Fisheries resources in Otago Harbour and on the adjacent coast

Prepared for

Port Otago Limited

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Executive Summary

This report describes the fish and shellfish resources in Otago Harbour and the nearby Otago coast as part of a suite of studies commissioned by Port Otago Limited aimed at providing baseline information for an assessment of environmental effects of proposed dredging of the approaches to Port Chalmers and disposal of dredged material at potential sites on the Otago coast.

The fisheries assessment in this report is based on a desktop literature review, commercial fisheries catch and effort data obtained from the Ministry of Fisheries and information derived through initial consultation with fishery stakeholder groups and individuals. Consultation with some groups, particularly Iwi, have yet to be completed and will be added in the next revision of this report.

New Zealand has a large EEZ that includes a diverse range of oceanic habitats from shallow inshore waters to abyssal depths spanning subtropical to sub-Antarctic waters. Within these diverse habitats, most fish species are highly mobile and the populations of most species are widely distributed.

Coastal Otago has a diversity of fisheries habitats including hard and soft shores and exposed and protected coasts and harbours. Otago Peninsula and Otago Harbour are major coastal features of the east coast of the South Island. There is a diverse fish and shellfish fauna on the coast and within Otago Harbour and the other harbours of Otago Peninsula. Research and studies of the fish and shellfish communities indicate that the known fish and shellfish fauna of Otago Harbour and coastal Otago is predominantly made up of common species that are widely distributed throughout central New Zealand waters. The marine fauna of the inshore coastal area is not known to be unique, presently at risk or of special ecological significance.

The shallow and protected habitats of Otago Harbour (especially the *Zostera* beds) and Blueskin Bay (its inshore margins) are nursery areas for a number of fish species, especially flatfishes. The available evidence indicates that the protected and sheltered waters of Blueskin Bay are important as one of a number of inshore nursery habitats for juvenile fishes on the east coast of the South Island.

The extensive intertidal flats within Otago Harbour support one of New Zealand's largest populations of cockles and this resource is currently being evaluated for commercial harvesting by a local fishing company.

Fisheries resources were of great traditional importance and played significant part of sustenance and customs in the pre-European life of Ngai Tahu. The fish and shellfish resources of Otago Harbour and the Otago coast remain highly valued by Ngai Tahu today both as a food resource and to meet customary needs.

Commercial fishing for a range of fish and shellfish species is extensive all along the Otago coast. There is an important flatfish fishery in Blueskin Bay and the partially sheltered waters of Blueskin Bay are important as a fishing area for small local commercial fishing vessels, particularly small trawlers that target flatfishes.

Recreational fishing for many fish and shellfish species is widespread within Otago Harbour (especially salmon, flatfish and cockles) and along the open coast (especially blue cod, red cod, groper, rock lobster and paua). The shipping channel and the harbour entrance area are important salmon fishing areas in the summer months.

Fisheries resources in Otago Harbour and on the adjacent coast (Ver 1 – Preliminary)

1. Introduction

This report describes the aquatic fish and shellfish resources inside Otago Harbour and on the adjacent Otago coast with an emphasis on those resources that are important for customary purposes, recreational or personal use and the commercial seafood industry.

Ocean habitats can be broadly classified into inshore and offshore with the usual dividing line between them being the edge of the continental shelf at about 100–200 m depth. Outside the continental shelf the seabed slopes more steeply until it reaches the deep sea floor at 1000 m depth or more. The most productive waters for fishes generally lie over the continental shelf and the continental slope to about 800 m depth.

New Zealand's 200 nautical mile Exclusive Economic Zone (EEZ) comprises 4.4 million square kilometres of ocean and 15,000 kilometers of coastline (http://www.fish.govt.nz) with a wide range of oceanic characteristics from subtropical water in the north to sub-Antarctic water around the southern island groups.

Most fish species are highly mobile and the populations of most species found in Otago are widely distributed within their preferred habitats. Most fish populations have no clear boundaries to their spatial distribution and their distribution may expand and contract as the population fluctuates in abundance over time. The specific distribution of each species is strongly influenced by the presence of its preferred habitat. Shellfish species are generally sessile or less mobile although most release their eggs and larvae into the sea where they can be transported over considerable distances.

Many fish species show seasonal movements for feeding or spawning. There is also considerable natural fluctuation in the abundance of many fish populations over time due to the effect of environmental factors that drive survival and recruitment of juveniles into the adult population. Combined with their mobility, these characteristics all make the assessment of the status of fish populations difficult to quantify accurately. It is usually less difficult to assess shellfish populations because they tend to be sessile or exhibit limited movement.

The fisheries assessment in this report is based on a desktop literature review, commercial fisheries catch and effort data obtained from the Ministry of Fisheries and information derived through some consultation with fishery stakeholder groups and individuals. Consultation with some groups, particularly Iwi have yet to be completed and will be added in the next revision.

2. Methods

2.1. The Fisheries Literature

There is a considerable body of scientific research and related information on New Zealand fish and shellfish. The scientific literature, Ministry of Fisheries' publications and the Ministry's website http://http://www.fish.govt.nz and other library and internet sources were searched for relevant biological information and data on the fish and shellfish resources of Otago Harbour, the coastal waters of Blueskin Bay and Otago Peninsula and the wider Otago coastal area. The literature search included on–line web–based sources such as FishBase (http://www.fishbase.org) and Google (http://scholar.google.co.nz). Included in the literature search were Ministry of Fisheries' reports on research trawl surveys, surveys of recreational fishing, shellfish surveys and stock assessment reports. A bibliography of the fisheries literature is included as part of this report.

2.2. Fisheries Catch and Effort data

The Ministry of Fisheries collects detailed information on commercial catch and effort by area on fishing returns completed by commercial fishers. This information provides information on fish species present in the Otago area as well as the relative abundance of commercial species. Extracts of relevant catch and effort data from the commercial fishery for the Otago area were obtained from the Ministry of Fisheries under the Official Information Act. The commercial fisheries catch and effort data also provides details of commercial fishing methods, the number of vessels, fishing effort, catch by species and the seasonality of fisheries in Otago.

Commercial fisheries catch and effort data was obtained for the most recent three commercial fishing years (1 October – 30 September, 2004–05, 2005–06 and 2006–07 for finfish and shellfish, except for rock lobster which has a fishing year from 1 April – 31 March). As the Ministry's commercial fishing years for finfish and rock lobster are different, some combined finfish and rock lobster data was obtained for the calendar years 2005 and 2006.

2.3. Consultation with the Fisheries Sector (this section to be revised following further consultation)

Stakeholder groups, including customary, recreational and commercial fishers are being consulted in order to obtain more detailed information on fishery resources and fishing areas or sites of particular significance. Groups and individuals consulted, information obtained and the issues they raised will be summarised in an appendix to this report when consultation is complete.

3. The Fisheries Environments of Otago Harbour and Coastal Otago

3.1. Otago Harbour

Grove & Probert (1999) provide a summary of the main physical features of Otago Harbour, which is a major feature of Otago coastal ecology, one of only a few large sheltered marine harbours in southern New Zealand. Otago Harbour waters generally have similar salinities to the open ocean outside the harbour's entrance although there is reduced salinity in the upper Harbour where the main freshwater inputs occur. As a fisheries environment, Otago Harbour is a shallow extension of the surrounding sea rather than an estuary.

Apart from the shipping channel which is deeper, most of Otago Harbour is less than 3 m deep at low tide. A high proportion of the harbour's seabed is comprised of muds and fine sands, with large areas of exposed intertidal sandflats at low tide. There are extensive areas of intertidal seagrass beds. Rocky shores, intertidal rock pools and shallow rocky reefs are present in the central part of the harbour around Portobello Peninsula, Quarantine Island/Kamau Taurua and Goat Island/Rakiriri which separate the upper and lower harbour areas.

Much of the original shoreline of Otago Harbour has been modified through a combination of urban, agricultural and commercial development. Drystone walls have been built along the shoreline for much of the harbour's margin. Significant areas at the head of the harbour and smaller areas at Port Chalmers have been reclaimed. The harbour's main channel has been progressively deepened and is maintained at navigable depths for shipping by dredging. The Mole at the harbour entrance has altered tidal flows and the morphology of the harbour's entrance. However, most of the modifications to the harbour have affected its margins. A high proportion of the harbour away from the shoreline is unmodified and in a largely natural state.

Overall, the large size of Otago Harbour with its shallow, sheltered waters, large areas of intertidal flats and marine vegetation makes it a valuable shallow water habitat for many kinds of fish and shellfish. The extensive intertidal and shallow subtidal sand and mud flats provide an excellent habitat for bivalve shellfish. The presence of large seagrass beds provides refuge for small and juvenile fishes. The harbour's main channel is a migration path for fish species as they move in and out of the harbour, including species such as freshwater eels and migrating juvenile and adult chinook salmon.

In summary, salinity similar to that of the open ocean, shallow depths and predominantly soft sediment habitats are the principal environmental features that influence the fish and shellfish resources present in Otago Harbour. Some shallow water species of fishes are resident in the harbour year–round. Many other coastal fish species are transient or occasional visitors, migrating in and out of the harbour with the tides, or seasonally. The soft sediments and large intertidal areas support intertidal and shallow–water bivalve shellfish species.

3.2. Coastal Otago

The shallow coastal waters of Otago are influenced by the northward flowing Southland Current (Heath 1985) which draws warm saline water from the Tasman Sea west of New Zealand through Foveaux Strait and northeastward up the east coast of the South Island (ECSI). The presence of this current consisting of relatively warm water means that the inshore fish fauna of Otago contains many of the same species found around central New

Zealand. Offshore Otago waters outside of the continental shelf are cooler due to a greater influence of waters with a sub–Antarctic origin.

The seabed along the open Otago coast is comprised of a mix of rocky (foul) bottom and areas of muds, sands and gravels. The continental shelf off Otago is narrow compared to its width elsewhere along the ECSI. Along much of the Otago coast, the continental shelf is 30–50 km wide but it narrows to about 20 km width directly east of Otago Peninsula and then widens to more than 30 km at Blueskin Bay, before progressively widening to the north off the Canterbury coast. East of Otago Peninsula, the continental shelf and slope is dissected by a number of submarine canyons.

The Otago coast is exposed, with a variety of inshore and offshore habitats. Otago Peninsula shores are a convoluted mix of prominent rocky headlands intermixed with exposed sandy bays and a number of small and large sheltered or semi-sheltered shallow inlets including Hooper's and Papanui Inlets on the southern side and Purakaunui and Waitati Inlets on the northern side. Immediately north and south of Otago Peninsula the coastline is made up of a similar mix of headlands and sandy bays, but there it is relatively straight with little shelter from onshore wind or swells. Blueskin Bay is partially sheltered from prevailing southwesterly winds and swells by Otago Peninsula.

Although the Otago continental shelf is relatively narrow, the mix of hard and soft shores, exposed and protected waters and varied seabed types provides a diversity of habitats that support a wide range of fish and shellfish species. Blueskin Bay provides a more sheltered coastal habitat of relatively shallow coastal waters.

4. Fish and Shellfish Fauna of Otago Harbour and Coastal Otago

4.1. Otago Harbour

Much of the early research on the fishes and marine life of Otago Harbour followed the establishment of the Portobello Marine Biological Station in 1897. In a report read to the Otago Institute in 1905, Thomson (1905) listed 67 species of fishes that had been taken inside Otago Harbour or in near proximity to the harbour. Thomson (1912) updated the 1905 list, including some revisions to nomenclature together with information on the location or distribution of many of the species.

Graham (1938) provided a record of 119 species of fishes caught in Otago Harbour and adjacent waters over a period of 27 months from studies at Portobello Marine Biological Station and from observations made at Dunedin fish markets over the years 1930-32. As with Thomson's (1905, 1912) earlier lists of Otago fish species, a number of the species identified by Graham (1938) were taken from catches outside the harbour.

