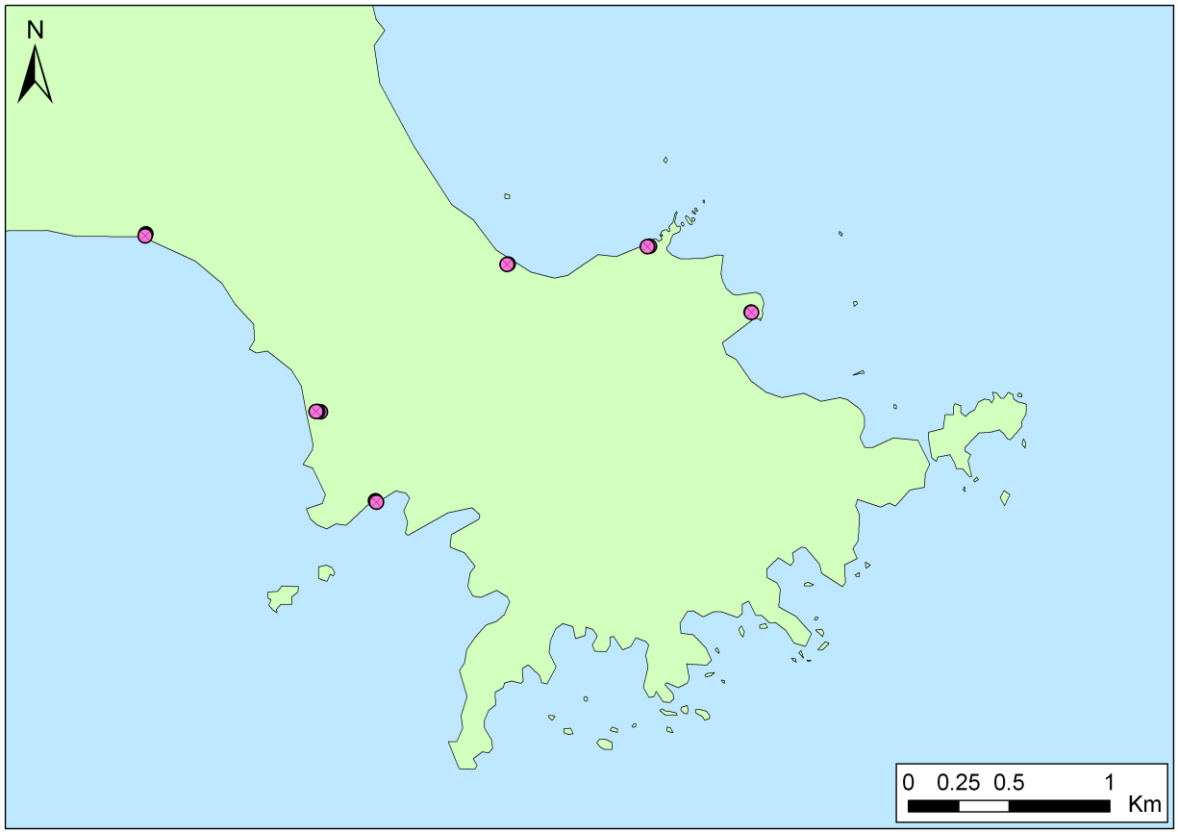

Figure 21: Beach wrack sampling sites

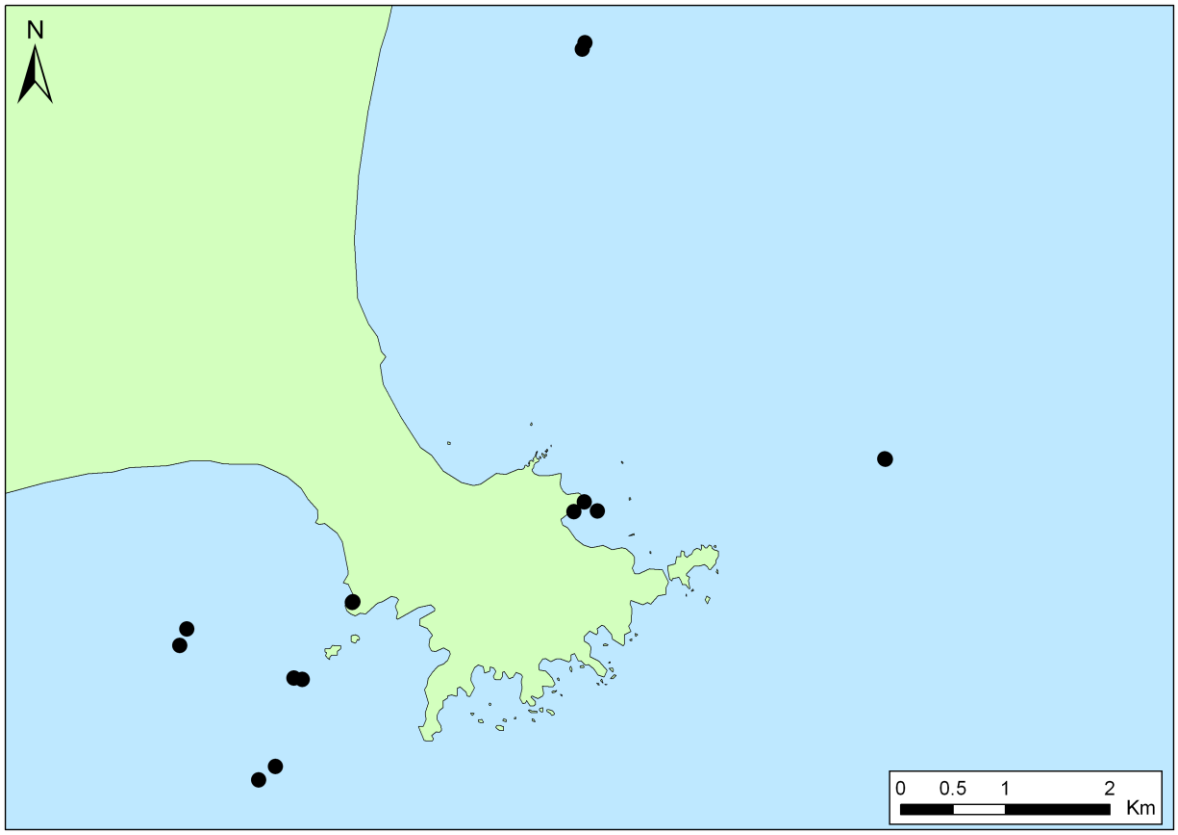

Figure 22: Sediment sampling sites

DEFINITIONS OF BIOSECURITY STATUS

Each species recovered during the survey was classified into one of five categories ("biosecurity status") 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 determine the true range and origin of many species reliably. The biosecurity status 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. A fifth biosecurity status ("indeterminate taxa") was used for specimens that could not be identified to species-level. Formal definitions for each biosecurity status are given below, and a full glossary is provided at the end of the report.

Native species

Native species 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?

Cryptogenic category 1 taxa (C1)

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 category 2 taxa (C2)

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.

Indeterminate taxa

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.

PUBLIC AWARENESS PROGRAMME

A well-targeted public awareness programme is an important component of this project. Because Kaikoura is a relatively small town, a large field research team is highly visible and requires the support and infrastructure of the community. It is important, therefore, that the community clearly understands the motives for the survey and how they may contribute to a successful national outcome (i.e. greater biosecurity awareness and protection). The attachment of local communities to their surrounding marine environment can act to the advantage of biosecurity if local vigilance can be harnessed for on-going passive surveillance for marine pests. Developing a strong public awareness programme is, therefore, critical to the success of the project and to on-going protection of New Zealand's marine environment from unwanted marine organisms.

NIWA worked closely with Biosecurity NZ and relevant local and regional authorities to develop a public awareness programme for the survey. We made joint media releases to local media immediately before the survey began. These outlined the activities to be undertaken during the survey and encouraged any public reports or observations on potentially introduced species, including providing points of contact for reporting (Appendix 4). Where possible, any reports were followed up by the survey team while they were on location or immediately after the survey was completed. A log was kept of any such reports and the response to them. The public awareness programme included a communication plan that outlined the personnel (in NIWA and Biosecurity NZ) who are authorised to respond to media enquiries and scope of issues that they were authorised to address.

Consideration of Maori interests is also an important part of the public awareness programme. In many parts of the country, including Kaikoura, Iwi hapu or whanau hold manamoana over local marine resources. It is important to establish appropriate lines of communication before the surveys to ensure the kaitiaki are aware of the survey's purpose and to seek their support for the sampling activities. NIWA's Maori Development Unit, Te Kuwaha o Taihoro Nukurangi, worked closely with Biosecurity NZ's Maori Strategic Unit team to identify appropriate hunga whakapa.

Media releases for the Kaikoura and Port Underwood joint port surveys were sent to the following organisations and stakeholders:

Media

- The Radio Network Marlborough
- Radio New Zealand Christhurch news desk
- Nelson Mail
- Radio New Zealand Our Changing World: Ms Veronika Meduna
- Radio New Zealand Wellington news desk
- The Dominion Post
- The Press

Stakeholders

- Te AtiawaNgati Toa Ki Wairau
- Te Runanga O Rangitane ki Wairau
- Ngati Rarua
- Te Tau Ihu Fishery Forum
- Marlborough District Council
- Ministry of Fisheries Officer, Blenheim
- Department of Conservation

Following media release, the following press coverage resulted:

- Marlborough Express: 'Hunt for foreign marine invaders in Marlborough', 16 April 2007, p.3.

Results

REVIEW OF MARINE SPECIES RECORDS FROM KAIKOURA

Five hundred and sixty-one taxa representing 14 phyla were recorded during the desktop review of existing marine species records from Kaikoura and surrounding areas. These include 486 native taxa (Table 5), eight non-indigenous species (NIS; Table 6), 14 cryptogenic category 1 (C1) taxa (Table 7), two cryptogenic category 2 (C2) taxa (Table 8) and 51 indeterminate taxa (Table 9). For general descriptions of the main groups of organisms recorded during this review, refer to Appendix 5. A list of Chapman and Carlton's (1994) criteria (see "

Baseline survey methods: Definitions of biosecurity status", above) that were met by the NIS and C1 taxa is given in Table 10.

The 486 native taxa compiled in our review of existing marine species records from Kaikoura are comprised of 14 phyla but are dominated by arthropods, bryozoans, annelids and chordates (fishes) (Table 5). It should be noted that whilst our review was thorough, achieving an exhaustive list of native species was not possible within the resources available to the study.

The eight non-indigenous species previously recorded from Kaikoura (Table 6) include one polychaete annelid (*Dipolydora armata*), one amphipod (*Monocorophium sextonae*), one fish (*Oncorhynchus tshawytscha*), one hydroid (*Obelia longissima*), three brown algae (*Punctaria latifolia*, *Sargassum verruculosum* and *Undaria pinnatifida*) and one sponge (*Chondropsis topsentii*). Available information on the ecology of each of these species, their global and New Zealand distributions, vectors and potential impacts are provided in Appendix 6. *Undaria pinnatifida* is the New Zealand Register of Unwanted Organisms (Table 3), the Australian CCIMPE Trigger List (Table 4), and an Australian list of priority domestic pests (Hayes *et al.* 2005)

The 14 C1 taxa previously recorded from Kaikoura and surrounding areas (Table 7) include three annelids (*Typosyllis armillaris*, *Heteromastus filiformis* and the *Capitella "capitata"* species complex) two arthropods (*Aora typica* and *Eurylana arcuata*), two bryozoans (*Scruparia ambigua* and *S. chelata*) and seven sponges (*Chelonaplysilla violacea, Darwinella gardineri, Tethya* cf. *bergquistae, Callyspongia* cf. *ramosa, Callyspongia diffusa, Haliclona clathrata* and *Crella incrustans*). The two C2 taxa (Table 8) recorded in our review of existing marine species records include one bryozoan (*"Carbasea" indivisa*) and one sponge (*Iophon* cf. *proximum*).

Two of the taxa recorded during the review are harmful algal species. These are the dinoflagellates *Dinophysis acuta* and *D. acuminata*. Both are widely distributed worldwide and are considered native in New Zealand (Table 5). They form blooms that are associated with Diarrhetic Shellfish Poisoning (DSP), although it appears that not all *Dinophysis acuminata* blooms are toxic (Faust and Gulledge 2002).

PORT ENVIRONMENT

Sampling was carried out at twenty-one different sites throughout Kaikoura (Figure 11 to Figure 22, Table 11). Maximum recorded depths ranged from 40 m at sites 9 (Atia Point) and 13 (Kaikoura inner harbour limit-east) to only 1.5 m at sites 3 (Goochs Beach) and 15 (South Bay slipway-west). Turbidity was greatest at site 18 (Kaikoura inner harbour limit-west) and least at site 14 (Kaikoura inner harbour limit-south). Salinity ranged from 34 ppt at sites 8 (Kaikoura inner harbour limit-north) and 10 (Nine pins rocks) up to 37 ppt at sites 6 (Fyffe cove slipway) and 19 (Gooch Bay beach). Water temperature was quite constant across sites, at an average of 12.4 degrees Celsius. During sampling, sea states ranged from 0-5 on the Beaufort scale (i.e. approximately 0-21 knots wind speed and 0-2 m wind speed), with most sites being sampled during conditions of Beaufort scale 1 and 2.

The organic content of sediments in the Kaikoura area was low, with a mean LOI (loss on ignition) value across the 15 analysed samples from eight sites of 2.1 % ± 0.4 % (Figure 23). Organic content was highest at the South Bay piles (site 17), which may have some influence from the human activity at the tourist wharfs.

Sediment samples could not be collected from several of the sampling sites around Kaikoura (Appendix 3) because the seabed at these sites were composed almost entirely of much larger cobbles and boulders. Of the sites that could be sampled, sediments consisted almost entirely of sand-sized particles (Table 12). Site 6 (Fyffe Cove slipway) also had a substantial proportion of larger gravel-sized particles.

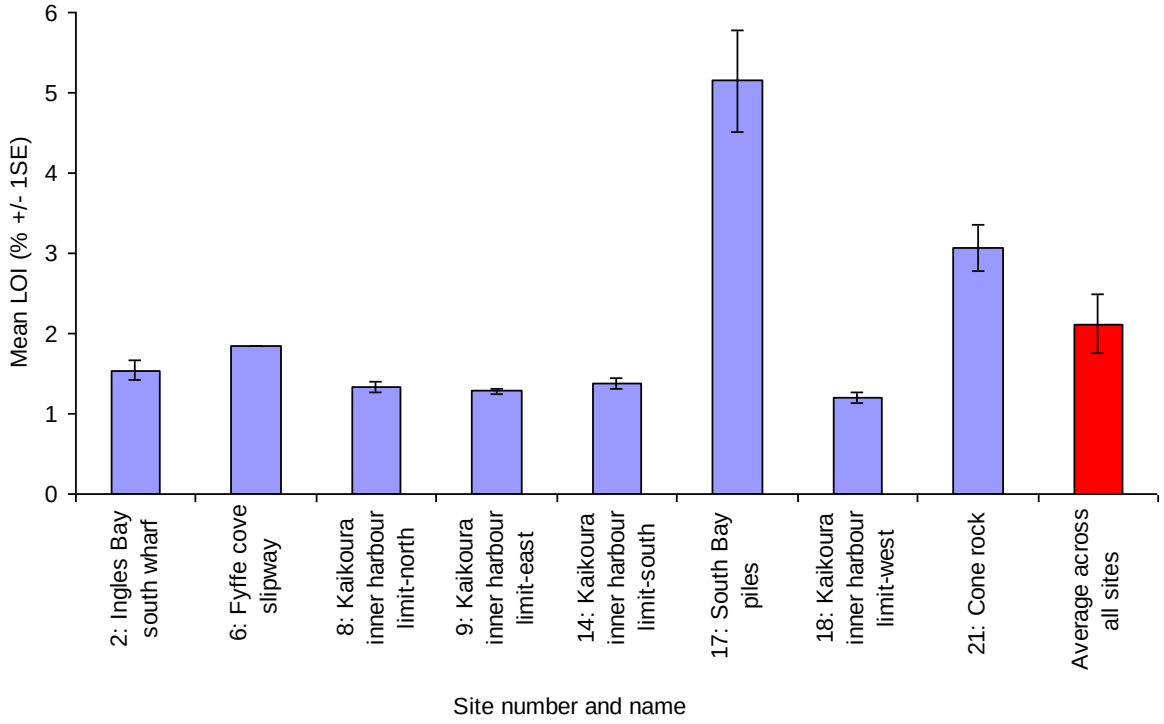

Figure 23: Organic content as determined by loss on ignition analyses of sediments from eight sites around Kaikoura.

SPECIES RECORDED

A total of 411 species or higher taxa were identified from the initial baseline survey of Kaikoura. This collection consisted of 296 native taxa (Table 13), four non-indigenous species (Table 14), eight cryptogenic category 1 (C1) taxa (Table 15), 20 cryptogenic category 2 (C2) taxa (Table 16) and one zooplankton (which were screened for target non-indigenous species but not otherwise identified), with the remaining 82 taxa being indeterminate (Table 17, Figure 24).

The biota recorded included a diverse array of organisms from 16 phyla, as well as a variety of zooplankton and three specimens that couldn't be identified to phylum (Figure 25). For general descriptions of the main groups of organisms (phyla) encountered during this study refer to Appendix 5, and for detailed species lists collected using each method refer to Appendix 7.

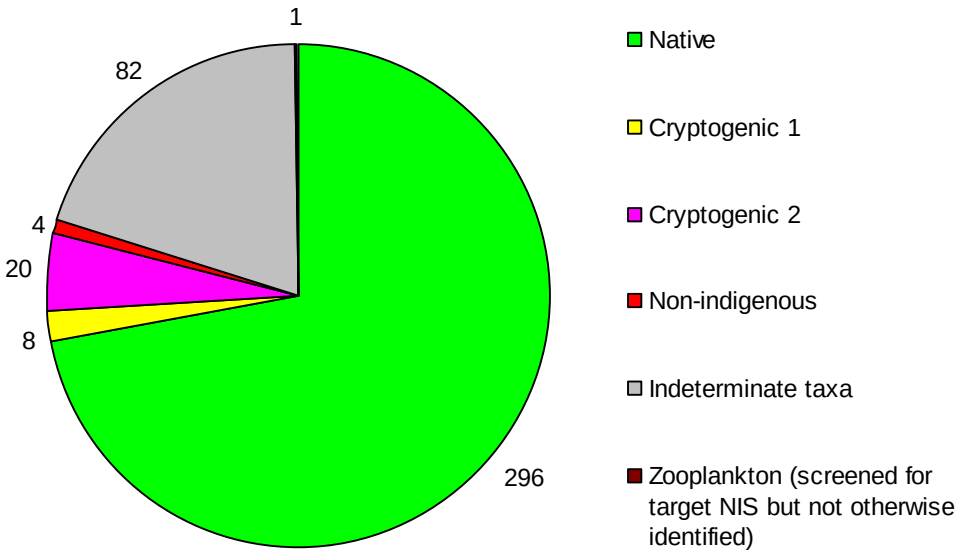

Figure 24: Biosecurity status of marine species collected from the Kaikoura port survey. Values indicate the number of taxa in each biosecurity category. Zooplankton are included separately because they were screened for target NIS but non-target species were not identified.

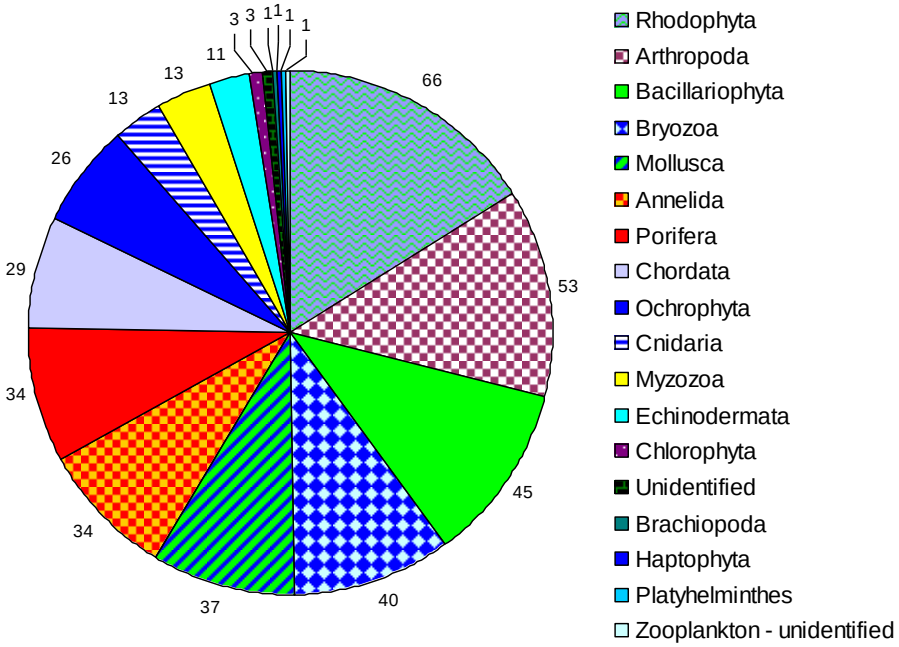

Figure 25: Phyla recorded during the Kaikoura port survey. Values indicate the number of taxa in each of these groups.

Native taxa

The 296 native species recorded during the Kaikoura survey (Table 13) represented 72 % of all species identified from this location and included diverse assemblages of rhodophytes (red algae, 66 taxa), arthropods (53 taxa), bacillariophytes (diatoms, 45 taxa), bryozoans (40 taxa), molluscs (37 taxa), annelids (34 taxa), porifera (sponges, 34 taxa), chordates (29 taxa) and ochrophytes (brown algae, 26 taxa). A number of other groups were also recorded, including

cnidarians, myzozoans (dinoflagellates), echinoderms, chlorophytes (green algae), brachiopods (lamp shells), haptophytes (plankton) and platyhelminths (flatworms; Table 13).

Non-indigenous taxa

The four non-indigenous species (NIS) recorded from the Kaikoura port survey (Table 14) represented just under 1 % of all taxa identified during the survey. The four taxa are the amphipod *Jassa slatteryi*, the hydroid *Pennaria disticha*, the brown alga *Undaria pinnatifida* and the sponge *Dendya clathrata*.

A list of Chapman and Carlton's (1994) criteria (see "

Baseline survey methods: Definitions of biosecurity status", above) that were met by the NIS recorded in this survey is given in Table 10. Possible means of introduction to New Zealand and their dates of introduction or description are provided in Table 14. None of these taxa are new species records for New Zealand (see "

Results: Species not previously recorded in New Zealand", below), but the record for *Dendya clathrata* represents an extension to its known range in New Zealand (see "

Results: Range extensions", below). *Undaria pinnatifida* is listed on the New Zealand Register of Unwanted Organisms (see "

Results: Notifiable and unwanted species", below).

Two of the species (*Pennaria disticha* and *Dendya clathrata*) have been present in New Zealand for almost a century or more but have distributions outside New Zealand that suggest non-native origins, whilst the other two species (*Jassa slatteryi* and *Undaria pinnatifida*) have only been recorded in New Zealand in much more recent times (Table 14).

Available information on the ecology of each NIS species, their global and New Zealand distribution, vectors and potential impacts is provided in Appendix 6. The local distributions as recorded during the port survey are mapped below for each species. These maps are composites of multiple replicate samples. Where overlayed presence and absence symbols occur on the map, this indicates that the species was found in at least one but not all replicates at that precise location.

***Jassa slatteryi* (Conlan, 1990)**

The NIS *Jassa slatteryi* occurred in two samples during the Kaikoura port survey; one box dredge taken from Cone Rock and one benthic core taken from Fyffe Cove (
Figure 26).

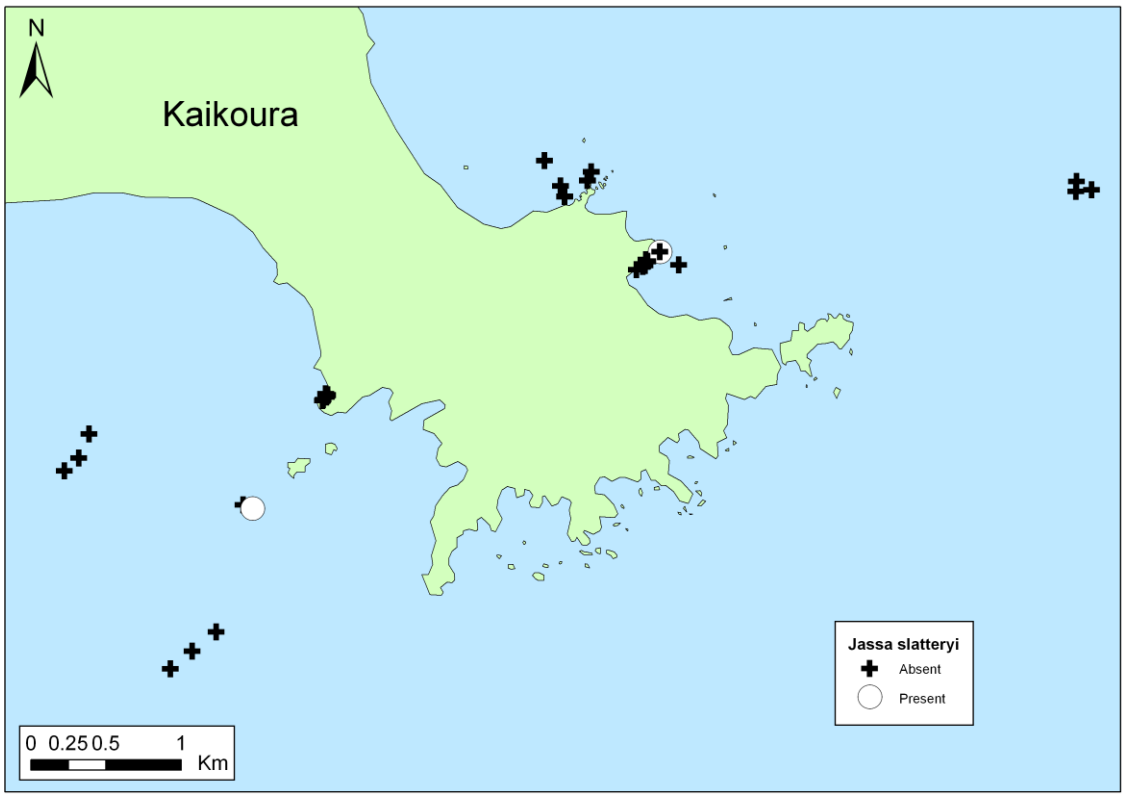

Figure 26: *Jassa slatteryi* distribution in the Kaikoura port survey.

***Pennaria disticha* (Goldfuss, 1820)**

The NIS *Pennaria disticha* occurred in one benthic sled sample taken at Kaikoura Inner Harbour limit – west (
Figure 27).

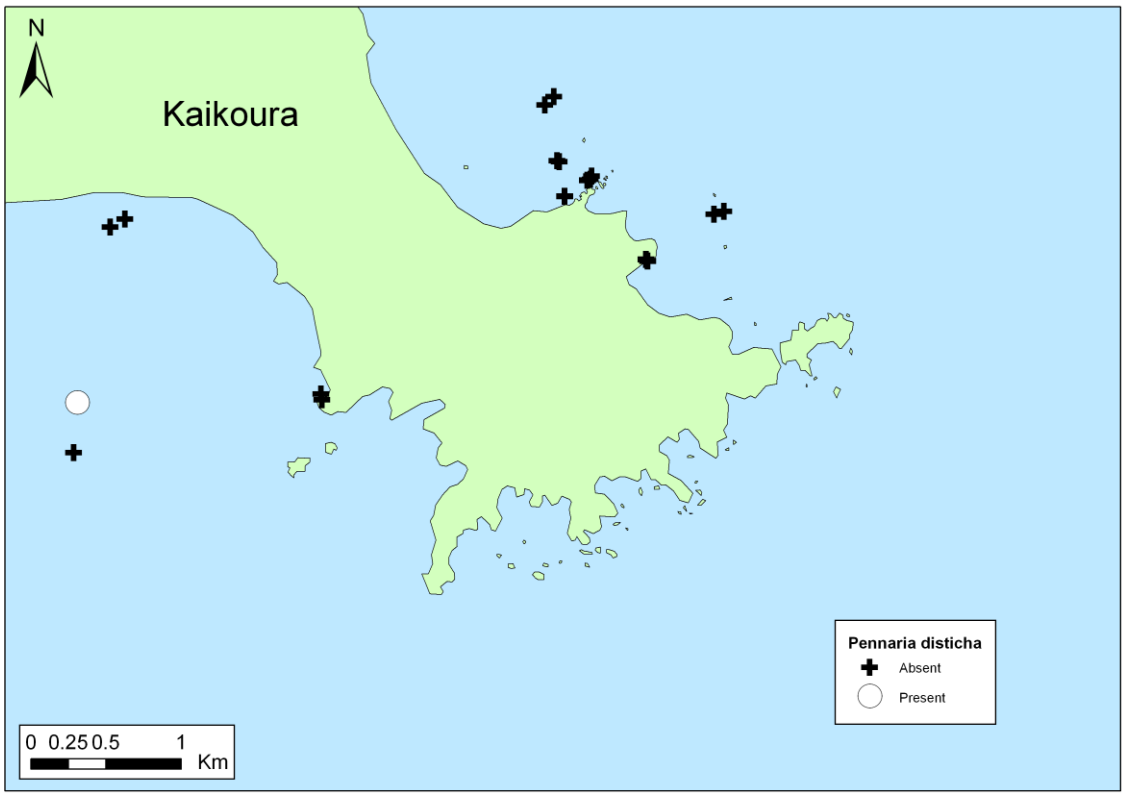

Figure 27: *Pennaria disticha* distribution in the Kaikoura port survey.

Undaria pinnatifida **((Harv.) Suringar)**

The NIS *Undaria pinnatifida* occurred in three samples; two pile scrapes both taken Ingles Bay north wharf, and one opportunistic visual search conducted at South Bay piles (
Figure 28).

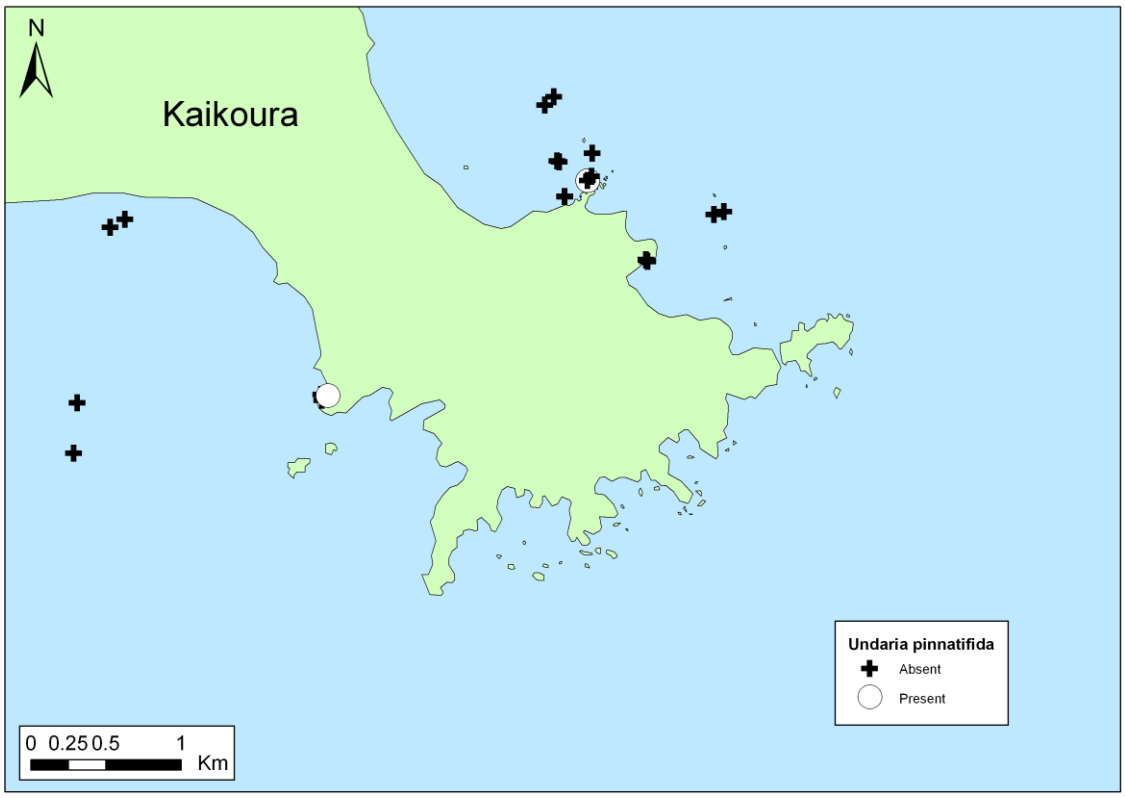

Figure 28: ***Undaria pinnatifida*** **distribution in the Kaikoura port survey.**

***Dendya clathrata* (Carter, 1881)**

The NIS *Dendya clathrata* occurred in two samples; one benthic sled taken from Ingles Boat mooring 1 and one formal diver visual search at Gooch Beach slipway. (
Figure 29).

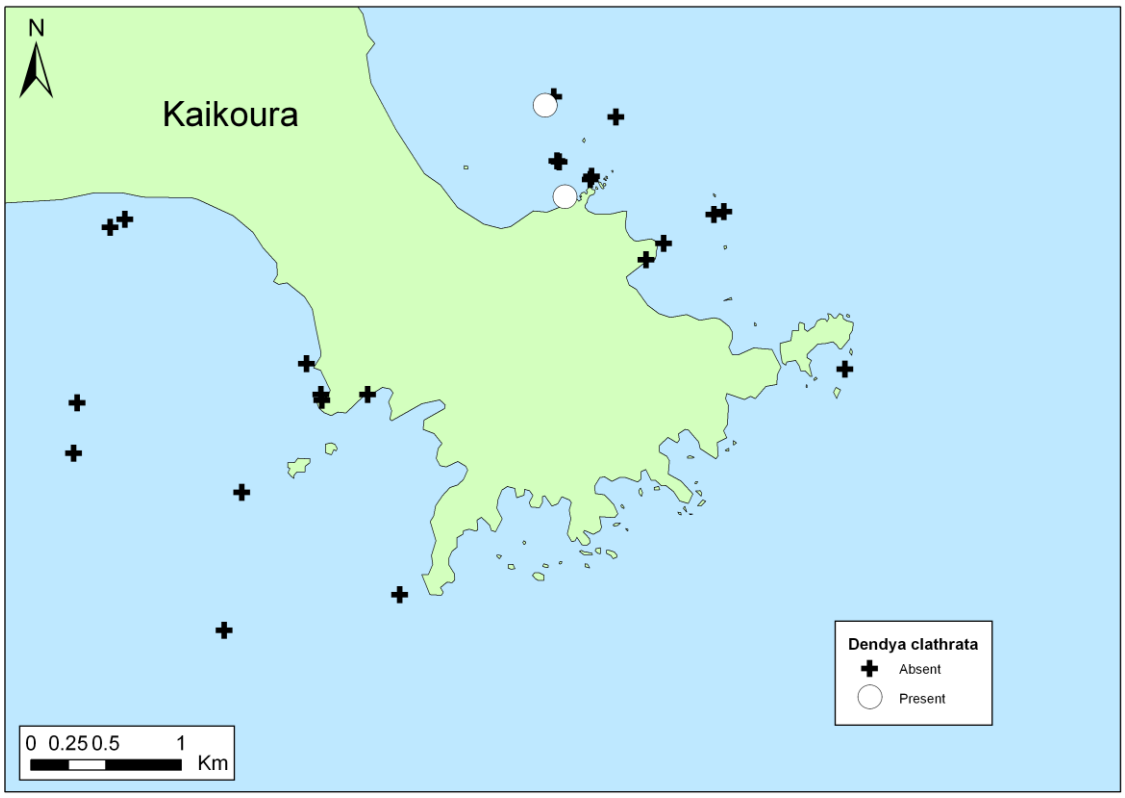

Figure 29: *Dendya clathrata* distribution in the Kaikoura port survey.

Cryptogenic category one taxa (C1)

There were eight cryptogenic category one (C1) taxa recorded from the Kaikoura port survey, representing almost 2 % of all species or higher taxa recorded. These organisms included one annelid, four ascidians and three sponges (Table 15). A list of Chapman and Carlton's (1994) criteria (see "

Baseline survey methods: Definitions of biosecurity status", above) that were met by the cryptogenic category one species recorded in this survey is given in Table 10.

One of the taxa included in the C1 category, *Didemnum* sp., encompasses a genus rather than an individual species, due to difficulties in identification of species within this genus. The genus *Didemnum* includes at least two species that have recently been reported from within New Zealand (*D. vexillum* and *D. incanum*) and two related, but distinct species from Europe (*D. lahillei*) and the north Atlantic (*D. vestum* sp. nov.) that have displayed invasive charactertistics (i.e. sudden appearance and rapid spread, Kott 2004b, 2004a). All can be dominant habitat modifiers. The taxonomy of the Didemnidae is complex and it is difficult to identify specimens to species level. 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. All *Didemnum* specimens were therefore identified only to genus level. We have reported these species collectively, as a species group (*Didemnum* sp.; Table 15).

None of the C1 taxa are new species records for New Zealand, and none are known to represent extensions to their known range in New Zealand. Possible means of introduction to New Zealand and their dates of introduction or description are provided in Table 15. Four of the taxa (*Capitella "capitata"* species complex, *Corella eumyota, Botrylloides leachi* and *Crella incrustans*) have been present in New Zealand for almost a century or more but have distributions outside New Zealand that suggest non-native origins, whilst some of the other taxa have only been recorded in New Zealand in much more recent times (Table 14, Table 15).

The local distributions as recorded during the port survey are mapped below for each C1 taxon. These maps are composites of multiple replicate samples. Where overlayed presence and absence symbols occur on the map, this indicates that the species was found in at least one but not all replicates at that precise location.

Capitella "capitata"

The *Capitella "capitata"* species complex was recorded from one anchor box dredge from South Bay (
Figure 30).

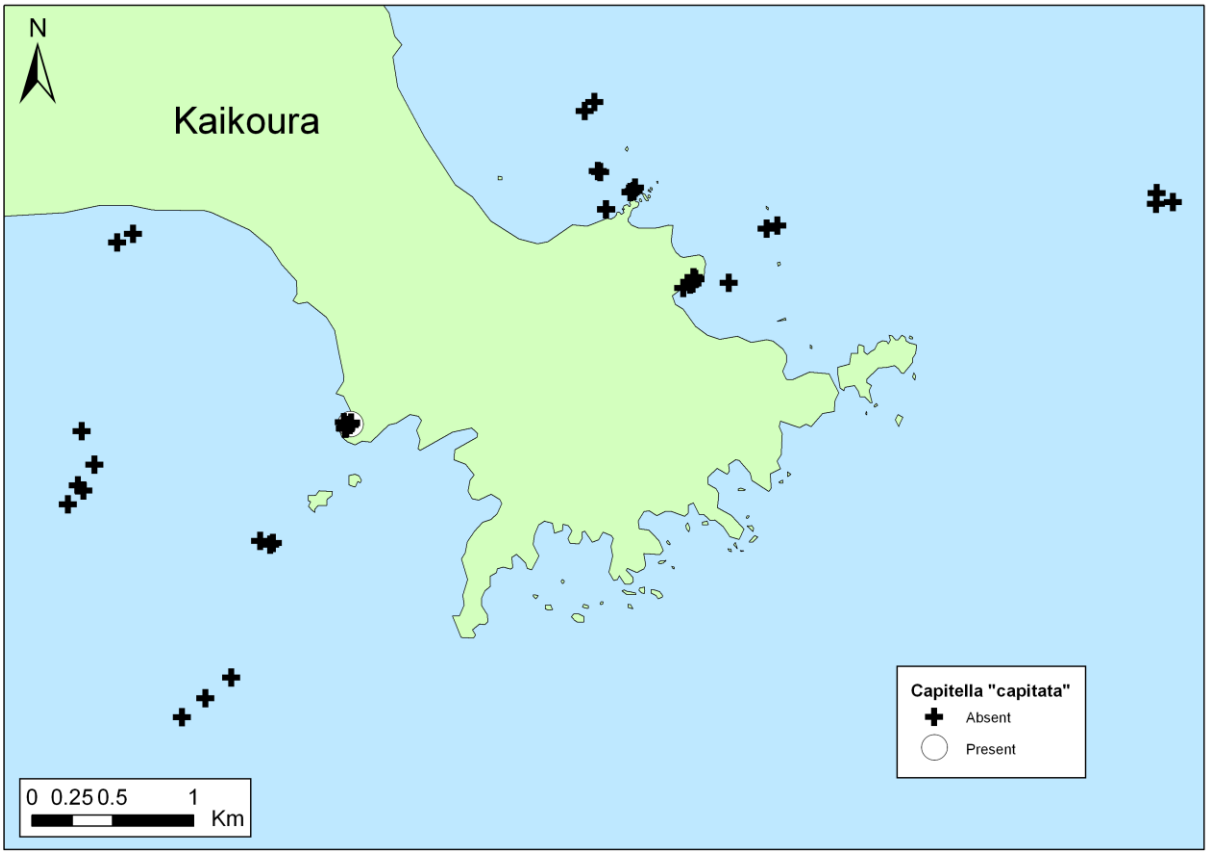

Figure 30: *Capitella "capitata"* species complex distribution in the Kaikoura port survey

***Didemnum* sp. (Savigny, 1816)**

***Didemnum* sp. occurred in three pile scrape samples; two taken from Ingles Bay north and one taken from Fyffe cove slipway (**
Figure 31).

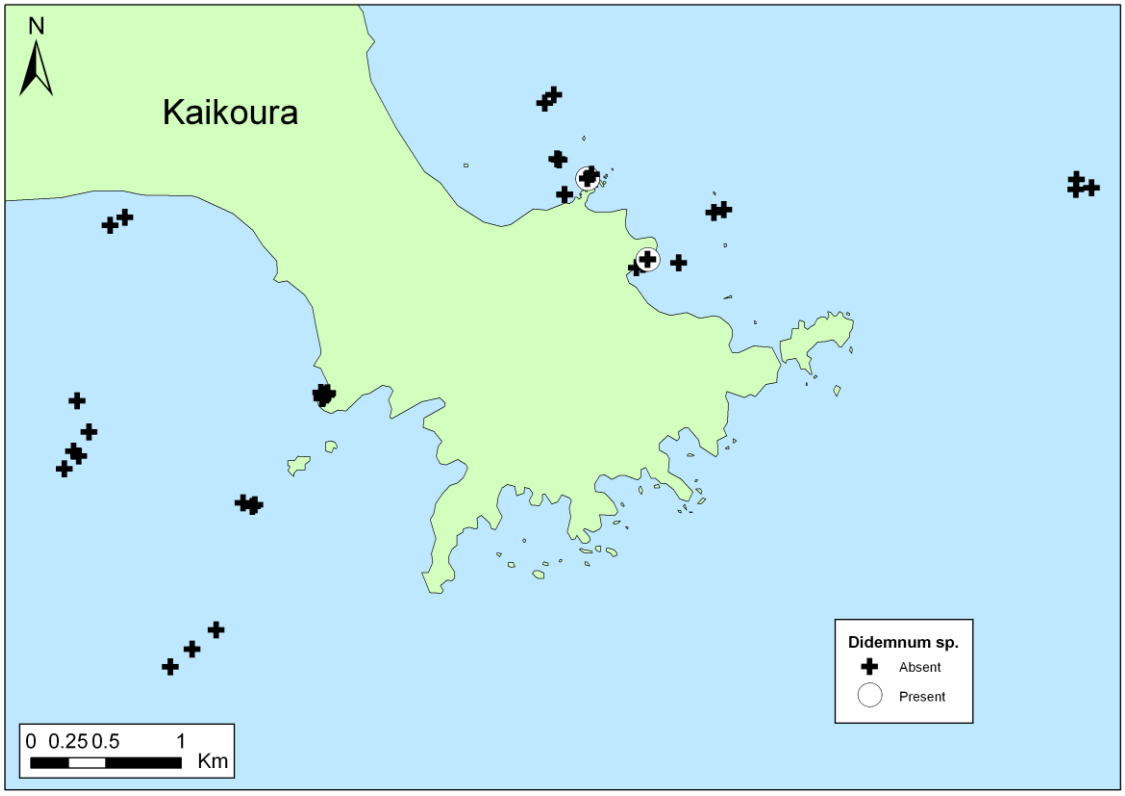

Figure 31: *Didemnum* sp. distribution in the Kaikoura port survey

Cystodytes dellechiajei (Della Valle, 1881)

***Cystodytes dellechiajei* occurred in six samples; four pile scrapes taken from Fyffe Cove Slipway, one benthic sled taken from Ingles Bay Boat mooring 1 and one search undertaken at Atia Point (**
Figure 32).

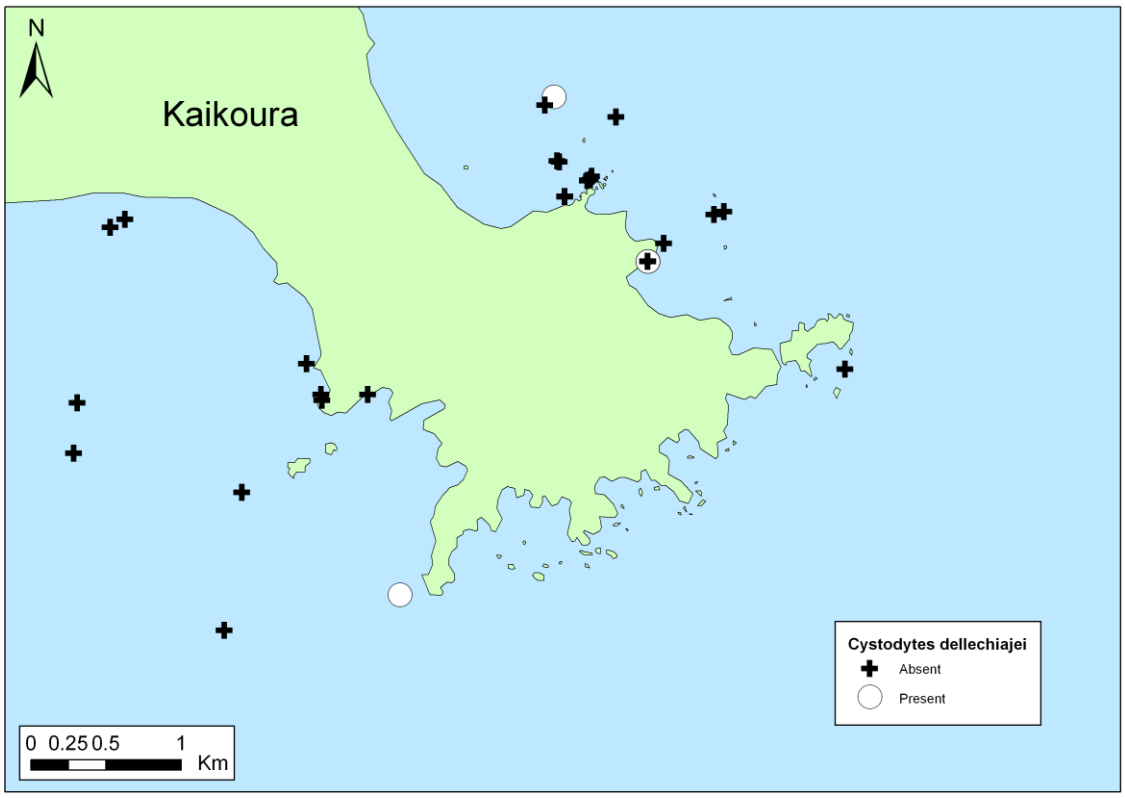

Figure 32: ***Cystodytes dellechiajei* distribution in the Kaikoura port survey**

***Corella eumyota* (Traustedt, 1882)**

***Corella eumyota* occurred in one pile scrape sample taken from Fyffe Cove slipway and benthic sled taken at South Bay (**
Figure 33).

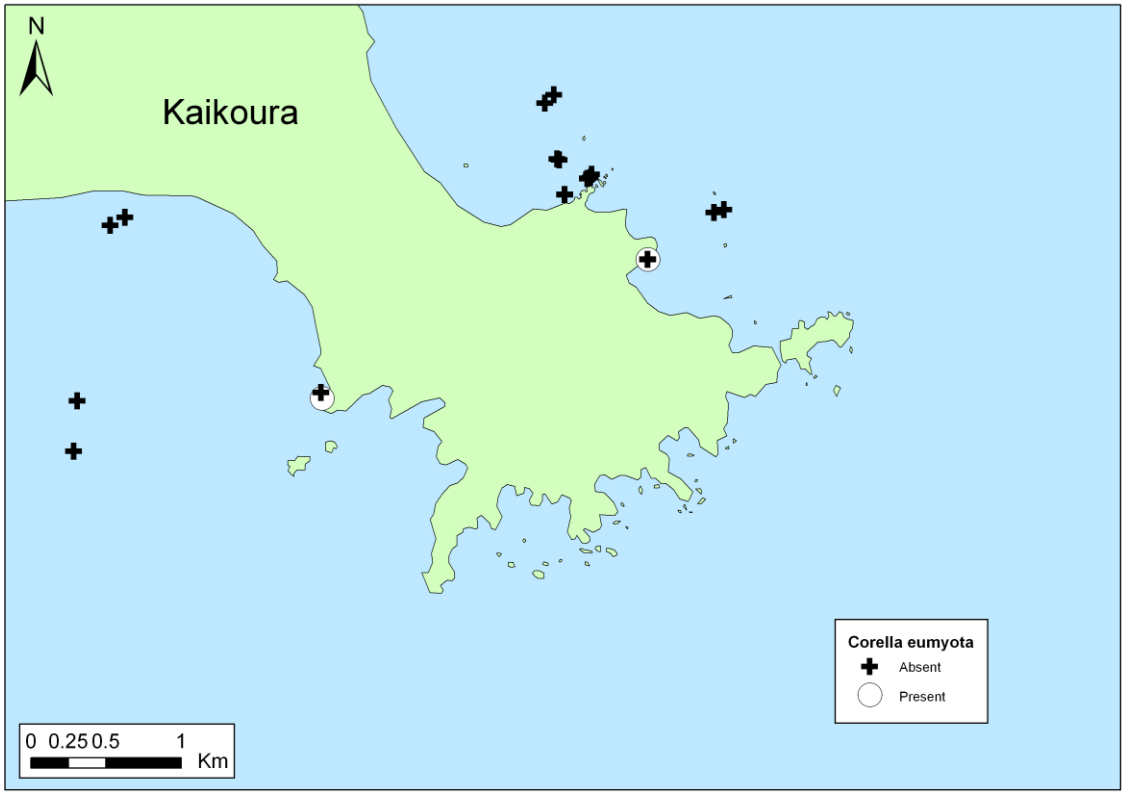

Figure 33: ***Corella eumyota* distribution in the Kaikoura port survey**

***Botrylloides leachi* (Savigny, 1816)**

***Botrylloides leachi* occurred in one pile scrape taken from Fyffe Cove slipway (** Figure 34).

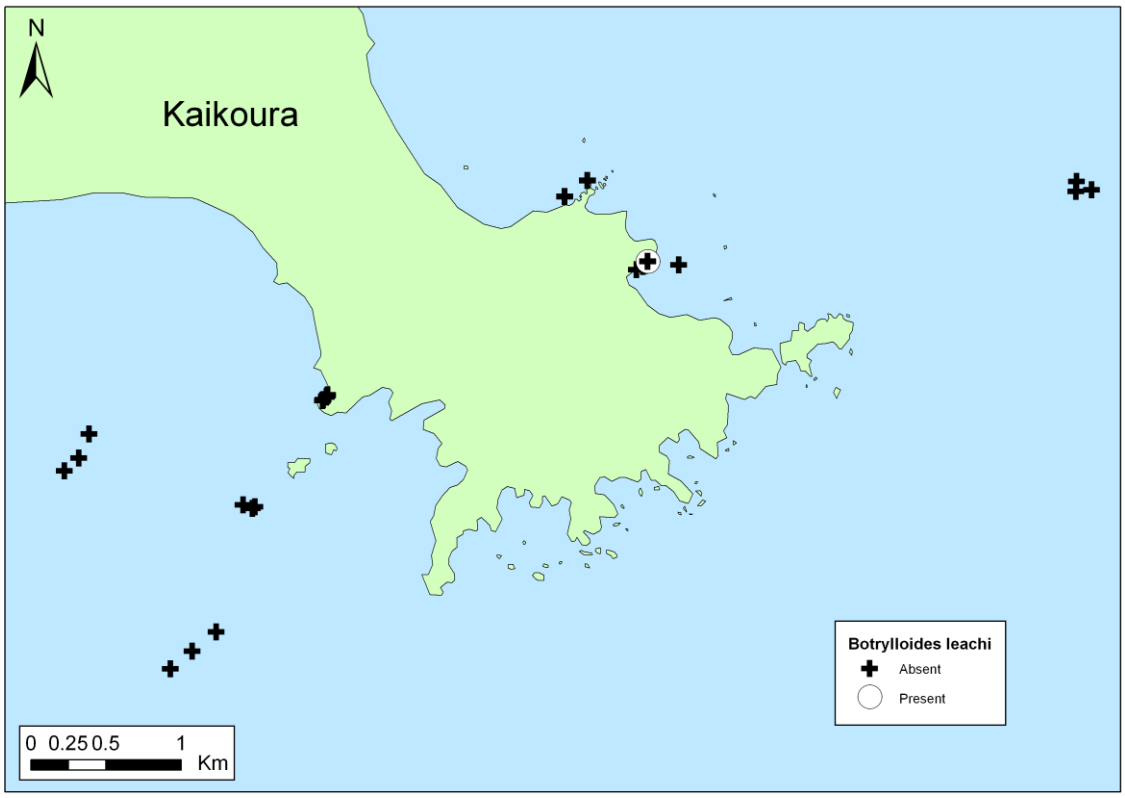

Figure 34: *Botrylloides leachi* distribution in the Kaikoura port survey.

Leucosolenia cf. *discoveryi* (Jenkin, 1908)

***Leucosolenia* cf. *discoveryi* was recorded in one pile scrape sample taken from Fyffe Cove slipway (slipway (**
Figure 35).

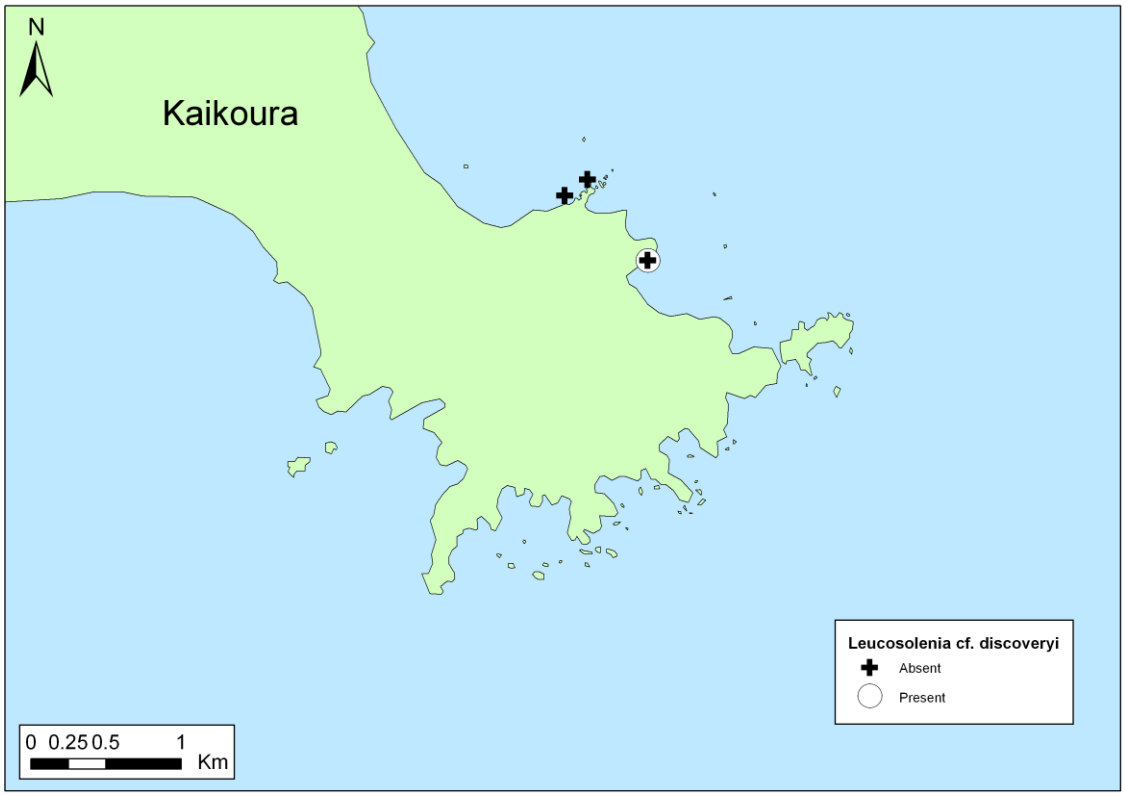

Figure 35: *Leucosolenia* cf. *discoveryi* distribution in the Kaikoura port survey

Callyspongia diffusa (Ridley, 1884)

***Callyspongia diffusa* (Ridley, 1884) was recorded in five samples; two pile scrapes taken from Fyffe Cove from Fyffe Cove slipway, one benthic sled taken from Ingles Bay north wharf, one beach wrack search wrack search conducted at South Bay slipway-west and one formal diver visual search conducted at South conducted at South Bay slipway-east (**

Figure 36).

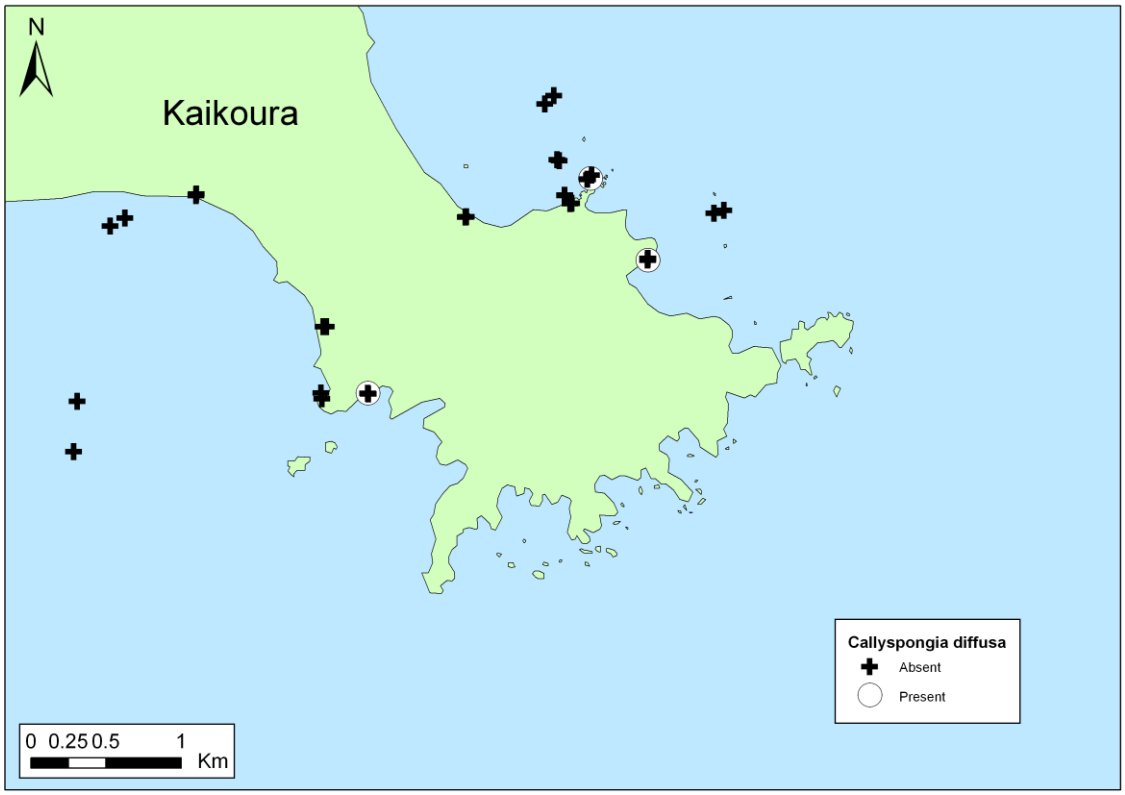

Figure 36: *Callyspongia diffusa* distribution in the Kaikoura port survey

Crella incrustans (Carter, 1885; Fromont, 1988)

***Crella incrustans* occurred in two samples; one formal diver visual search conducted at Cone Rock and Rock and one beach wrack search from South Bay slipway-west (**
Figure 37).

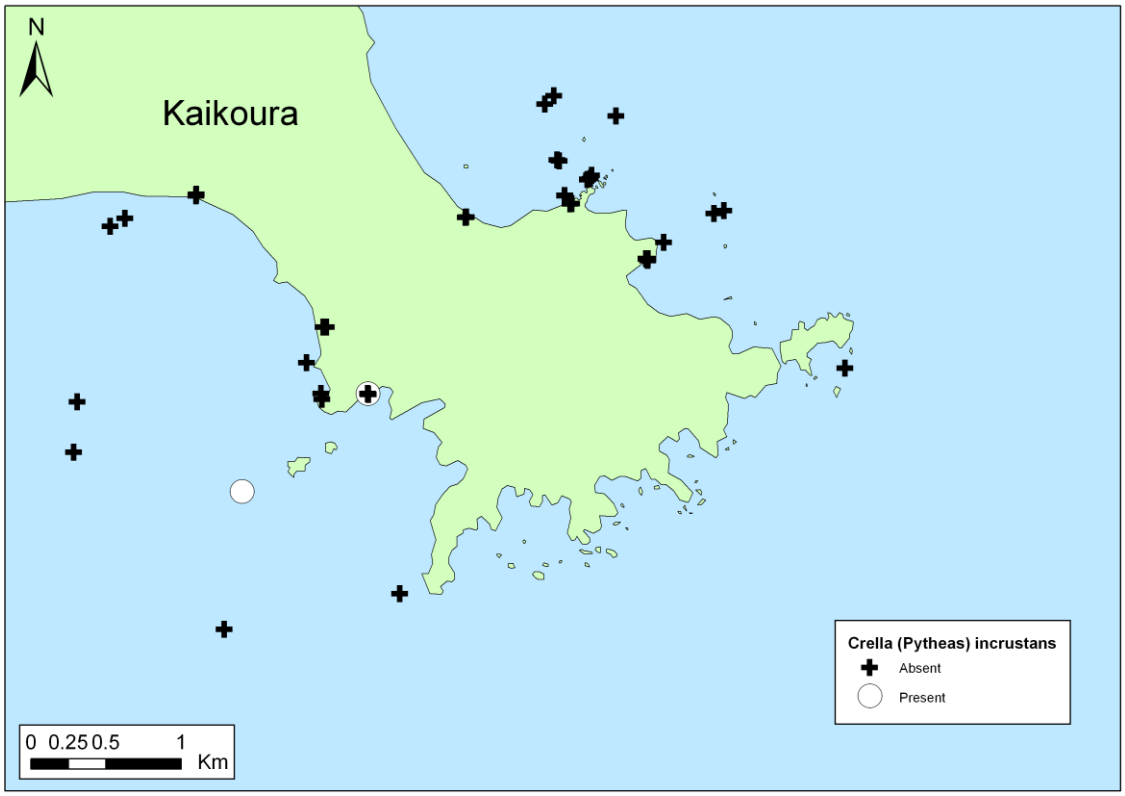

Figure 37: *Crella incrustans* distribution in the Kaikoura port survey

Cryptogenic category two taxa (C2)

Twenty cryptogenic category two (C2) taxa were recorded during the Kaikoura port survey (Table 16). These included three annelids and 17 sponges. These taxa are recently discovered new species, or might be new species, for which there is insufficient information to determine whether New Zealand lies within their native range. However, all of these new or potentially new species have previously been recorded in New Zealand (see "

Results: Species not previously recorded in New Zealand", below).

Indeterminate taxa

Eighty-two organisms from the Kaikoura port survey were classified as indeterminate taxa. This represents almost 20 % of all determinations made from this survey. Indeterminate taxa from the Kaikoura port survey were mostly algae, diatoms, annelids, arthropods and dinoflagellates, with several other groups also represented (Table 17).

Zooplankton

No target organisms (the Chinese mitten crab *Eriocheir sinensis* or other members of this genus, the European green crab *Carcinus maenas*, the northern Pacific seastar *Asterias amurensis* and the ascidian *Styela clava*) were identified from any of the zooplankton samples from Kaikoura. The samples were dominated by copepods.

Notifiable and unwanted species

One of the species recorded from the Kaikoura port survey, the Asian seaweed *Undaria pinnatifida*, is currently listed on the New Zealand Register of Unwanted Organisms (Table 3).

The Australian Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE) has recently endorsed a Trigger List (Table 4) of marine pest species (CCIMPE 2006). Five taxa on this list were recorded during the Kaikoura port survey. The NIS Asian kelp *Undaria pinnatifida* is on the "established" sub-list, the C1 ascidian *Didemnum* sp. is on the "exotic" sub-list, and three diatoms considered native in New Zealand due to their cosmopolitan oceanic distributions (*Pseudo-nitzschia australis*, *Chaetoceros concavicornis* and *C. convolutus*) are on the "holoplankton alert" sub-list (which means that their presence should be notified, but an eradication response within Australia is highly unlikely).

Australia has also 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.* 2005). A similar watch list for New Zealand is currently being prepared by MAF Biosecurity NZ. Only one of the 53 Australian priority domestic pests (i.e. those already present in Australia) was recorded from the Kaikoura port survey – the Asian kelp *Undaria pinnatifida*. Another priority domestic pest, the mollusc *Chiton glaucus*, has previously been recorded from Kaikoura (Marsden 1981), see also "

Results: Review of marine species records from Kaikoura", above). It is considered native in New Zealand. Three of the 37 priority international pests (i.e. those not yet in Australia) listed by Hayes *et al.* (2005) were recorded from the Kaikoura port survey – the three diatoms *Pseudo-nitzschia australis, Chaetoceros concavicornis* and *C. convolutus*, all considered native in New Zealand.

Species not previously recorded in New Zealand

None of the species recorded from the first port baseline survey of Kaikoura are new records for New Zealand waters; all have been recorded previously in New Zealand.

Range extensions

One species record from the Kaikoura port survey was highlighted as representing an extension to the known range of the species in New Zealand. This species, the sponge *Dendya clathrata*, was first described as *Leucosolenia intermedia* Kirk, 1895 from the Cook Strait in New Zealand, but subsequent taxonomic review (Van Soest *et al.* 2008) resulted in it being recognised as the non-indigenous species *D. clathrata*. The present record from Kaikoura is the only other known record of this species in New Zealand.

Cyst- and toxin-producing species

Cysts of five dinoflagellate taxa (Phylum Myzozoa) were collected during this survey. One of these, *Scrippsiella trochoidea*, is considered a native species (Table 13) and is not known to produce toxins. The remaining four taxa could not be identified to species level and are therefore classed as indeterminate (*Alexandrium* sp., *Gonyaulax* sp., *Scrippsiella* sp. and *Protoperidinium* sp.; Table 17). Several species of *Alexandrium* are known to produce toxins, but it is unknown if the *Alexandrium* sp. cysts collected during the Kaikoura port survey belonged to a toxin-producing species.

Of the organisms identified from the phytoplankton samples (52 different dinoflagellate and diatom taxa; Table 13 and Table 17), three toxin-producing species were identified - the native species *Dinophysis acuminata*, *D. tripos* and *Pseudo-nitzschia australis* (Table 13). *Dinophysis acuminata* and *D. tripos* are associated with Diarrhetic Shellfish Poisoning (DSP) events, but no blooms have been reported for *Dinophysis tripos* (Faust and Gulledge 2002). *Pseudo-nitzschia australis* can produce a domoic acid, which causes Amnesic Shellfish Poisoning (ASP, New Zealand Food Safety Authority 2003). However, not all isolates of *P. australis* in New Zealand have been confirmed to produce domoic acid (Hay *et al.* 2000).

Another two native diatom species recorded from the phytoplankton samples, *Chaetoceros convolutus* and *C. concavicornis*, are also worth noting. Although no direct toxic effects are known for these two species, their barbed setae can become lodged in fish gills, causing death (Kraberg and Montagnes 2007).

Depth stratification trends of NIS and C1 taxa

The proportion of native taxa, and of NIS and C1 taxa combined, recorded from different depth classes approximately reflected the sampling effort conducted in each depth class (Figure 38). The greatest number of samples (67 %) and variety of sampling methods (12 methods) were employed between 0 m and 5 m depth, and this depth range was also where the greatest proportion of NIS and C1 taxa (75 %) and native taxa (66 %) were recorded. Lesser sampling effort in the intertidal (beach wrack surveys only) and deeper depths (to a maximum of 40 m) was reflected by fewer taxa being recorded from those depths, although a greater proportion of taxa was recorded from some of those depths (the intertidal, >10 m – 15 m and >15 – 20 m depth ranges) than would be expected from the proportion of samples

collected there. This suggests that the methods used at those depths (primarily beach wrack surveys, benthic sleds, anchor box dredges and visual diver surveys) were especially effective at collecting both native and NIS & C1 taxa.

Nine of the 12 NIS and C1 taxa (75 %) recorded during the Kaikoura port survey were collected between 0 m and 5 m depth (Table 18). Six of these nine taxa were not recorded from deeper samples, whilst the other three taxa (*Callyspongia diffusa*, *Cystodytes dellechiajei* and *Dendya clathrata*) were also collected from other depths. The three NIS or C1 taxa that were not collected in samples from 0 m to 5 m depth were the sponge *Crella (Pytheas) incrustans*, the amphipod *Jassa slatteryi* and the alga *Pennaria disticha*. The latter species was recorded from only a single sample during the survey, and *C. incrustans* and *J. slatteryi* were each recorded in only two samples.

One hundred and ninety-five of the 296 native taxa (66 %) were recorded between 0 m and 5 m depth (Table 19). One hundred and eighteen of these were only recorded from this depth range, whilst the other 77 were also recorded from deeper collections or intertidal beach wrack surveys. Surveys of the intertidal beach wrack yielded 91 native taxa represented by 168 specimens, composed largely of algae (25 rhodophytes, 13 ochrophytes), bryozoans (18 taxa) and molluscs (14 taxa). Sampling in the deeper depth ranges yielded fewer native taxa, ranging from 44 to 55 taxa per depth category between >5 m and 20 m, only 22 native taxa were recorded from >20 m depth, despite no reduction in sampling effort (Figure 38).

The 12 NIS and C1 taxa collected during the Kaikoura port survey were represented by 29 records. They occurred in samples collected by seven different sampling methods (Table 18). Almost half of these records (14) were recorded from pile scrapings, which due to the shallow depths of water at Kaikoura wharves, were all less than 5 m deep. Benthic sleds and diver visual surveys yielded the next greatest numbers of NIS & C1 taxon records (5 and 4, respectively), from a variety of depths (Table 18). In contrast to the patterns seen for NIS and C1 species, the pile scraping method only returned 14 % of the 1090 native samples collected from Kaikoura (Table 19). The most native records resulted from phytoplankton samples (19 %, collected from just below the water surface) followed by beach wrack samples (15 %, from the intertidal), and then pile scrapings.