Paulin & Roberts (1990) undertook a fish collection programme to collect and identify fishes from 15 stations in Otago Harbour and adjacent waters in May 1990. Rocky reef and soft sediment habitats were both sampled for comparison of the fauna of sheltered harbour waters with nearby exposed coastal waters. The sampling used a variety of methods: rotenone poisoning, SCUBA, lines, nets, trawling and dredging, with the poisoning resulting in the collection of a number of small and cryptic species such as triplefins not normally caught by conventional fishing methods. Based on the results of their 1990 sampling together with a study of information from existing collections and previous Otago records, Paulin & Roberts (1990) found that a total of 159 species of fishes have been recorded from the Otago Peninsula region. They found that within their study area, species diversity was the greatest around the Mole at the harbour entrance where 22 species were present and at Quarantine Point where 13 species were collected. Both of these sites had rocky habitats. Paulin & Roberts (1990) reported that sampling at sites along the shore outside of the harbour was limited by rough sea conditions and poor underwater visibility. These factors together with the brief time period and relatively small area sampled led Paulin & Roberts (1990) to conclude that the list of 159 species should not be considered comprehensive and that the number of known Otago fish species would undoubtedly increase in the future.

As Otago Harbour is an extension of the sea rather than an estuarine environment, most of the fish species present in the harbour are also found on the open coast. Table 1 provides a list of fish species reported from Otago and nearby waters by Paulin & Roberts (1990) and species reported from other research and the commercial fishery. Table 1 indicates the presence of each species inside Otago Harbour and on the Otago coast.

The extensive intertidal sand and mud flats of Otago Harbour support a large cockle population which is very abundant and widespread throughout many parts of the harbour (and the subject of commercial interest at present). An estimate of cockle biomass by Breen ***et al.*** (1999) suggests that the cockle population in Otago Harbour is possibly the largest in New Zealand. Thomson (1912) noted that the rock lobster was extremely abundant within Otago harbour near the Portobello hatchery. Ralph & Yaldwyn (1956) found swimming crabs and dredge oysters on the harbour seafloor near Portobello and there is a small recreational fishery for dredge oysters in some of the harbour basins.

Table 2 provides a list of the known common edible shellfish and crustacean species reported from Otago waters together with information on their known presence within and outside Otago Harbour.

4.2. Coastal Otago

The fish and shellfish fauna of coastal Otago is comprised of species that are mostly common and widespread throughout most of central New Zealand. Fenaughty and Bagley (1981) give the results of a trawl survey using both bottom and midwater trawls covering 793 trawl stations conducted over a two year period along the continental shelf of the ECSI from Nugget Point to Cape Campbell. Almost all of the trawls were in coastal waters deeper than 50 metres. In total, 103 kinds of fish and shellfish were caught, with barracouta, spiny dogfish, hoki, red cod, ghost shark, arrow squid, rattails, silver warehou, tarakihi, gemfish and common warehou comprising 99% of the total catch weight. Most of the species caught in the survey reported by Fenaughty & Bagley (1981) were distributed throughout the survey area along the entire ECSI, including coastal Otago.

Beentjes *et al.* (2002) used fisheries research trawl data from winter and summer trawl surveys conducted from 10–400 m depth between Waiau River and Shag Point to identify a total of 100 fish species of demersal (bottom dwelling) fishes along ECSI with spiny dogfish, barracouta and red cod the most abundant species. The species composition in the research trawl data is very similar to that reported by Fenaughty & Bagley (1981).

Using side–scan sonar, O'Driscoll & McClatchie (1998) found pelagic schools of barracouta, jack mackerels and slender tuna off the Otago coast feeding on high densities of krill.

A study of the fish community of the Kakanui Estuary (Jellyman *et al.* 1997) conducted over a 12 month seasonal survey found a total of 20 species of estuarine and marine fishes, most of which are present in estuaries studied elsewhere in central New Zealand. A number of the species found by Jellyman *et al*. (1997) have been recorded from within Otago Harbour (Table 1) and a number of these species are likely to be present in other estuaries in Otago.

Shellfish resources in coastal Otago appear to be typical of resources elsewhere on the ECSI. Major cockle populations are found in Papanui and Waitati Inlets and Purakaunui Inlet on Otago Peninsula. Smaller populations of cockles occur in many other locations along the coast. Paua, kina, rock lobster, green lipped mussels, and paddle crabs occur on the open coast of Otago wherever suitable habitats are present. Cranfield *et al*. (1994) described the distribution of seven surf clams species at 16 locations throughout New Zealand from Northland to Southland, including at Blueskin Bay. Densities of up to 35 kg. m^{-1} of three surf clams, *Spisula aequilatera, Dosinia subrosea* and *Mactra murchisoni* were present at Blueskin Bay. These species were also abundant at the other sites surveyed in central and southern New Zealand.

Queen scallops occur along the edge of the continental shelf of Otago at depths from 130 – 200 m where the largest New Zealand populations have been found. Queen scallops are known only from the ECSI, Chatham Islands and New Zealand's southern islands (Michael & Cranfield 2001).

Otago coastal fish and shellfish species are listed in Tables 1 and 2 respectively.

4.3. Regional and National Significance

The New Zealand fish fauna consists of broad biogeographic groups broadly associated with different regions of the country and different ecological habitats (Moreland 1958, Ayling & Cox 1982, Paulin & Roberts 1990, Francis 1996).

Paulin & Roberts (1990) found that the fishes of Otago Harbour, Otago Peninsula and adjacent waters consist primarily of species that are widespread in central New Zealand waters, with a small component of cooler water species plus a few warm water species that are occasionally present. Using Principal Components Analysis (PCA) on presence–absence data, Francis (1996) identified the geographic distributions of reef and reef–associated fishes in the New Zealand region. In the south east coast region of New Zealand (Rakaia River to Puysegur Point), Francis (1996) identified a total of 83 reef or reef–associated fish species: 70 of which were widespread in New Zealand, 10 of which were cool temperate species found in New Zealand waters south of East Cape, 2 were species of sub–Antarctic origin found around southern New Zealand, and 1 species was of warm temperate origin.

Overall, both scientific studies and fishery data indicates that there is a diverse fish fauna in Otago Harbour and coastal Otago. The fauna is predominantly comprised of species that occur in similar habitats throughout much of the central region of New Zealand but also includes a few species associated with warmer northern waters and a few from cooler southern and sub–Antarctic waters. The edible shellfish and crustacean species found in Otago are also common and widespread in central New Zealand waters. The extensive intertidal sand and mud flats within Otago Harbour have particular significance as a bivalve shellfish habitat supporting what is probably the largest cockle population in New Zealand.

5. Areas of Importance for Spawning, Egg Laying or Juveniles

Roper & Jillett (1981) studied the occurrence and seasonal abundance of planktonic larvae, juvenile and adult flatfishes in Otago Harbour and Blueskin Bay. Larvae of three species, sand flounder, speckled sole and greenback flounder were common in Otago Harbour in late winter to early summer and corresponded with the abundance of juveniles of the same species in the harbour. Eight species of flatfishes were found on the Otago coast, but only the juveniles and adults of lemon, common, slender and speckled sole were common. They found a strong depth–size relationship of the common flatfish species with juveniles in shallow waters and inlets and small adults in the shallow in near–shore waters. Juvenile flatfishes were concentrated in finite nursery areas in the inlets of Otago Peninsula or very shallow waters of Blueskin Bay. Flatfish are known to spawn in coastal areas in depths of 30–45 m in winter to spring (Coleman 1974) although no specific spawning areas in Otago have been identified.

Beentjes & Cole (2002) provide a summary of available information on spawning and migrations of fish in coastal Otago. No definitive spawning areas have been identified in Otago. Armstrong (1988) studied the reproduction of paddle crabs in Blueskin Bay. Spawning of paddle crabs occurred from early spring to late summer.

Hurst et al. (2000) summarised the available information on areas of importance throughout New Zealand coastal waters for spawning, pupping, egg laying or presence of juveniles for 35 different inshore fish species that occur on the continental shelf in less than 200 m depth. Table 3 gives a summary of the information from Hurst et al. (2000) for the south east coast of the South Island. The maps in Hurst et al. (2000) indicate that the inshore waters of the Otago coast are used by a number of inshore species for spawning, egg laying and pupping although the relative importance of particular inshore areas of the coast such as Blueskin Bay and Otago Harbour compared to other coastal areas was not assessed. However, the results in Hurst et al. (2000) show that harbours and protected shallow inshore waters around New Zealand tend to be the main areas where the greatest numbers of eggs, larvae or juveniles of many inshore species are found.

6. Fisheries Uses of Otago Harbour and Coastal Otago

6.1. Recreational Fisheries

6.1.1. *Otago Harbour*

Bell (1998) conducted a detailed 12 month angler–diary survey of recreational fishing in Otago Harbour and the coastal area adjacent to the harbour entrance to determine species, methods and areas fished in and around the harbour. The results of that survey give the most detailed information describing recreational fishing activities in Otago Harbour and outside the harbour entrance.

Chinook salmon were targeted in 88.2% of all recreational fishing trips recorded by diarists (n=6020 trips). Fishers also targeted blue cod (5.4% of trips), trumpeter, (1.3% of trips), red cod (1.1% of trips), wrasse (1% of trips) and a range of other fish and shellfish species. Although chinook salmon was the main fish species targeted, barracouta (39%) and blue cod (19%) of the fish catch were the most frequently caught fish species with salmon comprising 10% of all fish caught.

Most recreational fishing in the harbour is from boats except around Port Chalmers and in the Dunedin Harbour basin where most fishing was by angling from shore. The survey results indicate that recreational fishing effort peaks in the harbour entrance and outer harbour areas in January/February as the salmon arrive from the sea. Fishing effort in the upper harbour basin peaks in March as the salmon move into the upper reaches of the harbour.

Hand gathering of shellfish is also an important component of the recreational fishery. Bell's (1998) survey indicates that cockles were the main shellfish harvested by recreational fishers in Otago Harbour, (85% of all shellfish taken) followed in catch by mussels, tuatua, paua, pipi and rock lobster.

Bell's (1998) survey also gathered information on the location of recreational fishing trips using maps of the harbour and adjacent coast divided into 13 fishing zones. The zone around Port Chalmers and Carey's Bay (mostly angling from the shore) together with three zones covering the harbour channel from Port Chalmers to The Spit, the harbour mouth from The Spit to the Mole and the immediate coastal area outside the harbour entrance accounted for nearly half of all recreational fishing trips recorded in the survey. Slightly less than 40% of recreational fishing trips took place in the upper harbour above Port Chalmers with most of these being angling from the shore in the Dunedin harbour basin area.

Bell's (1998) study indicates that the salmon fishery is a major focus of recreational fishing in Otago Harbour in the summer months. The catch data together with the detailed maps in Bell's (1998) report showing areas fished, methods used and species caught gives a comprehensive picture of recreational fishing in the harbour and its approaches. In the Dunedin harbour basin and around Port Chalmers, rod fishing from shore is the main angling method and salmon are the main target species. Salmon fishing from boats takes place at the entrance to Otago Harbour where salmon congregate and throughout the main shipping channel where salmon are found as they migrate into the harbour.

Fishing for other species in the harbour is mainly focused on set netting and hand gathering of cockles. Set netting is concentrated at a number of locations: between the Mole and Aramoana Spit; off Wellers Rock and Harwood, around Quarantine Island and in Macandrew Bay. Spearing for flatfish occurs on the flats between Harwood and Otakou and at a number

of sites in the upper harbour. Hand gathering of paua takes place at Taiaroa Head and the Mole. Cockle harvesting occurs around Aramoana, near Wellers Rock and along the sand banks adjacent to the shipping channel.

6.1.2. *Coastal Otago*

The Ministry of Fisheries has conducted a number of region-wide and national diary surveys of recreational fishing (Teirney *et al*. 1997, Bradford *et al*. 1998, Boyd & Reilly 2002) that provide estimates of harvest for fish and shellfish for New Zealand and give an overview of the main species taken in the Otago recreational fishery. The diary surveys were designed to collected harvest data for fishstocks over relatively large areas of coastline and did not always distinguish between catches in the harbours and on the open coast. Fisher & Bradford (1998) give more detailed catch and effort results from the 1998 national marine recreational fishing survey by fishing zone. In the area of coastal Otago from the Tokomairiro River to the Waitaki River, blue cod, flatfish, sea perch spiny dogfish, chinook salmon, red cod, and trumpeter were the main fish species caught. Cockles, mussels, oysters, rock lobster and paua were the main shellfish species gathered.

Much of the Otago coast is exposed and recreational fishing is very weather dependent. Most recreational fishing and shellfish on the coast occurs near the harbours or estuaries where there is safe small boat access and access to boat ramps. Fishing is highly seasonal with most fishing effort taking place in the summer months. A small number of charter vessels for recreational fishers operate from Karitane and Moeraki, concentrating mainly on blue cod and groper but also taking rock lobster and paua when conditions are suitable.

Overall, the recreational fishery in coastal Otago focuses on the most abundant and popular fish and shellfish species with much of the fishing effort occurring in sheltered waters close to the main population centres and where there is safe small boat access. Most recreational fishing from boats takes place in the warmer summer months.

6.2. Commercial Fisheries

6.2.1. *History and Background to the Commercial Fishery*

Fenaughty and Bagley (1981) describes the history of the fishing industry in Otago. Maori initially controlled most fishing until the mid 19th century, with the early commercial catch mostly dried or smoked barracouta caught by lining. Significant quantities of dried, pickled and smoked barracouta were exported from Otago to overseas markets in the mid 19th century. As the Otago population grew, the commercial fishery expanded with it. A significant commercial seine net fishery developed within Otago Harbour, principally targeting flounders for the local market but also catching a range of other species including red cod, moki, trevally, butterfish, and garfish (Douglas 1990). Outside Otago Harbour, barracouta, blue cod, groper and ling were taken by line fishing.

The advent of steam and motor vessel trawling around the end of the 19th century resulted in a rapid increase in the total commercial catch from Otago waters outside Otago Harbour. By the 1920's the Otago fishing fleet included two steam trawlers and three or four motor trawlers, up to 40 full and part–time line boats and 29 full and part–time seine boats. Most fish was landed at Port Chalmers and carted by truck to Dunedin. Total commercial catches rose to as high as 3,000 tonnes and then gradually declined and stabilised at around 2,000 tonnes annually. As the commercial trawl fishery developed outside Otago Harbour, catches of flounders and other species within the harbour gradually declined. The last of Otago Harbour's seine fishing boats ceased operation about 1947 (Douglas 1990). The development of an export market resulted in rapid growth of the Otago rock lobster fishery from the 1950s

and since then rock lobster fishing has remained an important and valuable component of the commercial fishing industry in Otago waters.

In the 1960s, new fisheries began to be developed in deeper waters and offshore as the fishing industry responded to the arrival of foreign fishing vessels in the waters around New Zealand. By the late 1970s there were between 70 and 80 commercial fishing vessels operating out of Otago Harbour plus about 15 from Oamaru, 30 from Moeraki, 20 from Karitane and 20 from Taieri Mouth (Fenaughty and Bagley 1981). Many of the smaller vessels were multi-purpose, fishing for rock lobster seasonally and switching to trawling, line fishing, set netting or cod potting at other times of the year.

The number of commercial fishing vessels operating out of Otago ports has fallen since the introduction of the QMS in 1986, although there are no longer any official statistics on the numbers, types and sizes of commercial fishing vessels operating out of each port. From information gained in discussions with the fishing industry, Beentjes & Cole (2002) reported that a total of 38 vessels were operating from the above Otago ports in 2002. Six vessels operated at Taieri Mouth (5 trawling, 1 potting for blue cod), twelve at Port Chalmers and Otakou (11 trawling, 2 set netting, four potting for rock lobster, 3 lining and one potting for blue cod), six vessels at Karitane trawling and potting for blue cod and rock lobster, eighteen multipurpose vessels operating from Moeraki and two vessels at Oamaru (one trawling, one lining and potting for rock lobster). This is only a quarter of the number of vessels reported in the late 1970s by Fenaughty and Bagley (1981). Recent consultation with stakeholders suggests that the number of vessels may now be only half the number reported by Beentjes & Cole (2002) in about 2002.

Fishing industry sources state that over the past two decades rising operating costs but relatively static fish prices have resulted in a steady attrition of vessels from the domestic fishing fleet. Much of the fish landed at Port Chalmers is now freighted to Christchurch for processing with processors ceasing their operations in the Dunedin area. More attrition of the domestic fishing fleet is expected in the near future due to the recent large increases in fuel costs.

Otago domiciled commercial fishing vessels are mostly small inshore vessels that concentrate all or most of their effort on the inshore fishery along the Otago coast. Some vessels fish day trips only, trawling for flatfishes, potting for blue cod or rock lobster, lining or set netting for groper, sharks or ling, or diving for paua. Day vessels operate in the waters close to Otago Peninsula and in Blueskin Bay. A few vessels make multi-day trips that range further along the Otago coast.

Larger trawlers operating from Bluff, Timaru and Lyttleton fish the entire ECSI, including the Otago coast seasonally. These vessels fish both inshore species and species found in the deeper waters of the outer continental shelf and shelf edge. A deepwater fishing fleet operates from the ports of Timaru, Nelson and Auckland. The deepwater fleet targets deepwater species around New Zealand, including the offshore waters of Otago. Squid jigging vessels also fish along the ECSI seasonally, including off the Otago coast.

6.2.2. *Commercial Fisheries Catch and Effort Data*

Ministry of Fisheries collects commercial catch data in different ways from different vessels and for different fisheries. Estimated catches are provided on fishing returns by all inshore fishers by fisheries statistical area and by deepwater vessels by latitude and longitude. Landed catch data giving the weight of each species landed is also provided at the end of each trip and trips may include fishing in more than one statistical area. Different statistical areas are used to record the catch of some species and the rock lobster fishery uses a different

fishing year from other species. These factors complicate comparing all of the fisheries and species together.

The commercial fishery data presented in this report represents the best compromise in terms of the use of the various fisheries statistical data types in order to fully describe the various commercial fisheries, target species and fishing methods around Otago Peninsula. Where different data types are used (e.g. estimated catch *vs* landed catch), there may be differences in the catch totals for some species in the various data tables. Some fisheries statistics data is not available from the Ministry due to Official Information Act restrictions to protect commercial confidentiality. This generally occurs where the data is for fewer than three vessels or fishers. Where data is not available for this reason, it is indicated in the tables as 'withheld'.

6.2.3. *Overview of the Present Otago Commercial Fishery*

Beentjes & Cole (2002) give a recent description of the commercial fishery in Otago within the Otago Regional Council's jurisdiction (Waitaki River to the Sisters and out to the 12 nm limit of the territorial sea). There are five fishing ports in the region, Oamaru, Moeraki, Karitane, Port Chalmers and Taieri Mouth. A wide range of fishing methods are used by inshore fishers, with the principal fishing methods being trawling, set netting, cod potting, rock lobster potting, line fishing, diving and hand gathering.

Commercial fishery catch statistics in New Zealand are available by Ministry of Fisheries' fishery statistical areas (FSA). Recent catch statistics for the Otago coastal area around Otago Peninsula (the Ministry of Fisheries' FSA024) are presented and discussed below. FSA024 encompasses the coastal area from Oamaru south to Taieri Island and extends offshore to longitude 173°E (Figure F1).

Table 4 gives the estimated catch of all species except rock lobster by all vessels (inshore and deepwater) vessels from FSA024 for each of the fishing years 1 October to 30 September, 2004–05, 2005–06 and 2006–07. Rock lobster is not included because rock lobster statistical areas have different boundaries and rock lobster fishing years are 1 April to the following 31 March. The rock lobster fishery is discussed later in the report. Some types of fishes in Table 4 and later tables are listed in species groups, for example flatfish, because the Ministry's fisheries statistics groups the catches of these species together.

The average estimated catch of all species in FSA024 over the three year period 2004–05 to 2006–07 averaged more than 3600 t annually. Cockles harvested from Waitati and Papanui Inlets make up close to 25% of the total harvest of all species. Arrow squid, barracouta, warehou, spiny dogfish and flatfish made up a further 45% of the average annual catch. A total of 22 species or species groups comprise 91.5% of the total catch weight and a further 73 species not listed individually in Table 4 account for the remaining 8.5% of the total catch. Table 5 lists all of the species or types of fishes included in the 'other species' category in Table 4. Rock lobster potting is also an important fishery in coastal Otago and this is dealt with in the next section of the report.

The breakdown of the total estimated catch in FSA024 by fishing method is given in Table 6 and the number of vessel days is given in Table 7. Bottom trawling takes nearly half of the total catch. Hand gathering (of cockles) and squid jigging together account for 36% of the total catch with set netting, cod potting and line fishing taking most of the balance. There was an average of more than 2600 vessel days fished by all methods, with trawling accounting for nearly half of the total vessel days.

Together, Tables 4 to 7 give an overall snapshot of the Otago commercial fishery (excluding rock lobsters) from Taieri Mouth to Oamaru and offshore. More than 100 fish and shellfish species occur in the commercial catch. Cockles, arrow squid, barracouta and spiny dogfish account for two thirds of the total catch of all species. Trawling is the fishing method harvesting the most fish, taking about half of the total catch. Hand gathering of cockles accounts for a quarter of the total catch and other fishing methods take the balance.

6.2.4. *Otago's Inshore Fisheries*

This section of the report describes each of the main inshore fisheries in coastal Otago and the coast of Otago Peninsula. Fisheries statistical data in this section of the report is mainly for inshore vessels, although it has not always been possible to separate out data for vessels that may operate in both inshore waters and deeper waters.

The inshore commercial fishery in Otago is diverse, encompassing a variety of fishing methods. Trawling, set netting, line fishing, cod potting, diving, hand gathering and rock lobster potting are all important commercial fishing methods in coastal Otago. Table 8 gives recent landed catches of the main wetfish and shellfish species by inshore vessels fishing in FSA024, excluding rock lobster, paua and cockles. Estimated rock lobster catches in Ministry of Fisheries statistical areas 920 and 921 (Figure F2) for recent rock lobster fishing years are given in Table 9, together with the number of vessel days and the number of vessels operating. The fishing year for rock lobsters is different than most other species. Table 10 gives estimated paua catches by paua statistical area (Figure F3).

The main fisheries by each fishing method are described below. Many inshore vessels operating in Otago are multipurpose, switching between fisheries at different times of the year. The use of a number of different fishing methods is common in Otago and is an important strategy for vessels to remain viable in the inshore fishery.

Table 11 gives the number of inshore vessels reporting the use of each fishing method in FSA024 and CRA920 in the calendar years 2005 and 2006.

Trawl fishery

Flatfish are a significant commercial catch of the trawl fishery in coastal Otago. The trawl net is towed along the seafloor and this is only possible where there are soft seabeds comprised of mud, sand or gravel as the trawl net would be damaged if towed over rocky areas. There is less trawlable ground south of Otago Peninsula than to the north. Almost all of inner and outer Blueskin Bay is good trawl ground and it also receives protection from prevailing southwest winds and swell making it a prime fishing area for local inshore trawlers. Flatfishes are the principal target species of inshore trawlers in coastal Otago, with the main flatfish fishery centred in Blueskin Bay. Fisheries catch and effort statistical data does not distinguish between the various flatfish species with most of the catch recorded against the generic name of flatfish. Beentjes *et al.*2002 determined that most of the catch on the ECSI was mostly lemon sole and N.Z. sole together with lesser but still significant quantities of sand flounders also taken. Very small quantities of all of the other flatfish species are also caught in Otago waters.

Table 12 gives the main species landed from FSA024 by inshore trawlers. This data includes the catch of larger inshore trawlers operating out of other ports along the ECSI that fish in FSA024 from time to time as it is not possible to separate the catch data for large and small vessels. Much of the trawl catch of arrow squid and barracouta is taken by larger inshore trawlers that target these species in deeper waters in the summer months. Most of the flatfish catch in FSA024 is taken by the small local trawlers working out of Port Chalmers. A range

of associated bycatch (non–targeted) species are also taken in the flatfish fishery, including barracouta, elephant fish, gurnard, rough skate, warehou and various shark species.