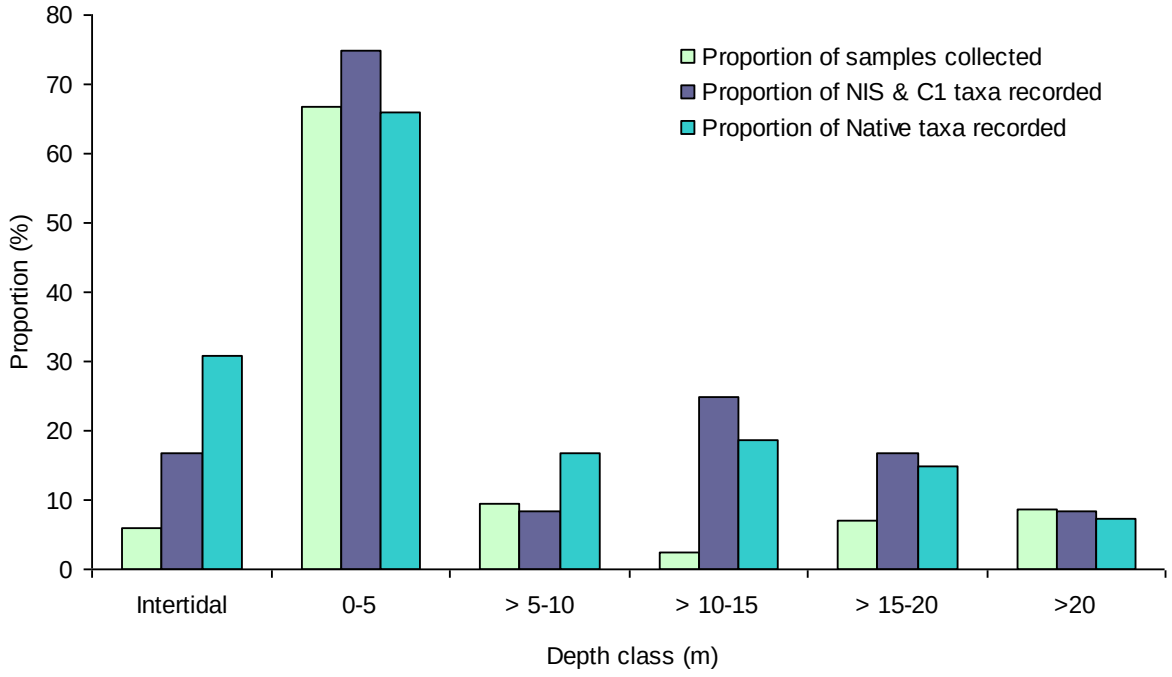

Figure 38: Proportion of taxa recorded from five depth classes during the Kaikoura port survey. The proportion of taxa sums to a total of >100% across depth classes, as some taxa were recorded from more than one depth class.

Possible vectors for the introduction of NIS and C1 taxa to the port

The possible vectors for the introduction of NIS and C1 taxa to New Zealand are indicated in Table 6 and Table 7 for taxa recorded during the desktop review of existing species records, and in Table 14 and Table 15 for taxa recorded during the Kaikoura port survey. Likely vectors of introduction are largely derived from Hayes *et al.* (2005) and expert opinion. Most of the NIS and C1 taxa recorded from Kaikoura during the port survey and review of existing species records are thought to have arrived in New Zealand via biofouling and international shipping.

The possible vector for introduction of most NIS and C1 taxa to Kaikoura, New Zealand was fouling on ships. Introduction by ships ballast water (S3) was less frequent, while introductions associated with fisheries operations (F1, F3) were also cited for several taxa. Some taxa can probably also take advantage of several other vectors to reach New Zealand (see Table 6, Table 7, Table 14 and Table 15).

Spread within New Zealand of the NIS and C1 taxa recorded from Kaikoura is also often likely to be via fouling of ships' hulls (S1) or associated with translocations of fish or shellfish (F2, F3). Natural translocation, via planktonic dispersal (N1) or long-distance movement of adults as detached plants (N3) may also be responsible for the spread of several of these taxa. The spread of some of these taxa throughout New Zealand is probably also assisted by several other vectors (see Table 6, Table 7, Table 14 and Table 15).

COMPARISON BETWEEN DESKTOP REVIEW OF EXISTING RECORDS AND PORT BASELINE SURVEY RECORDS

Three hundred and twenty-eight taxa (excluding indeterminate taxa and zooplankton that were only screened for target species) were recorded during the port baseline survey of Kaikoura, compared with 510 in the desktop review of existing species records from the area. This highlights both the strong history of biological research in the Kaikoura area over the past century (see "Introduction: E" and "

Results: Review of marine species records from Kaikoura", above), and the effectiveness of the Kaikoura port baseline survey, which in a single survey recorded almost two-thirds of the number of taxa that were recorded during the review of literature spanning many decades and projects (although the overlap in the actual taxa recorded was lower, as discussed below).

Of the 510 taxa recorded in the desktop review, 79 of these same taxa were subsequently recorded during the initial port baseline survey of Kaikoura (74 native (Table 5), one NIS (Table 6) three C1 (Table 7) and one C2 (Table 8)). Similarly, 250 of the 328 taxa (76 %) that were identified in the port survey were not recorded in the desktop review. The port baseline survey has therefore made a valuable contribution to the knowledge of the flora and fauna of the Kaikoura area.

The low overlap in the inventories compiled by these different methods is not unusual for surveys of this type (Ruiz and Hewitt 2002). Review of literature and museum records provides a broader spatial and temporal coverage of species from a region than a single field survey can, as such records have been obtained over time from a variety of survey methods and variable search effort. Because of this they do not provide a standardised baseline for comparison to other regions or surveys. All survey methods have inherent biases in the efficiency with which they sample different species. Thus, while the CRIMP protocols have been devised to ensure that a standardised methodology is used for baseline port surveys, the methods used do not sample all species efficiently. Thus, the two approaches used provide complementary inventories of the marine biota around Kaikoura.

Seven of the eight NIS recorded during our desktop review were not recorded during the Kaikoura port survey. One of these species, the chinook salmon *Oncorhynchus tshawytscha,* would not be expected to be recorded by port survey methods due to their anadromous, semelparous nature (see species information sheet, Appendix 6). The absence of the remaining six NIS from the Kaikoura port survey records could indicate that these taxa have gone locally extinct in the area since their discovery, or they may be present in densities low enough that they were not encountered during the port survey. More detailed delimitation surveys for these species would be needed to assess these possibilities. Conversely, three of the four NIS recorded during the port survey were not recorded during the desktop review. One of these, the sponge *Dendya clathrata*, was not previously known from this region (see "

Results: Range extensions", above). The other two – the amphipod *Jassa slatteryi* and the hydroid *Pennaria disticha*, are small organisms that may have been overlooked in previous surveys, or may have been missed in our desktop review. Furthermore, *J. slatteryi* was first described less than two decades ago, whereas many of the studies of the amphipod fauna in Kaikoura were conducted prior to this (eg. Barnard 1972; Lowry 1974; Fenwick 1976; Fenwick 1983).

Assessment of the risk of new introductions to Kaikoura

There is almost no international shipping traffic to Kaikoura (see "Introduction: Shipping movements and ballast discharge patterns", above). Furthermore, many non-indigenous species introduced to New Zealand ports by shipping do not survive to establish self-sustaining local populations. The risk of new introductions from overseas to Kaikoura is therefore very low. Nonetheless, the consequences of a marine invasion in such a relatively valued marine environment could be severe.

Non-indigenous species that do become established 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). There is one small cruise ship, the 'Clipper Odyssey', which visits Kaikoura and other New Zealand ports, and spends other periods of the year in Asia, Australia, Latin America, the Galapagos and North America (Abercrombie & Kent Inc 2008). This vessel could potentially bring new non-indigenous organisms to Kaikoura. The expected increase in cruise ship visits with the planned creation of new wharf structures could also present an increased risk of new marine invasions. Those coming from southern Australia probably present the greatest potential risk of introducing new non-indigenous species to Kaikoura, both because of the relatively short transit time (approximately two days for a cruise ship) and because of similarities in coastal environments between these locations. Six of the eight marine pests on the New Zealand Register of Unwanted Organisms are already present in southern Australia (*Carcinus maenas*, *Asterias amurensis*, *Undaria pinnatifida*, *Sabella spallanzanii*, *Caulerpa taxifolia*, and *Styela clava*). The native range of the other two species – *Eriocheir sinensis* and *Potamocorbula amurensis* – is the northwestern Pacific, including China and Japan.

The *Biosecurity Act 1993* and the Import Health Standard for Ships' Ballast Water from all Countries (Biosecurity New Zealand 2005) exist to reduce the risk of new marine invasions arriving in New Zealand via hull fouling and ballast water (see "Introduction: Shipping movements and ballast discharge patterns", above). In addition to these legal instruments, vessels operating in Kaikoura are requested to follow voluntary guidelines to reduce the risk of marine invasions in Kaikoura. These include:

- there must be no cleaning hulls below the water line and running gear within coastal areas
- cleaning on shore must occur above the high tide mark and ensure that no fouling material or contaminated water could re-enter the sea (Te Korowai o Te Tai o Marokura (Kaikoura Coastal Marine Guardians) 2007).

Assessment of translocation risk for NIS and C1 taxa found in the port

Although many of the NIS and C1 taxa recorded in Kaikoura have been recorded in other locations throughout New Zealand, they were not detected in all of the other New Zealand ports that have so far been surveyed (Inglis *et al.* 2007). There is, therefore, a risk that species established in Kaikoura could be spread to other New Zealand locations. However, there is very little shipping traffic between Kaikoura and other parts of New Zealand, consisting mostly of fishing vessels and at least one cruise ship see "Introduction: Shipping movements and ballast discharge patterns", above).

Most local fishing boats are moored in Kaikoura or taken out of the water following use, and therefore present little risk of translocation of organisms to other parts of New Zealand. Similarly, private trailer boats may be transported to Kaikoura for short pleasure voyages. If these are not adequately cleaned or dried between ports, there is a risk that they could translocate organisms between Kaikoura and other nearby boating destinations. The small cruise ship 'Clipper Odyssey' could potentially translocate organisms between Kaikoura and other New Zealand ports that it occasionally visits, including Auckland, Tauranga, Napier, Wellington, Marlborough Sounds, Lyttelton, Akaroa, Dunedin, Stewart Island, New Zealand's subantarctic islands and Fiordland (Abercrombie & Kent Inc 2008).

During the port survey, four NIS were recorded (the amphipod *Jassa slatteryi*, the hydroid *Pennaria disticha*, the brown algae *Undaria pinnatifida* and the sponge *Dendya clathrata*; Table 14) and eight C1 taxa were recorded (the polychaete species complex *Capitella* "*capitata*", the ascidians *Didemnum* sp., *Cystodytes dellechiajei*, *Corella eumyota* and *Botrylloides leachi*, and the sponges *Leucosolenia* cf. *discoveryi*, *Callyspongia diffusa* and *Crella incrustans*; Table 15). Most of these taxa have been recorded from the north east of the North Island, the Cook Strait area and the east coast of the South Island (see species information sheets, Appendix 6). However, none of these NIS or C1 taxa have been recorded from the northwest of the South Island, and most of them (all except the three C1 taxa *Didemnum* sp., *Botrylloides leachi* and *Crella incrustans*) have not been recorded from Fiordland. Most of them have also not been recorded from New Zealand's subantarctic islands. It may therefore be most desirable to prevent the spread of these organisms from Kaikoura to these regions of New Zealand.

Information on the ecology of the NIS and C1 taxa recorded during the Kaikoura port survey is limited, but only the Asian kelp *Undaria pinnatifida* and the ascidian *Didemnum* sp. are known to have potential for significant impacts. *Undaria pinnatifida* is currently listed on the New Zealand Register of Unwanted Organisms (Table 3), and both *U. pinnatifida* and *Didemnum sp*. are listed on the Australian Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE) Trigger List (Table 4). *Undaria pinnatifida* is highly invasive, grows rapidly and has the potential to overgrow and exclude native algal species and its presence may alter the food resources of herbivores that would normally consume native species (NIMPIS 2002). It can also become a problem for marine farms by increasing labour costs due to fouling problems, such as the fouling of mussel longlines. Due to its rapid growth rate, *U. pinnatifida* can also spread rapidly on vessel hulls and impact upon vessel performance. The translocation of this species to other parts of New Zealand is therefore especially undesirable. However, this species has already been recorded from most other parts of New Zealand, with the exception of the west coasts of the North and South Islands (see species information sheet, Appendix 6). Species in the genus *Didemnum* are common in ports,

harbours and on vessel hulls. They are capable of rapid growth under ideal conditions, and are able to shed fragments and recolonize substrata, making them a high risk for smothering natural and man-made substrata. Cruise ships or commercial fishing vessels that may occasionally travel from Kaikoura to these west coast areas pose a potential risk of translocation of *Undaria pinnatifida* and *Didemnum* sp.

Although there is a potential risk of translocating NIS and C1 taxa from Kaikoura to other parts of New Zealand, this risk may be lessened not only due to low levels of vessel traffic but also because the densities of these taxa in Kaikoura appear to be very low. As indicated in the "Results" section, according to our desktop review only one of the four NIS recorded during the port survey had been previously recorded from Kaikoura (*Undaria pinnatifida*). During the port survey, *Undaria pinnatifida* was recorded in only three samples, *Jassa slatteryi* and *Dendya clathrata* in two samples and *Pennaria disticha* in only one (see Appendix 7). Of the eight C1 taxa recorded during the port survey, three had been recorded previously (the *Capitella "capitata"* species complex, *Callyspongia diffusa* and *Crella incrustans*), and only two of the eight were recorded from more than three samples (*Cystodytes dellechiajei* was recorded from six samples and *Callyspongia diffusa* from five).

Management of existing NIS and C1 taxa in the port

The Kaikoura marine area is of high ecological value, and the prevention or reduction of impacts from non-indigenous species is therefore a high priority. Biosecurity issues throughout New Zealand are addressed in the *Biosecurity Act 1993* and managed by MAF Biosecurity New Zealand.

Of the NIS and C1 taxa recorded in the Kaikoura port survey, only one of the NIS (*Undaria pinnatifida*) and four of the C1 taxa (the *Capitella "capitata"* species complex, *Callyspongia diffusa*, *Crella incrustans* and *Cystodytes dellechiajei*) appear to be well established in the port, having been recorded from five or more samples during the port survey or having been previously recorded from Kaikoura (see preceding section). In contrast, the remaining three NIS (*Jassa slatteryi*, *Pennaria disticha* and *Dendya clathrata*) and four C1 taxa (*Didemnum* sp., *Corella eumyota*, *Botrylloides leachi* and *Leucosolenia* cf. *discoveryi*) recorded from the Kaikoura port survey occurred in three or fewer port surveys samples each, and according to our desktop review had not previously been recorded from Kaikoura (Table 14, Table 15, Table 18). These species may not be well established in the Kaikoura area. The control of these species may therefore warrant particular attention before their populations become established and widespread around Kaikoura. A more detailed delimitation survey is needed for these species to determine their current distribution and abundance more accurately before any control measures are considered. For most marine NIS, eradication by physical removal or chemical treatment is not yet a cost-effective option. Local population controls may be worth considering for the more restricted species noted above, but control efforts should perhaps be scaled by the potential impacts of the species, where these are known, and the extent to which they already occur throughout New Zealand. Of these taxa, only the ascidian *Didemnum* sp. is known to have potential for significant impacts (see preceding section). The other taxa appear to have lesser or no impacts, or their impacts are unknown but appear to be low.

The distribution of NIS and C1 taxa in Kaikoura appears to be centred around three areas – the Fyffe Cove slipway (seven NIS & C1 taxa recorded), the South taxa) and the Ingles Bay area (five taxa) (see Figure 26 to
Figure 37). Although these locations represent a large proportion of the total samples, there were several other locations where numerous samples were taken and no NIS or C1 taxa were recorded, including the inner harbour limits (sites 8, 9 and 18) and Goochs Beach and its slipway (where one NIS, *Dendya clathrata*, was recorded). Based on this distribution, it is suggested that management attention be focused on the Fyffe Cove, South Bay and Ingles Bay areas. All three areas have slipways or wharves and therefore receive a large proportion of the boat traffic in the area, and have hard substrata that many NIS and C1 taxa require as substrate. Management attention could include requirements for the slipways, wharf piles and vessels using these areas to be regularly inspected and/or cleaned. If new facilities are built for cruise ships or if the area becomes a greater focus for coastal fishing vessels, management may wish to consider the need for placing restrictions on the uptake or translocation of ballast water from these areas, and for imposing requirements on the upkeep of anti-fouling paints and inspection of vessel hulls.

Due to the logistical and / or technical difficulties associated with eradication of the potentially high impact NIS and C1 taxa in and near Kaikoura, it is recommended that management activity be directed toward mitigating the spread of these organisms to locations where they do not presently occur. Such management will require more detailed delimitation

surveys of their distribution within Kaikoura, and of the location and frequency of movements of potential vectors that might spread them to other domestic and international locations.

Prevention of new introductions

Interception of unwanted species transported by shipping is best achieved offshore, through control and treatment of ships destined for Kaikoura 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 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. A companion project is investigating the risk from fouling assemblages carried on vessels that travel to Fiordland, the Chatham Islands and New Zealand sub-Antarctic Islands. Shipping companies and vessel owners can reduce the risk of transporting NIS in hull fouling or sea chests through regular maintenance and antifouling of their vessels. Slow moving barges or vessels that are laid up in ports for long periods before travelling to Kaikoura can carry large densities of non-indigenous marine organisms with them. Cleaning and maintenance of these vessels is suggested to 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 port baseline 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 or cruising routes. We recommend that port companies consider undertaking such assessments for their ports when new import or export markets are forecast to develop, or when new cruise itineraries are suggested. The assessment would allow potential problem species to be identified and appropriate management and monitoring requirements to be put in place.

Conclusions and recommendations for monitoring and re-surveying

The national biological baseline surveys have significantly increased our understanding of the identity, prevalence and distribution of introduced and native species in New Zealand's shipping ports. They represent a first step towards a comprehensive assessment of the risks posed to native coastal marine ecosystems from non-indigenous marine species. Although measures are being taken by the New Zealand government to reduce the rate of new incursions, foreign species are likely to continue to be introduced to New Zealand waters by shipping. There is a need for continued monitoring of non-indigenous marine species in port environments to allow for (1) early detection and control of harmful or potentially harmful non-indigenous species, (2) to provide on-going evaluation of the efficacy of management activities, and (3) to allow trading or cruising partners to be notified of species that may be potentially harmful.

The initial port baseline survey of Kaikoura recorded 411 species or higher taxa. Excluding the 82 indeterminate records and the one collective zooplankton taxon, 250 of the remaining 328 taxa did not occur in our desktop review of existing marine species records from Kaikoura, and may be new records for the area. The initial port baseline survey has highlighted the diversity of the Kaikoura marine assemblage, with results indicating that it has few NIS taxa, a moderate number of C1 taxa, and only two that are likely to be of significant impact to the native environment.

Despite the large number of species detected, the large area of habitat available for marine organisms around Kaikoura means 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.* 2006). In generalised pest surveys, such as the port baseline 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; 42 % of native species recorded in the Kaikoura port survey 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, 1992b) 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.

The baseline survey provides a starting point for further investigations of the distribution, abundance and ecology of the species described within Kaikoura and for monitoring the rate of new incursions by NIS over time. 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 or C1 organism discovered in a given location ideally requires information on a range of factors, including the mechanism of their impact and their local abundance and distribution (Parker *et al.* 1999). To predict or quantify their impacts over larger areas or longer time scales requires additional information on the species' seasonality, population size and mechanisms of dispersal (Mack *et al.* 2000).

Acknowledgements

We thank Environment Canterbury and the Department of Conservation for resource consents and concessions to conduct sampling in and around Kaikoura. We thank the Kaikoura District Council, WhaleWatch Kaikoura and Encounter Kaikoura for providing information about and access to their facilities. We also thank the field team and taxonomists listed in the project team above.

Glossary

Term	Definition	Terms with the same or similar meaning
Biosecurity	The *Biosecurity Strategy for New Zealand* defines Biosecurity as the exclusion, eradication or effective management of risks posed by pests and diseases to the economy, environment and human health.	
Biosecurity status	A determination of the known or suspected geographic origin of a species or higher taxon. Categories of biosecurity status used in this report are *native, non-indigenous, cryptogenic* (category 1 or category 2), and *indeterminate*.	
Chief Technical Officer†	A person appointed as a Chief Technical Officer under section 101 of the Biosecurity Act 1993	
Cryptogenic species	Species that are neither clearly indigenous nor non-indigenous.	
Endemic	An organism restricted to a specified region or locality.	
Environment†	(a) Ecosystems and their constituent parts, including people and their communities; and (b) All natural and physical resources; and (c) Amenity values; and (d) The aesthetic, cultural, economic, and social conditions that affect or are affected by any matter referred to in paragraphs (a) to (c) of this definition	
Established	A non-indigenous organism that has formed self-sustaining populations within the new area of introduction, but is not necessarily an invasive species.	Naturalised
Generalised pest survey	A survey to identify and inventory the range of non-indigenous species present in an area	Blitz survey
Introduction	Direct or indirect movement by a human agency of an organism across a major geographical barrier to a region or locality that is beyond its natural distribution potential.	Translocation (*usually applied to secondary movement of the organism within a new region*)
Indeterminate taxa	Specimens that could not be identified to species level reliably because they were damaged, incomplete or immature, or because there was insufficient taxonomic or systematic information to allow identification to species level.	*(referred to as "Species indeterminata" in previous NZ port survey reports)*
Harmful organism	Organisms considered harmful to the environment, where "*environment*" has the broad definition described above.	Noxious, Pest
Invasive species	A *non-indigenous species* that has established in a new area and is expanding its range	
Indigenous species	An organism occurring within its natural past or present range and dispersal potential (organisms whose dispersal potential is independent of human intervention).	Native
Non-indigenous species	Any organism (including its seeds, eggs, spores, or other biological material capable of propagating that species) occurring outside its natural past or present range and dispersal potential (organisms whose dispersal is caused by human action).	Adventive Alien, Allochthonous, Exotic, Introduced, Non-native
Pathway	Used interchangeably with *vector*, but can also include the purpose (the reason why a species is moved), and route (the geographic corridor) by which a species is moved from one point to another (Carlton 2001).	Vector
Pest†	(1) A non-indigenous organism that is considered harmful to the environment, where "*environment*" has the broad definition described above. (2) An organism specified as a pest in a pest management strategy that has been approved under Part V of Biosecurity Act 1993.	
Prevalence	The ratio of the number of recorded occurrences of a species relative to the total number of observations.	
Species richness	The number of species present in an area.	

Term	Definition	Terms with the same or similar meaning
Species composition	The types or identities of species present in a sample, site, or region.	
Species density	The number of species per unit area.	
Targeted pest survey	A survey to determine characteristics of a particular pest population	
Unwanted organism†	Any organism that a *Chief Technical Officer* believes is capable or potentially capable of causing unwanted harm to any natural resources	
Vector	The physical means by which a species is transported	Pathway

†Terms defined by the New Zealand *Biosecurity Act 1993*

Sources for definitions of commonly used biosecurity terms include: Biosecurity Council (2003), Carlton (2001), Cohen and Carlton (1998), Colautii and MacIsaac (2004), Falk-Petersen *et al.* (2006), Gotelli and Colwell (2001), Gray (2000) and Occhipinti-Ambrogi and Galil (2004).

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Tables

Table 1: Number of replicate samples taken for each sampling method at each site in the baseline survey of Kaikoura. Exact geographic locations of survey sites are provided in Appendix 2.

Site #	Site name	Quadrat scraping	Photo stills and video	Large hand corer	Anchor box dredge	Sediment samples	Cyst cores	Zoo-plankton net	Phyto-plankton net	Qualitative diver visual surveys	Opportunistic visual surveys from above water	Benthic sled	Crab trap	Shrimp trap	Poison station	Beach seine net	Beach wrack walk	Total (excl. photo & video)
1	Ingles Bay north wharf	10	44				6	3	3		1	2	6	6				**37**
2	Ingles Bay south wharf				6	2	6		3	1			6	6				**30**
3	Goochs Beach															3	2	**5**
4	Ingles Bay Boat mooring 1						3	3	3			2						**11**
5	Ingles Bay boat mooring 2						3					2			1			**6**
6	Fyffe cove slipway	10	50	5		1	6	3	3	1			6	6	1	3	2	**47**
7	Gooch Beach slipway						6	3	3	1			6	6	1	3	2	**31**
8	Kaikoura inner harbour limit-north				3	2	3	3	3			2						**16**
9	Kaikoura inner harbour limit-east				3	2	3	3	3			3						**17**
10	Nine pins rocks									1								**1**
11	St Kilda Rocks											2						**2**
12	Point Kean							3	3	1								**7**
13	Atia Point							3	3	1								**7**
14	Kaikoura inner harbour limit-south				3	2	3	3	3	1								**15**
15	South bay slipway-west															3	3	**6**
16	South Bay slipway-east							3	3	1						3	3	**13**
17	South Bay piles				6	2	6				1	2			1			**18**
18	Kaikoura inner harbour limit- west				3	2	3	3	3			2						**16**
19	Gooch bay beach											2				3	3	**8**
20	Baxter reef																	**1**
21	Cone rock				3	2	3			1								**9**
Total		**20**	**94**	**5**	**27**	**15**	**51**	**33**	**36**	**9**	**2**	**19**	**24**	**24**	**4**	**18**	**15**	**303**

Table 2: Preservatives used for the major taxonomic groups of organisms collected during the port survey.

5 % Formalin solution	10 % Formalin solution	70 % Ethanol solution	80 % Ethanol solution	100 % Ethanol solution	Press instead of preserving
Algae (except *Codium* and *Ulva*)	Ascidiacea (colonial) [1, 2]	Alcyonacea [2]	Ascidiacea (solitary) [1]	Bryozoa	*Ulva* [4]
	Asteroidea	Crustacea (small)			
	Echinoidea	Holothuria [1, 2]			
	Ophiuroidea	Zoantharia [1, 2]			
	Brachiopoda	Porifera [1]			
	Crustacea (large)	Mollusca (with shell)			
	Ctenophora [1]	Mollusca [1, 2] (without shell)			
	Scyphozoa [1, 2]	Platyhelminthes [1, 3]			
	Hydrozoa	*Codium* [4]			
	Actiniaria & Corallimorpharia [1, 2]				
	Scleractinia				
	Nudibranchia [1]				
	Polychaeta				
	Actinopterygii & Elasmobranchii [1]				

[1] photographs were taken before preservation
[2] relaxed in menthol prior to preservation
[3] a formalin fix was carried out before final preservation took place
[4] a sub-sample was retained in silica gel beads for DNA analysis

Table 3: 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*

Table 4: Consultative Committee on Introduced Marine Pest Emergencies (CCIMPE) Trigger List (Endorsed by the National Introduced Marine Pest Coordinating Group, 2006).

Scientific Name/s		Common Name/s
Species Still Exotic to Australia		
1 *	Eriocheir spp.	Chinese Mitten Crab
2	Hemigrapsus sanguineus	Japanese/Asian Shore Crab
3	Crepidula fornicata	American Slipper Limpet
4 *	Mytilopsis sallei	Black Striped Mussel
5	Perna viridis	Asian Green Mussel
6	Perna perna	Brown Mussel
7 *	Corbula (Potamocorbula) amurensis	Asian Clam, Brackish-Water Corbula
8 *	Rapana venosa (syn Rapana thomasiana)	Rapa Whelk
9 *	Mnemiopsis leidyi	Comb Jelly
10 *	Caulerpa taxifolia (exotic strains only)	Green Macroalga
11	Didemnum spp. (exotic invasive strains only)	Colonial Sea Squirt
12 *	Sargassum muticum	Asian Seaweed
13	Neogobius melanostomus (marine/estuarine incursions only)	Round Goby
14	Marenzelleria spp. (invasive species and marine/estuarine incursions only)	Red Gilled Mudworm
15	Balanus improvisus	Barnacle
16	Siganus rivulatus	Marbled Spinefoot, Rabbit Fish
17	Mya arenaria	Soft Shell Clam
18	Ensis directus	Jack-Knife Clam
19	Hemigrapsus takanoi/penicillatus	Pacific Crab
20	Charybdis japonica	Lady Crab
Species Established in Australia, but not Widespread		
21 *	Asterias amurensis	Northern Pacific Seastar
22	Carcinus maenas	European Green Crab
23	Varicorbula gibba	European Clam
24 *	Musculista senhousia	Asian Bag Mussel, Asian Date Mussel
25	Sabella spallanzanii	European Fan Worm
26 *	Undaria pinnatifida	Japanese Seaweed
27 *	Codium fragile spp. tomentosoides	Green Macroalga
28	Grateloupia turuturu	Red Macroalga
29	Maoricolpus roseus	New Zealand Screwshell
Holoplankton Alert Species * For notification purposes, eradication response from CCIMPE is highly unlikely		
30 *	Pfiesteria piscicida	Toxic Dinoflagellate
31	Pseudo-nitzschia seriata	Pennate Diatom
32	Dinophysis norvegica	Toxic Dinoflagellate
33	Alexandrium monilatum	Toxic Dinoflagellate
34	Chaetoceros concavicornis	Centric Diatom
35	Chaetoceros convolutus	Centric Diatom

***** Species on Interim CCIMPE Trigger List

Table 5: Native taxa recorded during the desktop review of existing marine species records from Kaikoura and nearby areas. Also indicated is whether the taxon was subsequently recorded from the Kaikoura port baseline survey (this report).

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Annelida							
Polychaeta	Eunicida	Dorvilleidae	*Dorvillea australiensis*		Knox *et al.* (1985)		
Polychaeta	Eunicida	Eunicidae	*Eunice tentaculata*		Knox *et al.* (1985)		
Polychaeta	Eunicida	Onuphidae	*Hyalinoecia longibranchiata*	*Hyalinoecia tubicula*	Knox *et al.* (1985)		
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris sphaerocephala*	*Lumbrinereis sphaerocephala*	Knox *et al.* (1985)		Yes
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris brevicirra*	*Lumbrinereis brevicirra*	Knox *et al.* (1985)		
Polychaeta	Eunicida	Eunicidae	*Marphysa unibranchiata*		Knox *et al.* (1985)		
Polychaeta	Eunicida	Eunicidae	*Marphysa depressa*		Knox *et al.* (1985)		
Polychaeta	Eunicida	Eunicidae	*Lysidice ninetta*		Knox *et al.* (1985)		
Polychaeta	Eunicida	Lysaretidae	*Tainokia iridescens*		Knox *et al.* (1985)		
Polychaeta	Eunicida	Eunicidae	*Eunice rubella*		Knox *et al.* (1985)		
Polychaeta	Eunicida	Eunicidae	*Eunice aphroditois*		Knox *et al.* (1985)		
Polychaeta	Eunicida	Eunicidae	*Eunice australis*		Knox *et al.* (1985)		
Polychaeta	Eunicida	Eunicidae	*Marphysa capensis*		Knox *et al.* (1985)		
Polychaeta	Eunicida	Onuphidae	*Rhamphobrachium maculatum*		Knox *et al.* (1985)		
Polychaeta	Eunicida	Lysaretidae	*Oenone fulgida*		Knox *et al.* (1985)	Trawled south of Kaikoura Peninsula	
Polychaeta	Eunicida	Oenonidae	*Arabella iricolor*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Nereididae	*Namanereis quadraticeps*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Nereididae	*Platynereis australis*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Nereididae	*Perinereis pseudocamiguina*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Nereididae	*Perinereis vallata*	*Perinereis nuntia var. brevicirris*	Knox *et al.* (1985)		Yes
Polychaeta	Phyllodocida	Nereididae	*Perinereis vallata*	*Perinereis nuntia var. vallata*	Knox *et al.* (1985)		Yes

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus macroura*		Knox *et al.* (1985)		Yes
Polychaeta	Phyllodocida	Nereididae	*Perinereis camiguinoides*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Glyceridae	*Hemipodus digitifera*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Glyceridae	*Hemipodus simplex*		Knox *et al.* (1985)		Yes
Polychaeta	Phyllodocida	Glyceridae	*Glycera tesselata*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Nereididae	*Perinereis amblyodonta*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Haplosyllis spongicola*	*Syllis (Haplosyllis) spongicola*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis taeniaeformis*	*Trypanosyllis (Trypanodentata) taeniaeformis*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis gigantea*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Typosyllis variegata*	*Syllis (Typosyllis) variegata*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Typosyllis prolifera*	*Syllis (Typosyllis) prolifera*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Typosyllis pectinans*	*Syllis (Typosyllis) pectinans*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Odontosyllis polycera*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Ehlersia ferrugina*	*Syllis (Langherhansia) ferrugina*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Phyllodocidae	*Eulalia microphylla*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Pionosyllis stylifera*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Exogone heterosetosa*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Eusyllis kerguelensis*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Clavisyllis alternata*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Brania furcelligera*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Typosyllis brachycola*	*Syllis (Typosyllis) brachyiola*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Pholoidae	*Laubierpholoe maryae*		Pettibone 1992a, in Glasby & Read (1998)		
Polychaeta	Phyllodocida	Pisionidae	*Pisione oerstedi*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodoce patagonica*	*Phyllodoce (Anaitides)*	Knox *et al.* (1985)		

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
				patagonica			
Polychaeta	Phyllodocida	Syllidae	*Odontosyllis psammochroma*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Amblyosyllis granosa*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Nereididae	*Nereis falcaria*	*Nereis (Nereis) falcaria*	Knox *et al.* (1985)		Yes
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus polychromus*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus jacksoni*		Knox *et al.* (1985)		Yes
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus fiordlandica*		Knox *et al.* (1985), Knox (1956)		
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus banksi*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Polynoidae	*Lepidastheniella comma*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Polynoidae	*Hyperhalosydna striata*	*Hyperhalesydna striata*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Polynoidae	*Harmothoe macrolepidota*		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Nereididae	*Nereis jacksoni*	*Nereis (Nereis) jacksonia*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Nereididae	*Neanthes cricognatha*	*Nereis (Neanthes) cricognatha*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Glyceridae	*Glycera lamelliformis*	*Glycera lamellipoda*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Aphroditidae	*Aphrodita australis*	*Aphrodite australis*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Polynoidae	*Euphione squamosa*		Knox *et al.* (1985)		
Polychaeta	Sabellida	Sabellariidae	*Neosabellaria kaiparaensis*	*Sabellaria antipoda*	Knox *et al.* (1985)		
Polychaeta	Sabellida	Serpulidae	*Romanchella (Romanchella) solea*		Knox *et al.* (1985)		
Polychaeta	Sabellida	Sabellidae	*Megalomma suspiciens*		Knox *et al.* (1985)		
Polychaeta	Sabellida	Sabellidae	*Megalomma kaikourense*		Knight-Jones 1997, in Glasby & Read 1998		
Polychaeta	Sabellida	Serpulidae	*Neodexiospira steueri*	*Janua (Dexiospira) steueri*	Knox *et al.* (1985)		
Polychaeta	Sabellida	Serpulidae	*Galeolaria hystrix*		Knox *et al.* (1985)		Yes