Inshore trawlers fish at all depths although most of their fishing effort targets flatfishes which are mainly caught in depths less than about 60 m. Most of the trawl catch of arrow squid, barracouta, warehou, and tarakihi is taken in summer over the middle to outer continental shelf. The flatfish trawl fishery operates year–round with catches highest in summer but also distributed throughout the other seasons of the year along with the associated bycatch species (Figure F4).

Set net fishery

The set net fishery mainly targets school shark, rig and elephant fish with a range of other species in the catch including spiny dogfish, blue moki, common warehou, groper and ling (Table 13). Set netting occurs over all depths and bottom types from shallow waters in coastal bays to the edge of the continental shelf. Much of the catch of school shark and rig is taken in spring and summer when adults move into shallow protected waters such as Blueskin Bay where they give birth to their young (Figure F5).

Cod potting

Blue cod is the main species taken by cod potting (Table 14). There is some targeting of red cod in the winter months. Ling is the main bycatch. Potting for blue cod occurs throughout the year (Figure F6) over rough gravel or rocky (foul) habitats in depths from about 20 m to at least 100 m throughout the year (Figure F6). Much of the blue cod fishery in FSA024 happens along the coast to the north of Blueskin Bay where there is more rough and rocky habitats suited to blue cod.

Line fishing

Ling, bluenose and groper are the main target species in the line fishery in FSA024 (Table 15) with spiny dogfish the main bycatch. Fishing for ling and bluenose takes place in waters of 200 m or more on the continental slope and groper are targeted in depths of 50 – 200 m along the outer continental shelf.

Paua and kina diving

Both paua and kina are harvested by free diving as the use of underwater breathing apparatus is not permitted. Commercial divers operate in shallow waters along the coastal fringe. There are a number of closed areas to commercial paua fishing in coastal Otago. In FSA024 the paua closed areas are the coastline within 1 km of Taieri River mouth, the coast from Cape Saunders to 1 km south of Brighton, Otago Harbour (inside of Heyward Point to Taiaroa Head), Waikouiti Bay inside a line from Cornish Head to Karitane Peninsula and the coast from Brinn's Point to Omimi Point.

Fishery statistical areas for commercial paua catches are shown in Figure F3 and commercial paua catches for these areas are given in Table 10. Catch data for some areas is not available (withheld) due to commercial confidentiality, although the total withheld catch for all areas in Table 10 is available. This shows that the main paua catches in coastal Otago are made along the coast north of Shag River. Smaller quantities of paua are taken around Otago Peninsula, including the rocky shoreline from Wickliffe Bay to Taiaroa Head and the coast north of Heyward Point.

The kina fishery occurs in the same areas as the paua fishery but commercial catch statistics are withheld by the Ministry for FSA024. Kina harvesting is closed in the areas closed to paua fishing (above) as well as being prohibited along the coast from Bridge Point to All Day Bay, Lookout Bluff to Waianakarua River and Shag River to Moeraki Point. Beentjes & Cole (2002) indicated that the commercial harvest of kina from the whole of Otago and Canterbury was from 4 to 50 t annually over the 10 years to 2002.

Queen scallops

Michael & Cranfield (2001) describe the queen scallop fishery and summarise the literature on the biology and distribution of queen scallops off the Otago coast. Queen scallops are most abundant on the edge of the continental shelf between the Taiaroa and Papanui canyons in depths greater than 130 m. Very few are present in depths less than 110 m.

The commercial fishery for queen scallops uses specialized trawl gear and commercial catches have been highly variable. The queen scallop fishery in Otago developed in the late 1980s with catches peaking at nearly 250 t in the early 1990s before falling to less than 10 t in the 1998–99 fishing year. In the most recent 2004–05 to 2006–07 fishing years, catches of queen scallops off Otago have ranged from 6 t to 35 t.

Rock lobster

Recent estimated rock lobster catches are given in Table 9 for Ministry of Fisheries rock lobster statistical areas CRA920 (Waitaki River to Otago Harbour) and CRA921 (Otago Harbour to Nugget Point). The rock lobster fishing year is 1 April to the following 31 March, which is different than the fishing year for most other species. Recent annual catches for each of CRA920 and CRA921 are about 50 t.

Rock lobster are taken by potting on or near rocky shores or rocky reefs and seabed from the shallows and out to at least 100 m depth. The fishery is highly seasonal, with the main catches taken in the winter months of July and August. Beentjes & Cole (2002) show coastal areas where rock lobster fishing takes place. Rock lobster fishing occurs on rocky areas of the coast of Otago Peninsula south of Taiaroa Head but the main fishing areas are north of Brinn's Point and south of Brighton. Little rock lobster fishing occurs between Otago Harbour and Brinn's Point.

Although the 100 t annual catch of rock lobster from coastal Otago is much less than the 3,500 total catch of other fish and shellfish, the total economic value of the rock lobster fishery is significant due to its much higher market value per kilogram. The rock lobster fishery is very important to many Otago inshore fishers who operate multipurpose vessels. These fishers take rock lobster in winter and then switch to other methods for other parts of the year.

Cockles

The commercial cockle fishery occurs in Waitati and Papanui Inlets on Otago Peninsula. The total commercial cockle harvest is now the highest by weight of any single species in Otago (FSA024 – see Table 4). Cockles are harvested entirely by hand gathering. Up to the present time a single company, Southern Clams Ltd, has been the only commercial operator in the fishery. Two other commercial operators also have entitlements to harvest cockles in the Otago area but have yet to enter the fishery.

The cockle fishery requires high water quality due to the ability of bivalve shellfish to filter pathogens from the water. Recent water sanitation in Papanui Inlet has resulted in the cessation of commercial cockle harvesting from that area and the commercial cockle operator is now dependent entirely on harvests from Waitati Inlet. Water quality testing in Otago Harbour indicates that it would meet sanitary water quality standards. The Otago Harbour cockle population is considerably larger than in Waitati and Papanui Inlets (Breen *et al.* 1999) and Southern Clams Ltd is currently assessing the possibility of developing a fishery in Otago Harbour. This would require a change to the current regulations prohibiting all commercial shellfishing (except for rock lobster, oysters and crabs) within Otago Harbour.

6.3. Customary Fisheries (this section to be revised following further consultation)

The Waitangi Tribunal's Ngai Tahu Sea Fisheries Report (Waitangi Tribunal 1992) outlines the significance of Otago's fisheries resources to Ngai Tahu. The resources of the sea were a primary source of sustenance for all of Ngai Tahu. On the open coast, barracouta was a major source of kai around Otago Peninsula. Within Otago Harbour tuaki (cockles) were prized because of their large size. Patiki (flatfishes) were also taken in the harbour. The other harbours around Otago Peninsula were also important sources of flatfish and shellfish. On the Otago coast, rock lobster, paua and kina were important seafood resources. Tuna (eels), kanakana (lamprey) and whitebait were taken in the estuaries and rivers.

All of these resources remain important as a source of kai today and many continue to be used to meet customary needs. Around Otakou in Otago Harbour the fishery for tuaki is particularly important. Patiki are taken in all of the harbours of Otago Peninsula, including Otago Harbour. On the Otago coast, the East Otago Taiapure (a customary fishery area under the Fisheries Act 1996) incorporates the inshore waters of Waitati Inlet, Karitane, Blueskin Bay and Purakaunui Bay. The taiapure provides recognition of and additional protection to the customary seafood resources in the area.

7. Summary

Coastal Otago has a diversity of fisheries habitats including hard and soft shores and exposed and protected coasts and harbours. Otago Peninsula and Otago Harbour are major coastal features. There is a diverse fish and shellfish fauna on the coast and within Otago Harbour and the other harbours of Otago Peninsula. Research and studies of the fish and shellfish communities indicate that the known fish and shellfish fauna of Otago Harbour and coastal Otago is predominantly made up of common species that are distributed throughout central New Zealand waters. The marine fauna of the inshore coastal area is not known to be unique, presently at risk or of special ecological significance.

The shallow and protected habitats of Otago Harbour (especially the *Zostera* beds) and Blueskin Bay (its inshore margins) are nursery areas for a number of fish species, especially flatfishes. The available evidence indicates that the protected and sheltered waters of Blueskin Bay are probably important as one of the nursery areas for juvenile fishes on the east coast of the South Island.

The extensive intertidal flats within Otago Harbour support one of New Zealand's largest populations of cockles and this resource is currently being evaluated for commercial harvesting by a local fishing company.

Commercial fishing for a range of fish and shellfish species is extensive all along the Otago coast. There is an important flatfish fishery in Blueskin Bay and the partially sheltered waters of Blueskin Bay has some added significance as a fishing area for small local commercial fishing vessels, particularly small trawlers that target flatfishes.

Recreational fishing for many fish and shellfish species is widespread within Otago Harbour (especially salmon, flatfish and cockles) and along the open coast (especially blue cod, red cod, groper, rock lobster and paua). The shipping channel and the harbour entrance area are important salmon fishing areas in the summer months.

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Table 1: Fish species recorded in Otago Harbour (H) and coastal Otago C) by [1]Paulin & Roberts (1990), [2]Jellyman et al. (1997) and [3]commercial catches 2004-05 to 2006-07

Common name	Species name(s)	Location			
Ahuru	*Auchenoceros punctata*	H, C	1		
Alert pigfish	*Alertichthys blacki*	C	1		
Banded bellowsfish	*Centriscops humerosus*	C	1		3
Banded kokopu	*Galaxias fasciatus*	H	1	2	
Banded triplefin	*Notoclinops segmentatus*	H	1		
Banded wrasse	*Notolabrus fucicola*	H, C	1	2	3
Barracouta	*Thyrsites atun*	C	1	2	3
Bass	*Polyprion americanus*	C	1		3
Bastard cod	*Pseudophycis barbata*	C	1		
Bigeye seaperch	*Helicolenus barathri*	C	1		
Black flounder	*Rhombosolea retiaria*	H	1	2	
Black goby	*Gobiomorphus atrata*	H, C	1		
Black oreo	*Allocyttus niger*	C			3
Blind electric ray	*Typhlonyke aysoni*	C	1		
Blue cod	*Parapercis colias*	H, C	1		3
Blue moki	*Latridopsis ciliaris*	H, C	1		3
Blue shark	*Prionace glauca*	C			3
Bluenose	*Hyperoglyphe antarctica*	C	1		
Brill	*Colistium nudipinnis*	C	1		3
Broad snout sevengill shark	*Notorynchus cepedianus*	C	1		3
Brown trout	*Salmo trutta*	C		2	3
Butterfish, greenbone	*Odax pullus*	H	1		3
Butterfly perch	*Caesioperca lepidoptera*	H	1		3
Butterfly tuna	*Gasterochisma malampus*	C	1		
Carpet shark	*Cephaloscyllium isabellum*	H, C	1		3
Chinook salmon	*Oncorhynchus tshawytscha*	C		2	
Clingfish	*Gastroscyphus hectoris*	C	1		
Cockabully	*Tripterygion nigripinne*	C		2	
Common bully	*Gobiomorphus cotidianus*	C		2	
Common roughy	*Paratrachicythys trailli*	H, C	1		
Common triplefin	*Forsterygion lapillum*	C	1		
Common warehou	*Seriolella brama*	H, C	1		3
Copper moki	*Latridopsis forsteri*	C	1		
Crested bellowsfish	*Notopogon lillei*	C	1		3
Dark toadfish	*Neophrynichthys latus*	H	1		
Dealfish	*Trachiopterus trachiopterus*	C	1		
Deepwater triplefin	*Forsterygion bathytaton*	C	1		