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Polychaeta	Sabellida	Serpulidae	*Spirobranchus cariniferus*	*Pomatoceros cariniferus*	Knox *et al.* (1985)		
Polychaeta	Sabellida	Oweniidae	*Owenia petersenae*	*Owenia fusiformis*	Knox *et al.* (1985)		
Polychaeta	Sabellida	Serpulidae	*Protula bispiralis*		Knox *et al.* (1985)	On edge of canyon, Kaikoura Peninsula region	
Polychaeta	Sabellida	Serpulidae	*Nidificaria pocillator*	*Pileolaria (Dulicaria) pocillator*	Knox *et al.* (1985)		
Polychaeta	Sabellida	Serpulidae	*Protolaeospira lebruni*	*Paralaeospira lebruni*	Knox *et al.* (1985)		
Polychaeta	Sabellida	Serpulidae	*Paralaeospira levinseni*		Knox *et al.* (1985)		
Polychaeta	Sabellida	Sabellidae	*Pseudopotamilla oligophthalamus*	*Potamilla oligophthalamus*	Knox *et al.* (1985)		
Polychaeta	Sabellida	Sabellidae	*Pseudobranchiomma grandis*	*Branchiomma serratibranchis*	Knox *et al.* (1985)		
Polychaeta	Scolecida	Opheliidae	*Armandia maculata*		Knox *et al.* (1985)		
Polychaeta	Scolecida	Orbiniidae	*Proscoloplos cygnachaetus*		Knox *et al.* (1985)		
Polychaeta	Scolecida	Orbiniidae	*Scoloplos (Leodamus) ohlini*		Knox *et al.* (1985)		
Polychaeta	Scolecida	Arenicolidae	*Abarenicola affinis*	*Abarenicola affinis affinis*	Knox *et al.* (1985)		
Polychaeta	Scolecida	Scalibregmatidae	*Hyboscolex longiseta*		Knox *et al.* (1985)		
Polychaeta	Scolecida	Orbiniidae	*Scoloplos (Scoloplos) cylindrifer*		Knox *et al.* (1985)		
Polychaeta	Scolecida	Orbiniidae	*Orbinia papillosa*		Knox *et al.* (1985)		
Polychaeta	Scolecida	Maldanidae	*Axiothella quadrimaculata*		Knox *et al.* (1985)		
Polychaeta	Scolecida	Scalibregmatidae	*Scalibregma inflatum*		Knox *et al.* (1985)		
Polychaeta	Spionida	Spionidae	*Scolecolepides benhami*		Knox *et al.* (1985)		
Polychaeta	Spionida	Spionidae	*Scolelepis antipoda*		Knox *et al.* (1985)		
Polychaeta	Terebellida	Terebellidae	*Terebella plagiostoma*	*Terebella haplochaeta*	Knox *et al.* (1985)		
Polychaeta	Terebellida	Terebellidae	*Polycirrus kerguelensis*		Knox *et al.* (1985)		
Polychaeta	Terebellida	Terebellidae	*Thelepus plagiostoma*		Knox *et al.* (1985)		

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Polychaeta	Terebellida	Terebellidae	*Nicolea armilla*	*Nicolea armilla*	Knox *et al.* (1985)		Yes
Polychaeta	Terebellida	Pectinariidae	*Pectinaria australis*	*Pectinaria (Lagis) australis*	Knox *et al.* (1985)		
Polychaeta	Terebellida	Flabelligeridae	*Flabelligera affinis*		Knox *et al.* (1985)		
Polychaeta	Terebellida	Cirratulidae	*Protocirrineris nuchalis*	*Cirratulus nuchalis*	Knox *et al.* (1985)		
Polychaeta	Terebellida	Flabelligeridae	*Pherusa parmata*		Knox *et al.* (1985)		
Polychaeta	Terebellida	Cirratulidae	*Dodecaceria berkeleyi*	*Dodecaceria berkleyi*	Knox *et al.* (1985)		
Arthropoda							
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa frequens*		Barnard (1972), Fenwick (1976)		
Malacostraca	Amphipoda	Eophliantidae	*Wandelia wairarapa*		Lowry (1974)		
Malacostraca	Amphipoda	Lysianassidae	*Ocosingo fenwicki*		Lowry and Stoddart (1984)		
Malacostraca	Amphipoda	Ischyroceridae	*Cerapus harfootus*		Lowry (1981)		
Malacostraca	Amphipoda	Ischyroceridae	*Cerapus stoorus*		Lowry (1981)		
Malacostraca	Amphipoda	Ischyroceridae	*Cerapus fallohideus*		Lowry (1981)		
Malacostraca	Amphipoda	Ischyroceridae	*Ischyrocerus longimanus*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Ischyroceridae	*Jassa justi*	*Jassa falcata*	Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Ischyroceridae	*Ventojassa frequens*		Lowry (1974)		
Malacostraca	Amphipoda	Amphilochidae	*Amphilochus filidactylus*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Lysianassidae	*Hippomedon whero*		Fenwick (1983)		
Malacostraca	Amphipoda	Oedicerotidae	*Patuki roperi n.sp.*		Fenwick (1983)		
Malacostraca	Amphipoda	Amphilochidae	*Amphilochus opunake*		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Hyalidae	*Hyale rubra*		Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Gammaridae	*Maera incerta*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Leucothoidae	*Leucothoe trailli*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Hyalidae	*Talorchestia quoyana*		Lowry (1974)		
Malacostraca	Amphipoda	Hyalidae	*Talorchestia cookii*		Lowry (1974)		
Malacostraca	Amphipoda	Hyalidae	*Orchestia chiliensis*		Lowry (1974)		
Malacostraca	Amphipoda	Eusiridae	*Gondogeneia danai*		Barnard (1972), Lowry (1974)		

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Malacostraca	Amphipoda	Hyalidae	*Hyale maroubrae*		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Melphidippidae	*Horniella whakatane*	*Metaceradocus whakatane*	Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Hyalidae	*Hyale grenfelli*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Hyalidae	*Apohyale media*	*Hyale media*	Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis typica*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Isaeidae	*Gammaropsis tawahi*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Eusiridae	*Paramoera chevreuxi*		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Eusiridae	*Oradarea novaezealandiae*		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Eophliantidae	*Bircenna fulva*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Hyalidae	*Allorchestes novizealandiae*		Lowry (1974)		
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine houtete*		Lowry (1974)		
Malacostraca	Amphipoda	Podoceridae	*Podocerus karu*		Lowry (1974)		
Malacostraca	Amphipoda	Podoceridae	*Podocerus karu*		Barnard (1972), Fenwick (1976)		
Malacostraca	Amphipoda	Cyproideidae	*Peltopes peninsulae*		Fenwick (1976)		
Malacostraca	Amphipoda	Phoxocephalidae	*Paraphoxus waipiro*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Dexaminidae	*Atylus taupo*		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Dexaminidae	*Polycheria obtusa*		Fenwick (1976)		
Malacostraca	Amphipoda	Gammaridae	*Maera tepuni*		Fenwick (1976)		
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine muriwai*		Barnard (1972), Fenwick (1976)		
Malacostraca	Amphipoda	Gammaridae	*Maera masteri*		Lowry (1974)		
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine houtete*		Barnard (1972), Fenwick (1976)		
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine pacifica*		Fenwick (1976), Lowry (1974)		Yes
Malacostraca	Amphipoda	Iphimediidae	*Iphimedia spinosa*	*Panoploea spinosa*	Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Nihotungidae	*Nihotunga noa*		Barnard (1972), Fenwick (1976), Lowry (1974)		

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Malacostraca	Amphipoda	Eusiridae	*?Prostebbingia levis*	*Pontogeniella levis*	Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine muriwai*		Lowry (1974)		
Malacostraca	Amphipoda	Aoridae	*Microdeutopus apopo*		Fenwick (1976)		
Malacostraca	Amphipoda	Melitidae	*Elasmopus bollonsi*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Melitidae	*Ceradocopsis peke*		Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Ceinidae	*Ceina egregia*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Eophliantidae	*Cylindryllioides kaikoura*		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Eophliantidae	*Wandelia wairarapa*		Fenwick (1976)		
Malacostraca	Amphipoda	Eusiridae	*Gondogeneia rotorua*		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Aoridae	*Haplocheira barbimana barbimana*		Moore & Myers 1983		
Malacostraca	Amphipoda	Melitidae	*Mallacoota subcarinata*		Fenwick (1976)		
Malacostraca	Amphipoda	Aoridae	*Aora maculata*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Ampithoidae	*Ampithoe (Pleonex) lessoniae*		Lowry (1974)		
Malacostraca	Amphipoda	Ampithoidae	*Ampithoe aorangi*		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Ampithoidae	*Ampithoe hinatore*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Amphilochidae	*Neocyproidea pilgrimi*		Lowry (1974)		
Malacostraca	Amphipoda	Amphilochidae	*Gitanopsis desmondi*		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Amphilochidae	*Gitanopsis kupe*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Melitidae	*Parapherusa crassipes*		Barnard (1972), Fenwick (1976)		
Malacostraca	Amphipoda	Eusiridae	*Paracalliope novizealandiae*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Eusiridae	*Eusiroides monoculoides*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Eusiridae	*Whangarusa translucens*	*Apherusa translucens*	Lowry (1974)		
Malacostraca	Amphipoda	Eusiridae	*Whangarusa translucens*	*Apherusa translucens*	Fenwick (1976)		

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Malacostraca	Amphipoda	Colomastigidae	*Colomastix subcastellata*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Melitidae	*Elasmopus neglectus*		Fenwick (1976), Lowry (1974)		Yes
Malacostraca	Amphipoda	Melitidae	*Parapherusa crassipes*		Lowry (1974)		
Malacostraca	Amphipoda	Melitidae	*Elasmopus wahine*		Fenwick (1976)		
Malacostraca	Amphipoda	Melitidae	*Ceradocus rubromaculatus haumuri*		Lowry (1974)		
Malacostraca	Amphipoda	Melitidae	*Melita inaequistylis*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Melitidae	*Melita festiva*		Fenwick (1976)		
Malacostraca	Amphipoda	Melitidae	*Melita awa*		Fenwick (1976)		
Malacostraca	Amphipoda	Melitidae	*Mallacoota subcarinata*		Lowry (1974)		
Malacostraca	Amphipoda	Amphilochidae	*Gitanopsis squamosa*		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Colomastigidae	*Colomastix magnirama*		Fenwick (1976)		
Malacostraca	Amphipoda	Podoceridae	*Podocerus manawatu*		Barnard (1972), Fenwick (1976), Lowry (1974)		Yes
Malacostraca	Amphipoda	Stegocecephalidae	*Tetradeion crassum*		Lowry (1974)		
Malacostraca	Amphipoda	Sebidae	*Seba typica*		Lowry (1974)		
Malacostraca	Amphipoda	Stenothoidae	*Stenothoe moe*		Lowry (1974)		
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia akaroica*		Barnard (1972), Lowry (1974)		Yes
Malacostraca	Amphipoda	Phtisicidae	*Caprellina longicollis*		Fenwick (1976)		Yes
Malacostraca	Amphipoda	Caprellidae	*Pseudoprotomima hurleyi*		Fenwick (1976)		
Malacostraca	Amphipoda	Stegocecephalidae	*Tetradeion crassum*		Barnard (1972), Fenwick (1976)		
Malacostraca	Amphipoda	Stenothoidae	*Mesoproboloides excavata*		Fenwick (1977)		
Malacostraca	Amphipoda	Stenothoidae	*Stenothoe moe*		Barnard (1972), Fenwick (1976)		
Malacostraca	Amphipoda	Stenothoidae	*Raumahara rongo*		Barnard (1972), Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Stenothoidae	*Probolisca ovata*		Fenwick (1976), Lowry (1974)		
Malacostraca	Amphipoda	Podoceridae	*Podocerus wanganui*		Fenwick (1976)		Yes
Malacostraca	Amphipoda	Sebidae	*Seba typica*		Barnard (1972), Fenwick (1976)		
Malacostraca	Amphipoda	Phliantidae	*Iphinotus typicus*		Barnard (1972), Lowry (1974)		

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Malacostraca	Decapoda	Hymenosomatidae	*Halicarcinus cookii*		Melrose (1975)		
Malacostraca	Decapoda	Hymenosomatidae	*Halicarcinus varius*		Melrose (1975)		Yes
Malacostraca	Decapoda	Majidae	*Notomithrax ursus*		Woods and McLay (1994)		Yes
Malacostraca	Decapoda	Lithodidae	*Lithodes murrayi*		NIWA (2008)		
Malacostraca	Decapoda	Galatheidae	*Munida larvae*		Stonehouse (1965)		
Malacostraca	Decapoda	Palinuridae	*Jasus edwardsi*		Bentley *et al.* (2005); Booth and Bowring (1988)		Yes
Malacostraca	Decapoda	Lithodidae	*Neolithodes brodiei*		NIWA (2008)		
Malacostraca	Isopoda	Sphaeromatidae	*Ischyromene cordiforaminalis*	*Dynamenella cordiforaminalis*	Hurley and Jansen (1977)		
Malacostraca	Isopoda	Cirolanidae	*Natatolana rossi*	*Cirolana rossi*	Keable (2006)		Yes
Malacostraca	Isopoda	Cirolanidae	*Cirolana kokoru*		Bruce (2004)		
Malacostraca	Isopoda	Idoteidae	*Maoridotea naylori*		Jones and Fenwick (1978)		
Malacostraca	Isopoda	Sphaeromatidae	*Amphoroidea media*		Hurley and Jansen (1970)		Yes
Malacostraca	Isopoda	Sphaeromatidae	*Isocladus armatus*		Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Isocladus calcareus*		Jansen (1971)		
Malacostraca	Isopoda	Sphaeromatidae	*Scutuloidea maculata*		Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Cilicaea dolorosa*		Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Cymodocella egregia*		Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Amphoroidea longipes*		Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Exosphaeroma echinensis*		Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Exosphaeroma obtusum*		Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Amphoroidea falcifer*		Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Dynamenopsis varicolor*		Hurley and Jansen (1970)		
Malacostraca	Isopoda	Sphaeromatidae	*Dynameniodes decima*		Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Ischyromene insulsa*	*Dynamenella insulsa*	Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Ischyromene huttoni*	*Dynamenella huttoni*	Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Ischyromene condita*	*Dynamenella condita*	Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Ischyromene hirsuta*	*Dynamenella hirsuta*	Hurley and Jansen (1970, 1977)		

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Malacostraca	Isopoda	Sphaeromatidae	*Cilicaea caniculata*		Hurley and Jansen (1977)		
Malacostraca	Isopoda	Sphaeromatidae	*Dynameniodes vulcanata*		Hurley and Jansen (1977)		
Maxillopoda	Calanoida	Calanidae	*Calanoides macrocarinatus*	*Calanoides carinatus*	Bradford (1970)		
Maxillopoda	Calanoida	Metridinidae	*Metridia lucens*		Bradford (1970)		
Maxillopoda	Calanoida	Eucalanidae	*Eucalanus longiceps*		Bradford (1970)		
Maxillopoda	Calanoida	Clausocalanidae	*Clausocalanus brevipes*		Bradford (1970)		
Maxillopoda	Calanoida	Centropagidae	*Centropages aucklandicus*		Bradford (1970)		
Maxillopoda	Calanoida	Calanidae	*Calanus tonsus*		Bradford (1970)		
Maxillopoda	Calanoida	Calanidae	*Calanus australis*		Bradford (1970)		
Maxillopoda	Calanoida	Calanidae	*Calanus tenuicornis*		Bradford (1970)		
Maxillopoda	Calanoida	Metridinidae	*Pleuromamma gracilis*		Bradford (1970)		
Maxillopoda	Sessilia	Tetraclitidae	*Epopella plicata*		Marsden (1981)		Yes
Maxillopoda	Sessilia	Chthamalidae	*Chamaesipho columna*		Morton and Miller (1968)		
Ostracoda	Myodocopida	Cylindroleberididae	*Leuroleberis zealandica*		Fenwick (1984)		Yes
Bryozoa							
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperia granulosa*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Microporellidae	*Microporella agonistes*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Electridae	*Electra lesueuri*	*Electra pilosa*	NIWA (2008)		
Gymnolaemata	Cheilostomata	Cribrilinidae	*Figularia huttoni*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Crepidacanthidae	*Crepidacantha kirkpatricki*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Crepidacanthidae	*Crepidacantha crinispina*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperiopsis spiculata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Escharellidae	*Escharella spinosissima*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperiopsis cervicornis*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Eurystomellidae	*Eurystomella foraminigera*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Celleporidae	*Galeopsis polyporus*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Buffonellodidae	*Aimulosia marsupium*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Lepraliellidae	*Celleporaria agglutinans*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria immersa*		NIWA (2008)		

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Gymnolaemata	Cheilostomata	Catenicellidae	*Scalicella crystallina*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Catenicellidae	*Pterocella scutella*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Chaperiidae	*Chaperiopsis lanceola*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Foveolariidae	*Foveolaria elliptica*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Microporellidae	*Fenestrulina reticulata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Microporellidae	*Calloporina angustipora*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Hippothoidae	*Plesiothoa trigemma*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Hippothoidae	*Hippothoa flagellum*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Electridae	*Villicharixa strigosa*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Hippopodinidae	*Cosciniopsis vallata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Catenicellidae	*Costaticella bicuspis*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Flustridae	*Gregarinidra inarmata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Romancheinidae	*Exochella tricuspis*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Romancheinidae	*Exochella conjuncta*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Romancheinidae	*Exochella armata*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides angela*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Exochellidae	*Escharoides aff. excavata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Hippopodinidae	*Hippomenella vellicata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Beaniidae	*Beania magellanica*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Arachnopusiidae	*Arachnopusia unicornis*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Aeteidae	*Aetea truncata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Catenicellidae	*Orthoscuticella margaritacea*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Bitectiporidae	*Bitectipora mucronifera*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Calloporidae	*Crassimarginatella cucullata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Microporellidae	*Microporella discors*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Catenicellidae	*Claviporella aurita*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Catenicellidae	*Catenicella elegans*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Calwelliidae	*Malakosaria sinclairii*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Calloporidae	*Retevirgula acuta*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Calloporidae	*Odontionella cyclops*		NIWA (2008)		Yes

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Gymnolaemata	Cheilostomata	Beaniidae	*Beania plurispinosa*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Calloporidae	*Crassimarginatella fossa*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Bugulidae	*Dimetopia cornuta*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Buffonellodidae	*Buffonellodes rhomboidalis*	*Xenogma rhomboidalis*	NIWA (2008)		
Gymnolaemata	Cheilostomata	Bitectiporidae	*Schizosmittina cinctipora*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Bitectiporidae	*Parkermavella punctigera*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Bitectiporidae	*Hippomonavella flexuosa*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Bitectiporidae	*Bitectipora rostrata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Catenicellidae	*Cribricellina cribraria*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Calloporidae	*Leptinatella gordoni*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Microporellidae	*Fenestrulina thyreophora*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Hippothoidae	*Antarctothoa tongima*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Hippothoidae	*Antarctothoa delta*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Aeteidae	*Aetea australis*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Smittinidae	*Prenantia firmata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Escharinidae	*Chiastosella enigma*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Phidoloporidae	*Stephanollona scintillans*	*Stephanollona longispinata*	NIWA (2008)		
Gymnolaemata	Cheilostomata	Petraliellidae	*Mobunula bicuspis*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Smittinidae	*Smittoidea maunganuiensis*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Smittinidae	*Hemismittoidea hexaspinosa*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Smittinidae	*Smittina rosacea*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Candidae	*Caberea darwinii*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Smittinidae	*Parasmittina aotea*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Microporidae	*Opaeophora lepida*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Microporidae	*Micropora mortenseni*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Microporidae	*Micropora inarmata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Microporidae	*Micropora gracilis*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Microporellidae	*Microporella intermedia*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Smittinidae	*Smittina torques*		NIWA (2008)		

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Gymnolaemata	Cheilostomata	Candidae	*Scrupocellaria ornithorhyncus*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Antroporidae	*Akatopora circumsaepta*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Schizoporellidae	*Chiastosella watersi*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Candidae	*Tricellaria aculeata*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Candidae	*Bugulopsis monotrypa*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Candidae	*Emma rotunda*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Candidae	*Canda filifera*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Candidae	*Caberea zelandica*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Candidae	*Caberea solida*		NIWA (2008)		Yes
Gymnolaemata	Cheilostomata	Candidae	*Caberea rostrata*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Candidae	*Caberea guntheri*		NIWA (2008)		
Gymnolaemata	Cheilostomata	Steginoporellidae	*Steginoporella magnifica*		NIWA (2008)		
Gymnolaemata	Ctenostomata	Penetrantiidae	*Penetrantia parva*		NIWA (2008)		
Gymnolaemata	Ctenostomata	Penetrantiidae	*Penetrantia irregularis*		NIWA (2008)		
Gymnolaemata	Ctenostomata	Flustrellidridae	*Elzerina binderi*		NIWA (2008)		
Stenolaemata	Cyclostomata	Margarettidae	*Margaretta barbata*		NIWA (2008)		Yes
Stenolaemata	Cyclostomata	Crisiidae	*Bicrisia biciliata*		NIWA (2008)		
Stenolaemata	Cyclostomata	Lichenoporidae	*Disporella pristis*		NIWA (2008)		
Stenolaemata	Cyclostomata	Cinctiporidae	*Cinctipora elegans*		NIWA (2008)		
Stenolaemata	Cyclostomata	Phidoloporidae	*Phidolopora avicularis*		NIWA (2008)		
Stenolaemata	Cyclostomata	Diaperoeciidae	*Diaperoecia purpurascens*		NIWA (2008)		
Stenolaemata	Cyclostomata	Theonoidae	*Telopora lobata*		NIWA (2008)		
Stenolaemata	Cyclostomata	Crisiidae	*Bicrisia edwardsiana*		NIWA (2008)		Yes
Chlorophyta							
Ulvophyceae	Caulerpales	Caulerpaceae	*Caulerpa brownii*		Fenwick (1976)		Yes
Ulvophyceae	Cladophorales	Cladophoraceae	*Chaetomorpha coliformis*		South and Adams (1976)		
Chordata							
Actinopterygii	Anguilliformes	Synaphobranchidae	*Diastobranchus capensis*		NIWA (2008)		
Actinopterygii	Anguilliformes	Congridae	*Bassanago hirsutus*		NIWA (2008)		
Actinopterygii	Beryciformes	Trachichthyidae	*Paratrachichthys trailli*		NIWA (2008)		
Actinopterygii	Beryciformes	Trachichthyidae	*Hoplostethus*		NIWA (2008)		

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			mediterraneus				
Actinopterygii	Beryciformes	Trachichthyidae	*Hoplostethus atlanticus*		NIWA (2008)		
Actinopterygii	Gadiformes	Macrouridae	*Caelorinchus fasciatus*		NIWA (2008)		
Actinopterygii	Gadiformes	Macrouridae	*Lepidorhynchus denticulatus*		NIWA (2008)		
Actinopterygii	Gadiformes	Macrouridae	*Coryphaenoides subserrulatus*		NIWA (2008)		
Actinopterygii	Gadiformes	Macrouridae	*Coryphaenoides serrulatus*		NIWA (2008)		
Actinopterygii	Gadiformes	Macrouridae	*Coryphaenoides dossenus*		NIWA (2008)		
Actinopterygii	Gadiformes	Macrouridae	*Caelorinchus oliverianus*		NIWA (2008)		
Actinopterygii	Gadiformes	Macrouridae	*Caelorinchus innotabilis*		NIWA (2008)		
Actinopterygii	Gadiformes	Macrouridae	*Caelorinchus bollonsi*		NIWA (2008)		
Actinopterygii	Gadiformes	Macrouridae	*Caelorinchus mycterismus*		NIWA (2008)		
Actinopterygii	Gadiformes	Macrouridae	*Macrourus carinatus*		NIWA (2008)		
Actinopterygii	Gadiformes	Macrouridae	*Trachyrincus aphyodes*		NIWA (2008)		
Actinopterygii	Gadiformes	Moridae	*Pseudophycis bachus*		NIWA (2008)		Yes
Actinopterygii	Gadiformes	Moridae	*Mora moro*		NIWA (2008)		
Actinopterygii	Gadiformes	Moridae	*Lepidion microcephalus*		NIWA (2008)		
Actinopterygii	Gadiformes	Moridae	*Halargyreus johnsonii*		NIWA (2008)		
Actinopterygii	Gadiformes	Merlucciidae	*Merluccius australis*		NIWA (2008)		
Actinopterygii	Gadiformes	Merlucciidae	*Macruronus novaezelandiae*		NIWA (2008), Stonehouse (1964)		
Actinopterygii	Gasterosteiformes	Syngnathidae	*Hippocampus abdominalis*		NIWA (2008)		
Actinopterygii	Mugiliformes	Mugilidae	*Parapercis colias*		NIWA (2008)		
Actinopterygii	Notacanthiformes	Notacanthidae	*Notacanthus sexspinis*		NIWA (2008)		
Actinopterygii	Ophidiiformes	Ophidiidae	*Genypterus blacodes*		NIWA (2008)		
Actinopterygii	Osmeriformes	Alepocephalidae	*Alepocephalus australis*		NIWA (2008)		
Actinopterygii	Osmeriformes	Argentinidae	*Argentina elongata*		NIWA (2008)		
Actinopterygii	Perciformes	Epigonidae	*Epigonus telescopus*		NIWA (2008)		
Actinopterygii	Perciformes	Cheilodactylidae	*Nemadactylus*		NIWA (2008)		

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			macropterus				
Actinopterygii	Perciformes	Centrolophidae	*Seriolella punctata*		NIWA (2008)		
Actinopterygii	Perciformes	Centrolophidae	*Seriolella brama*		NIWA (2008)		
Actinopterygii	Perciformes	Carangidae	*Pseudocaranx dentex*		NIWA (2008)		
Actinopterygii	Perciformes	Arripidae	*Arripis trutta*		NIWA (2008)		Yes
Actinopterygii	Perciformes	Gempylidae	*Thyrsites atun*		NIWA (2008)		
Actinopterygii	Perciformes	Latridae	*Latridopsis ciliaris*		NIWA (2008)		
Actinopterygii	Perciformes	Uranoscopidae	*Kathetostoma giganteum*		NIWA (2008)		
Actinopterygii	Perciformes	Gempylidae	*Rexea solandri*		NIWA (2008)		
Actinopterygii	Perciformes	Trichiuridae	*Lepidopus caudatus*		NIWA (2008)		
Actinopterygii	Perciformes	Sparidae	*Pagrus auratus*		NIWA (2008)		
Actinopterygii	Perciformes	Polyprionidae	*Polyprion oxygeneios*		NIWA (2008)		
Actinopterygii	Perciformes	Latridae	*Latris lineata*		NIWA (2008)		
Actinopterygii	Pleuronectiformes	Pleuronectidae	*Rhombosolea plebeia*		NIWA (2008)		
Actinopterygii	Pleuronectiformes	Pleuronectidae	*Peltorhamphus novaezeelandiae*		NIWA (2008)		Yes
Actinopterygii	Pleuronectiformes	Bothidae	*Arnoglossus scapha*		NIWA (2008)		
Actinopterygii	Pleuronectiformes	Pleuronectidae	*Pelotretis flavilatus*		NIWA (2008)		
Actinopterygii	Scorpaeniformes	Triglidae	*Chelidonichthys kumu*		NIWA (2008)		
Actinopterygii	Syngnathiformes	Centriscidae	*Centriscops humerosus*		NIWA (2008)		
Actinopterygii	Zeiformes	Zeidae	*Zeus faber*		NIWA (2008)		
Actinopterygii	Zeiformes	Oreosomatidae	*Pseudocyttus maculatus*		NIWA (2008)		
Actinopterygii	Zeiformes	Oreosomatidae	*Neocyttus rhomboidalis*		NIWA (2008)		
Actinopterygii	Zeiformes	Oreosomatidae	*Allocyttus verrucosus*		NIWA (2008)		
Actinopterygii	Zeiformes	Cyttidae	*Cyttus traversi*		NIWA (2008)		
Actinopterygii	Zeiformes	Oreosomatidae	*Allocyttus niger*		NIWA (2008)		
Elasmobranchii	Carcharhiniformes	Triakidae	*Mustelus lenticulatus*		Francis and Mace (1980)		
Elasmobranchii	Carcharhiniformes	Triakidae	*Mustelus lenticulatus*		NIWA (2008)		
Elasmobranchii	Carcharhiniformes	Triakidae	*Galeorhinus galeus*		NIWA (2008)		
Elasmobranchii	Rajiformes	Rajidae	*Bathyraja shuntovi*		NIWA (2008)		
Elasmobranchii	Squaliformes	Dalatiidae	*Dalatias licha*		NIWA (2008)		
Elasmobranchii	Squaliformes	Dalatiidae	*Etmopterus baxteri*		NIWA (2008)		
Elasmobranchii	Squaliformes	Dalatiidae	*Centroscymnus plunketi*		NIWA (2008)		

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Elasmobranchii	Squaliformes	Dalatiidae	*Centroscymnus owstoni*		NIWA (2008)		
Elasmobranchii	Squaliformes	Dalatiidae	*Centroscymnus crepidater*		NIWA (2008)		
Elasmobranchii	Squaliformes	Centrophoridae	*Deania calcea*		NIWA (2008)		
Elasmobranchii	Squaliformes	Centrophoridae	*Centrophorus squamosus*		NIWA (2008)		
Elasmobranchii	Squaliformes	Squalidae	*Squalus acanthias*		NIWA (2008)		
Holocephali	Chimaeriformes	Rhinochimaeridae	*Harriotta raleighana*		NIWA (2008)		
Holocephali	Chimaeriformes	Chimaeridae	*Hydrolagus bemisi*		NIWA (2008)		
Holocephali	Chimaeriformes	Chimaeridae	*Chimaera lignaria*		NIWA (2008)		
Holocephali	Chimaeriformes	Callorhinchidae	*Callorhinchus milii*		NIWA (2008)		
Holocephali	Chimaeriformes	Rhinochimaeridae	*Rhinochimaera pacifica*		NIWA (2008)		
Cnidaria							
Anthozoa	Actiniaria	Actiniidae	*Aulactinia veratra*	*Cnidopus veratra*	Ottaway (1975)		
Anthozoa	Actiniaria	Actiniidae	*Actinia tenebrosa*		Ottaway (1975), Ottaway (1979) in Fautin (2008)		
Anthozoa	Actiniaria	Actiniidae	*Phlyctenactis tuberculosa*		Morton and Miller (1968)		Yes
Hydrozoa	Hydroida	Campanulariidae	*Obelia geniculata*		Ralph (1956)		Yes
Echinodermata							
Asteroidea	Forcipulatida	Asteriidae	*Allostichaster insignis*		Davison and van Berkel (1987)		
Asteroidea	Forcipulatida	Asteriidae	*Stichaster australis*		Davison and van Berkel (1987)		
Asteroidea	Forcipulatida	Asteriidae	*Allostichaster polyplax*		Davison and van Berkel (1987)		
Asteroidea	Forcipulatida	Asteriidae	*Sclerasterias mollis*		Davison and van Berkel (1987)		
Asteroidea	Forcipulatida	Asteriidae	*Astrostole scabra*		Davison and van Berkel (1987), Town (1980)		Yes
Asteroidea	Notomyotida	Benthopectinidae	*Benthopecten pikei*		Davison and van Berkel (1987)	1000m deep 11miles off Kaikoura	
Asteroidea	Paxillosida	Astropectinidae	*Dipsacaster magnificus*		Davison and van Berkel (1987)	off Point Gibson, Kaikoura region	
Asteroidea	Paxillosida	Astropectinidae	*Proserpinaster neozelanicus*	*Persephonaster neozelanicus*	Davison and van Berkel (1987)	off Point Gibson, Kaikoura region	
Asteroidea	Spinulosida	Echinasteridae	*Henricia compacta*		Davison and van Berkel (1987)		
Asteroidea	Valvatida	Odontasteridae	*Odontaster benhami*		Davison and van Berkel (1987)		

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Asteroidea	Valvatida	Asterinidae	*Stegnaster inflatus*		Davison and van Berkel (1987)		
Asteroidea	Valvatida	Asterinidae	*Patiriella regularis*		Davison and van Berkel (1987)		
Asteroidea	Valvatida	Goniasteridae	*Mediaster sladeni*		Davison and van Berkel (1987)		
Asteroidea	Valvatida	Odontasteridae	*Diplodontias dilatatus*	*Asterodon dilatatus*	Davison and van Berkel (1987)		Yes
Asteroidea	Valvatida	Odontasteridae	*Eurygonias hyalacanthus*		Davison and van Berkel (1987)		
Asteroidea	Velatida	Korethrasteridae	*Peribolaster lictor*		Davison and van Berkel (1987)	On longline, off Kaikoura	
Crinoidea	Comatulida	Antedonidae	*Florometra austini*		Davison and van Berkel (1987)		
Echinoidea	Cidaroida	Cidaridae	*Goniocidaris parasol*		Davison and van Berkel (1987)		
Echinoidea	Cidaroida	Echinidae	*Dermechinus horridus*		Davison and van Berkel (1987)	300m to 440m deep on Conway Rise, Kaikoura region	
Echinoidea	Cidaroida	Cidaridae	*Goniocidaris umbraculum*		Davison and van Berkel (1987)		
Echinoidea	Cidaroida	Echinidae	*Gracilechinus multidentatus*		Davison and van Berkel (1987)	1000m deep 11miles off Kaikoura	
Echinoidea	Cidaroida	Echinidae	*Pseudechinus huttoni*		Davison and van Berkel (1987)		
Echinoidea	Cidaroida	Echinidae	*Pseudechinus flemingi*		Davison and van Berkel (1987)	290m deep on Conway Rise, Kaikoura region	
Echinoidea	Cidaroida	Cidaridae	*Ogmocidaris benhami*		Davison and van Berkel (1987)		
Echinoidea	Echinoida	Echinometridae	*Evechinus chloroticus*		Davison and van Berkel (1987)		
Echinoidea	Spatangoida	Spatangidae	*Spatangus multispinus*		Davison and van Berkel (1987)	Goose Bay and Point Gibson, Kaikoura	
Echinoidea	Temnopleurida	Temnopleuridae	*Pseudechinus novaezealandiae*		Davison and van Berkel (1987)		
Holothuroidea	Apodida	Chiridotidae	*Kolostoneura novaezealandiae*		Davison and van Berkel (1987)		
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus mollis*		Davison and van Berkel (1987)		Yes
Holothuroidea	Dendrochirotida	Cucumariidae	*Neocucumella bicolummata*		Davison and van Berkel (1987)		
Holothuroidea	Dendrochirotida	Cucumariidae	*Squamocnus brevidentis*	*Ocnus brevidentis*	Davison and van Berkel (1987)		
Holothuroidea	Molpadiida	Caudinidae	*Paracaudina chilensis*		Davison and van Berkel (1987)	in 200m south of Kaikoura	
Ophiuroidea	Ophiurida	Ophiodermatidae	*Ophiopeza maculata*		Davison and van Berkel (1987)		
Ophiuroidea	Ophiurida	Ophiodermatidae	*Ophiopeza gracilis*		Davison and van Berkel (1987)		
Ophiuroidea	Ophiurida	Ophionereididae	*Ophionereis fasciata*		Davison and van Berkel (1987)		

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Ophiuroidea	Ophiurida	Ophiocomidae	*Ophiopteris antipodum*		Davison and van Berkel (1987)		
Ophiuroidea	Ophiurida	Ophiothrieidae	*Clarkcoma bollonsi*		Davison and van Berkel (1987)	Kaikoura regions 260m deep east of Point Gibson and 300m deep Conway Rise	
Ophiuroidea	Ophiurida	Ophiactidae	*Ophiactis profundi novaezealandiae*		Davison and van Berkel (1987)	480m deep on Conway Rise, Kaikoura Region	
Ophiuroidea	Ophiurida	Ophiactidae	*Ophiactis resiliens*		Davison and van Berkel (1987)		
Ophiuroidea	Ophiurida	Ophiothrieidae	*Ophiothrix aristulata*		Davison and van Berkel (1987)	300m deep on Conway Rise, Kaikoura Region	
Ophiuroidea	Ophiurida	Gorgonocephalidae	*Astrothrombus rugosus*		Davison and van Berkel (1987)	Conway Rise Kaikoura region	
Ophiuroidea	Ophiurida	Gorgonocephalidae	*Astrothorax waitei*		Davison and van Berkel (1987)		
Ophiuroidea	Ophiurida	Gorgonocephalidae	*Gorgonocephalus chilensis*		Davison and van Berkel (1987)		
Ophiuroidea	Ophiurida	Ophiacanthidae	*Ophiacantha vilis*		Davison and van Berkel (1987)	400m deep on Conway Rise, Kaikoura Region	
Ophiuroidea	Ophiurida	Ophiacanthidae	*Ophiacantha levispina*		Davison and van Berkel (1987)	480m deep on Conway Rise, Kaikoura Region	
Ophiuroidea	Ophiurida	Amphiuridae	*Amphiura pusilla*		Davison and van Berkel (1987)		
Ophiuroidea	Ophiurida	Amphiuridae	*Amphipholis squamata*		Davison and van Berkel (1987)		
Ophiuroidea	Phrynophiurida	Ophiomyxidae	*Ophiomyxa brevirima*		Davison and van Berkel (1987)		
Magnoliophyta							
Liliopsida	Potamogetonales	Zosteraceae	*Zostera novazelandica*		Woods and Schiel (1997)		
Mollusca							
Bivalvia	Mytiloida	Mytilidae	*Mytilus galloprovincialis*	*Mytilus edulis*	Schiel and Hickford (2001)		
Bivalvia	Mytiloida	Mytilidae	*Aulacomya maoriana*	*Aulacomya atra maoriana*	Denny and Schiel (2001)		Yes
Bivalvia	Mytiloida	Mytilidae	*Perna canaliculus*		Schiel and Hickford (2001)		
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus pulex*		Denny and Schiel (2001)		Yes
Cephalopoda	Teuthida	Onychoteuthidae	*Moroteuthis ingens*		NIWA (2008)		
Gastropoda	Docoglossa	Nacellidae	*Cellana flava*		Morton and Miller (1968)		
Gastropoda	Docoglossa	Nacellidae	*Cellana denticulata*		Marsden (1981)		Yes
Gastropoda	Docoglossa	Nacellidae	*Cellana radians*		Marsden (1981)		Yes
Gastropoda	Docoglossa	Nacellidae	*Cellana ornata*		Dunmore and Schiel (2003)		

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Gastropoda	Neogastropoda	Muricidae	*Haustrum haustorium*		Marsden (1981)		Yes
Gastropoda	Neogastropoda	Buccinidae	*Cominella maculosa*		Marsden (1981)		Yes
Gastropoda	Neogastropoda	Buccinidae	*Cominella glandiformis*		Denny and Schiel (2001)		
Gastropoda	Neotaenioglossa	Littorinidae	*Austrolittorina antipodum*		Marsden (1981)		
Gastropoda	Neotaenioglossa	Littorinidae	*Austrolittorina cincta*		Marsden (1981)		
Gastropoda	Vetigastropoda	Turbinidae	*Turbo smaragdus*		Robinson (1992)		Yes
Gastropoda	Vetigastropoda	Trochidae	*Melagraphia aethiops*		Marsden (1981)		Yes
Gastropoda	Vetigastropoda	Haliotidae	*Haliotis virginea virginea*		Poore (1973)		
Gastropoda	Vetigastropoda	Turbinidae	*Cookia sulcata*		Schiel and Hickford (2001)		
Gastropoda	Vetigastropoda	Haliotidae	*Haliotis iris*		Poore (1973)		
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Cryptoconchus porosus*		Marsden (1981)		
Polyplacophora	Acanthochitonina	Acanthochitonidae	*Acanthochitona zelandica*		Poore (1973)		
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton pelliserpentis*	*Chiton pelliserpentis*	Horn (1986)		Yes
Polyplacophora	Ischnochitonina	Ischnochitonidae	*Eudoxochiton nobilis*		Marsden (1981)		
Polyplacophora	Neoloricata	Chitonidae	*Chiton glaucus*		Marsden (1981)		
Myzozoa							
Dinophyceae	Dinophysiales	Dinophysiaceae	*Dinophysis acuminata*		Trusewich *et al.* (1996), Hoe Chang pers. comm.		Yes
Dinophyceae	Dinophysiales	Dinophysiaceae	*Dinophysis acuta*		Hoe Chang, pers. comm.		
Ochrophyta							
Phaeophyceae	Ectocarpales	Adenocystaceae	*Adenocystis utricularis*		Morton and Miller (1968)		
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora retroflexa*		South and Adams (1976)		Yes
Phaeophyceae	Fucales	Hormosiraceae	*Hormosira banksii*		South and Adams (1976)		Yes
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora scalaris*		South and Adams (1976)		Yes
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora torulosa*		South and Adams (1976)		Yes
Phaeophyceae	Fucales	Sargassaceae	*Carpophyllum maschalocarpum*		South and Adams (1976)		Yes
Phaeophyceae	Fucales	Durvillaeaceae	*Durvillaea antarctica*		South and Adams (1976)		
Phaeophyceae	Laminariales	Lessoniaceae	*Macrocystis pyrifera*		South and Adams (1976)		Yes
Platyhelminthes							
Turbellaria	Polycladida	Anonymidae	*Anonymus kaikourensis*		Holleman (1998)		
Turbellaria	Polycladida	Anonymidae	*Anonymus multivirilis*		Holleman (1998)		

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Porifera							
Demospongiae	Dendroceratida	Darwinellidae	*Darwinella oxeata*		Bergquist (1996)		
Demospongiae	Dictyoceratida	Thorectidae	*Thorecta reticulata*		Cook and Bergquist (1996)		
Demospongiae	Hadromerida	Polymastiidae	*Polymastia aurantium*	*Polymastia granulosa (Brøndsted, 1923)*	Bergquist (1968)		Yes
Demospongiae	Hadromerida	Tethyidae	*Tethya burtoni*	*Tethya aurantium (Pallas, 1766)*	Bergquist (1968)		
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia conica*		Bergquist and Warne (1980)		Yes
Demospongiae	Haplosclerida	Chalinidae	*Haliclona kaikoura*		Bergquist (1980)		
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia fistulosa*		Bergquist (1980)		Yes
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia stellata*		Bergquist (1980)		Yes
Demospongiae	Haplosclerida	Chalinidae	*Haliclona fragilis*		Bergquist (1980)		
Demospongiae	Poecilosclerida	Latruncullidae	*Latrunculia triverticillata*		Alvarez *et al.* (2002)		
Demospongiae	Poecilosclerida	Latruncullidae	*Latrunculia kaikoura*		Alvarez *et al.* (2002)		
Demospongiae	Poecilosclerida	Chondropsidae	*Strongylacidon conulosa*		Bergquist and Fromont (1988)		Yes
Rhodophyta							
Florideophyceae	Corallinales	Corallinaceae	*Corallina officinalis*		Morton and Miller (1968)		Yes

[1] If the taxon name given in the cited literature record has since been synonymised, this column contains the name as it was given in the literature record. The column to the left ("Taxon name") contains the current valid name.

Table 6: Non-indigenous species recorded during the desktop review of existing marine species records from Kaikoura and nearby areas. Also indicated are the probable vectors of introduction to and spread within New Zealand (see Appendix 6 for definitions), the date of introduction or detection (d) in New Zealand, and whether the taxon was subsequently recorded in the Kaikoura port baseline survey (this report).

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recor-ded in port survey?	Probable vectors for introduction to NZ	Probable vectors for spread within NZ	Date of first introduction or detection (d)
Annelida										
Polychaeta	Spionida	Spionidae	*Dipolydora armata*	*Polydora armata*	Knox *et al.* (1985)			F2, S1, S3	F2, N1, S1, S3	About 1900
Arthropoda										
Malacostraca	Amphipoda	Corophiidae	*Monocorophium sextonae*	*Corophium sextonae*	Barnard (1972), Lowry (1974)			S1	S1, S3	Pre-1921
Chordata										
Actinopterygii	Salmoniformes	Salmonidae	*Oncorhynchus tshawytscha*		Unwin and James (1998)	"Bottom set net fishery up to a few hundred m deep off the Kaikoura coast"		F1	F1, N3, SR1, SR2	early 1900's
Cnidaria										
Hydrozoa	Hydroida	Campanulariidae	*Obelia longissima*		Vervoort and Watson (2003)			S1	F2, F3, N1, S1	Pre-1928
Ochrophyta										
Phaeophyceae	Ectocarpales	Chordariaceae	*Punctaria latifolia*		Nelson (1999)			D, F3, IR1, IR2, NB, NQ, N2, N3, RE, S1, S2, S3, S5	D, F3, IR1, IR2, NB, NQ, N2, N3, RE, S1, S2, S3, S5, SP	Pre-1947
Phaeophyceae	Fucales	Sargassaceae	*Sargassum verruculosum*		Hooker and Harvey (1845), Adams (1983)			D, F3, IR1, IR2, NB, NQ, N2, N3, RE, S1, S2, S3, S5	D, F3, IR1, IR2, NB, NQ, N2, N3, RE, S1, S2, S3, S5, SP	Pre-1845
Phaeophyceae	Laminariales	Alariaceae	*Undaria pinnatifida*		South and Adams (1976)		Yes	D, F3, IR1, IR2, NB, NQ, N2, N3, RE, S1, S2, S3, S5	D, F3, IR1, IR2, NB, NQ, N2, N3, RE, S1, S2, S3, S5, SP	Pre-1987
Porifera										
Demospongiae	Poecilosclerida	Chondropsidae	*Chondropsis*		Michelle Kelly,			S1	F2, F3, N1, S1	Suspected

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Locations recorded if not from immediate Kaikoura area	Recor-ded in port survey?	Probable vectors for introduction to NZ	Probable vectors for spread within NZ	Date of first introduction or detection (d)
			topsentii		unpublished record					1800's

[1] If the taxon name given in the cited literature record has since been synonymised, this column contains the name as it was given in the literature record. The column to the left ("Taxon name") contains the current valid name.

Table 7: Cryptogenic category one (C1) taxa recorded during the desktop review of existing marine species records from Kaikoura and nearby areas. Also indicated are the probable vectors of introduction to and spread within New Zealand (see Appendix 6 for definitions), the date of introduction or detection (d) in New Zealand, and whether the taxon was subsequently recorded in the Kaikoura port baseline survey (this report).

Phylum & Class	Order	Family	Taxon name	Name as given in literature record[1]	Reference	Recorded in port survey?	Probable vectors for introduction to NZ	Probable vectors for spread within NZ	Date of first introduction or detection (d)
Annelida									
Polychaeta	Phyllodocida	Syllidae	*Typosyllis armillaris*	*Syllis (Typosyllis) armillaris*	Knox *et al.* (1985)		N/A	N/A	N/A
Polychaeta	Scolecida	Capitellidae	*Heteromastus filiformis*		Knox *et al.* (1985)		S1	F2, F3, S1, S2	Pre-1900
Polychaeta	Scolecida	Capitellidae	*Capitella "capitata"* species complex		Knox *et al.* (1985)	Yes	F3, S1, S2	D, F1, F3, S1, S2, S3	Pre-1900
Arthropoda									
Malacostraca	Amphipoda	Aoridae	*Aora typica*		Myers and Moore (1983)		S1, S3	S1, S3	Probably post 1998
Malacostraca	Isopoda	Cirolanidae	*Eurylana arcuata*	*Cirolana arcuata*	Jansen (1981)		S1	S1	Pre-1961
Bryozoa									
Gymnolaemata	Cheilostomata	Scruparidae	*Scruparia ambigua*		NIWA (2008)		D, P2, S1	D, NB, N2, P2, S1	1911 d
Gymnolaemata	Cheilostomata	Scruparidae	*Scruparia chelata*		NIWA (2008)		P2, S1	P2, S1	N/A
Porifera									
Demospongiae	Dendroceratida	Darwinellidae	*Chelonaplysilla violacea*		Bergquist (1996)		S1	S1	1967 d*
Demospongiae	Dendroceratida	Darwinellidae	*Darwinella gardineri*		Bergquist (1996)		S1, S3	D, F3, NB, N1, N2, S1	1991 d*
Demospongiae	Hadromerida	Tethyidae	*Tethya* cf. *bergquistae*		Michelle Kelly, unpublished record		S1	S1	Pre-1968
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia diffusa*		Bergquist and Warne (1980)	Yes	S1	S1	1980 d*
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia* cf. *ramosa*		Michelle Kelly, unpublished record		S1	S1	1923 d*
Demospongiae	Haplosclerida	Chalinidae	*Haliclona clathrata*		Bergquist and Warne (1980)		S1	S1	1923 d*
Demospongiae	Poecilosclerida	Crellidae	*Crella incrustans*		Michelle Kelly, unpublished record	Yes	S1	S1	1924 d*

[1] If the taxon name given in the cited literature record has since been synonymised, this column contains the name as it was given in the literature record. The column to the left ("Taxon name") contains the current valid name. * This is the first published record for the species in New Zealand. The actual date of collection of the specimen was probably 5-10 years prior to publication.

Table 8: Cryptogenic category two (C2) taxa recorded during the desktop review of existing marine species records from Kaikoura and nearby areas. Also indicated is whether the taxon was subsequently recorded from the Kaikoura port baseline survey (this report).

Phylum & Class	Order	Family	Taxon name	Biosecurity status	Name as given in literature record	Reference	Recorded in port survey?
Bryozoa							
Gymnolaemata	Cheilostomata	Incertae sedis	*"Carbasea" indivisa*	C2		NIWA (2008)	
Porifera							
Demospongiae	Poecilosclerida	Acarnidae	*Iophon* cf. *proximum*	C2		Michelle Kelly, unpublished record	Yes

Table 9: Indeterminate taxa recorded during the desktop review of existing marine species records from Kaikoura and nearby areas. Also indicated is whether the taxon was subsequently recorded in the Kaikoura port baseline survey (this report).

Phylum & Class	Order	Family	Taxon name	Name as given in literature record	Reference	Locations recorded if not from immediate Kaikoura area	Recorded in port survey?
Annelida							
Polychaeta	Phyllodocida	Nereididae	*Laeonereis* sp.		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodoce (Genetyllis)* sp.		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Phyllodocidae	*Phyllodoce* sp.		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Nereididae	*Nicon* sp.		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Palmyridae	*Paleanotus* sp.		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Autolytus* sp.		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Polynoidae	*Lepidasthenia* sp.		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Sphaerosyllis* sp.	*Sphaerosyllis hirsuta*	Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Syllidae	*Syllides* sp.		Knox *et al.* (1985)		
Polychaeta	Phyllodocida	Glyceridae	*Glycera* sp.	*Glycera americana*	Knox *et al.* (1985)		Yes
Polychaeta	Sabellida	Sabellidae	*Fabricia* sp.		Knox *et al.* (1985)		
Polychaeta	Sabellida	Sabellidae	*Oridia* sp.		Knox *et al.* (1985)		
Polychaeta	Sabellida	Sabellidae	*Sabellastarte* sp.		Knox *et al.* (1985)		
Polychaeta	Sabellida	Serpulidae	*Temporaria* sp.		Knox *et al.* (1985)	off Amauri Bluff, Kaikoura	
Polychaeta	Sabellida	Sabellidae	*Amphiglena* sp.	*Amphiglena mediterranea*	Knox *et al.* (1985)		
Polychaeta	Sabellida	Serpulidae	*Serpula* sp.	*Serpula vermicularis*	Knox *et al.* (1985)		
Polychaeta	Sabellida	Sabellidae	*Branchiomma* sp.	*Branchiomma nigromaculata*	Knox *et al.* (1985)		
Polychaeta	Sabellida	Sabellidae	*Megalomma* sp.		Knox *et al.* (1985)		
Polychaeta	Scolecida	Capitellidae	*Leochrides* sp.		Knox *et al.* (1985)		
Polychaeta	Scolecida	Maldanidae	*Axiothella* sp.		Knox *et al.* (1985)		
Polychaeta	Scolecida	Orbiniidae	*Scoloplos (Scoloplos)* sp.	*Scoloplos (Scoloplos) armiger*	Knox *et al.* (1985)		
Polychaeta	Scolecida	Orbiniidae	*Scoloplos (Leodamus)* sp.		Knox *et al.* 1985		
Polychaeta	Spionida	Spionidae	*Boccardia* sp.	*Boccardia (Boccardia) atakourica*	Knox *et al.* (1985)		
Polychaeta	Spionida	Spionidae	*Boccardia* sp.	*Boccardia (Boccardia) polybranchia*	Knox *et al.* (1985)		
Polychaeta	Spionida	Magelonidae	*Magelona* sp.	*Magelona papillicornis*	Knox *et al.* (1985)		
Polychaeta	Spionida	Spionidae	*Polydora* sp.		Knox *et al.* (1985)		
Polychaeta	Terebellida	Cirratulidae	*Caulleriella* sp.		Knox *et al.* (1985)		

Polychaeta	Terebellida	Terebellidae	*Pista* sp.		Knox *et al.* (1985)		
Polychaeta	Terebellida	Ampharetidae	*Ampharete* sp.		Knox *et al.* (1985)		
Polychaeta	Terebellida	Cirratulidae	*Caulleriella* sp.	*Caulleriella bioculatus*	Knox *et al.* (1985)		
Polychaeta	Terebellida	Cirratulidae	*Cirriformia* sp.	*Cirriformia tentaculata*	Knox *et al.* (1985)		
Polychaeta	Terebellida	Cirratulidae	*Cirriformia* sp.	*Cirriformia chrysoderma*	Knox *et al.* (1985)		
Polychaeta	Terebellida	Cirratulidae	*Cirriformia* sp.	*Cirriformia filigera*	Knox *et al.* (1985)		
Polychaeta	Terebellida	Cirratulidae	*Tharyx* sp.	*Tharyx marioni*	Knox *et al.* (1985)		
Polychaeta	Terebellida	Terebellidae	*Lysilla* sp.		Knox *et al.* (1985)		
Polychaeta	Terebellida	Terebellidae	*Terebella* sp.		Knox *et al.* (1985)		
Polychaeta	Terebellida	Terebellidae	*Streblosoma* sp.		Knox *et al.* (1985)		
Arthropoda							
Malacostraca	Amphipoda	Eusiridae	*Eusirus* sp.		Lowry (1974)		
Malacostraca	Amphipoda	Isaeidae	*Photis* sp.		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Amaryllidae	*Amaryllis* sp.		Fenwick (1976)		
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia* spp.		Barnard (1972), Lowry (1974)		
Malacostraca	Amphipoda	Lysianassidae	*Parawaldeckia* sp.		Fenwick (1976)		Yes
Malacostraca	Amphipoda	Caprellidae	*Caprella* sp. *1*		Fenwick (1976)		
Malacostraca	Amphipoda	Caprellidae	*Caprella* sp. *2*		Fenwick (1976)		
Malacostraca	Amphipoda	Stenothoidae	*Stenothoe* sp.		Fenwick (1976)		
Maxillopoda	Calanoida	Eucalanidae	*Eucalanus* sp.		Bradford (1970)		
Bryozoa							
Gymnolaemata	Cheilostomata	Phidoloporidae	*Rhynchozoon* sp.	*Rhynchozoon larreyi*	NIWA (2008)		
Gymnolaemata	Ctenostomata	Alcyonidiidae	*Alcyonidium* cf. *mytili*		NIWA (2008)		
Stenolaemata	Cyclostomata	Crisiidae	*Crisia ?acropora*		NIWA (2008)		
Chordata							
Actinopterygii	Osmeriformes	Alepocephalidae	*Alepocephalus* sp.		NIWA (2008)		
Actinopterygii	Osmeriformes	Alepocephalidae	*Rouleina* sp.		NIWA (2008)		
Holocephali	Chimaeriformes	Chimaeridae	*Chimaera* sp.		NIWA (2008)		
Echinodermata							
Holothuroidea	Apodida	Chiridotidae	*Chiridota* sp.	*Chiridota mortenseni*	Davison and van Berkel (1987)		
Holothuroidea	Dendrochirotida	Cucumariidae	*Psolidiella* sp.		Davison and van Berkel (1987)		
Ophiuroidea	Ophiurida	Ophiactidae	*Ophiactis* sp.		Davison and van Berkel (1987)	480m deep on Conway Rise, Kaikoura Region	

[1] If the taxon name given in the cited literature record has since been synonymised, this column contains the name as it was given in the literature record. The column to the left ("Taxon name") contains the current valid name.

Table 10: The Chapman and Carlton (1994) criteria (C1 – C9) that each NIS and C1 taxon from the Kaikoura desktop review and port survey meets. Criteria were assigned following expert advice or are based on those give by Cranfield *et al.* (1998).

Taxon	Status	Source of record	C1	C2	C3	C4	C5	C6	C7	C8	C9
			Has the species suddenly appeared locally where it has not been found before?	Has the species spread subsequently?	Is the species' distribution associated with human mechanisms of dispersal?	Is the species associated with, or dependent on, other introduced species?	Is the species prevalent in, or restricted to, new or artificial environments?	Is the species' distribution restricted compared to natives?	Does the species have a disjunct worldwide distribution?	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 NZ?	Is the species isolated from the genetically and morphologically most similar species elsewhere in the world?
Typosyllis armillaris (polychaete)	C1	Desktop review	No	No	No	No	No	No	No	No	No
Capitella "capitata" species complex (polychaete)	C1	Desktop review & port survey	No	No	No	No	No	No	No	Yes	No
Heteromastus filiformis (polychaete)	C1	Desktop review	No	No	No	No	No	No	No	Yes	No
Dipolydora armata (polychaete)	NIS	Desktop review	No	No	No	No	No	No	Yes	Yes	No
Aora typica (amphipod)	C1	Desktop review	No	No	No	No	No	No	No	No	No
Monocorophium sextonae (amphipod)	NIS	Desktop review	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Jassa slatteryi (amphipod)	NIS	Port survey	Yes	No	Yes	No	No	Yes		Yes	Yes
Eurylana arcuata (isopod)	C1	Desktop review	?	?	?	No	No	No	Yes	Yes	Yes
Scruparia ambigua (bryozoan)	C1	Desktop review	No	Unsure; inadequate records to know about absences, let	Not necessesarily. Can attach to seaweeds. Nothing to	Sometimes, not entirely.	No	No	No	No	Don't think so.

Taxon	Status	Source of record	C1	C2	C3	C4	C5	C6	C7	C8	C9
				alone presences.	preclude drifting throughout southern oceans.						
Scruparia chelata (bryozoan)	C1	Desktop review	No	No	No	No	No	No	No	No	No
Oncorhynchus tshawytscha (fish)	NIS	Desktop review	No	No	No	No	No	No	No	No	No
Didemnum sp. (ascidian)	C1	Port survey	Unable to assess criteria for the genus as a whole.								
Cystodytes dellechiajei (ascidian)	C1	Port survey	No	Unknown, there is no published data to support subsequent spread or indeed time of introduction.	Possibly because it is associated with artificial structures and boat hulls, but no published studies to support a 'yes' answer	No	No	Insufficient biogeographic information to answer	Yes	Yes	No
Corella eumyota (ascidian)	C1	Port survey	Yes	Yes	Yes	No	Yes	No	Yes	Yes	No
Botrylloides leachi (ascidian)	C1	Port survey	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No
Obelia longissima (hydroid)	NIS	Desktop review	Yes	Yes	Yes	No	No	No	No	No	Yes
Pennaria disticha (hydroid)	NIS	Port survey	Yes	No	Yes	No	Yes	Yes	No	No	No
Punctaria latifolia (alga)	NIS	Desktop review	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Sargassum verruculosum (alga)	NIS	Desktop review	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes
Undaria pinnatifida (alga)	NIS	Desktop review & port survey	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Dendya clathrata (sponge)	NIS	Port survey	No	No	Possibly	Yes	No	Yes	Yes	Yes	Not known
Leucosolenia cf. *discoveryi* (sponge)	C1	Port survey	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes
Darwinella gardinerl (sponge)	C1	Desktop review	No	?early collections in	? Likely	No	Yes	No	Yes	Unlikely, but has vigorous	Probably; don't know

Taxon	Status	Source of record	C1	C2	C3	C4	C5	C6	C7	C8	C9
				these locations were not at all comprehensive and the species could have been overlooked.						viviparous swimming larvae	enough about interocean genetics
Chelonaplysilla violacea (sponge)	C1	Desktop review	No	? Early collections in these locations were not at all comprehensive and the species could have been overlooked.	No	No	Yes	No	Yes	Unlikely, but has vigorous viviparous swimming larvae	Probably; don't know enough about interocean genetics
Tethya cf. *bergquistae* (sponge)	C1	Desktop review	? Early collections in these locations were not at all comprehensive and the species could have been overlooked.	? Early collections in these locations were not at all comprehensive and the species could have been overlooked.	? Likely	No	No	No	Yes	Unlikely (oviparous, creeping larvae, and buds)	Probably; don't know enough about interocean genetics
Callyspongia diffusa (sponge)	C1	Desktop review & port survey	No	? Early collections in these locations were not at all comprehensive and the species could have been overlooked.	? Likely	No	No	No	Yes	Unlikely (short-lived viviparous larvae)	Probably; don't know enough about interocean genetics
Callyspongia cf. *ramosa* (sponge)	C1	Desktop review	Yes	? Early collections in these locations were not at all comprehensive	? Likely	No	No	No	Yes	Unlikely (short-lived viviparous larvae)	Probably; don't know enough about interocean genetics

Taxon	Status	Source of record	C1	C2	C3	C4	C5	C6	C7	C8	C9
				and the species could have been overlooked.							
Haliclona clathrata (sponge)	C1	Desktop review	No	? Early collections in these locations were not at all comprehensive and the species could have been overlooked.	? Likely	No	No	No	Yes	Unlikely (short-lived viviparous larvae)	Probably; don't know enough about interocean genetics
Chondropsis topsentii (sponge)	NIS	Desktop review	No	No	Yes	No	No	Yes	No	Yes	No
Crella incrustans (sponge)	C1	Desktop review & port survey	Yes	? Early collections in these locations were not at all comprehensive and the species could have been overlooked.	? Likely	No	No	No	Yes	Unlikely (short-lived viviparous larvae)	Probably; don't know enough about interocean genetics

Table 11: Physical characteristics of the sites sampled during the first port baseline survey of Kaikoura.

Site number	Site name	Maximum recorded depth (m)	Secchi depth (m)	Salinity (ppt)	Water temperature (degC)	Sea state (Beaufort scale)
1	Ingles Bay north wharf	7.0	3.5	36	12.4	1
2	Ingles Bay south wharf	3.3	1.5	36	12.4	1
3	Goochs Beach	1.5	2.9	36	12.5	0
4	Ingles Bay Boat mooring 1	12.2	2.4	36	12.5	1
5	Ingles Bay boat mooring 2	7.6	4.2	35	12.6	2
6	Fyffe cove slipway	7.5	1.8	37	12.0	1
7	Gooch Bay slipway	6.0	2.1	36	12.5	2
8	Kaikoura inner harbour limit-north	17.5	5.6	34	12.3	4
9	Kaikoura inner harbour limit-east	39.9	3.8	36	12.4	4
10	Nine pins rocks	10.0	3.4	34	12.3	4
11	St Kilda Rocks	14.2	5.0	36	12.1	2
12	Point Kean	19.8	3.1	36	12.5	3
13	Atia Point	40.0	1.9	36	12.3	2
14	Kaikoura inner harbour limit-south	30.0	8.7	36	12.3	2
15	south bay slipway-west	1.5	0.9	36	11.9	4
16	South Bay slipway-east	10.5	0.8	36	12.3	3
17	South Bay piles	3.0	1.1	35	13.0	N/R
18	Kaikoura inner harbour limit- west	19.8	0.7	36	12.3	2
19	Gooch bay beach	9.0	0.8	37	12.0	4
20	Baxter reef	4.0	0.9	36	11.9	5
21	Cone rock	24.0	1.6	N/R	12.9	2
Average across all sites		**13.7**	**2.7**	**35.8**	**12.4**	**2.5**
SE of average across all sites		**2.5**	**0.4**	**0.2**	**0.1**	**0.3**

N/R: Measurements were not recorded from these sites

Table 12: Sediment particle sizes at eight sites sampled during the first port baseline survey of Kaikoura. Data are percent net dry weight in each size class.

Site number	Site name	Clay <3.9um, >2um	Silt <62.5um, >3.9um	Sand >62.5um, <2mm	Gravel >2mm, <4mm	Small pebbles >4mm, <8mm
2	Ingles Bay south wharf	0.00	1.53	98.15	0.32	0.00
6	Fyffe cove slipway	0.00	0.03	83.29	15.60	1.07
8	Kaikoura inner harbour limit-north	0.01	0.99	99.00	0.00	0.00
9	Kaikoura inner harbour limit-east	0.00	1.75	98.24	0.00	0.00
14	Kaikoura inner harbour limit-south	0.01	0.98	98.15	0.86	0.00
17	South Bay piles	0.03	6.98	92.76	0.23	0.00
18	Kaikoura inner harbour limit- west	0.00	0.94	99.05	0.00	0.00
21	Cone rock	0.10	6.29	93.61	0.00	0.00

Table 13: Native taxa recorded from Kaikoura in the first port baseline survey. Also indicated is whether the taxon represents a new record for New Zealand and if it was recorded from the desktop review of existing marine species records from Kaikoura and nearby locations.

Phylum & Class	Order	Family	Taxon name	New record for NZ?	Recorded in desktop review?
Annelida					
Polychaeta	Eunicida	Lumbrineridae	*Lumbrineris sphaerocephala*		Yes
Polychaeta	Phyllodocida	Glyceridae	*Glycera russa*		
Polychaeta	Phyllodocida	Glyceridae	*Hemipodus simplex*		Yes
Polychaeta	Phyllodocida	Goniadidae	*Glycinde trifida*		
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus macroura*		Yes
Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus verrilli*		
Polychaeta	Phyllodocida	Nereididae	*Nereis falcaria*		Yes
Polychaeta	Phyllodocida	Nereididae	*Perinereis vallata*		Yes
Polychaeta	Phyllodocida	Nereididae	*Platynereis Platynereis_australis_* group		
Polychaeta	Phyllodocida	Polynoidae	*Lepidonotus jacksoni*		Yes
Polychaeta	Phyllodocida	Sigalionidae	*Labiosthenolepis laevis*		
Polychaeta	Phyllodocida	Sigalionidae	*Sthenelais novaezealandiae*		
Polychaeta	Phyllodocida	Syllidae	*Trypanosyllis zebra*		
Polychaeta	Sabellida	Sabellidae	*Branchiomma curtum*		
Polychaeta	Sabellida	Serpulidae	*Galeolaria hystrix*		Yes
Polychaeta	Sabellida	Serpulidae	*Spirobranchus latiscapus*		
Polychaeta	Scolecida	Arenicolidae	*Abarenicola devia*		
Polychaeta	Scolecida	Maldanidae	*Macroclymenella stewartensis*		
Polychaeta	Scolecida	Scalibregmatidae	*Travisia kerguelensis*		
Polychaeta	Spionida	Spionidae	*Prionospio australiensis*		
Polychaeta	Terebellida	Ampharetidae	*Ampharete kerguelensis*		
Polychaeta	Terebellida	Terebellidae	*Nicolea armilla*		Yes
Arthropoda					
Malacostraca	Amphipoda	Dexaminidae	*Paradexamine pacifica*		Yes
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia akaroica*		Yes
Malacostraca	Amphipoda	Liljeborgiidae	*Liljeborgia hansoni*		
Malacostraca	Amphipoda	Melitidae	*Ceradocus rubromaculatus*		
Malacostraca	Amphipoda	Melitidae	*Elasmopus neglectus*		Yes
Malacostraca	Amphipoda	Melitidae	*Mallacoota nananui*		
Malacostraca	Amphipoda	Phoxocephalidae	*Torridoharpinia hurleyi*		
Malacostraca	Amphipoda	Phtisicidae	*Caprellina longicollis*		Yes
Malacostraca	Amphipoda	Podoceridae	*Podocerus manawatu*		Yes
Malacostraca	Amphipoda	Podoceridae	*Podocerus wanganui*		Yes
Malacostraca	Decapoda	Callianassidae	*Callianassa filholi*		
Malacostraca	Decapoda	Cancridae	*Metacarcinus novaezelandiae*		
Malacostraca	Decapoda	Crangonidae	*Nauticaris marionis*		
Malacostraca	Decapoda	Crangonidae	*Philocheras australis*		
Malacostraca	Decapoda	Crangonidae	*Philocheras pilosoides*		
Malacostraca	Decapoda	Diogenidae	*Paguristes pilosus*		
Malacostraca	Decapoda	Goneplacidae	*Neommatocarcinus huttoni*		

Phylum & Class	Order	Family	Taxon name	New record for NZ?	Recorded in desktop review?
Malacostraca	Decapoda	Hippolytidae	*Hippolyte bifidirostris*		
Malacostraca	Decapoda	Hippolytidae	*Hippolyte multicolorata*		
Malacostraca	Decapoda	Hymenosomatidae	*Elamena longirostris*		
Malacostraca	Decapoda	Hymenosomatidae	*Halicarcinus varius*		Yes
Malacostraca	Decapoda	Majidae	*Notomithrax ursus*		Yes
Malacostraca	Decapoda	Ocypodidae	*Macrophthalmus hirtipes*		
Malacostraca	Decapoda	Paguridae	*Diacanthurus rubricatus*		
Malacostraca	Decapoda	Palemonidae	*Palaemon affinis*		
Malacostraca	Decapoda	Palinuridae	*Jasus edwardsi*		Yes
Malacostraca	Decapoda	Plagusiidae	*Plagusia chabrus*		
Malacostraca	Decapoda	Porcellanidae	*Petrolisthes novaezelandiae*		
Malacostraca	Decapoda	Portunidae	*Nectocarcinus antarcticus*		
Malacostraca	Decapoda	Xanthidae	*Pilumnus lumpinus*		
Malacostraca	Isopoda	Arcturidae	*Neastacilla levis*		
Malacostraca	Isopoda	Cirolanidae	*Natatolana narica*		
Malacostraca	Isopoda	Cirolanidae	*Natatolana rossi*		Yes
Malacostraca	Isopoda	Idoteidae	*Batedotea elongata*		
Malacostraca	Isopoda	Idoteidae	*Euidotea durvillei*		
Malacostraca	Isopoda	Plakarthriidae	*Plakarthrium typicum*		
Malacostraca	Isopoda	Sphaeromatidae	*Amphoroidea media*		Yes
Malacostraca	Isopoda	Sphaeromatidae	*Cassidina typa*		
Malacostraca	Tanaidacea	Tanaididae	*Zeuxoides aka*		
Maxillopoda	Sessilia	Archaeobalanidae	*Austrominius modestus*		
Maxillopoda	Sessilia	Balanidae	*Notomegabalanus decorus*		
Maxillopoda	Sessilia	Tetraclitidae	*Epopella plicata*		Yes
Ostracoda	Myodocopida	Cylindroleberididae	*Leuroleberis zealandica*		Yes
Pycnogonida	Pantopoda	Ammotheidae	*Achelia assimilis*		
Bacillariophyta					
Bacillariophyceae	Bacillariales	Bacillariaceae	*Cylindrotheca cloisterium*		
Bacillariophyceae	Bacillariales	Bacillariaceae	*Nitzschia closterium*		
Bacillariophyceae	Bacillariales	Bacillariaceae	*Nitzschia longissima*		
Bacillariophyceae	Bacillariales	Bacillariaceae	*Pseudo-nitzschia australis*		
Bacillariophyceae	Bacillariales	Bacillariaceae	*Pseudonitzschia delicatissma*		
Bacillariophyceae	Naviculales	Naviculaceae	*Meuniera membranacea*		
Coscinodiscophyceae	Chaetocerotales	Chaetocerotaceae	*Chaetoceros affinis*		
Coscinodiscophyceae	Chaetocerotales	Chaetocerotaceae	*Chaetoceros concavicornis*		
Coscinodiscophyceae	Chaetocerotales	Chaetocerotaceae	*Chaetoceros convolutus*		
Coscinodiscophyceae	Chaetocerotales	Chaetocerotaceae	*Chaetoceros decipiens*		
Coscinodiscophyceae	Chaetocerotales	Chaetocerotaceae	*Chaetoceros didymus*		
Coscinodiscophyceae	Coscinodiscales	Coscinodiscaceae	*Coscinodiscus wailesii*		
Coscinodiscophyceae	Coscinodiscales	Heliopeltaceae	*Actinoptychus senarius*		
Coscinodiscophyceae	Hemiaulales	Hemiaulaceae	*Cerataulina pelagica*		
Coscinodiscophyceae	Hemiaulales	Hemiaulaceae	*Eucampia zoodiacus*		
Coscinodiscophyceae	Lithodesmidales	Lithodesmiaceae	*Ditylum brightwelli*		
Coscinodiscophyceae	Melosirales	Melosiraceae	*Melosira moniliformis*		
Coscinodiscophyceae	Melosirales	Stephanopyxidaceae	*Stephanopyxis orbicularis*		
Coscinodiscophyceae	Rhizosoleniales	Rhizosoleniaceae	*Rhizosolenia imbricata*		
Coscinodiscophyceae	Rhizosoleniales	Rhizosoleniaceae	*Rhizosolenia setigera*		