Table 1 continued

Common name	Species name(s)	Location			
Dragonet	*Foetorepus calauropomus*	C	1		
Dragonet	*Foetorepus phasis*	C	1		
Dwarf cod	*Austrophycis marginatus*	C	1		
Electric ray	*Torpedo fairchildi*	C	1		3
Elephant fish	*Callorhinchus milii*	C	1		3
Estuarine triplefin	*Forsterygion sp.*	H	1		
Estuary stargazer	*Leptoscopus macropygus*	H	1	2	
Flathead	*Hoplichthys haswelli*	C	1		
Frigate tuna	*Auxis thazard*	C	1		
Frostfish	*Lepidopus caudatus*	C	1		
Garfish	*Euleptorhamphus viridis*	H	1		
Gemfish	*Rexea solandri*	C	1		3
Ghost shark	*Hydrolagus novaezealandiae*	H	1		3
Giant bully	*Gobiomorphus gobiodes*	H	1	2	
Giant chimera	*Chimaera phantasma*	C			3
Giant kokopu	*Galaxias attenuatus*	H	1		
Giant stargazer	*Kathetostoma giganteum*	H, C	1		3
Girdled wrasse	*Pseudolabrus cinctus*	H	1		
Globefish	*Contusus richei*	H, C	1		
Graham's gudgeon	*Grahamichthys ?radiata*	H	1		
Greenback flounder	*Rhombosolea tapirina*	H	1		3
Grey mullet	*Mugil cephalus*	C			3
Groper	*Polyprion oxygeneios*	C	1		3
Hagfish	*Eptatretus cirrhatus*	H, C	1		3
Hairy conger	*Bassanago hirsutus*	C			3
Hake	*Merluccius australis*	C	1		3
Halfbeak	*Hyporhamphus ihi*	H	1		3
Hoki	*Macruronus novaezelandiae*	C	1		3
Horse mackerel	*Trachurus novaezelandiae*	H, C	1		3
Inanga	*Galaxias maculatus*	C		2	
Javelin fish	*Lepidorhynchus denticulatus*	C			3
John dory	*Zeus faber*	C	1		3
Kahawai	*Arripis trutta*	H	1		3
Kelpfish	*Chironemus marmoratus*	C			3
Kingfish	*Seriola lalandi*	C	1		3
Lamprey	*Geotria australis*	C	1	2	
Lemon sole	*Pelotretis flavilatus*	H, C	1		3
Limpopo rockfish	*Acanthoclinus fuscus*	H, C	1		
Ling	*Genypterus blacodes*	H, C	1		3

Table 1 continued

Common name	*Species name(s)*	Location			
Longfinned eel	*Anguilla dieffenbachii*	C	1	2	
Longfinned triplefin	*Ruanoho decemdigitatus*	H	1		
Longfinned worm eel	*Muraenichthys breviceps*	H	1		
Long-nosed chimaera	*Harriotta raleighana*	C			3
Longsnout pipefish	*Leptonotus norae*	H	1		
Lookdown dory	*Cyttus traversi*	C	1		3
Lumpfish	*Trachelochismus pinnalatus*	H	1		
Mako shark	*Isurus oxyrinchus*	C			3
Maori chief	*Paranotothenia angustata*	C	1		
Marblefish	*Aplodactylus arctidens*	H, C	1		
Mirror dory	*Zenopsis nebulosus*	C	1		3
Moray cod	*Muraenolepis ?marmoratus*	C	1		
Mottled triplefin	*Forsterygion malcolmi*	H	1		
New Zealand sole	*Peltorhamphus novaezeelandiae*	H, C	1		3
Obliquebanded rattail	*Coelorinchus aspercephalus*	C	1		
Oliver's rattail	*Coelorinchus oliverianus*	C	1		
Opalfish	*Hemerocoetes artus*	C	1		
Opalfish	*Hemerocoetes monopterygius*	H, C	1		
Opalfish	*Hemerocoetes morlandi*	C	1		
Opalfish	*Hemerocoetes pauciradiatus*	C	1		
Orange clingfish	*Diplocrepis puniceus*	H	1		
Orange roughy	*Hoplostethus atlanticus*	C			3
Pale ghost shark	*Hydrolagus bemisi*	C			3
Parore	*Girella tricuspidata*	C			3
Pilchard	*Sardinops neopilchardus*	C	1		
Pipefish	*Leptonotus elevatus*	H, C	1		
Porbeagle shark	*Lamna nasus*	C	1		3
Porcupine fish	*Allomycterus jaculiferus*	C	1		
Prickly dogfish	*Oxynotus bruniensis*	C	1		
Rainbow trout	*Oncorhynchus mykiss*	C		2	
Rays bream	*Brama brama*	C	1		3
Red cod	*Pseudophycis bachus*	H, C	1		3
Red gurnard	*Chelidonichthys kumu*	C	1		3
Red moki	*Cheilodactylus spectabilis*	C	1		
Red scorpionfish	*Scorpaena papillosus*	H	1		
Red snapper	*Centroberyx affinis*	C	1		
Redbanded perch	*Ellerkeldia huntii*	C	1		
Remora	*Remora remora*	C	1		

Table 1 continued

Common name	*Species name(s)*	Location			
Ribaldo	*Mora moro*	C			3
Rig or smoothhound	*Mustelus lenticulatus*	H, C	1		3
Rock cod	*Lotella rachinus*	H, C	1		
Rockfish	*Taumakoides littoreus*	H	1		
Rockfish	*Taumakoides marilynae*	H	1		
Rockfish	*Taumakoides rua*	H	1		
Rockling	*Gaidropsarus novaezelandiae*	H	1		
Rosy dory	*Cyttopsis rosea*	C			3
Rough skate	*Dipturus nasutus*	H, C	1		3
Sand diver	*Tewara cranwellae*	H	1		
Sand flounder	*Rhombosolea plebeia*	H, C	1	2	3
Sand stargazer	*Crapatulus novaezealandiae*	H, C	1		
Sandfish	*Gonorynchus forsteri, G greyi*	C			3
Sandfish	*Gonorynchus gonorynchus*	H, C	1		
Scaly gurnard	*Lepidotrigla brachyoptera*	C	1		3
Scarlet wrasse	*Pseudolabrus miles*	H, C	1		
School shark	*Galeorhinus galeus*	H, C	1		3
Sculpin	*Antipodocotus galatheae*	C	1		
Sea perch, jock stewart	*Helicolenus percoides*	H, C	1		3
Seahorse	*Hippocampus abdominalis*	H, C	1		
Seal shark	*Dalatias licha*	C			3
Shortfinned eel	*Anguilla australis*	H	1	2	
Shortsnout pipefish	*Lissocampus filum*	C	1		
Shovelnose dogfish	*Deania calcea*	C	1		3
Silver dory	*Cyttus novaezealandiae*	C	1		3
Silver warehou	*Seriolella punctata*	C	1		3
Silverside	*Argentina elongata*	H, C	1		
Skipjack tuna	*Katsuwonus pelamis*	C			3
Slender stargazer	*Crapatulus angusticeps*	C	1		
Slender tuna	*Allothunnus fallai*	C			3
Smallscaled cod	*Paranotothenia microlepidota*	H, C	1		
Smelt	*Retropinna retropinna*	H, C	1	2	
Smooth leatherjacket	*Parika scaber*	H, C	1		3
Smooth oreo	*Pseudocyttus maculatus*	C			3
Smooth pipefish	*Stigmatopora macropterygia*	H, C	1		
Smooth skate	*Dipturus innominatus*	C	1		3
Snapper	*Pagrus auratus*	C	1		
Southern boarfish	*Pseudopentaceros richardsoni*	H, C	1		

Table 1 continued

Common name	*Species name(s)*	Location			
Southern conger eel	*Conger verreauxi*	H, C	1		
Southern pigfish	*Congiopodus leucopaecilus*	H, C	1		3
Speckled sole	*Peltorhamphus latus*	H, C	1		
Spectacled triplefin	*Ruanoho whero*	H	1		
Spiny dogfish	*Squalus acanthias*	C	1		3
Spotted flounder	*Azygopus pinnifasciatus*	C	1		
Spotted gurnard	*Pterygotrigla picta*	C	1		
Spotted stargazer	*Genyagnus monopterygius*	H, C	1		3
Spotty	*Notolabrus celidotus*	H, C	1		
Sprat	*Sprattus antipodum*	C		2	
Stingray	*Dasyatus brevicaudata*	H	1		3
Stout sprat	*Sprattus muelleri*	C	1		
Striped clingfish	*Trachelochismus melobesia*	H	1		
Sunfish	*Mola mola*	H	1		3
Tarakihi	*Nemadactylus macropterus*	H, C	1		3
Telecope fish	*Mendosoma lineatum*	H	1		
Thornfish	*Bovichtus variegatus*	C	1		
Thresher shark	*Alopias vulpinus*	C	1		3
Tommyfish	*Limnichthys polyactis*	H	1		
Topnot	*Notoclinus fenestratus*	H	1		
Torrentfish	*Cheimarrichthys fosteri*	C		2	
Trevally	*Pseudocaranx dentex*	C	1		3
Triplefin	*Gilloblennius tripennis*	H, C	1		
Trumpeter	*Latris lineata*	H, C	1		3
Turbot	*Colistium guntheri*	C	1		3
Twister	*Bellapiscis medius*	H, C	1		
Undescribed triplefin	*Forsterygion* couplet 21	H	1		
Undescribed triplefin	*genus et species nova*	C	1		
Variable triplefin	*Forsterygion varium*	H	1		
White Warehou	*Seriolella caerulea*	C			3
Witch	*Arnoglossus scapha*	C	1		3
Yellow weaver	*Parapercis gillesi*	C	1		
Yellowbelly flounder	*Rhombosolea leporina*	H, C	1		3
Yellow-black triplefin	"Tripterygion" sp.	H	1		
Yelloweyed mullet	*Aldrichetta forsteri*	H	1	2	3
Yellowfin tuna	*Thunnus albacares*	C			3

Table 2: Edible shellfish and crustacean species recorded by various authors and in commercial fisheries statistics from Otago Harbour (H) and coastal Otago (C)

Common name	Species name(s)	Location
Arrow squid	*Nototodarus sloanii,*	H, C
Arrow squid	*Nototodarus gouldi*	C
Cockle	*Austrovenus stutchburyi*	H, C
Deepwater clam	*Panopea zelandica*	C
Surf clam	*Dosinia subrosea*	C
Dredge oyster	*Tiostrea chilensis*	H, C
Kina	*Evechinus chloroticus*	C
Surf clam	*Mactra murchisoni*	C
Octopus	*Pinnoctopus cordiformis*	C
Paddle Crab	*Ovalipes catharus*	H, C
Paua	*Haliotis iris*	C
Pipi	*Paphies australis*	H, C
Queen Scallop	*Zygochlamys delicatula*	C
Rock lobster	*Jasus edwardsii*	H, C
Sea cucumber	*Stichopus mollis*	H, C
Surf clam	*Spisula aequilatera*	C
Tuatua	*Paphies subtriangulata*	C

Table 3: Juvenile distribution, and spawning, pupping or egg laying of species on the inner and outer continental shelf on the east coast of the South Island south of Banks Peninsula (data from Hurst *et al.* 2000)

	Juvenile abundance[1]		Spawning, pupping or egg laying[2]	
	Inner shelf	Outer shelf	Inner shelf	Outer shelf
Arrow squid	H	H		
Banded stargazer				
Barracouta	H	M		
Blue cod	+		S	
Blue mackerel			O	
Blue moki	+			
Common warehou	M		?	
Elephant fish	H	L	R	
Gemfish		L		
Giant stargazer	Low	M		
Grey mullet				
Groper				
Hake	Low	L	n/d	n/d
Jack mackerel	Low	L		?
Horse mackerel	Low	+	?	
Murphy's mackerel		+		
John dory				
Kahawai				
Kingfish				
Lemon sole	Low	L	?	
Ling	Low	H	n/d	n/d
New Zealand sole	+		?	
Red cod	H	H		R
Red gurnard	Low	L	R	R
Rig	M	L	?	
Sand flounder	Low		+	
Sea perch	+	H		+
School shark	H	L	?	
Silver warehou	M	M	n/d	n/d
Spiny dogfish	H	H		+
Tarakihi	H	H		
Trevally				
Yellowbelly flounder				
Yelloweyed mullet				

[1] key to abundance
H = high
M = moderate
L = low
+ = present

[2] key to spawning, pupping or egg laying
? = possible
+ = literatur
S = spent
O = occastional ripe/running ripe
R = common ripe running ripe
R = common ripe running ripe
N/A = not determined