Phylum & Class	Order	Family	Taxon name	New record for NZ?	Recorded in desktop review?
Coscinodiscophyceae	Rhizosoleniales	Rhizosoleniaceae	*Rhizosolenia stolterfothii*		
Coscinodiscophyceae	Rhizosoleniales	Rhizosoleniaceae	*Rhizosolenia styliformis*		
Coscinodiscophyceae	Thalassiosirales	Lauderiaceae	*Lauderia annulata*		
Coscinodiscophyceae	Thalassiosirales	Skeletonemaceae	*Skeletonema costatum*		
Coscinodiscophyceae	Thalassiosirales	Thalassiosiraceae	*Thalassiosira decipiens*		
Coscinodiscophyceae	Thalassiosirales	Thalassiosiraceae	*Thalassiosira rotula*		
Coscinodiscophyceae	Triceratiales	Triceratiaceae	*Odontella mobiliensis*		
Coscinodiscophyceae	Triceratiales	Triceratiaceae	*Triceratium alternans*		
Fragilariophyceae	Fragilariales	Fragillariaceae	*Asterionella gracialis*		
Fragilariophyceae	Striatellales	Striatellaceae	*Grammatophora marina*		
Fragilariophyceae	Thalassionemales	Thalassionemataceae	*Thalassionema nitzschioides*		
Brachiopoda					
Rhynchonellata	Terebratulida	Terebratulidae	*Calloria inconspicua*		
Bryozoa					
Gymnolaemata	Cheilostomata	Bugulidae	*Dimetopia cornuta*		Yes
Gymnolaemata	Cheilostomata	Calloporidae	*Crassimarginatella papulifera*		
Gymnolaemata	Cheilostomata	Calloporidae	*Odontionella cyclops*		Yes
Gymnolaemata	Cheilostomata	Calwelliidae	*Calwellia gracilis*		
Gymnolaemata	Cheilostomata	Candidae	*Bugulopsis monotrypa*		Yes
Gymnolaemata	Cheilostomata	Candidae	*Caberea solida*		Yes
Gymnolaemata	Cheilostomata	Candidae	*Canda filifera*		Yes
Gymnolaemata	Cheilostomata	Candidae	*Emma cervicornis*		
Gymnolaemata	Cheilostomata	Candidae	*Emma rotunda*		Yes
Gymnolaemata	Cheilostomata	Candidae	*Emma triangula*		
Gymnolaemata	Cheilostomata	Candidae	*Scrupocellaria ornithorhyncus*		Yes
Gymnolaemata	Cheilostomata	Candidae	*Tricellaria aculeata*		Yes
Gymnolaemata	Cheilostomata	Catenicellidae	*Catenicella elegans*		Yes
Gymnolaemata	Cheilostomata	Catenicellidae	*Claviporella aurita*		Yes
Gymnolaemata	Cheilostomata	Catenicellidae	*Claviporella pulchra*		
Gymnolaemata	Cheilostomata	Catenicellidae	*Costaticella bicuspis*		Yes
Gymnolaemata	Cheilostomata	Catenicellidae	*Costaticella solida*		
Gymnolaemata	Cheilostomata	Catenicellidae	*Cribricellina cribraria*		Yes
Gymnolaemata	Cheilostomata	Catenicellidae	*Orthoscuticella fissurata*		
Gymnolaemata	Cheilostomata	Catenicellidae	*Orthoscuticella margaritacea*		Yes
Gymnolaemata	Cheilostomata	Catenicellidae	*Pterocella scutella*		Yes
Gymnolaemata	Cheilostomata	Catenicellidae	*Scalicella crystallina*		Yes
Gymnolaemata	Cheilostomata	Cellariidae	*Cellaria tenuirostris*		
Gymnolaemata	Cheilostomata	Electridae	*Electra cf. lesueuri*		
Gymnolaemata	Cheilostomata	Flustridae	*Carbasea indivisa*		
Gymnolaemata	Cheilostomata	Hippothoidae	*Antarctothoa delta*		Yes
Gymnolaemata	Cheilostomata	Microporellidae	*Fenestrulina disjuncta*		
Gymnolaemata	Cheilostomata	Romancheinidae	*Escharoides angela*		Yes
Gymnolaemata	Cheilostomata	Romancheinidae	*Exochella armata*		Yes
Gymnolaemata	Cheilostomata	Schizoporellidae	*Chiastosella watersi*		Yes
Gymnolaemata	Ctenostomata	Vesiculariidae	*Amathia wilsoni*		
Stenolaemata	Cyclostomata	Crisiidae	*Bicrisia edwardsiana*		Yes
Stenolaemata	Cyclostomata	Crisiidae	*Crisia setosa*		
Stenolaemata	Cyclostomata	Lichenoporidae	*Disporella novaehollandiae*		
Stenolaemata	Cyclostomata	Margarettidae	*Margaretta barbata*		Yes
Chlorophyta					

Phylum & Class	Order	Family	Taxon name	New record for NZ?	Recorded in desktop review?
Ulvophyceae	Caulerpales	Caulerpaceae	*Caulerpa brownii*		Yes
Chordata					
Actinopterygii	Gadiformes	Moridae	*Pseudophycis bachus*		Yes
Actinopterygii	Gobiesociformes	Gobiesocidae	*Gastrocyathus gracilis*		
Actinopterygii	Gobiesociformes	Gobiesocidae	*Gastroscyphus hectoris*		
Actinopterygii	Mugiliformes	Mugilidae	*Aldrichetta forsteri*		
Actinopterygii	Perciformes	Aplodactylidae	*Aplodactylus arctidens*		
Actinopterygii	Perciformes	Arripidae	*Arripis trutta*		Yes
Actinopterygii	Perciformes	Clinidae	*Cristiceps aurantiacus*		
Actinopterygii	Perciformes	Clinidae	*Ericentrus rubrus*		
Actinopterygii	Perciformes	Labridae	*Notolabrus celidotus*		
Actinopterygii	Perciformes	Tripterygiidae	*Forsterygion lapillum*		
Actinopterygii	Perciformes	Tripterygiidae	*Forsterygion varium*		
Actinopterygii	Perciformes	Tripterygiidae	*Grahamina capito*		
Actinopterygii	Perciformes	Tripterygiidae	*Ruanoho decemdigitatus*		
Actinopterygii	Pleuronectiformes	Pleuronectidae	*Peltorhamphus novaezeelandiae*		Yes
Actinopterygii	Salmoniformes	Retropinnidae	*Retropinna retropinna*		
Actinopterygii	Scorpaeniformes	Scorpaenidae	*Scorpaena cardinalis*		
Actinopterygii	Tetradontiformes	Monocanthidae	*Parika scaber*		
Ascidiacea	Enterogona	Didemnidae	*Lissoclinum notti*		
Ascidiacea	Enterogona	Polyclinidae	*Aplidium knoxi*		
Ascidiacea	Pleurogona	Molgulidae	*Molgula mortenseni*		
Ascidiacea	Pleurogona	Pyuridae	*Pyura pachydermatina*		
Ascidiacea	Pleurogona	Styelidae	*Cnemidocarpa bicornuta*		
Ascidiacea	Pleurogona	Styelidae	*Cnemidocarpa nisiotis*		
Cnidaria					
Anthozoa	Actiniaria	Actiniidae	*Phlyctenactis tuberculosa*		Yes
Anthozoa	Actiniaria	Diadumenidae	*Mimetridium cryptum*		
Hydrozoa	Hydroida	Campanulariidae	*Obelia geniculata*		Yes
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia bispinosa*		
Hydrozoa	Hydroida	Sertulariidae	*Amphisbetia minima*		
Hydrozoa	Hydroida	Sertulariidae	*Stereotheca elongata*		
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus johnstoni*		
Hydrozoa	Hydroida	Sertulariidae	*Symplectoscyphus subarticulatus*		
Hydrozoa	Leptothecata	Sertulariidae	*Salacia bialycula*		
Echinodermata					
Asteroidea	Forcipulatida	Asteriidae	*Astrostole scabra*		Yes
Asteroidea	Forcipulatida	Asteriidae	*Coscinasterias muricata*		
Asteroidea	Valvatida	Asterinidae	*Patiriella mortenseni*		
Asteroidea	Valvatida	Goniasteridae	*Pentagonaster pulchellus*		
Asteroidea	Valvatida	Odontasteridae	*Diplodontias dilatatus*		Yes
Echinoidea	Spatangoida	Loveniidae	*Echinocardium cordatum*		
Holothuroidea	Apodida	Chiridotidae	*Taeniogyrus dendyi*		
Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus mollis*		Yes
Ophiuroidea	Ophiurida	Amphiuridae	*Amphiura magellanica*		
Haptophyta					
Prymnesiophyceae	Prymnesiales	Phaeocystaceae	*Phaeocystis globosa*		
Mollusca					
Bivalvia	Mytiloida	Mytilidae	*Aulacomya maoriana*		Yes
Bivalvia	Mytiloida	Mytilidae	*Modiolarca impacta*		

Phylum & Class	Order	Family	Taxon name	New record for NZ?	Recorded in desktop review?
Bivalvia	Mytiloida	Mytilidae	*Xenostrobus pulex*		Yes
Bivalvia	Nuculoida	Nuculidae	*Nucula hartvigiana*		
Bivalvia	Veneroida	Mactridae	*Scalpomactra scalpellum*		
Bivalvia	Veneroida	Psammobiidae	*Soletellina nitida*		
Bivalvia	Veneroida	Veneridae	*Protothaca crassicosta*		
Bivalvia	Veneroida	Veneridae	*Tawera spissa*		
Gastropoda	Basommatophora	Siphonariidae	*Siphonaria australis*		
Gastropoda	Docoglossa	Lottidae	*Radiacmea inconspicua*		
Gastropoda	Docoglossa	Nacellidae	*Cellana denticulata*		Yes
Gastropoda	Docoglossa	Nacellidae	*Cellana radians*		Yes
Gastropoda	Neogastropoda	Buccinidae	*Austrofusus glans*		
Gastropoda	Neogastropoda	Buccinidae	*Cominella maculosa*		Yes
Gastropoda	Neogastropoda	Muricidae	*Haustrum haustorium*		Yes
Gastropoda	Neogastropoda	Muricidae	*Xymene plebeius*		
Gastropoda	Neogastropoda	Olividae	*Amalda australis*		
Gastropoda	Neogastropoda	Olividae	*Amalda depressa*		
Gastropoda	Neogastropoda	Terebridae	*Pervicacia tristis*		
Gastropoda	Neotaenioglossa	Batillariidae	*Zeacumantus subcarinatus*		
Gastropoda	Neotaenioglossa	Littorinidae	*Nodilittorina antipodum*		
Gastropoda	Neotaenioglossa	Naticidae	*Tanea zealandica*		
Gastropoda	Neotaenioglossa	Ranellidae	*Argobuccinum pustulosum*		
Gastropoda	Neotaenioglossa	Rissoidae	*Rissoina chathamensis*		
Gastropoda	Vetigastropoda	Haliotidae	*Haliotis australis*		
Gastropoda	Vetigastropoda	Trochidae	*Cantharidus purpureus*		
Gastropoda	Vetigastropoda	Trochidae	*Diloma zelandica*		
Gastropoda	Vetigastropoda	Trochidae	*Melagraphia aethiops*		Yes
Gastropoda	Vetigastropoda	Trochidae	*Micrelenchus dilatatus*		
Gastropoda	Vetigastropoda	Trochidae	*Trochus viridis*		
Gastropoda	Vetigastropoda	Turbinidae	*Turbo smaragdus*		Yes
Polyplacophora	Ischnochitonina	Chitonidae	*Onithochiton neglectus*		
Polyplacophora	Ischnochitonina	Chitonidae	*Sypharochiton pelliserpentis*		Yes
Myzozoa					
Dinophyceae	Dinophysiales	Dinophysiaceae	*Dinophysis acuminata*		Yes
Dinophyceae	Dinophysiales	Dinophysiaceae	*Dinophysis tripos*		
Dinophyceae	Peridiniales	Ceratiaceae	*Ceratium furca*		
Dinophyceae	Peridiniales	Ceratiaceae	*Ceratium fusus*		
Dinophyceae	Peridiniales	Ceratiaceae	*Ceratium tripos*		
Dinophyceae	Peridiniales	Peridiniaceae	*Scrippsiella trochoidea*		
Ochrophyta					
Phaeophyceae	Dictyotales	Dictyochaceae	*Dictyocha speculum*		
Phaeophyceae	Dictyotales	Dictyotaceae	*Dictyota kunthii*		
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora distenta*		
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora retroflexa*		Yes
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora scalaris*		Yes
Phaeophyceae	Fucales	Cystoseiraceae	*Cystophora torulosa*		Yes
Phaeophyceae	Fucales	Cystoseiraceae	*Landsburgia quercifolia*		
Phaeophyceae	Fucales	Hormosiraceae	*Hormosira banksii*		Yes
Phaeophyceae	Fucales	Notheiaceae	*Notheia anomala*		
Phaeophyceae	Fucales	Sargassaceae	*Carpophyllum maschalocarpum*		Yes
Phaeophyceae	Fucales	Sargassaceae	*Sargassum sinclairii*		
Phaeophyceae	Fucales	Seirococcaceae	*Marginariella boryana*		

Phylum & Class	Order	Family	Taxon name	New record for NZ?	Recorded in desktop review?
Phaeophyceae	Fucales	Seirococcaceae	*Marginariella urvilliana*		
Phaeophyceae	Laminariales	Alariaceae	*Ecklonia radiata*		
Phaeophyceae	Laminariales	Lessoniaceae	*Lessonia variegata*		
Phaeophyceae	Laminariales	Lessoniaceae	*Macrocystis pyrifera*		Yes
Phaeophyceae	Sphacelariales	Stypocaulaceae	*Halopteris campanula*		
Phaeophyceae	Sphacelariales	Stypocaulaceae	*Halopteris funicularis*		
Phaeophyceae	Sporochnales	Sporochnaceae	*Carpomitra costata*		
Porifera					
Calcarea	Clathrinida	Leucettidae	*Leucetta n. sp.1*		
Calcarea	Leucosolenida	Leucosoleniidae	*Leucosolenia echinata*		
Demospongiae	Dictyoceratida	Irciniidae	*Ircinia akaroa*		
Demospongiae	Hadromerida	Polymastiidae	*Polymastia aurantium*		Yes
Demospongiae	Hadromerida	Polymastiidae	*Polymastia cf. hursuta*		
Demospongiae	Halichondrida	Axinellidae	*Pararaphoxya cf. pulchra*		
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia conica*		Yes
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia fistulosa*		Yes
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia stellata*		Yes
Demospongiae	Haplosclerida	Chalinidae	*Haliclona cf. punctata*		
Demospongiae	Poecilosclerida	Chondropsidae	*Strongylacidon conulosa*		Yes
Demospongiae	Poecilosclerida	Crellidae	*Crella affinis*		
Demospongiae	Poecilosclerida	Mycalidae	*Mycale (Carmia) tasmani*		
Rhodophyta					
Florideophyceae	Balliales	Balliaceae	*Ballia callitricha*		
Florideophyceae	Ceramiales	Ceramiaceae	*Antithamnion applicitum*		
Florideophyceae	Ceramiales	Ceramiaceae	*Centroceras clavulatum*		
Florideophyceae	Ceramiales	Ceramiaceae	*Ceramium flaccidum*		
Florideophyceae	Ceramiales	Ceramiaceae	*Ceramium rubrum*		
Florideophyceae	Ceramiales	Ceramiaceae	*Ceramium vestitum*		
Florideophyceae	Ceramiales	Ceramiaceae	*Euptilota formosissima*		
Florideophyceae	Ceramiales	Dasyaceae	*Heterosiphonia squarrosa*		
Florideophyceae	Ceramiales	Delesseriaceae	*Acrosorium venulosum*		
Florideophyceae	Ceramiales	Delesseriaceae	*Hymenena durvillaei*		
Florideophyceae	Ceramiales	Delesseriaceae	*Hymenena palmata*		
Florideophyceae	Ceramiales	Delesseriaceae	*Hymenena variolosa*		
Florideophyceae	Ceramiales	Delesseriaceae	*Phycodrys quercifolia*		
Florideophyceae	Ceramiales	Rhodomelaceae	*Adamsiella angustifolia*		
Florideophyceae	Ceramiales	Rhodomelaceae	*Bostrychia arbuscula*		
Florideophyceae	Ceramiales	Rhodomelaceae	*Chondria macrocarpa*		
Florideophyceae	Ceramiales	Rhodomelaceae	*Cladhymenia oblongifolia*		
Florideophyceae	Ceramiales	Rhodomelaceae	*Dasyclonium incisum*		
Florideophyceae	Ceramiales	Rhodomelaceae	*Dipterosiphonia heteroclada*		
Florideophyceae	Ceramiales	Rhodomelaceae	*Echinothamnion hystrix*		
Florideophyceae	Ceramiales	Rhodomelaceae	*Lophurella hookeriana*		
Florideophyceae	Ceramiales	Rhodomelaceae	*Polysiphonia aterrima*		
Florideophyceae	Ceramiales	Rhodomelaceae	*Pterosiphonia pennata*		
Florideophyceae	Ceramiales	Rhodomelaceae	*Streblocladia glomerulata*		
Florideophyceae	Corallinales	Corallinaceae	*Arthrocardia wardii*		
Florideophyceae	Corallinales	Corallinaceae	*Corallina officinalis*		Yes
Florideophyceae	Corallinales	Corallinaceae	*Jania micarthrodia*		
Florideophyceae	Corallinales	Corallinaceae	*Jania rosea*		
Florideophyceae	Gelidiales	Gelidiaceae	*Pterocladiella capillacea*		

Phylum & Class	Order	Family	Taxon name	New record for NZ?	Recorded in desktop review?
Florideophyceae	Gigartinales	Caulacanthaceae	*Caulacanthus ustulatus*		
Florideophyceae	Gigartinales	Cystocloniaceae	*Craspedocarpus erosus*		
Florideophyceae	Gigartinales	Cystocloniaceae	*Rhodophyllis acanthocarpa*		
Florideophyceae	Gigartinales	Cystocloniaceae	*Rhodophyllis membranacea*		
Florideophyceae	Gigartinales	Gigartinaceae	*Gigartina atropurpurea*		
Florideophyceae	Gigartinales	Gigartinaceae	*Gigartina clavifera*		
Florideophyceae	Gigartinales	Gigartinaceae	*Sarcothalia livida*		
Florideophyceae	Gigartinales	Kallymeniaceae	*Callophyllis hombroniana*		
Florideophyceae	Gigartinales	Kallymeniaceae	*Iridaea lanceolata*		
Florideophyceae	Gigartinales	Phyllophoraceae	*Gymnogongrus furcatus*		
Florideophyceae	Gracilariales	Gracilariaceae	*Gracilaria truncata*		
Florideophyceae	Gracilariales	Gracilariaceae	*Melanthalia abscissa*		
Florideophyceae	Nemaliales	Gelidiaceae	*Pterocladia lucida*		
Florideophyceae	Palmariales	Rhodothamniellaceae	*Camontagnea hirsuta*		
Florideophyceae	Plocamiales	Plocamiaceae	*Plocamium angustum*		
Florideophyceae	Plocamiales	Plocamiaceae	*Plocamium cirrhosum*		
Florideophyceae	Rhodymeniales	Champiaceae	*Champia chathamensis*		
Florideophyceae	Rhodymeniales	Champiaceae	*Champia novae-zelandiae*		
Florideophyceae	Rhodymeniales	Faucheaceae	*Hymenocladia sanguinea*		
Florideophyceae	Rhodymeniales	Rhodymeniaceae	*Rhodymenia obtusa*		

Table 14: Non-indigenous species recorded from Kaikoura in the first port baseline survey. Also indicated are whether the taxon is a new record for New Zealand or represents an extension to the known range within New Zealand, the probable vectors of introduction to and spread within New Zealand (see Appendix 6 for definitions), the date of introduction or detection in New Zealand, and if it was recorded from the desktop review of existing marine species records from Kaikoura and nearby locations.

Phylum & Class	Order	Family	Taxon name	New record for NZ?	NZ range extension?	Recorded in desktop review?	Probable vectors for introduction to NZ	Probable vectors for spread within NZ	Date of first introduction or detection
Arthropoda									
Malacostraca	Amphipoda	Ischyroceridae	*Jassa slatteryi*	No	No	No	S1	F2, F3, NB, S1	1990
Cnidaria									
Hydrozoa	Hydroida	Pennariidae	*Pennaria disticha*	No	No	No	S1	F2, N1, S1, S3	Pre-1928
Ochrophyta									
Phaeophyceae	Laminariales	Alariaceae	*Undaria pinnatifida*	No	No	Yes	D, F3, IR1, IR2, NB, NQ, N2, N3, RE, S1, S2, S3, S5	D, F3, IR1, IR2, NB, NQ, N2, N3, RE, S1, S2, S3, S5, SP	Pre-1987
Porifera									
Calcarea	Clathrinida	Clathrinidae	*Dendya clathrata*	No	Yes	No	S1	N1	Pre-1895

Table 15: Cryptogenic category one (C1) taxa recorded from Kaikoura in the first port baseline survey. Also indicated are the probable vectors of introduction to and spread within New Zealand (see Appendix 6 for definitions), the date of introduction or detection (d) in New Zealand, and whether the taxon was recorded from the desktop review of existing marine species records from Kaikoura and nearby locations.

Phylum & Class	Order	Family	Taxon name	New record for NZ?	NZ range extension?	Recorded in desktop review?	Probable vectors for introduction to NZ	Probable vectors for spread within NZ	Date of first introduction or detection (d)
Annelida									
Polychaeta	Scolecida	Capitellidae	*Capitella "capitata"* species complex	No	No	Yes	F3, S1, S2	D, F1, F3, S1, S2, S3	Pre-1900
Chordata									
Ascidiacea	Enterogona	Didemnidae	*Didemnum* sp.#	No	Don't know NZ distribution well enough to judge		S1, S3	S1, S3	Probably post 1998
Ascidiacea	Enterogona	Polycitoridae	*Cystodytes dellechiajei*	No	No		S1	S1	Pre-1961
Ascidiacea	Enterogona	Rhodosomatidae	*Corella eumyota*	No	Don't know NZ distribution well enough to judge		S1	S1	Early 1900's
Ascidiacea	Pleurogona	Botryllinae	*Botrylloides leachi*	No	Don't know NZ distribution well enough to judge		S1	S1	Pre-1900
Porifera									
Calcarea	Leucosolenida	Leucosoleniidae	*Leucosolenia* cf. *discoveryi*	No	No		S1	N1, S1	Feb 2003
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia diffusa*	No	No	Yes	S1	S1	1980 d*
Demospongiae	Poecilosclerida	Crellidae	*Crella incrustans*	No	No	Yes	S1	S1	1924 d*

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

* This is the first published record for the species in New Zealand. The actual date of collection of the specimen was probably 5-10 years prior to publication.

Table 16: Cryptogenic category two (C2) taxa recorded from Kaikoura in the first port baseline survey. Also indicated is whether the taxon represents a new record for New Zealand and if it was recorded from the desktop review of existing marine species records from Kaikoura and nearby locations.

Phylum & Class	Order	Family	Taxon name	New record for NZ?	Recorded in desktop review?
Annelida					
Polychaeta	Spionida	Magelonidae	*Magelona magelona*-03		
Polychaeta	Spionida	Spionidae	*Scolelepis Scolelepis*-A		
Polychaeta	Terebellida	Terebellidae	*Terebella Terebella*-B		
Porifera					
Demospongiae	Astrophoria	Ancorinidae	*Stelletta* n. sp. 2		
Demospongiae	Axinellidae	Halichondriidae	*Pipestela* n. sp. 2		
Demospongiae	Hadromerida	Polymastiidae	*Polymastia* n. sp. 1		
Demospongiae	Hadromerida	Tethyidae	*Tethya* n. sp. 1		
Demospongiae	Halichondrida	Halichondriidae	*Halichondria* new sp. 1		
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia* new sp. 11		
Demospongiae	Haplosclerida	Callyspongiidae	*Callyspongia* new sp. 5		
Demospongiae	Haplosclerida	Chalinidae	*Chalinula* new sp. 3		
Demospongiae	Haplosclerida	Chalinidae	*Chalinula* new sp. 5		
Demospongiae	Haplosclerida	Chalinidae	*Chalinula* new sp. 6		
Demospongiae	Haplosclerida	Chalinidae	*Haliclona* new sp. 17		
Demospongiae	Poecilosclerida	Acarnidae	*Iophon* cf. *laevistylus*		
Demospongiae	Poecilosclerida	Acarnidae	*Iophon* cf. *proximum*		Yes
Demospongiae	Poecilosclerida	Chondropsidae	*Chondropsis* new sp. 4		
Demospongiae	Poecilosclerida	Chondropsidae	*Chondropsis* sp. undet		
Demospongiae	Poecilosclerida	Tedaniidae	*Tedania* new sp. 4		
Demospongiae	Poecilosclerida	Tedaniidae	*Tedania* new sp.3		

Table 17: Indeterminate taxa recorded from Kaikoura in the first port survey. Also indicated is whether the taxon was recorded from the review of existing marine species records from Kaikoura and nearby locations.

Phylum & Class	Order	Family	Taxon name	Recorded in desktop review?
Annelida				
Polychaeta	Eunicida	Lumbrineridae	Lumbrineridae Indet.	
Polychaeta	Phyllodocida	Glyceridae	Glycera sp.	Yes
Polychaeta	Phyllodocida	Nephtyidae	Nephtys sp.	
Polychaeta	Scolecida	Orbiniidae	Scoloplos sp.	
Polychaeta	Terebellida	Cirratulidae	Cirratulidae Indet.	
Polychaeta	Terebellida	Flabelligeridae	Flabelligeridae	
Polychaeta	Terebellida	Terebellidae	Terebellidae Indet.	
Polychaeta			Polychaeta Indet.	
Arthropoda				
Malacostraca	Amphipoda		Amphipoda Indet.	
Malacostraca	Amphipoda	Ampeliscidae	Ampelisca sp.	
Malacostraca	Amphipoda	Dexaminidae	Paradexamine sp.	
Malacostraca	Amphipoda	Lysianassidae	Parawaldeckia sp.	Yes
Malacostraca	Isopoda		Isopoda	
Malacostraca	Isopoda	Anthuridae	Anthuridae Indet.	
Malacostraca	Isopoda	Sphaeromatidae	Exosphaeroma sp.	
Maxillopoda	Sessilia	Tetraclitidae	Epopella sp. 1	
Bacillariophyta				
Bacillariophyceae	Bacillariales	Bacillariaceae	Nitzschia sp.	
Bacillariophyceae	Bacillariales	Bacillariaceae	Pseudo-nitzschia sp.	
Bacillariophyceae	Naviculales	Naviculaceae	Navicula sp.	
Bacillariophyceae	Naviculales	Pleurosigmataceae	Gyrosigma sp.	
Bacillariophyceae	Naviculales	Pleurosigmataceae	Pleurosigma sp.	
Coscinodiscophyceae	Chaetocerotales	Chaetocerotaceae	Chaetoceros sp.	
Coscinodiscophyceae	Coscinodiscales	Coscinodiscaceae	Coscinodiscus sp.	
Coscinodiscophyceae	Leptocylindrales	Leptocylindraceae	Leptocylindrus sp.	
Coscinodiscophyceae	Melosirales	Melosiraceae	Melosira sp.	
Coscinodiscophyceae	Thalassiosirales	Skeletonemaceae	Detonula sp.	
Coscinodiscophyceae	Thalassiosirales	Thalassiosiraceae	Thalassiosira sp.	
Coscinodiscophyceae	Triceratiales	Triceratiaceae	Odontella sp.	
Fragilariophyceae	Licmophorales	Licmophoraceae	Licmophora sp.	
Fragilariophyceae	Striatellales	Striatellaceae	Grammatophora sp.	
Bryozoa				
Gymnolaemata	Cheilostomata	Catenicellidae	Catenicella sp.	
Gymnolaemata	Cheilostomata	Chaperiidae	Chaperia sp.	
Stenolaemata	Cyclostomata	Crisiidae	Crisia sp.	
Stenolaemata	Cyclostomata	Tubuliporidae	Idmidronea sp.	
Stenolaemata	Cyclostomata	Tubuliporidae	Tubulipora sp.	
Chlorophyta				
Ulvophyceae	Cladophorales	Cladophoraceae	Cladophora sp.	
Ulvophyceae	Ulvales	Ulvaceae	Ulva sp.	
Chordata				
Actinopterygii	Perciformes	Gobiidae	Gobiidae	
Ascidiacea			Ascidiacea	
Cnidaria				
Anthozoa	Actiniaria		Actiniaria sp.	
Hydrozoa	Anthoathecata	Corynidae	Coryne sp.	
Hydrozoa	Hydroida	Campanulariidae	Obelia sp.	

Phylum & Class	Order	Family	Taxon name	Recorded in desktop review?
Echinodermata				
Ophiuroidea	Ophiurida	Ophiactidae	Ophiactis sp.	
Ophiuroidea	Ophiurida	Ophiodermatidae	Ophiopeza sp.	
Mollusca				
Bivalvia	Veneroida	Mactridae	Mactridae Indet.	
Bivalvia			Bivalvia	
Cephalopoda	Octopoda	Octopodidae	Octopus sp.	
Gastropoda			Gastropoda	
Myzozoa				
Dinophyceae	Gymnodiniales	Gymnodiniaceae	Gyrodinium sp.	
Dinophyceae	Peridinales	Kolkwitziellaceae	Oblea sp.	
Dinophyceae	Peridiniales	Ceratiaceae	Ceratium sp.	
Dinophyceae	Peridiniales	Gonyaulacaceae	Alexandrium sp.	
Dinophyceae	Peridiniales	Gonyaulacaceae	Gonyaulax sp.	
Dinophyceae	Peridiniales	Peridiniaceae	Scrippsiella sp.	
Dinophyceae	Peridiniales	Protoperidiniaceae	Protoperidinium sp.	
Ochrophyta				
Phaeophyceae	Ectocarpales	Scytosiphonaceae	Colpomenia sp.	
Phaeophyceae	Fucales	Cystoseiraceae	Cystophora sp.	
Phaeophyceae	Fucales	Durvillaceaceae	Durvillea sp.	
Phaeophyceae	Fucales	Sargassaceae	Carpophyllum sp.	
Phaeophyceae	Fucales	Seirococcaceae	Marginariella sp.	
Phaeophyceae	Sphacelariales	Stypocaulaceae	Halopteris sp.	
Platyhelminthes				
			Platyhelminthes	
Rhodophyta				
Florideophyceae	Bangiales	Bangiaceae	Porphyra sp.	
Florideophyceae	Ceramiales	Ceramiaceae	Ceramium sp.	
Florideophyceae	Ceramiales	Ceramiaceae	Griffithsia sp.	
Florideophyceae	Ceramiales	Delesseriaceae	Delesseria sp.	
Florideophyceae	Ceramiales	Delesseriaceae	Delesseriaceae Indet.	
Florideophyceae	Ceramiales	Delesseriaceae	Hymenena sp.	
Florideophyceae	Ceramiales	Delesseriaceae	Schizoseris sp.	
Florideophyceae	Ceramiales	Rhodomelaceae	Adamsiella sp.	
Florideophyceae	Ceramiales	Rhodomelaceae	Echinothamnion sp.	
Florideophyceae	Ceramiales	Rhodomelaceae	Polysiphonia sp.	
Florideophyceae	Corallinales	Corallinaceae	Arthrocardia sp.	
Florideophyceae	Corallinales	Corallinaceae	Corallinaceae	
Florideophyceae	Corallinales	Corallinaceae	Jania sp.	
Florideophyceae	Gigartinales	Cystocloniaceae	Rhodophyllis sp.	
Florideophyceae	Gigartinales	Gigartinaceae	Gigartina sp.	
Florideophyceae	Plocamiales	Plocamiaceae	Plocamium sp.	
Florideophyceae	Rhodymeniales	Rhodymeniaceae	Rhodymenia sp.	
Unidentified				
			Unidentified algae	
			Unidentified invertebrates	
			Unknown	

Table 18: Depth class and method of collection for each NIS and C1 species collected during the Kaikoura port survey. Data are numbers of samples each taxon occurred in.

Taxon name	Biosec. status	Method *	Intertidal	0 - 5 m	5 - 10 m	10 - 15 m	15 - 20 m	> 20 m	Total
Botrylloides leachi	C1	PSC		1					1
Callyspongia diffusa	C1	BSLD		1					1
		PSC		2					2
		VISD		1					1
		WRACK	1						1
Capitella "capitata"	C1	ANCH		1					1
Corella eumyota	C1	BSLD		1					1
		PSC		1					1
Crella (Pytheas) incrustans	C1	VISD				1			1
		WRACK	1						1
Cystodytes dellechiajei	C1	BSLD				1			1
		PSC		4					4
		VISD					1		1
Dendya clathrata	NIS	BSLD				1			1
		VISD		1					1
Didemnum sp.	C1	PSC		3					3
Jassa slatteryi	NIS	ANCH						1	1
		BCOR			1				1
Leucosolenia cf. *discoveryi*	C1	PSC		1					1
Pennaria disticha	NIS	BSLD					1		1
Undaria pinnatifida	NIS	PSC		2					2
		VISS		1					1
Total number of NIS & C1 specimens			**2**	**20**	**1**	**3**	**2**	**1**	**29.0**
Proportion of all NIS & C1 specimens (%)			**6.9**	**69.0**	**3.4**	**10.3**	**6.9**	**3.4**	**100.0**
Total number of NIS & C1 taxa			**2**	**9**	**1**	**3**	**2**	**1**	**12.0**
Proportion of all NIS & C1 taxa (%)			**16.7**	**75.0**	**8.3**	**25.0**	**16.7**	**8.3**	**#**

***** Survey methods: ANCH = Anchor box dredge for benthic infauna; BCOR = large hand corer for benthic infauna; BSLD = benthic sled; PSC = quadrat scrapings on wharf pilings; VISD = qualitative diver visual survey; VISS: opportunistic visual survey from above water; CYST = dinoflagellate cyst core; CRBTP = crab trap, SHRTP = shrimp trap; PHYT = phytoplankton net tow; POIS = fish poison station; SEINE = beach seine netting; WRACK = beach wrack survey.

The proportion of taxa in each depth class sums to greater than 100%, as some taxa were recorded from more than one depth class

Table 19: Depth class and method of collection for each native species collected during the Kaikoura port survey. Data are numbers of samples each species occurred in.