Table 4: Estimated catch (kg) of the main species in FSA024 by all fishing vessels (inshore and deepwater) and all fishing methods 2004-05 to 2006-07 fishing years, excluding rock lobster and paua

Common name	Species name(s)	2004/05	2005/06	2006/07	Total all years	Annual average	3 year average % by species
Cockle	*Austrovenus stutchburyi*	799,550	942,982	907,163	2,649,695	883,232	24.5%
Arrow squid	*Nototodarus sloanii, N. gouldi*	781,079	802,615	870,136	2,453,829	817,943	22.7%
Barracouta	*Thyrsites atun*	179,125	499,822	398,072	1,077,019	359,006	10.0%
Common warehou	*Seriolella brama*	272,514	201,479	80,797	554,790	184,930	5.1%
Spiny dogfish	*Squalus acanthias*	97,300	222,892	86,974	407,166	135,722	3.8%
Flatfish	*Rhombosolea leporina, R. plebeia, R. retiaria, R. tapirina, Pelotretis flavilatus, Peltorhamphus novaezeelandiae, Colistium guntheri, C. nudipinnis*	181,601	98,765	92,927	373,293	124,431	3.5%
Ling	*Genypterus blacodes*	103,634	121,997	114,441	340,072	113,357	3.1%
Red Cod	*Pseudophycis bachus*	108,912	145,620	83,713	338,245	112,748	3.1%
Rough skate	*Dipturus nasutus*	149,144	76,728	68,519	294,390	98,130	2.7%
Blue cod	*Parapercis colias*	79,122	85,846	84,780	249,748	83,249	2.3%
Elephant fish	*Callorhinchus milii*	65,664	62,897	44,895	173,456	57,819	1.6%
School shark	*Galeorhinus galeus*	62,454	49,673	38,303	150,430	50,143	1.4%
Gurnard	*Chelidonichthys kumu*	47,760	44,702	40,926	133,388	44,463	1.2%
Rig	*Mustelus lenticulatus*	40,767	49,020	42,736	132,523	44,174	1.2%
Tarakihi	*Nemadactylus macropterus*	26,191	51,119	47,540	124,850	41,617	1.2%
Blue moki	*Latridopsis ciliaris*	27,621	19,393	32,096	79,110	26,370	0.7%
Smooth skate	*Dipturus innominatus*	14,652	33,835	30,474	78,961	26,320	0.7%
Silver warehou	*Seriolella punctata*	61,620	12,805	4,285	78,710	26,237	0.7%
Sea perch	*Helicolenus spp.*	25,116	22,108	23,075	70,299	23,433	0.7%
Giant stargazer	*Kathetostoma spp.*	21,934	16,119	14,336	52,389	17,463	0.5%
Groper & Bass	*Polyprion oxygeneios, P. americanus*	20,398	16,064	13,523	49,985	16,662	0.5%
Ghost shark	*Hydrolagus novaezealandiae*	13,240	7,256	5,671	26,167	8,722	0.2%
All other species (see Table 5)		268,999	396,466	252,427	917,892	305,964	8.5%
Total all species		3,448,395	3,980,203	3,377,807	10,806,406	3,602,135	100.0%

Table 5: List of 'All other species' in Table 4 ('X' indicates species was present)

Common name	Species name(s)	Year(s) present 2004/05	2005/06	2006/07
Banded bellowsfish	*Centriscops humerosus*	X		
Banded wrasse	*Notolabrus fucicola*	X	X	X
Bellowsfish	*Centriscops spp.*	X		
Black oreo	*Allocyttus niger*	X	X	X
Bladder kelp	*Macrocystis pyrifera*	X		
Blue shark	*Prionace glauca*		X	X
Broadsnouted sevengill	*Notorynchus cepedianus*	X	X	X
Brown Trout	*Salmo trutta*	X		
Butterfish	*Odax pullus*			X
Butterfly perch	*Caesioperca lepidoptera*		X	
Carpet Shark	*Cephaloscyllium isabellum*		X	X
Common warehou	*Seriolella brama*	X	X	X
Conger eel	*Conger spp.*	X	X	X
Crested bellowsfish	*Notopogon lilliei*			
Giant chimera	*Chimaera phantasma*			
Deepwater clam	*Panopea zelandica*			X
Deepwater dogfish				X
Dredge oyster	*Tiostrea chilensis*	X		
Eels, marine		X		
Electric ray	*Torpedo fairchildi*	X		
Garfish	*Hyporhamphus ihi*	X		
Gemfish	*Rexea solandri*	X		
Grey mullet	*Mugil cephalus*	X		X
Hagfish	*Eptatretus cirrhatus*			X
Hairy conger	*Bassanago hirsutus*			X
Hake	*Merluccius australis*	X	X	X
Hoki	*Macruronus novaezelandiae*	X		X
Jack mackerel	*Trachurus declivis,T.murphyi,T.novaezelandiae*		X	X
Javelin fish	*Lepidorhynchus denticulatus*			
John dory	*Zeus faber*			X
Kahawai	*Arripis trutta*	X		
Kelpfish	*Chironemus marmoratus*	X		
Kina	*Evechinus chloroticus*			X
Kingfish	*Seriola lalandi*	X		X
Leatherjacket	*Parika scaber*	X	X	X
Limpets			X	X
Long-nosed chimaera	*Harriotta raleighana*		X	X
Lookdown dory	*Cyttus traversi*			X
Mako shark	*Isurus oxyrinchus*		X	
Mirror dory	*Zenopsis nebulosus*	X		
Octopus	*Pinnoctopus cordiformis*	X	X	X
Oreos	*Oreosomatidae*		X	
Other sharks & dogfish unspecified		X	X	X
Pigfish	*Congiopodus leucopaecilus*			
Orange roughy	*Hoplostethus atlanticus*			
Paddle crab	*Ovalipes catharus*	X	X	X
Pale Ghost Shark	*Hydrolagus bemisi*			X

Table 5 continued

Common name	Species name(s)	Year(s) present 2004/05	2005/06	2006/07
Parore	*Girella tricuspidata*			X
Parrotfish		X	X	X
Porbeagle Shark	*Lamna nasus*			X
Queen Scallop	*Chlamys delicatula*	X	X	X
Rattails	*Macrouridae*	X	X	X
Rays Bream	*Brama brama*		X	X
Ribaldo	*Mora moro*	X	X	X
Rosy Dory	*Cyttopsis rosea*			X
Sandfish	*Gonorynchus forsteri, G. greyi*			X
Scaly Gurnard	*Lepidotrigla brachyoptera*			X
Sea cucumber	*Stichopus mollis*	X		
Seal Shark	*Dalatias licha*	X	X	X
Shovelnose dogfish	*Deania calcea*			X
Silver Dory	*Cyttus novaezealandiae*			X
Silver Warehou	*Seriolella punctata*	X	X	X
Skate, Other	*Rajidae (Family)*			X
Skipjack Tuna	*Katsuwonus pelamis*		X	
Slender Tuna	*Allothunnus fallai*		X	
Slickhead	Alepocephalidae (Family)			
Smooth Oreo	*Pseudocyttus maculatus*	X	X	X
Spotted Stargazer	*Genyagnus monopterygius*	X	X	
Starfish	Asteroidea and Ophiuroidea (Classes)		X	X
Stingray (Unspecified)		X	X	
Sunfish	*Mola mola*	X		
Thresher Shark	*Alopias vulpinus*		X	
Trevally	*Pseudocaranx dentex*	X		
Trumpeter	*Latris lineata*	X	X	X
Whelks		X	X	X
White Warehou	*Seriolella caerulea*	X	X	X
Wrasses	Labridae (family)			X
Witch	*Arnoglossus scapha*			
Yellow-eyed Mullet	*Aldrichetta forsteri*			X
Yellowfin Tuna	*Thunnus albacares*			X

Table 6: Estimated catch (kg) by fishing method in FSA024, (all species combined) 2004-05 to 2006-07 fishing years (inshore and deepwater vessels) excluding rock lobster and paua

Fishing Method	2004/05	2005/06	2006/07	Total catch all years	Annual average catch	3 year average % catch by method
Bottom trawl	1,709,592	1,948,743	1,446,382	5,104,718	1,701,573	47%
Hand gathering	799,550	942,982	907,163	2,649,695	883,232	25%
Squid jig	412,349	410,785	421,775	1,244,908	414,969	12%
Set net	288,521	324,164	200,539	813,224	271,075	8%
Cod potting	89,001	160,864	161,540	411,405	137,135	4%
Lining	99,666	79,625	122,839	302,130	100,710	3%
Other	49,716	113,040	117,569	280,326	93,442	3%
Total	3,448,395	3,980,203	3,377,807	10,806,406	3,602,135	

Table 7: Total vessel days fished annually in FSA024 by each of the main fishing methods 2004-05 to 2006-07 fishing years (inshore and deepwater vessels), excluding rock lobster and paua

Fishing Method	2004/05	2005/06	2006/07	Total days all years	3 year average annual vessel days
Bottom trawl	1,571	1,141	911	3,623	1,208
Hand gathering	withheld	withheld	withheld	withheld	
Squid jig	105	158	63	326	109
Set net	483	618	442	1,543	514
Lining	109	101	122	332	111
Cod potting	608	737	713	2,058	686
Other	withheld	withheld	withheld	withheld	
Total (excl. hand gathering and other)	2,876	2,755	2,251	7,882	2,627

Table 8: Landed catch (kg) of the main fish and shellfish species taken from FSA024 by inshore fishing vessels, 2004-05 to 2006-07 fishing years (excluding cockles, paua and rock lobster)

Common name	Species name(s)	2004/05	2005/06	2006/07	Total catch all years	Annual average catch	3 year average % by species
Flatfish	*Rhombosolea leporina, R. plebeia, R. retiaria, R. tapirina, Pelotretis flavilatus, Peltorhamphus novaezeelandiae, Colistium guntheri, C. nudipinnis*	170,091	94,350	92,276	356,717	118,906	9.2%
Spiny dogfish	*Squalus acanthias*	88,550	162,847	55,224	306,621	102,207	7.9%
Ling	*Genypterus blacodes*	92,042	108,890	104,996	305,928	101,976	7.9%
Rough skate	*Dipturus nasutus*	147,164	73,513	66,984	287,660	95,887	7.5%
Blue cod	*Parapercis colias*	78,937	85,566	84,455	248,958	82,986	6.5%
Red Cod	*Pseudophycis bachus*	66,047	114,657	59,564	240,268	80,089	6.2%
Elephant fish	*Callorhinchus milii*	63,504	62,537	44,736	170,777	56,926	4.4%
School shark	*Galeorhinus galeus*	62,204	49,673	38,093	149,970	49,990	3.9%
Gurnard	*Chelidonichthys kumu*	47,190	44,327	40,461	131,978	43,993	3.4%
Rig	*Mustelus lenticulatus*	40,627	49,020	41,956	131,603	43,868	3.4%
Tarakihi	*Nemadactylus macropterus*	26,158	50,859	47,485	124,502	41,501	3.2%
Barracouta	*Thyrsites atun*	19,290	65,652	20,620	105,562	35,187	2.7%
Arrow squid	*Nototodarus sloanii, N. gouldi*	16,554	62,710	166	79,430	26,477	2.1%
Blue moki	*Latridopsis ciliaris*	27,621	19,393	32,096	79,110	26,370	2.0%
Smooth skate	*Dipturus innominatus*	14,592	33,205	27,714	75,511	25,170	2.0%
Sea perch	*Helicolenus spp.*	19,776	10,573	21,295	51,644	17,215	1.3%
Giant stargazer	*Kathetostoma spp.*	20,711	15,384	12,944	49,039	16,346	1.3%
Hapuku & Bass	*Polyprion oxygeneios, P. americanus*	19,635	15,654	13,191	48,480	16,160	1.3%
Ghost shark	*Hydrolagus novaezealandiae*	4,786	1,511	3,994	10,291	3,430	0.3%
Other species		272,978	407,158	225,143	905,279	301,760	23.5%
Total		1,298,456	1,527,479	1,033,391	3,859,326	1,286,442	100.0%