Species	Method *	Intertidal	0 - 5 m	5 - 10 m	10 - 15 m	15 - 20 m	> 20 m	Total
Abarenicola devia	ANCH		1					**1**
Achelia assimilis	BSLD		1	1				**2**
	VISD			1				**1**
Acrosorium venulosum	BSLD			2				**2**
	PSC		1					**1**
	VISD				1			**1**
Actinoptychus senarius	PHYT		1					**1**
Adamsiella angustifolia	ANCH		3					**3**
	BSLD		2	1				**3**
	SEINE		2					**2**
	VISD		1					**1**
Aglaophamus macroura	ANCH					2	3	**5**
Aglaophamus verrilli	ANCH						1	**1**
Aldrichetta forsteri	SEINE		3					**3**
Amalda australis	ANCH					5		**5**
Amalda depressa	ANCH					1		**1**
Amathia wilsoni	BSLD		1	1				**2**
	WRACK	1						**1**
Ampharete kerguelensis	BSLD				1			**1**
Amphisbetia bispinosa	BSLD			1				**1**
Amphisbetia minima	SEINE		1					**1**
Amphiura magellanica	BSLD		1					**1**
Amphoroidea media	PSC		3					**3**
Antarctothoa delta	BSLD			2	2			**4**
	SEINE		2					**2**
	VISD					1		**1**
	WRACK	1						**1**
Antithamnion applicitum	ANCH		1					**1**
Aplidium knoxi	PSC		5					**5**
Aplodactylus arctidens	CRBTP		1					**1**
Argobuccinum pustulosum	VISD					1		**1**
Arripis trutta	SEINE		4					**4**
Arthrocardia wardii	ANCH		1					**1**
	PSC		9					**9**
	VISD		1					**1**
Asterionella gracialis	PHYT		4					**4**
Astrostole scabra	CRBTP		4					**4**
	PSC		1					**1**
	VISD					2		**2**
Aulacomya maoriana	PSC		5					**5**
	WRACK	1						**1**
Austrofusus glans	ANCH						3	**3**
Austrominius modestus	PSC		1					**1**
Ballia callitricha	ANCH		1					**1**
	WRACK	1						**1**
Batedotea elongata	VISD		1					**1**
Bicrisia edwardsiana	BSLD			2				**2**

Species	Method *	Intertidal	0 - 5 m	5 - 10 m	10 - 15 m	15 - 20 m	> 20 m	Total
Bostrychia arbuscula	SEINE		1					**1**
	WRACK	1						**1**
Branchiomma curtum	BSLD				1			**1**
	PSC		6					**6**
Bugulopsis monotrypa	BSLD		1	1	1			**3**
	VISD				1	1		**2**
	WRACK	1						**1**
Caberea solida	VISD				2			**2**
Callianassa filholi	ANCH		4			1		**5**
Callophyllis hombroniana	PSC		1					**1**
	WRACK	2						**2**
Calloria inconspicua	WRACK	1						**1**
Callyspongia conica	SEINE		1					**1**
Callyspongia fistulosa	PSC		5					**5**
Callyspongia stellata	WRACK	1						**1**
Calwellia gracilis	VISD				1	1		**2**
	WRACK	1						**1**
Camontagnea hirsuta	ANCH		1					**1**
Canda filifera	BSLD				1			**1**
	VISD				1			**1**
	WRACK	1						**1**
Cantharidus purpureus	ANCH		1					**1**
	BCOR			1				**1**
	BSLD		2	2	2			**6**
	CRBTP		1					**1**
	PSC		9					**9**
	VISD		1					**1**
Caprellina longicollis	ANCH		1			1	1	**3**
	PSC		5					**5**
	SEINE		1					**1**
	VISD				1	1		**2**
	WRACK	1						**1**
Carbasea indivisa	VISD					1		**1**
Carpomitra costata	BSLD			1				**1**
Carpophyllum maschalocarpum	ANCH		1					**1**
	BSLD			1				**1**
	PSC		4					**4**
	SEINE		3					**3**
	VISD		2					**2**
	WRACK	3						**3**
Cassidina typa	PSC		1					**1**
Catenicella elegans	BSLD			1				**1**
	WRACK	2						**2**
Caulacanthus ustulatus	WRACK	1						**1**
Caulerpa brownii	ANCH		6			1		**7**
	BSLD		2					**2**
	SEINE		10					**10**
	VISD		2			1		**3**
	WRACK	8						**8**
Cellana denticulata	WRACK	3						**3**
Cellana radians	WRACK	2						**2**
Cellaria tenuirostris	VISD				1			**1**

Species	Method *	Intertidal	0 - 5 m	5 - 10 m	10 - 15 m	15 - 20 m	> 20 m	Total
	SEINE		1					**1**
Ceradocus rubromaculatus	VISD		1					**1**
Ceramium flaccidum	VISD		1					**1**
Ceramium rubrum	BSLD			1				**1**
Ceramium vestitum	BSLD			1				**1**
Cerataulina pelagica	PHYT		3					**3**
Ceratium furca	PHYT		3					**3**
Ceratium fusus	PHYT		1					**1**
Ceratium tripos	PHYT		1					**1**
Chaetoceros affinis	PHYT		1					**1**
Chaetoceros concavicornis	PHYT		1					**1**
Chaetoceros convolutus	PHYT		1					**1**
Chaetoceros decipiens	PHYT		2					**2**
Chaetoceros didymus	PHYT		3					**3**
Champia chathamensis	WRACK	1						**1**
Champia novae-zelandiae	SEINE		1					**1**
Chiastosella watersi	PSC		1					**1**
Chondria macrocarpa	BSLD		1					**1**
	PSC		3					**3**
	SEINE		1					**1**
	VISD		3					**3**
Cladhymenia oblongifolia	ANCH		1					**1**
	BSLD		1	2				**3**
	PSC		4					**4**
	SEINE		3					**3**
	VISD		2					**2**
Claviporella aurita	BSLD			1				**1**
Claviporella pulchra	VISD				1			**1**
Cnemidocarpa bicornuta	BSLD		1					**1**
	VISD				1			**1**
	WRACK	1						**1**
Cnemidocarpa nisiotis	BSLD		1					**1**
	PSC		1					**1**
	VISD				1			**1**
	WRACK	2						**2**
Cominella maculosa	CRBTP		1					**1**
	WRACK	1						**1**
Corallina officinalis	ANCH		1					**1**
	CRBTP		1					**1**
	PSC		1					**1**
	VISD		1					**1**
	WRACK	1						**1**
Coscinasterias muricata	BSLD		1					**1**
Coscinodiscus wailesii	PHYT		1					**1**
Costaticella bicuspis	WRACK	1						**1**
Costaticella solida	WRACK	2						**2**
Craspedocarpus erosus	ANCH		1					**1**
	BSLD			1	1			**2**
	SEINE		3					**3**
	WRACK	2						**2**
Crassimarginatella papulifera	PSC		1					**1**
Crella (Pytheas) affinis	VISD					1		**1**

Species	Method *	Intertidal	0 - 5 m	5 - 10 m	10 - 15 m	15 - 20 m	> 20 m	Total
	WRACK	1						**1**
Crisia setosa	WRACK	1						**1**
Cristiceps aurantiacus	BSLD		1					**1**
Cylindrotheca cloisterium	PHYT		2					**2**
Cystophora distenta	BSLD		1					**1**
	SEINE		1					**1**
	VISD		2					**2**
	WRACK	1						**1**
Cystophora retroflexa	BSLD			1				**1**
	PSC		1					**1**
	SEINE		2					**2**
	WRACK	4						**4**
Cystophora scalaris	SEINE		2					**2**
	VISD		1					**1**
	WRACK	1						**1**
Cystophora torulosa	ANCH		3					**3**
	SEINE		4					**4**
	WRACK	3						**3**
Dasyclonium incisum	BSLD			1				**1**
	SEINE		1					**1**
Diacanthurus rubricatus	BSLD					1		**1**
	VISD						1	**1**
Dictyocha speculum	PHYT		1					**1**
Dictyota kunthii	PSC		1					**1**
Diloma zelandica	WRACK	2						**2**
Dimetopia cornuta	VISD					1		**1**
	WRACK	1						**1**
Dinophysis acuminata	PHYT		4					**4**
Dinophysis tripos	PHYT		1					**1**
Diplodontias dilatatus	BSLD		1					**1**
	VISD		1		2			**3**
	WRACK	1						**1**
Dipterosiphonia heteroclada	VISD				1			**1**
Disporella novaehollandiae	WRACK	1						**1**
Ditylum brightwelli	PHYT		16					**16**
Echinocardium cordatum	ANCH					1		**1**
	BSLD					1		**1**
Echinothamnion hystrix	BSLD		1	2				**3**
	SEINE		2					**2**
	VISD		1					**1**
	WRACK	2						**2**
Ecklonia radiata	BSLD		1					**1**
	PSC		2					**2**
	SEINE		5					**5**
	WRACK	3						**3**
Elamena longirostris	BSLD				1			**1**
Elasmopus neglectus	PSC		2					**2**
Electra cf. lesueuri	SEINE		1					**1**
Emma cervicornis	BSLD			1				**1**
Emma rotunda	BSLD			1				**1**
	VISD					1		**1**
Emma triangula	BSLD				2			**2**

Species	Method *	Intertidal	0 - 5 m	5 - 10 m	10 - 15 m	15 - 20 m	> 20 m	Total
Epopella plicata	PSC		1					**1**
Ericentrus rubrus	SEINE		1					**1**
Escharoides angela	BSLD		1					**1**
Eucampia zoodiacus	PHYT		2					**2**
Euidotea durvillei	BSLD		1	1				**2**
Euptilota formosissima	ANCH		3			1	1	**5**
	BSLD		2	1		1		**4**
	PSC		1					**1**
	SEINE		9					**9**
	VISD			1	1			**2**
	WRACK	9						**9**
Exochella armata	BSLD			2	2			**4**
	SEINE		1					**1**
	VISD					1		**1**
	WRACK	1						**1**
Fenestrulina disjuncta	BSLD			1				**1**
Forsterygion lapillum	BSLD		1					**1**
	POIS		1					**1**
	SEINE		5					**5**
Forsterygion varium	CRBTP		1					**1**
Galeolaria hystrix	BSLD			1				**1**
Gastrocyathus gracilis	PSC		1					**1**
Gastroscyphus hectoris	BSLD		1					**1**
Gigartina atropurpurea	BSLD			2				**2**
	WRACK	2						**2**
Gigartina clavifera	SEINE		1					**1**
	WRACK	2						**2**
Glycera russa	ANCH						1	**1**
Glycinde trifida	ANCH					1	1	**2**
	BSLD				1			**1**
Gracilaria truncata	BSLD			2				**2**
	SEINE		3					**3**
	WRACK	1						**1**
Grahamina capito	BSLD		1					**1**
	POIS		1					**1**
	SEINE		2					**2**
Grammatophora marina	PHYT		3					**3**
Gymnogongrus furcatus	SEINE		1					**1**
Halicarcinus varius	ANCH		1					**1**
Haliclona cf. punctata	SEINE		1					**1**
Haliotis australis	PSC		2					**2**
Halopteris campanula	PSC		1					**1**
Halopteris funicularis	SEINE		1					**1**
	VISD				1			**1**
Haustrum haustorium	WRACK	1						**1**
Hemipodus simplex	BCOR			1				**1**
	BSLD			1				**1**
Heterosiphonia squarrosa	VISD				1			**1**
Hippolyte bifidirostris	BSLD				1			**1**
Hippolyte multicolorata	BSLD		1					**1**
Hormosira banksii	ANCH		1					**1**
	SEINE		4					**4**

Species	Method *	Intertidal	0 - 5 m	5 - 10 m	10 - 15 m	15 - 20 m	> 20 m	Total
Hymenena durvillaei	BSLD		1					**1**
	WRACK	1						**1**
Hymenena palmata	BSLD				1			**1**
	PSC		2					**2**
	VISD		1					**1**
	WRACK	2						**2**
Hymenena variolosa	PSC		1					**1**
	SEINE		1					**1**
Hymenocladia sanguinea	BSLD			1				**1**
	SEINE		2					**2**
	VISD		1					**1**
	WRACK	2						**2**
Ircinia akaroa	VISD		1					**1**
Iridaea lanceolata	WRACK	1						**1**
Jania micarthrodia	WRACK	1						**1**
Jania rosea	BSLD			1				**1**
	SEINE		1					**1**
	WRACK	1						**1**
Jasus edwardsi	BSLD		1					**1**
	WRACK	4						**4**
Labiosthenolepis laevis	ANCH					2	1	**3**
Landsburgia quercifolia	ANCH		4					**4**
	PSC		1					**1**
	SEINE		7					**7**
	WRACK	3						**3**
Lauderia annulata	PHYT		10					**10**
Lepidonotus jacksoni	PSC		2					**2**
	VISD				1			**1**
Lessonia variegata	PSC		2					**2**
	SEINE		1					**1**
	WRACK	2						**2**
Leucetta n. sp.1	VISD				1			**1**
Leucosolenia echinata	VISD				2	1		**3**
Leuroleberis zealandica	ANCH						1	**1**
	BCOR			2				**2**
	PSC		1					**1**
Liljeborgia akaroica	VISD						1	**1**
Liljeborgia hansoni	BSLD		1					**1**
Lissoclinum notti	PSC		1					**1**
Lophurella hookeriana	SEINE		1					**1**
Lumbrineris sphaerocephala	PSC		1					**1**
Macroclymenella stewartensis	ANCH		5					**5**
Macrocystis pyrifera	PSC		1					**1**
	SEINE		2					**2**
	WRACK	1						**1**
Macrophthalmus hirtipes	ANCH		1					**1**
Mallacoota nananui	BSLD				1			**1**
Margaretta barbata	BSLD		1		1			**2**
	VISD				2	2		**4**
	WRACK	2						**2**
Marginariella boryana	BSLD			1				**1**
	SEINE		1					**1**

Species	Method *	Intertidal	0 - 5 m	5 - 10 m	10 - 15 m	15 - 20 m	> 20 m	Total
Marginariella urvilliana	BSLD		1					**1**
	VISD			1				**1**
	WRACK	1						**1**
Melagraphia aethiops	BSLD					1		**1**
	WRACK	4						**4**
Melanthalia abscissa	SEINE		2					**2**
	VISD		1					**1**
	WRACK	1						**1**
Melosira moniliformis	PHYT		1					**1**
Metacarcinus novaezelandiae	ANCH		1					**1**
	CRBTP		1					**1**
	WRACK	1						**1**
Meuniera membranacea	PHYT		4					**4**
Micrelenchus dilatatus	ANCH						1	**1**
	BSLD		3	1				**4**
	PSC		5					**5**
	WRACK	1						**1**
Mimetridium cryptum	WRACK	1						**1**
Modiolarca impacta	PSC		1					**1**
	WRACK	1						**1**
Molgula mortenseni	PSC		1					**1**
Mycale (Carmia) tasmani	PSC		1					**1**
Natatolana narica	ANCH					1		**1**
Natatolana rossi	ANCH		1					**1**
	PSC		1					**1**
	SHRTP		24					**24**
Nauticaris marionis	BSLD		1					**1**
Neastacilla levis	BSLD					1		**1**
Nectocarcinus antarcticus	BSLD				1	1		**2**
Neommatocarcinus huttoni	ANCH					1		**1**
Nereis falcaria	PSC		6					**6**
Nicolea armilla	PSC		2					**2**
Nitzschia closterium	PHYT		1					**1**
Nitzschia longissima	PHYT		4					**4**
Nodilittorina antipodum	ANCH		1					**1**
	PSC		1					**1**
	WRACK	2						**2**
Notheia anomala	WRACK	1						**1**
Notolabrus celidotus	SEINE		3					**3**
Notomegabalanus decorus	PSC		2					**2**
Notomithrax ursus	BSLD		1					**1**
	CRBTP		2					**2**
	PSC		1					**1**
	SEINE		1					**1**
	WRACK	4						**4**
Nucula hartvigiana	BCOR			1				**1**
Obelia geniculata	PSC		2					**2**
Odontella mobiliensis	PHYT		10					**10**
Odontionella cyclops	WRACK	1						**1**
Onithochiton neglectus	PSC		1					**1**
Orthoscuticella fissurata	VISD					1		**1**
	WRACK	1						**1**
Orthoscuticella margaritacea	VISD				1			**1**

Paguristes pilosus	ANCH						1	**1**
Palaemon affinis	SEINE		2					**2**
Paradexamine pacifica	BSLD				1			**1**
Pararaphoxya cf. pulchra	VISD				1			**1**
Parika scaber	BSLD				1			**1**
Patiriella mortenseni	CRBTP		1					**1**
	VISD				1			**1**
Peltorhamphus novaezeelandiae	SHRTP		1					**1**
Pentagonaster pulchellus	VISD					1		**1**
Perinereis vallata	WRACK	1						**1**
Pervicacia tristis	ANCH					3		**3**
	BCOR			1				**1**
	BSLD					1		**1**
Petrolisthes novaezelandiae	ANCH		1				1	**2**
	BSLD		2			1		**3**
	PSC		6					**6**
Phaeocystis globosa	PHYT		1					**1**
Philocheras australis	ANCH		2					**2**
	BSLD		1					**1**
Philocheras pilosoides	BSLD						1	**1**
Phlyctenactis tuberculosa	BSLD			2	1			**3**
	VISD		1					**1**
	WRACK	1						**1**
Phycodrys quercifolia	WRACK	1						**1**
Pilumnus lumpinus	PSC		3					**3**
Plagusia chabrus	CRBTP		1					**1**
	VISD				1			**1**
	WRACK	1						**1**
Plakarthrium typicum	PSC		2					**2**
Platynereis Platynereis_australis_group	BSLD		1					**1**
	PSC		4					**4**
Plocamium angustum	ANCH		1					**1**
	BSLD		1	1	2			**4**
	SEINE		4					**4**
	VISD			1	1	1		**3**
	WRACK	3						**3**
Plocamium cirrhosum	BSLD				1			**1**
Podocerus manawatu	PSC		3					**3**
	WRACK	1						**1**
Podocerus wanganui	ANCH		1					**1**
	BCOR			1				**1**
	PSC		1					**1**
	SEINE		1					**1**
	WRACK	2						**2**
Polymastia aurantium	VISD					1		**1**
Polymastia cf. hursuta	VISD				1			**1**
Polysiphonia aterrima	BSLD			1				**1**
	SEINE		3					**3**
Prionospio australiensis	ANCH					1	1	**2**
Protothaca crassicosta	WRACK	1						**1**
Pseudo-nitzschia australis	PHYT		22					**22**
Pseudonitzschia delicatissma	PHYT		13					**13**
Pseudophycis bachus	CRBTP		2					**2**
Pterocella scutella	BSLD		1					**1**

Pterocladia lucida	ANCH		5					**5**
	BSLD		2	2				**4**
	PSC		1					**1**
	SEINE		11					**11**
	WRACK	7						**7**
Pterocladiella capillacea	ANCH		1					**1**
	SEINE		1					**1**
	WRACK	2						**2**
Pterosiphonia pennata	VISD		1					**1**
Pyura pachydermatina	BSLD				1			**1**
	PSC		1					**1**
	VISD				2	1		**3**
	WRACK	2						**2**
Radiacmea inconspicua	BSLD		1					**1**
Retropinna retropinna	SEINE		4					**4**
Rhizosolenia imbricata	PHYT		14					**14**
Rhizosolenia setigera	PHYT		20					**20**
Rhizosolenia stolterfothii	PHYT		3					**3**
Rhizosolenia styliformis	PHYT		24					**24**
Rhodophyllis acanthocarpa	ANCH		1					**1**
	BSLD				2			**2**
	PSC		2					**2**
	SEINE		2					**2**
Rhodophyllis membranacea	ANCH		1					**1**
Rhodymenia obtusa	WRACK	2						**2**
Rissoina chathamensis	BCOR			2				**2**
Ruanoho decemdigitatus	CRBTP		2					**2**
Salacia bialycula	BSLD				1			**1**
	PSC		1					**1**
	WRACK	1						**1**
Sarcothalia livida	ANCH		1					**1**
	VISD		1					**1**
	WRACK	2						**2**
Sargassum sinclairii	ANCH		1					**1**
	BSLD			1				**1**
Scalicella crystallina	VISD				1	1		**2**
	WRACK	1						**1**
Scalpomactra scalpellum	ANCH					3	3	**6**
Scorpaena cardinalis	CRBTP		1					**1**
Scrippsiella trochoidea	PHYT		4					**4**
Scrupocellaria ornithorhyncus	VISD				1			**1**
	WRACK	1						**1**
Siphonaria australis	ANCH		1					**1**
Skeletonema costatum	PHYT		6					**6**
Soletellina nitida	ANCH					1		**1**
Spirobranchus latiscapus	BSLD				1			**1**
Stephanopyxis orbicularis	PHYT		1					**1**
Stereotheca elongata	ANCH						1	**1**
	BSLD		1	1	1			**3**
	SEINE		2					**2**
	WRACK	4						**4**
Sthenelais novaezealandiae	ANCH						1	**1**
Stichopus mollis	VISD					1		**1**
Streblocladia glomerulata	SEINE		1					**1**

Strongylacidon conulosa	VISD				1			**1**
Symplectoscyphus johnstoni	ANCH		2					**2**
	PSC		2					**2**
	WRACK	1						**1**
Symplectoscyphus subarticulatus	VISD				1			**1**
	WRACK	1						**1**
Sypharochiton pelliserpentis	WRACK	2						**2**
Taeniogyrus dendyi	BCOR			1				**1**
Tanea zealandica	ANCH					1	1	**2**
	BSLD						1	**1**
Tawera spissa	BCOR			4				**4**
Thalassionema nitzschioides	PHYT		2					**2**
Thalassiosira decipiens	PHYT		8					**8**
Thalassiosira rotula	PHYT		7					**7**
Torridoharpinia hurleyi	ANCH		1				2	**3**
Travisia kerguelensis	ANCH					1	2	**3**
Tricellaria aculeata	VISD				1			**1**
Triceratium alternans	PHYT		3					**3**
Trochus viridis	VISD				1			**1**
Trypanosyllis zebra	PSC		1					**1**
Turbo smaragdus	ANCH		1					**1**
	CRBTP		1					**1**
	PSC		4					**4**
Xenostrobus pulex	WRACK	1						**1**
Xymene plebeius	BSLD		1	1				**2**
Zeacumantus subcarinatus	ANCH					2		**2**
	BCOR			2				**2**
	PSC		1					**1**
	WRACK	2						**2**
Zeuxoides aka	PSC		2					**2**
Total number of native specimens		**168**	**685**	**72**	**72**	**62**	**31**	**1090**
Proportion of all native specimens (%)		**15.4**	**62.8**	**6.6**	**6.6**	**5.7**	**2.8**	**100.0**
Total number of native taxa		**91**	**195**	**50**	**55**	**44**	**22**	**296**
Proportion of all native taxa (%)		**30.7**	**65.9**	**16.9**	**18.6**	**14.9**	**7.4**	**#**

***** Survey methods: ANCH = Anchor box dredge for benthic infauna; BCOR = large hand corer for benthic infauna; BSLD = benthic sled; PSC = quadrat scrapings on wharf pilings; VISD = qualitative diver visual survey; VISS: oportunistic visual survey from above water; CYST = dinoflagellate cyst core; CRBTP = crab trap, SHRTP = shrimp trap; PHYT = phytoplankton net tow; POIS = fish poison station; SEINE = beach seine netting; WRACK = beach wrack survey.

The proportion of taxa in each depth class sums to greater than 100%, as some taxa were recorded from more than one depth class

Appendices

Appendix 1: Sampling procedures for ZBS2005-19 surveys.

These sampling procedures were specified by MAF Biosecurity New Zealand in the tender documents for Project ZBS2005-19. Modifications to the procedures necessitated by local conditions in the Kaikoura survey are described in the "Methods" section of this current report and were agreed to by MAF Biosecurity New Zealand prior to the survey.

(Derived and modified from Hewitt and Martin 1996, 2001(Appendix C))

All samples collected are to be labeled with data that will allow the determination of: the date samples were collected; where the sampling occurred (regional); the site of collection (wharf, breakwater etc); the sample method (pile, core, qualitative); and the depth. The Hewitt and Martin protocols provide an easy and informative site code and sample labeling method; however other methods may be considered and will need to be negotiated with Biosecurity New Zealand to ensure that specimen linkage with sample information can be maintained. Special care should be given to quality assurance, quality control including chain-of-custody.

1.0 Dinoflagellates

1.1. Sediment sampling for cyst-forming species (small cores)

Sediment cores are taken from locations where the deposition and undisturbed accumulation of dinoflagellate cysts are likely to occur. Selection of sites will be based on depth, local biogeography and sediment characteristics of the area. As a general guide, sites where there is an accumulation of uncompacted fine sediment to a depth of 20-30 cm are suitable sites for constructing the sedimentary history of the port environment however, recent work has shown that sandy substrates should not be overlooked (C. Bolch pers.comm.). These samples are taken using cores. The cores will provide information on the formation of dinoflagellate blooms. Coarse-grained habitats may provide gross level information (presence/absence) for a port environment. At each site, sediment cores are to be taken by divers using 20 cm long tubes with 2.5 cm internal diameter. Tubes are forced into the substrate then capped at each end with a rubber bung to provide an airtight seal. Cores are labeled and are stored upright in the dark at 4°C prior to size fractionation and examination for dinoflagellate cysts.

1.2. Sediment preparation and cyst identification

The top 6 cm of sediment core is to be carefully extruded from the coring tube and stored at 4°C in a sealed container until further examination. Subsamples (approx. 1-2 cm^3) of each core sample are mixed with filtered seawater to obtain a watery slurry. Subsamples (5-10 mL) are sonicated for 2 min (Braun Labsonic homogenizer, intermediate probe, 100 watts) to dislodge detritus particles. The sample is screened through a 90 µm sieve and the remaining fraction is panned to remove denser sand grains and large detrital particles. Subsamples (1 mL) are examined and counted on wet-mount slides, using a compound light microscope. Where possible, a total of at least 100 cysts are counted in each sample. Identification of species follows Bolch and Hallegraeff (1990). Cysts of suspected toxic species are photographed with a light microscope using bright field or differential interference contrast illumination.

1.3. Cyst germination

Following sonication and size-fractionation of sediments, cysts of suspected toxic species are located and isolated by micropipette under a light microscope and then washed twice in filtered seawater. Individual cysts are placed into tissue culture wells containing 2mL of 75% filtered seawater with nutrients added according to medium GPM of Loeblich (1975). Additional incubations are to be carried out using size-fractionated sediments. Subsamples of the 20-90µm size fraction are added to 20mL of growth medium in sterile polystyrene petri-dishes, and sealed with parafilm. All incubations are be carried out at 20ºC at a light intensity of $80\mu Em^{-2}s^{-1}$ (12h light:12h dark) and examined regularly for germination. Active swimming dinoflagellate cells from incubations should be isolated by micropipette, washed in sterile growth medium and their identity determined where possible.

1.4. Plankton sampling and culture

Plankton samples are to be collected by vertical and horizontal tows of a hand-deployed plankton net (25cm diam. Opening, 20µm Nytal mesh, Swiss Screens, Melbourne Vic.). The samples should be sealed in plankton jars and labeled using waterproof labels, placed in a cooled container and returned to the laboratory, net samples diluted 1:1 with growth medium. Germanium dioxide ($10mg.l^{-1}$) is added to inhibit overgrowth by diatom species and these enrichment cultures incubated as described above. Incubations are examined regularly by light microscopy, and single cells of suspected toxic species isolated by micropipette for further culture and toxicity determination.

1.5. Toxicity testing

Suspected toxic species are grown in laboratory culture, under the conditions described previously, and tested for toxin (saxitoxin) production by High Performance Liquid Chromatography (HPLC) (Oshima *et al.* 1989).

2.0 Crabs, Macroalgae, Seastars

2.1. Trapping

Crab species are sampled using light-weight plastic-coated wire-framed traps (60cm long, 45cm wide and 20cm high) covered 1.27cm square mesh netting. Entry to the trap is through slits at the apex of inwardly-directed V-shaped panels at each end of the trap. The internal bait bag should be baited with fish heads or carcasses. Traps weighted with chain or lead weights and deployed with surface buoys. Whenever possible, traps should be deployed in the late afternoon and recovered early the next morning. Each collected sample is labeled using waterproof labels. Crab traps are also effective for targeting the known introduced species *Charybdis japonica* and *Carcinus maenas*.

2.2. Visual searches – wharves and marinas

Visual searches for crab, target species (e.g., *Charybdis japonica, Undaria pinnatifida, Asterias amurensis*) and unusual/rare species (species not seen before in the region) should also be made at selected wharves in the port and marina areas. Divers are to swim the length of the wharf at two depths (5m and bottom) to provide a completed visual survey of the outer wharf between about 5m depth and the bottom (10-14m). Surveys of beach wrack are to be made of suitable beaches to collect crab exuviae. Each collected sample is labeled using waterproof labels.

2.3 Visual searches – other regions

Visual searches for crab, macroalgae and target species will be carried out by divers in rocky reef, rocky rip-rap, shipwrecks, kelp and seagrass meadows, over soft bottoms and beach searches. Divers will either be free swimming or towed using a manta board (snorkel). When using the manta board, (skin) divers will be towed along 100m transects at a speed of less than 2 knots. Beach wrack surveys along beach and estuaries will search the beach using parallel transects to the waters edge at distances of 2, 5 and 10 m (and further if required) up the shoreline. Each collected sample is labelled using waterproof labels.

3.0 Zooplankton

Zooplankton is sampled with a standard 100µm mesh, 70cm diameter free-fall drop net. The net is weighted so as to achieve a fall rate of approximately 1m per second and the depth reached is monitored using a Tekna maximum indicating (divers) depth gauge (or similar) attached to the frame of the net. Each drop is timed with a stopwatch and the net is allowed to fall from the surface to a depth 0.5-1 m from the substrate. Timing commences when the cod end of the net sinks below the surface. One drop is conducted at each site. On recovery the net is washed down on the outside only to avoid contamination of the sample. Each individual sample is labelled using waterproof labels. Retained plankton is preserved in 5% formalin and returned to the laboratory for sorting and identification. Replicate plankton tows are made at each sample site.

4.0 Hard Substrate Invertebrates and Plants

4.1 Wharf pile communities

Piles or projecting steel facings are to be selected from wharves having different types of shipping activity. Three piles or facings are to be selected in series from near one end of each wharf, starting about 10 m from the end to reduce "edge" effects, with 10 to 20 m distance separating each pile or facing. Three outer and three inner piles may be sampled from wharves with inner piles, which are likely to have much reduced water movement or ambient light levels. Thus the minimum number of piles sampled is three outer and the maximum is six (three outer and three inner). Data suggests that sampling inner piles increases biodiversity information but it does not significantly increase detection of introduced species compared to sampling outer piles only.

The selected piles or facings are to be marked (spray paint) and their positions recorded (GPS) and photographed. For each pile divers then take:

a) Video film of the outer surface of each pile/facing from approximately high-water level down to the deepest exposed part of the pile/facing using digital video cameras (or similar). The video camera is to be fitted with lights to ensure colour correctness of the footage. A distance-measuring rod with a scale and digital depth meter is also attached to the camera to ensure that the camera remains a constant distance (approx. 50 cm) from the pile or substrate. The scale and depth meter are positioned so they fall within the field of view of the camera and provide real-time depth information on the video footage.

b) Still photographs using an underwater film camera (e.g., Nikonos V) or a digital camera (of adequate resolution) are taken using a 35 mm lens and overlens to provide a 1:6 frame image (which is suitable for taxonomic work). A strobe is used to ensure that colour correctness is maintained. The use of the framer and strobe both ensure that higher-resolution records of the fouling communities and selected species are taken and can be compared between and amongst quadrats images. Each quadrat is photographed. The 1:6 framer ensures that four

photographs will cover the 0.1m^2 quadrat. Thus, to photograph three piles, with three quadrats each will use 36 images. Divers will record the order of photographs by using a label within the images or noting pile and photo order on a dive slate that is then recorded on the boat data sheet.

c) Quantitative 0.1 m^2 (33.33 v 33.33 cm) quadrat samples of the fouling communities present at three depths (0.5, 3.0 and 7.0 m) are collected by scraping the attached flora and fauna as carefully as possible into plastic bags. These samples are labeled (using pre-labeled waterproof labels) and sealed under water. The samples are then rough sorted within 12 hours of collection and narcotised where needed (e.g., anemones, chitons, flatworms) and preserved in the suitable fixative (5% formalin or 70% ethanol) for subsequent fine sorting and identification in the laboratory.

4.2. Breakwaters

Using equipment detailed in section 4.1 above, divers will take video and still photographs and collect representative samples of the attached plant and animal communities within a distance of 0.5 m from a weighted transect line. Each sample is labeled using waterproof labels to indicate that it is a qualitative sample. The transect line is 50 m in distance and therefore an area of 50 m^2 is covered. Transects run parallel to the breakwater. Typically, breakwaters are sampled on the inside and outside of the structure.

5.0 Soft Substrate Invertebrates and Plants

5.1. Epibenthos

Visual searches by divers to locate and collect representative samples of soft-bottom epibenthic species are to be carried out at selected sites as described in sections 2.2 and 2.3. Each individual sample for a location is labeled as qualitative sample using waterproof labels.

At each wharf to be sampled, divers will video a 50 m transect between one of the piles and the outer series of infaunal cores (see section 5.2), along a weighted transect line marked at 1m intervals. Video and 35 mm still photographs will also be taken at offshore dredge disposal sites and within kelp forests and seagrass meadows. Qualitative samples may also be taken during this sampling activity. Samples taken are labeled using waterproof labels.

5.2. Benthic Infauna

Divers will take infaunal samples using a tubular 0.025m^2 (17.9cm internal diameter) hand corer. The corer is 40 cm in length and marked (grooves) at 20 cm and 25 cm from the bottom to indicate the depth to which a core is taken. The upper end of the corer is closed except for a mesh-covered 8 cm diameter hole, which is sealed with a rubber bung to aid retention of the infaunal sample when the corer is withdrawn from the sediment.

When sampling around wharves, channel markers and facings, a core is taken from the bottom of each outer pile or facing sampled. A second set of three replicated cores are then taken 50 m directly out from the wharf/facing. Thus, for each wharf area sampled this provides a total of six core samples (three at the base of the piles/facings and three 50 m out from the piles/facings).

Each core sampled is transferred to a 1-mm mesh bag with a drawstring mouth and then sieved underwater, either in situ or after the divers returns to the surface. Each individual sample is labeled using waterproof labels. The retained sieved material is then washed into a plastic bag and preserved in 5% buffered formalin for subsequent sorting and identification in the laboratory.

To avoid the use of divers, core samples may also be taken using vessel deployed grab samplers (see Hewitt and Martin 2001). If using vessel deployed grab samples caution must be taken to ensure that the cores taken at the base of the piles/facings occurs within 1m out from the base of the pile/facing.

6.0 Fish

6.1. Poison Stations

Rotenone, clove oil or a similar poison is to be used to sample fish associated with shipwrecks, hulks, breakwaters and around the base of piles and facings. The poison is mixed according to instructions immediately before use and dispensed using squeeze bottles. Poisoned fish are collected by divers and snorklers using hand nets and either frozen or preserved in buffered 5% formalin for identification and photographing upon return to the laboratory. The use of poisons may require permits or may not be allowed within a region. In such cases an alternative method to poison sampling the fish must be negotiated with Biosecurity New Zealand.

6.2. Nets

Seine nets are to be used to collect fish on ocean beaches and in estuaries. All species of fish and invertebrate taken with the seine nets are to be recorded and a representative sample collected and preserved (frozen or buffered 5% formalin) for identification upon return to the laboratory. Each species collected must be photographed. The use of nets may require permits or may not be allowed within a region. In such cases an alternative method to net sampling the fish must be negotiated with Biosecurity New Zealand.

7.0 Environmental Data

7.1. Temperature, salinity and dissolved oxygen

A submersible data logger (SDL) equipped with pressure, conductivity and temperature sensors will be used to record data on salinity and water temperature at 0.5 m intervals from the surface to near bottom. Light levels will be estimated from Secchi disk readings. The researchers undertaking this work should also endeavour to collect existing salinity, water temperature and dissolved oxygen information from the region to provide a seasonal and temporal overview of the salinity and water temperature. It is expected that collected and existing data will be analysed and reported upon within the survey report. Field data is recorded on boat data sheets.

7.2. Sediment Analysis

7.2.1 Sediment Collection

Sediment samples (minimum 100 g wet weight) are to be taken for analysis of grain size and organic content, to characterise the habitats of any introduced epibenthic and infaunal species found. Samples are taken with each set of infaunal cores and at other selected sites. Thus as a minimum 2 sediment samples are collected (one at the base of the pile/facing and one 50 m out from the base of the pile/facing) when core samples are collected. The sediment is collected by divers using sealable plastic containers, which are then labeled and frozen to stabilise the organic content levels and returned to the laboratory for analysis.