Table 9: Estimated rock lobster catch (kg), vessel days and number of vessels operating in CRA areas 920 and 921, April fishing years 2004-05 to 2006-07

April Fishing Year	CRA Statistical Area	Estimated rock lobster catch (kg)	Vessel Days	Number of Vessels
2004/05	920	51,210	871	17
2005/06	920	45,405	525	12
2006/07	920	56,847	467	12
2004/05	921	36,191	199	6
2005/06	921	40,946	195	8
2006/07	921	59,812	284	10

Table 10: Estimated paua (*Haliotis iris* and *H. australis*) catch taken in Otago waters by paua statistical area, 2004-05 to 2006-07 fishing years

Paua statistical area	Description of area	2004-05	2005-06	2006-07
H32	Taieri Mouth - Bruce Rocks	0	0	0
H33	Bruce Rocks - Cape Saunders	(withheld)	(withheld)	
H34	Cape Saunders - Wickliffe Bay	1,500	(withheld)	(withheld)
H35	Wickliffe Bay - Taiaroa Head	(withheld)	1,900	3,395
H36	Taiaroa Head - Heyward Point		(withheld)	
H37	Heyward Point - Omimi Creek	(withheld)	(withheld)	(withheld)
H38	Omimi Creek - Brinns Point	0	0	0
H39	Brinns Point - Karitane Point	0	0	0
H40	Karitane Point - Cornish Head	0	0	0
H41	Cornish Head - Shag River	2,900	0	(withheld)
H42	Shag River - Katiki Beach	8,730	9,333	5,374
H43	Katiki Beach - Kakaho Beach	7,731	20,292	13,407
H44	Kakaho Beach - All Day Bay	0	(withheld)	0
H45	All Day Bay - Awamoa Rd	1,790	(withheld)	1,785
H46	Awamoa Rd - Meadowbank	(withheld)	0	0
Total paua catch from above areas where data was witheld		1,700	3,660	2,200
Total paua catch all areas H32 to H 46 including withheld quantity		24,351	35,185	26,161

Table 11: Number of vessels reporting the use of each fishing method in coastal Otago in the calendar years 2005 and 2006

	Calendar Year	
Fishing method	2005	2006
Rock lobster potting	11	12
Bottom trawl	38	34
Cod potting	20	18
Set netting	14	15
Lining	4	7

Table 12: Landed catch of the main species caught by bottom trawling in FSA024, 2004-05 to 2006-07 fishing years

Common name	Species name(s)	2004/05	2005/06	2006/07	Total catch all years	Annual average catch	3 year average % by species
Arrow squid	*Nototodarus sloanii, N. gouldi*	100,735	151,772	293,148	545,656	181,885	19%
Flatfish	*Rhombosolea leporina, R. plebeia, R. retiaria, R. tapirina, Pelotretis flavilatus, Peltorhamphus novaezeelandiae, Colistium guntheri, C. nudipinnis*	195,223	104,699	104,398	404,320	134,773	14%
Barracouta	*Thyrsites atun*	44,128	101,047	248,310	393,485	131,162	14%
Rough skate	*Dipturus nasutus*	168,596	123,016	75,428	367,040	122,347	13%
Red Cod	*Pseudophycis bachus*	80,203	107,761	68,898	256,861	85,620	9%
Common warehou	*Seriolella brama*	60,144	55,464	45,529	161,137	53,712	6%
Elephant fish	*Callorhinchus milii*	48,410	39,538	35,446	123,394	41,131	4%
Tarakihi	*Nemadactylus macropterus*	30,166	39,727	43,935	113,828	37,943	4%
Gurnard	*Chelidonichthys kumu*	13,885	21,583	11,939	47,408	15,803	2%
Other species		227,927	153,117	109,106	490,150	163,383	17%
Total		969,418	897,724	1,036,137	2,903,278	967,759	100%

Table 13: Landed catch of the main species caught by set netting in FSA024

Common name	Species name(s)	2004/05	2005/06	2006/07	Total catch all years	Annual average catch	3 year average % by species
Spiny dogfish	*Squalus acanthias*	39,591	113,321	20,403	173,315	57,772	25%
School shark	*Galeorhinus galeus*	60,210	49,370	45,530	155,110	51,703	22%
Rig	*Mustelus lenticulatus*	36,465	42,079	33,272	111,815	37,272	16%
Elephant fish	*Callorhinchus milii*	16,139	23,640	12,811	52,589	17,530	7%
Moki	*Latridopsis ciliaris*	17,499	13,027	13,343	43,868	14,623	6%
Common warehou	*Seriolella brama*	31,649	4,916	2,460	39,025	13,008	6%
Hapuku & Bass	*Polyprion oxygeneios, P. americanus*	10,546	9,530	6,665	26,741	8,914	4%
Ling	*Genypterus blacodes*	17,240	9,149	0	26,389	8,796	4%
Other species		35,952	26,518	14,557	77,027	25,676	11%
Total		265,290	291,550	149,040	705,880	235,293	100%

Table 14: Landed catch of the main species caught by cod potting in FSA024

Common name	Species name(s)	2004/05	2005/06	2006/07	Total catch all years	Annual average catch	3 year average % by species
Blue cod	Parapercis colias	60,438	71,006	72,640	204,085	68,028	60%
Ling	Genypterus blacodes	8,364	30,140	40,995	79,500	26,500	23%
Red Cod	Pseudophycis bachus	6,402	13,344	10,466	30,211	10,070	9%
Other species		2,847	10,266	15,167	28,279	9,426	8%
Total		78,051	124,757	139,268	342,075	114,025	100%

Table 15: Landed catch of the main species caught by lining methods (bottom long line, dahn line, hand line or trot line) in FSA024

Common name	Species name(s)	2004/05	2005/06	2006/07	Total catch all years	Annual average catch	3 year average % by species
Ling	*Genypterus blacodes*	56,672	55,169	48,550	160,391	53,464	49%
Bluenose	*Hyperoglyphe antarctica*	40,896	15,654	32,121	88,671	29,557	27%
Spiny dogfish	*Squalus acanthias*	20,561	15,377	5,009	40,947	13,649	12%
Sea perch	*Helicolenus spp.*	1,673	2,496	6,153	10,322	3,441	3%
Hapuku & Bass	*Polyprion oxygeneios, P. americanus*	4,822	3,495	not available	8,316	2,772	3%
Other species		4,333	2,842	12,077	19,253	6,418	6%
Total		128,957	95,033	103,910	327,900	109,300	100%