7.2.2 Particle Size Analysis

After samples are thawed in the laboratory a sub-sample, approximately 25 g (dry weight), of sediment is taken for organic content analysis. The remaining sediment is wet-sieved through a 2mm mesh sieve and separated into <2 mm and > 2 mm fractions. Both fractions and the

organic content sub-sampled are then oven dried at 80ºC (2-4 days). The two fractions are analysed as follows:

- > 2 mm fraction. The total fraction is dry-sieved through a nest of sieves and the fraction retained on each sieve (2, 2.8, 4, 5.6, and 8 mm meshes: 0.5 Phi intervals) is weighed. Sediment retained on the largest sieve includes all particles with size larger than 8 mm. The individual sieved weights are then added to the dry weight of the > 2 mm fraction to give a total dry weight for the entire sediment sample. The proportion of each component in the > 2 mm fraction is then calculated as a percentage of the total dry sample.
- < 2 mm fraction. The dry weight of the total < 2 mm fraction is measured to 0.01 g and the sediment or, depending on the amount available, a sub-sample (taken by "coning and quartering") is analysed using a Malvern Laser Particle Size Analyser. Particle size data from this analysis is then combined with data analysis of the > 2 mm fraction.

7.2.3 Organic Content

Approximately 25 g of dry, unsieved sediment is weighed in a crucible to 0.00001 g then ashed in a muffle furnace at 480ºC for 4 hrs. The crucible is allowed to cool before being reweighed. The difference between the net dry and net ash-free weights is then calculated. This difference, or weight loss, is expressed as a percentage of the initial dry weight and represents the organic content of the sediment sample.

8.0 References

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Appendix 2. Geographic locations (NZGD49) of sample sites in the Kaikoura initial port baseline survey

Site number	Site name	Easting	Northing	Survey method*	Number of sample units
1	Ingles Bay north wharf	2567878	5865909	BCOR	6
1	Ingles Bay north wharf	2567872	5865857	BSLD	1
1	Ingles Bay north wharf	2567881	5865880	BSLD	1
1	Ingles Bay north wharf	2567881	5865850	CRBTP	3
1	Ingles Bay north wharf	2567886	5865859	CRBTP	3
1	Ingles Bay north wharf	2567857	5865882	CYST	1
1	Ingles Bay north wharf	2567862	5865873	CYST	1
1	Ingles Bay north wharf	2567863	5865888	CYST	1
1	Ingles Bay north wharf	2567871	5865874	CYST	1
1	Ingles Bay north wharf	2567872	5865837	CYST	1
1	Ingles Bay north wharf	2567900	5865894	CYST	1
1	Ingles Bay north wharf	2567885	5865847	PHYT	1
1	Ingles Bay north wharf	2567906	5865885	PHYT	1
1	Ingles Bay north wharf	2567964	5865926	PHYT	1
1	Ingles Bay north wharf	2567853	5865851	PSC	15
1	Ingles Bay north wharf	2567878	5865909	SEDIMENT	2
1	Ingles Bay north wharf	2567881	5865850	SHRTP	3
1	Ingles Bay north wharf	2567886	5865859	SHRTP	3
1	Ingles Bay north wharf	2567885	5866032	VISS	1
1	Ingles Bay north wharf	2567882	5865911	ZOOP	1
1	Ingles Bay north wharf	2567940	5865911	ZOOP	1
1	Ingles Bay north wharf	2567942	5865919	ZOOP	1
2	Ingles Bay south wharf	2568179	5865259	ANCH	2
2	Ingles Bay south wharf	2568223	5865280	ANCH	2
2	Ingles Bay south wharf	2568237	5865287	ANCH	1
2	Ingles Bay south wharf	2568460	5865291	ANCH	1
2	Ingles Bay south wharf	2568244	5865325	CRBTP	6
2	Ingles Bay south wharf	2568179	5865259	CYST	2
2	Ingles Bay south wharf	2568223	5865280	CYST	2
2	Ingles Bay south wharf	2568237	5865287	CYST	1
2	Ingles Bay south wharf	2568246	5865291	CYST	1
2	Ingles Bay south wharf	2568199	5865255	PHYT	1
2	Ingles Bay south wharf	2568250	5865297	PHYT	1
2	Ingles Bay south wharf	2568251	5865292	PHYT	1
2	Ingles Bay south wharf	2568244	5865325	PSC	15
2	Ingles Bay south wharf	2568237	5865287	SEDIMENT	1
2	Ingles Bay south wharf	2568460	5865291	SEDIMENT	1
2	Ingles Bay south wharf	2568244	5865325	SHRTP	6
2	Ingles Bay south wharf	2568244	5865325	VISD	1
2	Ingles Bay south wharf	2568251	5865292	ZOOP	3
3	Goochs Beach	2567056	5865635	SEINE	1
3	Goochs Beach	2567079	5865633	SEINE	1
3	Goochs Beach	2567091	5865627	SEINE	1
3	Goochs Beach	2567042	5865601	WRACK	2
3	Goochs Beach	2567047	5865603	WRACK	1
4	Ingles Bay Boat mooring 1	2567568	5865984	BCOR	3
4	Ingles Bay Boat mooring 1	2567569	5866352	BSLD	1
4	Ingles Bay Boat mooring 1	2567630	5866408	BSLD	1
4	Ingles Bay Boat mooring 1	2567568	5865984	CYST	3

Site number	Site name	Easting	Northing	Survey method*	Number of sample units
4	Ingles Bay Boat mooring 1	2567580	5866101	PHYT	1
4	Ingles Bay Boat mooring 1	2567590	5866099	PHYT	1
4	Ingles Bay Boat mooring 1	2567600	5866108	PHYT	1
4	Ingles Bay Boat mooring 1	2567568	5865984	SEDIMENT	2
4	Ingles Bay Boat mooring 1	2567575	5866100	ZOOP	1
4	Ingles Bay Boat mooring 1	2567579	5866077	ZOOP	1
4	Ingles Bay Boat mooring 1	2567618	5866064	ZOOP	1
5	Ingles Bay boat mooring 2	2567675	5865815	BCOR	3
5	Ingles Bay boat mooring 2	2567650	5865981	BSLD	1
5	Ingles Bay boat mooring 2	2567665	5865975	BSLD	1
5	Ingles Bay boat mooring 2	2567675	5865815	CYST	3
5	Ingles Bay boat mooring 2	2567675	5865815	POIS	1
5	Ingles Bay boat mooring 2	2567675	5865815	SEDIMENT	2
6	Fyffe cove slipway	2568335	5865378	BCOR	6
6	Fyffe cove slipway	2568264	5865330	CRBTP	6
6	Fyffe cove slipway	2568335	5865378	CYST	6
6	Fyffe cove slipway	2568270	5865295	PHYT	1
6	Fyffe cove slipway	2568315	5865360	PHYT	1
6	Fyffe cove slipway	2568350	5865377	PHYT	1
6	Fyffe cove slipway	2568253	5865315	POIS	1
6	Fyffe cove slipway	2568253	5865315	PSC	20
6	Fyffe cove slipway	2568335	5865378	SEDIMENT	2
6	Fyffe cove slipway	2568089	5865155	SEINE	1
6	Fyffe cove slipway	2568092	5865145	SEINE	1
6	Fyffe cove slipway	2568119	5865126	SEINE	1
6	Fyffe cove slipway	2568264	5865330	SHRTP	6
6	Fyffe cove slipway	2568361	5865434	VISD	1
6	Fyffe cove slipway	2568254	5865326	WRACK	1
6	Fyffe cove slipway	2568256	5865324	WRACK	2
6	Fyffe cove slipway	2568322	5865357	ZOOP	1
6	Fyffe cove slipway	2568332	5865362	ZOOP	1
6	Fyffe cove slipway	2568338	5865366	ZOOP	1
7	Gooch Bay slipway	2567701	5865745	BCOR	6
7	Gooch Bay slipway	2567738	5865699	CRBTP	3
7	Gooch Bay slipway	2567766	5865727	CRBTP	3
7	Gooch Bay slipway	2567689	5865757	CYST	6
7	Gooch Bay slipway	2567630	5865741	PHYT	1
7	Gooch Bay slipway	2567748	5865787	PHYT	1
7	Gooch Bay slipway	2567772	5865773	PHYT	1
7	Gooch Bay slipway	2567701	5865745	POIS	1
7	Gooch Bay slipway	2567701	5865745	PSC	15
7	Gooch Bay slipway	2567701	5865745	SEDIMENT	2
7	Gooch Bay slipway	2567723	5865691	SEINE	3
7	Gooch Bay slipway	2567738	5865699	SHRTP	3
7	Gooch Bay slipway	2567766	5865727	SHRTP	3
7	Gooch Bay slipway	2567701	5865745	VISD	1
7	Gooch Bay slipway	2567738	5865690	WRACK	2
7	Gooch Bay slipway	2567749	5865692	WRACK	1
7	Gooch Bay slipway	2567707	5865818	ZOOP	1
7	Gooch Bay slipway	2567741	5865834	ZOOP	1
7	Gooch Bay slipway	2567748	5865846	ZOOP	1
8	Kaikoura inner harbour limit-north	2568189	5869634	ANCH	1
8	Kaikoura inner harbour limit-north	2568317	5869701	ANCH	1

Site number	Site name	Easting	Northing	Survey method*	Number of sample units
8	Kaikoura inner harbour limit-north	2568344	5869762	ANCH	1
8	Kaikoura inner harbour limit-north	2568080	5869132	BSLD	1
8	Kaikoura inner harbour limit-north	2568085	5869198	BSLD	1
8	Kaikoura inner harbour limit-north	2568189	5869634	CYST	1
8	Kaikoura inner harbour limit-north	2568317	5869701	CYST	1
8	Kaikoura inner harbour limit-north	2568344	5869762	CYST	1
8	Kaikoura inner harbour limit-north	2567942	5869167	PHYT	1
8	Kaikoura inner harbour limit-north	2567992	5869115	PHYT	1
8	Kaikoura inner harbour limit-north	2568012	5869165	PHYT	1
8	Kaikoura inner harbour limit-north	2568317	5869701	SEDIMENT	1
8	Kaikoura inner harbour limit-north	2568344	5869762	SEDIMENT	1
8	Kaikoura inner harbour limit-north	2567955	5869170	ZOOP	1
8	Kaikoura inner harbour limit-north	2567964	5869154	ZOOP	1
8	Kaikoura inner harbour limit-north	2567987	5869196	ZOOP	1
9	Kaikoura inner harbour limit-east	2571105	5865779	ANCH	1
9	Kaikoura inner harbour limit-east	2571109	5865846	ANCH	1
9	Kaikoura inner harbour limit-east	2571208	5865789	ANCH	1
9	Kaikoura inner harbour limit-east	2572304	5866013	BSLD	1
9	Kaikoura inner harbour limit-east	2572339	5866024	BSLD	1
9	Kaikoura inner harbour limit-east	2572396	5865996	BSLD	1
9	Kaikoura inner harbour limit-east	2571215	5865788	CYST	3
9	Kaikoura inner harbour limit-east	2572140	5866147	PHYT	1
9	Kaikoura inner harbour limit-east	2572144	5866091	PHYT	1
9	Kaikoura inner harbour limit-east	2572175	5866119	PHYT	1
9	Kaikoura inner harbour limit-east	2571208	5865789	SEDIMENT	1
9	Kaikoura inner harbour limit-east	2571215	5865788	SEDIMENT	1
9	Kaikoura inner harbour limit-east	2572171	5866075	ZOOP	1
9	Kaikoura inner harbour limit-east	2572251	5866074	ZOOP	1
9	Kaikoura inner harbour limit-east	2572284	5866100	ZOOP	1
10	Nine pins rocks	2568042	5866273	VISD	1
11	St Kilda Rocks	2568696	5865625	BSLD	1
11	St Kilda Rocks	2568761	5865644	BSLD	1
12	Point Kean	2569761	5864750	PHYT	1
12	Point Kean	2569786	5864784	PHYT	1
12	Point Kean	2569791	5864884	PHYT	1
12	Point Kean	2569568	5864598	VISD	1
12	Point Kean	2569746	5864823	ZOOP	1
12	Point Kean	2569750	5864855	ZOOP	1
12	Point Kean	2569768	5864892	ZOOP	1
13	Atia Point	2566740	5862778	PHYT	1
13	Atia Point	2566795	5862723	PHYT	1
13	Atia Point	2566838	5862684	PHYT	1
13	Atia Point	2566604	5863100	VISD	1
13	Atia Point	2566761	5862788	ZOOP	1
13	Atia Point	2566812	5862764	ZOOP	1
13	Atia Point	2566871	5862737	ZOOP	1
14	Kaikoura inner harbour limit-south	2565077	5862607	ANCH	1
14	Kaikoura inner harbour limit-south	2565223	5862724	ANCH	1
14	Kaikoura inner harbour limit-south	2565383	5862853	ANCH	1
14	Kaikoura inner harbour limit-south	2565267	5862728	CYST	1
14	Kaikoura inner harbour limit-south	2565420	5862871	CYST	2
14	Kaikoura inner harbour limit-south	2565069	5863103	PHYT	1
14	Kaikoura inner harbour limit-south	2565120	5863106	PHYT	1

Site number	Site name	Easting	Northing	Survey method*	Number of sample units
14	Kaikoura inner harbour limit-south	2565160	5863029	PHYT	1
14	Kaikoura inner harbour limit-south	2565223	5862724	SEDIMENT	1
14	Kaikoura inner harbour limit-south	2565383	5862853	SEDIMENT	1
14	Kaikoura inner harbour limit-south	2565436	5862863	VISD	1
14	Kaikoura inner harbour limit-south	2565075	5863079	ZOOP	1
14	Kaikoura inner harbour limit-south	2565082	5863095	ZOOP	1
14	Kaikoura inner harbour limit-south	2565151	5862957	ZOOP	1
15	south bay slipway-west	2566362	5864415	SEINE	1
15	south bay slipway-west	2566380	5864410	SEINE	1
15	south bay slipway-west	2566390	5864412	SEINE	1
15	South Bay Slipway-west	2566390	5864429	VISD	1
15	South Bay slipway-west	2566390	5864429	WRACK	1
15	South Bay slipway-west	2566391	5864427	WRACK	1
15	South Bay slipway-west	2566394	5864423	WRACK	1
16	South Bay slipway-east	2566112	5864433	BCOR	6
16	South Bay slipway-east	2566112	5864433	CYST	6
16	South Bay slipway-east	2565981	5864395	PHYT	1
16	South Bay slipway-east	2566073	5864443	PHYT	1
16	South Bay slipway-east	2566112	5864433	PHYT	1
16	South Bay slipway-east	2566112	5864433	SEDIMENT	2
16	South Bay slipway-east	2566085	5864861	SEINE	1
16	South Bay slipway-east	2566086	5864872	SEINE	1
16	South Bay slipway-east	2566087	5864889	SEINE	1
16	South Bay slipway-east	2565983	5864635	VISD	1
16	South Bay slipway-east	2566095	5864871	WRACK	1
16	South Bay slipway-east	2566103	5864871	WRACK	1
16	South Bay slipway-east	2566116	5864870	WRACK	1
16	South Bay slipway-east	2565681	5864273	ZOOP	1
16	South Bay slipway-east	2565707	5864286	ZOOP	1
16	South Bay slipway-east	2565717	5864316	ZOOP	1
17	South Bay piles	2566090	5864390	ANCH	1
17	South Bay piles	2566094	5864395	ANCH	1
17	South Bay piles	2566116	5864412	ANCH	1
17	South Bay piles	2566118	5864420	ANCH	1
17	South Bay piles	2566124	5864424	ANCH	1
17	South Bay piles	2566124	5864427	ANCH	1
17	South Bay piles	2566080	5864429	BSLD	1
17	South Bay piles	2566087	5864392	BSLD	1
17	South Bay piles	2566072	5864388	CYST	1
17	South Bay piles	2566077	5864392	CYST	1
17	South Bay piles	2566084	5864390	CYST	1
17	South Bay piles	2566110	5864407	CYST	1
17	South Bay piles	2566113	5864425	CYST	1
17	South Bay piles	2566116	5864416	CYST	1
17	South Bay piles	2566124	5864424	POIS	1
17	South Bay piles	2566118	5864420	SEDIMENT	1
17	South Bay piles	2566124	5864427	SEDIMENT	1
17	South Bay piles	2566124	5864424	VISS	1
18	Kaikoura inner harbour limit- west	2564373	5863923	ANCH	1
18	Kaikoura inner harbour limit- west	2564467	5864008	ANCH	1
18	Kaikoura inner harbour limit- west	2564536	5864167	ANCH	1
18	Kaikoura inner harbour limit- west	2564434	5864040	BSLD	1
18	Kaikoura inner harbour limit- west	2564458	5864375	BSLD	1

Site number	Site name	Easting	Northing	Survey method*	Number of sample units
18	Kaikoura inner harbour limit- west	2564373	5863923	CYST	1
18	Kaikoura inner harbour limit- west	2564467	5864008	CYST	1
18	Kaikoura inner harbour limit- west	2564536	5864167	CYST	1
18	Kaikoura inner harbour limit- west	2564441	5864475	PHYT	1
18	Kaikoura inner harbour limit- west	2564466	5864576	PHYT	1
18	Kaikoura inner harbour limit- west	2564527	5864475	PHYT	1
18	Kaikoura inner harbour limit- west	2564467	5864008	SEDIMENT	1
18	Kaikoura inner harbour limit- west	2564536	5864167	SEDIMENT	1
18	Kaikoura inner harbour limit- west	2564430	5864520	ZOOP	1
18	Kaikoura inner harbour limit- west	2564470	5864547	ZOOP	1
18	Kaikoura inner harbour limit- west	2564472	5864524	ZOOP	1
19	Gooch bay beach	2564676	5865541	BSLD	1
19	Gooch bay beach	2564775	5865593	BSLD	1
19	Gooch bay beach	2565241	5865759	SEINE	1
19	Gooch bay beach	2565256	5865750	SEINE	1
19	Gooch bay beach	2565272	5865741	SEINE	1
19	Gooch bay beach	2565248	5865743	WRACK	1
19	Gooch bay beach	2565249	5865749	WRACK	1
19	Gooch bay beach	2565251	5865753	WRACK	1
20	Baxter reef	2565880	5864100	MISC	1
21	Cone rock	2565561	5863697	ANCH	1
21	Cone rock	2565623	5863672	ANCH	1
21	Cone rock	2565640	5863684	ANCH	1
21	Cone rock	2565561	5863697	CYST	1
21	Cone rock	2565623	5863672	CYST	1
21	Cone rock	2565640	5863684	CYST	1
21	Cone rock	2565561	5863697	SEDIMENT	1
21	Cone rock	2565640	5863684	SEDIMENT	1
21	Cone rock	2565554	5863779	VISD	1

*Survey methods: ANCH = anchor box dredge; BCOR = large benthic hand corer; CRBTP = crab trap; CYST = dinoflagellate cyst core; PHYT = phytoplankton net; POIS = fish poison station; PSC = pile scrape quadrats and diver observations on wharf pilings and hard substrata; SEDIMENT = sediment samples; SEINE = beach seine net; SHRTP = shrimp trap; VISD = visual diver transects; WRACK = beach wrack walks; ZOOP = zooplankton net. Photo stills and videos are not listed – these were conducted at the same locations as the PSC locations.

Appendix 3: Sampling site/ method combinations specified by MAF Biosecurity New Zealand that were not conducted

Site number	Site name	Sampling method	Replicate	Reason for not sampling
1	Ingles Bay north wharf	Large hand core or anchor box dredge	1-6	Very rocky seabed with thin layer of sand over rubble. Not enough sediment for hand core or anchor box dredge
1	Ingles Bay north wharf	Piling quadrat scraping	Quadrat depth 7 m on all pilings	Shallow site; piles not tall enough/ water not deep enough for 7 m depth quadrat
1	Ingles Bay north wharf	Sediment samples	1-2	Very little sediment at this rocky seabed site. Could not collect enough for a sample despite numerous attempts.
2	Ingles Bay south wharf	Piling quadrat scraping	All	No pilings at this site
2	Ingles Bay south wharf	Zooplankton tows	1-3	Water too shallow to tow net
3	Goochs Beach	Beach wrack	10 m from water edge	Shore not wide enough for search 10 m up from shoreline
4	Ingles Bay Boat mooring 1	Large hand core or anchor box dredge	1-3	Seabed too cobbly to collect sample
4	Ingles Bay Boat mooring 1	Sediment samples	1-2	Seabed too cobbly to collect sample
5	Ingles Bay Boat mooring 2	Large hand core or anchor box dredge	1-3	Seabed too cobbly to collect sample
5	Ingles Bay Boat mooring 2	Sediment samples	1-2	Seabed too cobbly to collect sample
6	Fyffe cove slipway	Large hand core or anchor box dredge	6	Repicates 1-5 were completed; replicated 6 was accidentally omitted
6	Fyffe cove slipway	Piling quadrat scraping	Quadrat depth 3 m and 7 m on all pilings	Shallow site; piles not tall enough/ water not deep enough for 3 m and 7 m depth quadrats
6	Fyffe cove slipway	Sediment samples	2	Not enough sediment at this site for two samples, despite numerous attempts (too rocky, had difficulty even getting one sample)
6	Fyffe cove slipway	Beach wrack	10 m from water edge	Shore not wide enough for search 10 m up from shoreline
7	Gooch Bay slipway	Large hand core or anchor box dredge	1-6	Seabed too cobbly to collect sample
7	Gooch Bay slipway	Sediment samples	1-2	Seabed too cobbly to collect sample
7	Gooch Bay slipway	Piling quadrat scraping	All	No pilings at this site
7	Gooch Bay slipway	Beach wrack	10 m from water edge	Shore not wide enough for search 10 m up from shoreline
15	South Bay slipway-west	Visual diver search or benthic sled	1	Not safe to conduct these methods at this site
16	South Bay slipway-east	Large hand core or anchor box dredge	1-6	Only bedrock and boulders at this site
16	South Bay slipway-east	Sediment samples	1-2	Only bedrock and boulders at this site
16	South Bay slipway-east	Cyst core	1-6	Only bedrock and boulders at this site

Appendix 4. Media Release circulated as part of the public awareness programme

Media Release **7 May 2007**

Kaikoura to be surveyed for marine pests

Researchers from the National Institute of Water & Atmospheric Research (NIWA) will be surveying marine habitats in Kaikoura for foreign organisms next week (14-20 May).

The survey is being carried out as part of Biosecurity New Zealand's national biological baseline survey and resurvey programme.

The programme is designed to determine which non-native marine species have already become established in New Zealand and to develop a baseline for the detection of new pests.

A team of divers will carry out a thorough search of all port structures, seabed habitats, and beaches, collecting samples of plants, plankton, invertebrates, fish, and seafloor sediments. They will also lay down baited traps overnight to collect crabs and shrimps.

The surveys will be weather-dependent and may be postponed if conditions are not favourable.

The samples collected will be identified by experts in New Zealand and overseas to determine their origins. This process can take several months. Seabed communities and fouling organisms will be photographed and filmed to identify species that have not been captured in individual samples.

Boat operators should watch out for divers during daylight hours from 8 am to 5 pm. Divers will be operating around the wharves and marine farms at depths of 5 m and close to the seafloor. They will also be operating around rocky reefs, rocky rip-rap, shipwrecks, kelp and seagrass meadows, over soft bottoms, and around beaches.

Dive vessels are clearly marked as 'Research vessels' and the skippers will be monitoring local VHF channels. A dive flag will be prominently displayed whenever diving is underway.

Biosecurity New Zealand and NIWA would like to hear from anyone who has seen any new or unusual plants or animals in the area.

To report any suspicious finds, please call the free Biosecurity New Zealand hotline: 0800 80 99 66

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Additional Information

The survey will cover the following sites:

Ingles Bay wharf
Goochs Beach
Ingles Bay boat mooring
Fyffe cove slipway
Gooch beach slipway
Kaikoura inner harbour
Nine pin rock
St Kilda rocks
Point Kean/Lynch reef
Atia Point
South Bay slipway
South Bay piles
Gooch Bay beach
Baxter reef
Cone rock

Appendix 5: 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 attached to each of their body segments as well as external gills. The anterior segments bear the tentacles used as sensory organs, tasting palps and eyespots, however, some are blind. 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 are 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 millimetres to many centimetres and superficially resemble spiders found on land.

Phylum Bacillariophyta

Diatoms: Diatoms are abundant unicellular organisms that are capable of inhabiting marine and freshwater environments. Their cell walls are made of silica which form radial or bilaterally symmetrical patterns. They reproduce asexually and produce energy via photosynthesis.

Phylum Brachiopoda

Brachiopods have a shell consisting of two valves that enclose the animal. Most living brachiopods are fixed to the substrate with a leathery holdfast called a pedicle. They feed via a lophophore; a cartilage based fan with flexible filaments. They are specialists in nutrient poor environments, have low metabolic rates and very small body to lophophore ratios.

Phylum Bryozoa

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

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, most 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 sub Antarctic 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 Cyanobacteria

Cyanobacteria or blue-green algae are photosynthetic prokaryotes. They form a pigment during photosynthesis that leads to their blue-green colour and some species are also capable of fixing nitrogen under certain circumstances. They lack cilia and perform locomotion by gliding across surfaces. They also possess thick cell walls to protect them from desiccation. They show considerable morphological diversity and are found in a wide variety of terrestrial and aquatic habitats.

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 Echinodermata

Echinoderms: The phylum echinodermata is made up of five classes. They are: Crinoidea (sea lilies), Asteroidea (sea stars), Holothuroidea (sea cucumbers), Ophiuroidea (brittle stars), and Echinoidea (sea urchins). This phylum is an exclusively marine phylum that lack eyes or

brains but have radially symmetrical body plans. Their most notable features are their external calcareous plates and spines from which they get their name (Echinoderm means 'spiny-skinned'). Internally they are unique as well with a hydraulic water vascular system that controls their movement and is monitored by the madreporite which controls their intake of water. They occupy a wide range of habitats including subtidal and intertidal zones.

Phylum Entoprocta
Superficially this phylum is very similar to the Bryozoans and both are referred to as moss animals. There are about 60 known species worldwide and all of them are small with no individual exceeding 1.5mm in length. They live in moss-like colonies containing thousands of individuals, forming mats of considerable size. Each animal is crowned with a circlet of ciliated tentacles, within which lies the mouth. The defining characteristic between entoprocts and bryozoans is the location of the anal opening. In entoprocts it is within the crown circlet, in bryozoans the anus is located outside the tentacles.

Phylum Haptophyta
Most species from this phylum are single-celled flagellates, also having amoeboid, coccoid, palmelloid or filamentous stages. The cells are golden or yellow-brown due to the presence of accessory pigments. It usually has two flagella of equal or sub equal length both of which are smooth and an appendage between them called a haptonema which may be used for capturing food. The surface of the cell is covered in granules and calcified scales may potentially be visible under a light microscope.

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.

Phylum Mollusca
Molluscs: There are 4 main classes of Mollusca which include Polyplacophora (Chitons), Gastropoda (marine snails, sea hares, nudibranchs and limpets), Bivalvia (mussels, clams, oysters), and Cephalopoda (squid, cuttlefish and octopus). They are a highly diverse group of marine animals characterised by the presence of an external or internal shell. There are two structures in this phylum that are found no where else in the animal kingdom; they are the mantle and the radula. The mantle is a fold in the body wall that secretes the calcareous shell which is typical of the phylum. The radula is a toothed, tongue or ribbon like organ variously modified for special feeding techniques.

Phylum Myzozoa
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 Nemertea
Ribbon worms: The ribbon worms are cylindrical to somewhat flattened, highly contractile, soft-bodied, unsegmented worms. Generally they are small but a few species can reach up to 6m in length. They are usually very slender, brightly coloured, and have an unusual anterior proboscis equipped with a sharp spine to capture prey. They live by either burrowing in sand,

living in algal clumps or mats or in oyster shells. They reproduce sexually as well as asexually by fragmentation.

Phylum Platyhelminthes

Flatworms: The flatworms are unsegmented, flattened, and very soft-bodied. The mouth is located ventrally near the midpoint of the animal or at the anterior end. There are three Classes of flatworm; Turbellaria, Trematoda, and the Cestoda. Many are very small but some can reach considerable sizes and they range in colour from very drab, transparent animals to ones with bright colours.

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 are a taxonomically difficult group of marine invertebrates. Most sponges possess skeletal support from need-like spicules and they vary greatly in colour and shape, and include sheet-like encrusting forms, branching forms and tubular forms. Sponge surfaces have thousands of small pores to through which water is drawn into the colony, where small food particles are filtered out before the water is again expelled through one or several other holes.

Phylum Sipuncula

Sipunculids: The phylum Sipuncula (peanut worms) is a group of unsegmented, marine coelomates that are closely related to annelids and molluscs. They have two body regions: a trunk and a more slender proboscis or introvert. This introvert lies enrolled in the body cavity of the animal giving it an oval or peanut shape and only when it is feeding does the introvert fold out. They have a variety of epidermal structures, such as papillae, hooks and shields. They live in a variety of habitats including burrows in silt and sand, under rock crevices and some species bore into coral or soft rock. They have also been known to inhabit the empty shells and tubes of other species.

Appendix 6: Species information sheets for each non-indigenous species recorded from the Kaikoura port survey or desktop review of existing marine species records.

The species information sheets are designed to summarise basic information on the biology, ecology, distribution (international and national), and potential impacts of each of the non-indigenous species that was recorded during the port baseline survey. They are modeled on similar fact sheets that have been developed for on-line databases on non-indigenous marine species elsewhere in the world (e.g NIMPIS, NISbase, NASbase, Global Invasive Species Database, NEMESIS, Baltic Sea Alien Species, etc). Information on each species was compiled from available literature, on-line databases on alien marine species, searchable databases with taxonomic and/or biogeographic data (e.g. ITIS, OBIS, Australian Faunal Directory, Algaebase, Fishbase, etc) and from background material provided by the specialist taxonomists who identified the specimens. Key published sources of information for each species are listed on the bottom of each sheet. Whilst the sources of all photographs and diagrams are acknowledged, we have not sought specific permission to use them.

Pathways for introduction and dispersal

Likely pathways for the introduction and spread of each species are classified according to the 22 vector categories used by Hayes *et al.* (2005) in recent risk profiling of priority Australian marine pests (Table 1). Three additional categories – N1, N2, N3 – have been added to describe different pathways for natural spread of the species within New Zealand. For each species, the likely pathways of introduction to New Zealand are largely derived from Cranfield *et al.* (1998), published information, or expert opinion. The categories met by any given species are indicated in its species information sheet.

Table 1: Potential pathways for the introduction and spread of non-indigenous species within New Zealand (after Hayes *et al.* 2005).

Code	Description
B1	Biocontrol: deliberate translocation as a biocontrol agent
B2	Biocontrol: accidental translocation with deliberate biocontrol release
C	Canals: natural range expansion through man-made canals
D	Debris: transport of species on human generated debris
F1	Fisheries: deliberate translocations of fish or shellfish to establish or support fishery
F2	Fisheries: accidental with deliberate translocations of fish or shellfish
F3	Fisheries: accidental with fishery products, packing or substrate
F4	Fisheries: accidental as bait
IR1	Individual release: deliberate release by individuals
IR2	Individual release: accidental release by individuals (e.g. aquarium discards)
NB	Navigation buoys and marina floats: accidental as attached or free-living fouling organisms
P1	Plant introductions: deliberate translocation of plant species (e.g. for erosion control)
P2	Plant introductions: accidental with deliberate plant translocations
RE	Recreational equipment: accidental with recreational equipment
S1	Ships: accidental as attached or free-living fouling organisms
S2	Ships: accidental with solid ballast (e.g. rocks, sand, etc)
S3	Ships: accidental with ballast water, sea water systems, live wells or other deck basins
S4	Ships: accidental associated with cargo
S5	Ships: accidental associated with dredge spoil
SP	Seaplanes: accidental as attached or free-living fouling organisms
SR1	Scientific research: deliberate release with research activities
SR2	Scientific research: accidental release with research activities
U	Unknown
N1	Natural: planktonic dispersal
N2	Natural: rafting of adults on biogenic substrata
N3	Natural: long-distance movement of adults

Potential impacts

The impacts on New Zealand ecosystems have not been documented for most species. Where detailed information is available on known impacts of the species here or overseas, this is included. "Potential impacts" were identified on the basis of the species' life habits or those of similar functional species. We classified "potential" impacts into the 15 categories used by Hayes *et al.* (2005) to evaluate the impacts of priority Australian marine pests (Table 2). The categories met by any given species are indicated in its species information sheet. Some species met none of the potential impact categories and therefore none of these categories are listed for those species.

Table 2: Categories used to identify potential impacts of each species (after Hayes *et al.* 2005).

Impact category	Code	Description
Human health	H1	Human health
Economic	M1	Aquatic transport
Economic	M2	Water abstraction/nuisance fouling
Economic	M3	Loss of aquaculture/commercial/recreational harvest
Economic	M4	Loss of public/tourist amenity
Economic	M5	Damage to marine structures/archaeology
Environmental	E1	Detrimental habitat modification
Environmental	E2	Alters trophic interactions and food-webs
Environmental	E3	Dominates/out competes and limits resources of native species.
Environmental	E4	Predation of native species
Environmental	E5	Introduces/facilitates new pathogens, parasites or other NIS
Environmental	E6	Alters bio-geochemical cycles
Environmental	E7	Induces novel behavioral or eco-physiological responses
Environmental	E8	Genetic impacts: hybridisation and introgression
Environmental	E9	Herbivory

Distribution maps

We followed the approach used by the Australian National Introduced Marine Pest Information System (NIMPIS) to present information on the global distribution of each species. NIMPIS uses a bioregional classification of the world's oceans developed by The World Conservation Union (IUCN) to define areas for conservation purposes (Kelleher *et al.* 1995). A conservative approach has been adopted whereby a species is considered present in all areas of a bioregion if it has been recorded from any location within that bioregion's boundaries[1]. Since bioregions represent environmentally similar geographic areas, if a species is present in one portion of a bioregion, there is a strong likelihood that it could spread via natural processes to other areas in that bioregion. Nonetheless, the species does not necessarily occur throughout the entire bioregion. In preparing the maps, published distribution information was not always precise, so if a location record indicated a whole country or large area of coastline and provided no further information, all regions encompassing that country or coastline were shaded on our maps. Also note that the species could occur in other (unshaded) regions, but we have not seen records for these regions. The same conditions apply to the New Zealand distribution maps, which divides New Zealand and its offshore islands into 16 regions (after Francis 1996).

We have made our best attempt to identify the provenance of each species. In each case we have attempted to identify: (1) the natural biogeographic range of the species ("native range"),

[1] The geographic locations of each sample in which the species was found during the New Zealand port baseline surveys are available within the BIODS database associated with this project.

(2) bioregions in which it has been introduced by humans (deliberately or inadvertently; "non-native" range), and (3) regions in which the species' provenance is uncertain ("cryptogenic" range). In many instances, the provenance for particular bioregions is not clear from existing distribution records. In some cases this is because we have not been able to access primary monographs or publications that might resolve this, but in most cases it is simply because the biogeographic information and/or systematics do not permit clear identification of provenance. In these instances, we have had to make our own interpretations of the information available to us.

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Hayes, K.; Sliwa, C.; Migus, S.; McEnnulty, F.; Dunstan, P. (2005). National priority pests. Part II, Ranking of Australian marine pests. Report undertaken for the Department of Environment and Heritage by CSIRO Marine Research. Commonwealth of Australia. 102 p

Appendix 7. Species x sample x site results for all taxa recorded by each method from the Kaikoura port survey.

Please email surveillance@mpi.govt.nz to receive the results for each sampling method used below

Appendix 7a.	**Results from the anchor box dredge samples.**
Appendix 7b.	**Results from the benthic core (large hand corer) samples.**
Appendix 7c.	**Results from the benthic sled samples.**
Appendix 7d.	**Results from the crab trap samples.**
Appendix 7e.	**Results from the dinoflagellate cyst core samples.**
Appendix 7f.	**Results from the phytoplankton tow samples.**
Appendix 7g.	**Results from the poison station samples.**
Appendix 7h.	**Results from the pile scraping quadrats.**
Appendix 7i.	**Results from the beach seine net samples.**
Appendix 7j.	**Results from the shrimp trap samples.**
Appendix 7k.	**Results from the qualitative diver visual searches.**
Appendix 7l.	**Results from the opportunistic visual searches conducted from above water.**
Appendix 7m.	**Results from the beach wrack samples.**
Appendix 7n.	**Results from the zooplankton tow samples.**