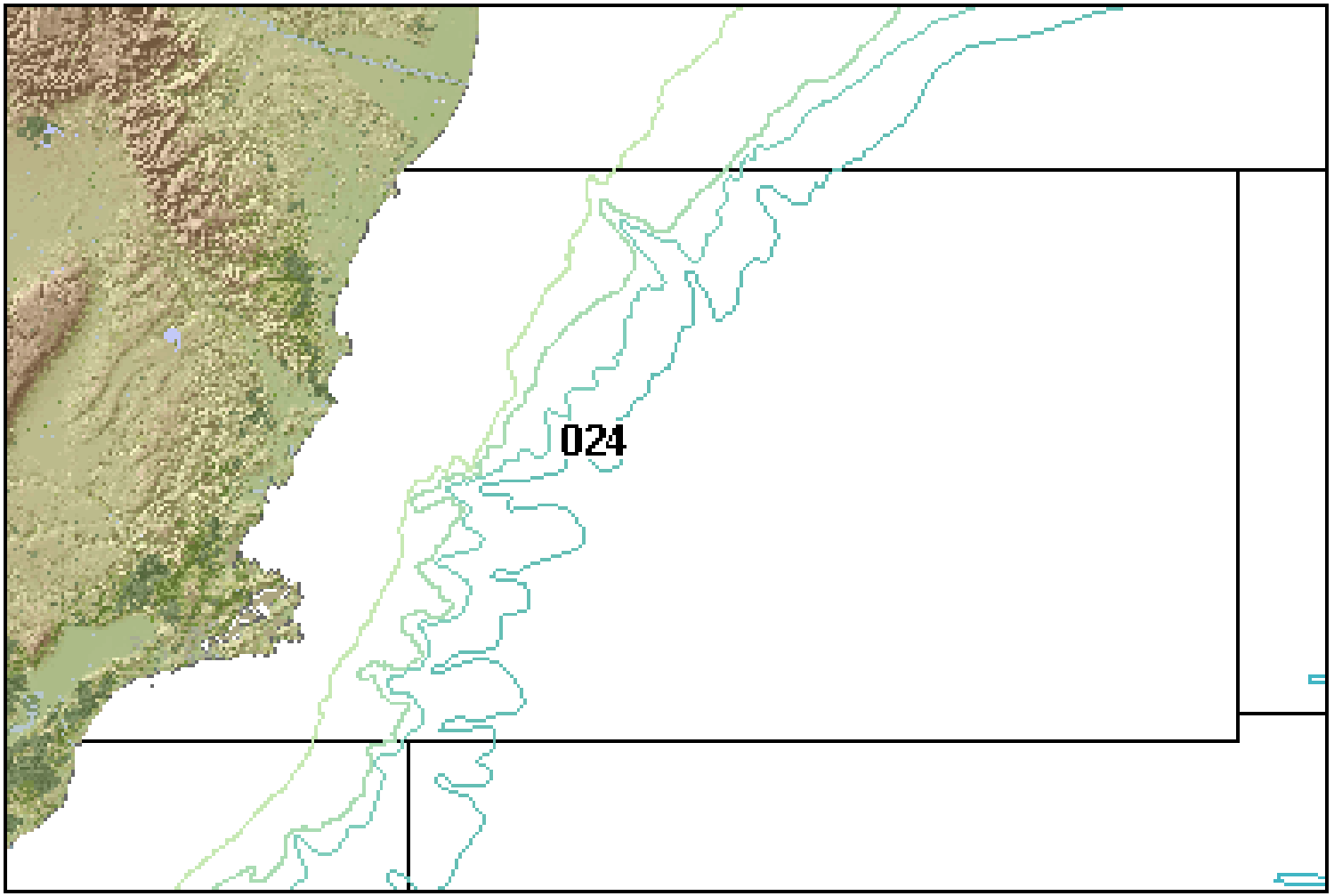

Figure F1: Ministry of Fisheries fisheries statistical area FSA024

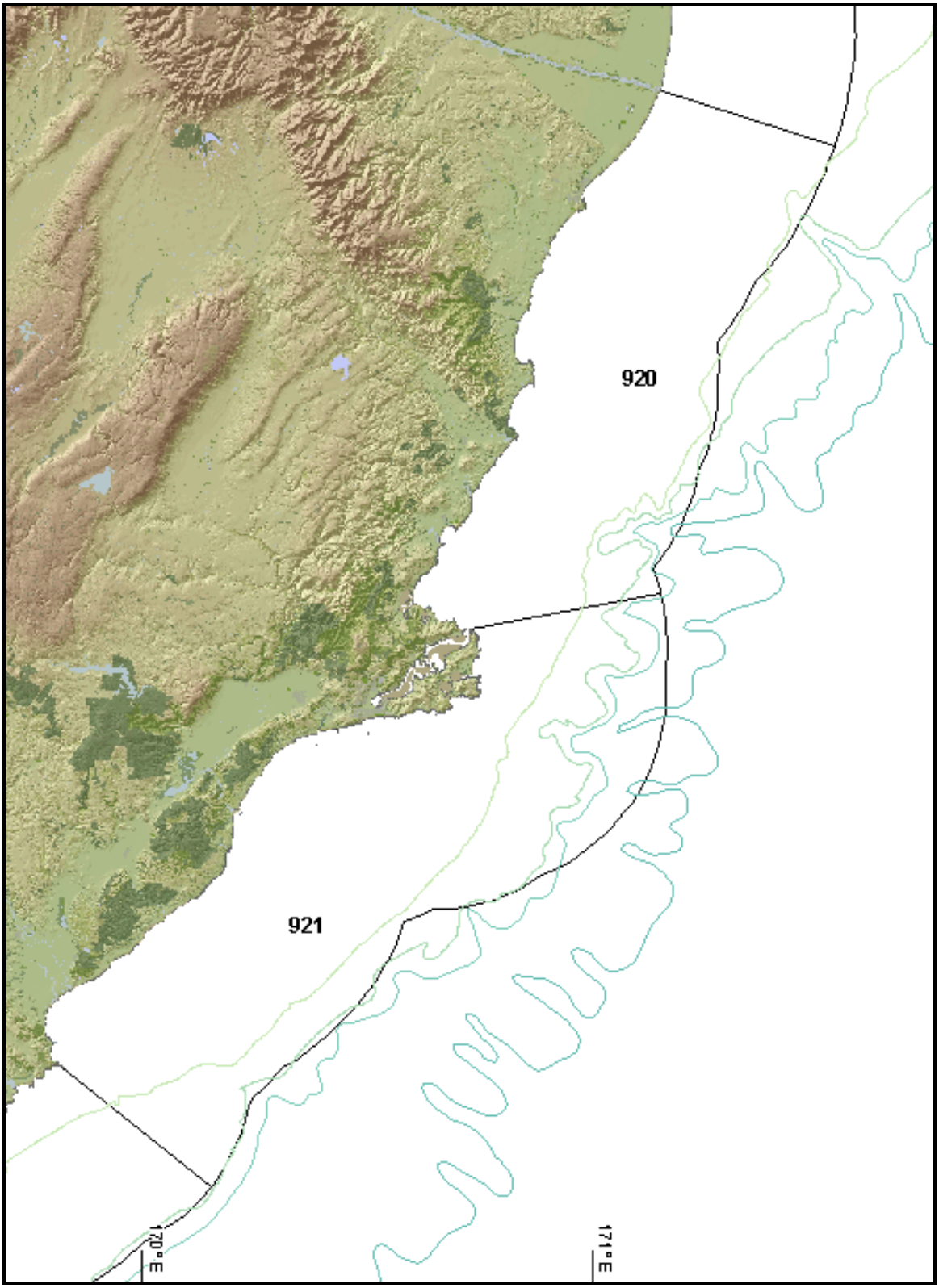

Figure F2: Ministry of Fisheries fisheries rock lobster statistical area CRA920 and 921

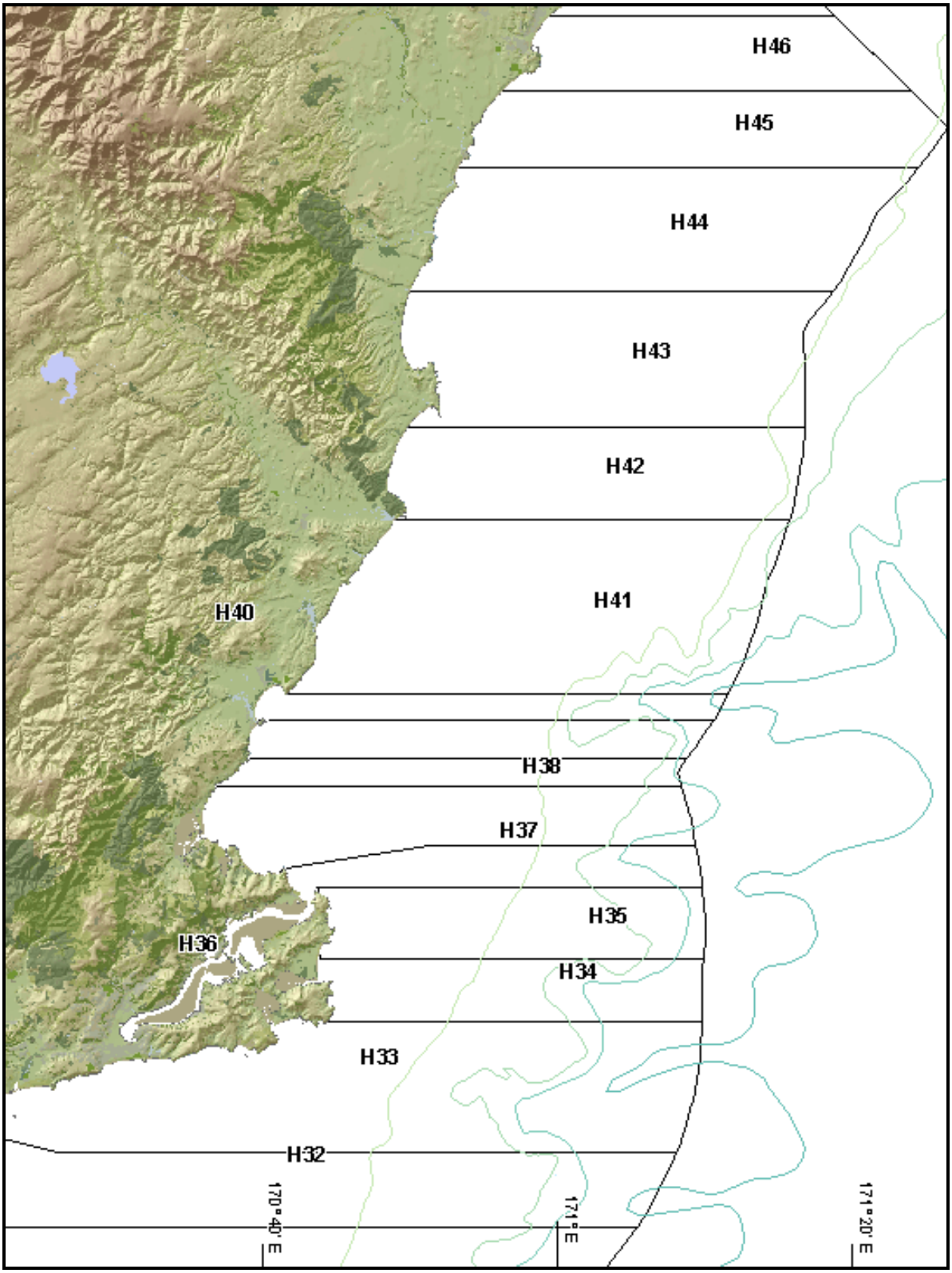

Figure F3: Ministry of Fisheries paua statistical areas H32 to H46

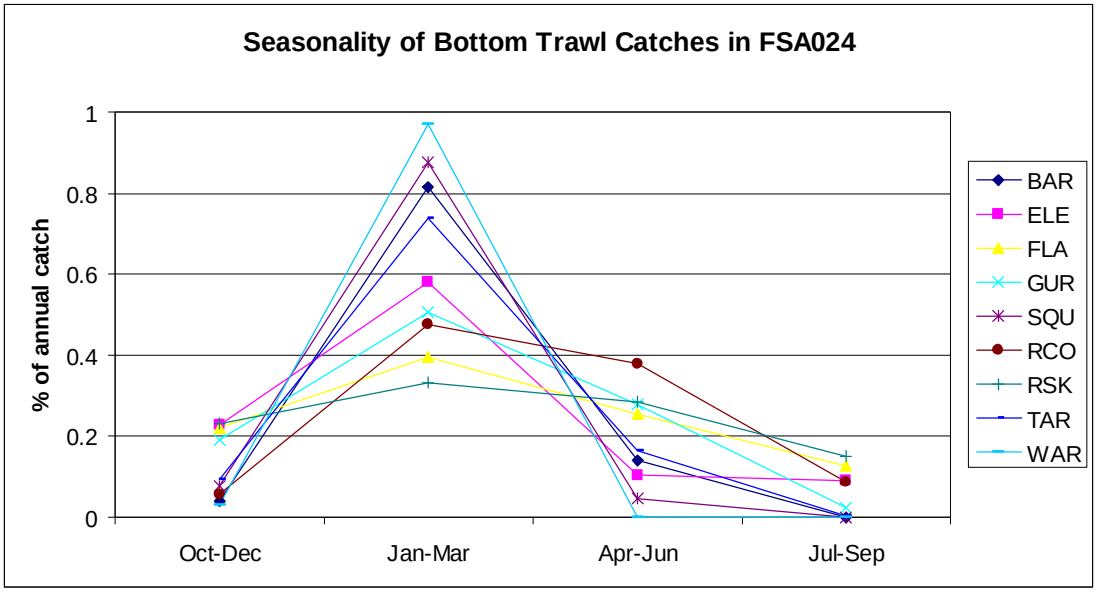

Figure F4: Seasonality of species catches in the trawl fishery in FSA024

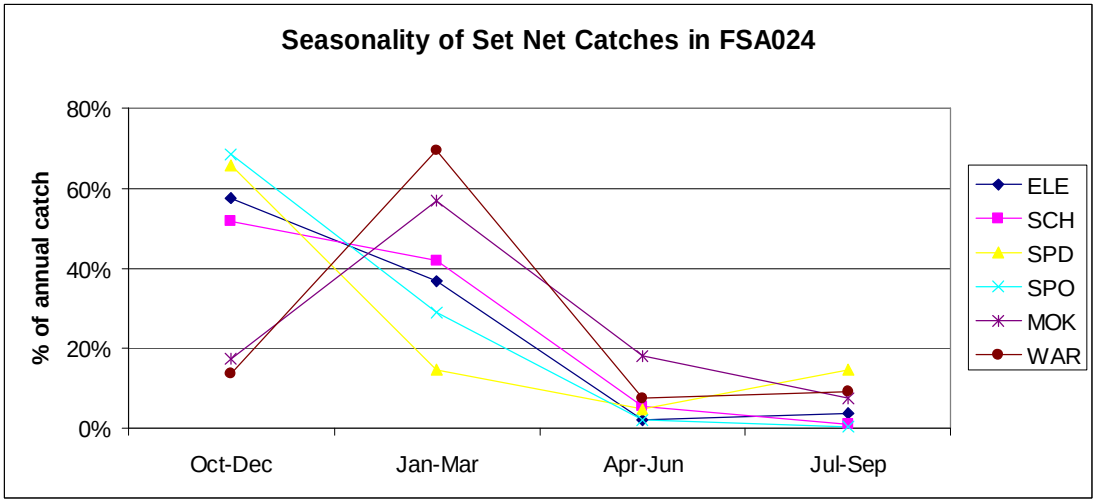

Figure F5: Seasonality of species catches in the set net fishery in FSA024

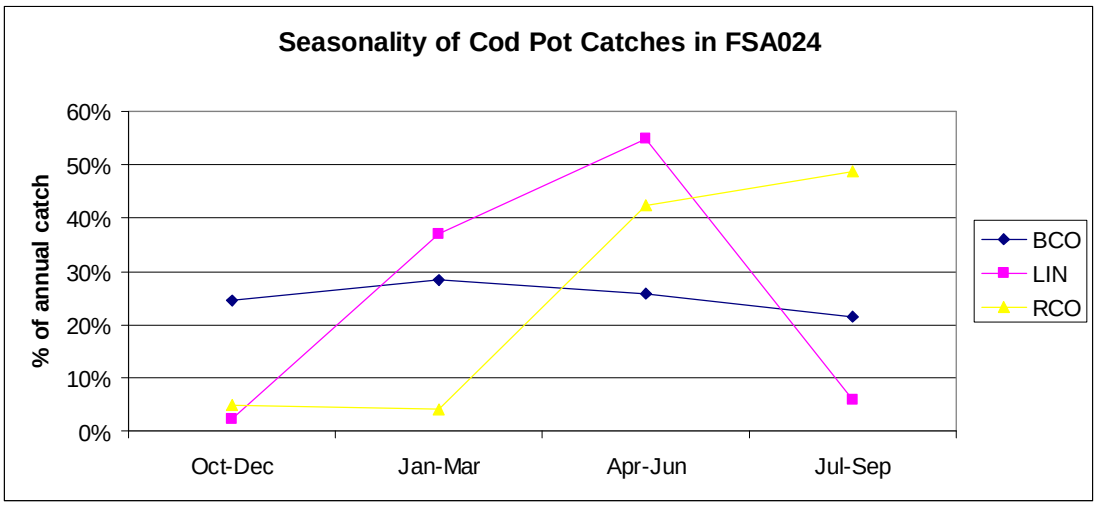

Figure F6: Seasonality of species catches in the cod pot fishery in FSA024