BEFORE THE OTAGO REGIONAL COUNCIL

IN THE MATTER	of the Resource Management Act 1991
AND	
IN THE MATTER	of an application for resource consents for Project Next Generation
BY	**PORT OTAGO LIMITED**
	Applicant

STATEMENT OF EVIDENCE OF RICHARD OWEN BOYD
ON BEHALF OF PORT OTAGO LIMITED
Date 7 April 2011

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INTRODUCTION, QUALIFICATIONS & EXPERIENCE

1. My full name is Richard Owen Boyd. I am presently a Director of and principal consultant to Boyd Fisheries Consultants Limited. I provide advice to clients in the fields of fisheries research, fisheries resource assessments, and related environmental assessments.

2. I have nearly 40 years experience in fisheries science, research and related management issues. From 1972 until 1978 I was employed by the Fisheries Service of Environment Canada in Vancouver as a fisheries biologist. From 1978 until 1989 I was employed by the Ministry of Agriculture and Fisheries in Auckland, initially as a fisheries scientist and later as Scientist in Charge of the Auckland Region. Since 1989 I have worked as a fisheries consultant and I have undertaken projects for the Ministry of Research, Science and Technology, Ministry of Fisheries, Ministry of Foreign Affairs and Trade, New Zealand Seafood Industry Council, New Zealand Federation of Commercial Fishermen, Te Ohu Kai Moana, amongst others.

3. Projects involving fisheries environmental assessments that I have undertaken in relation to dredging, disposal, deposits on the seabed or disturbance of the seabed include Ports of Auckland dredge disposal in the Hauraki Gulf; Maui B oil extraction west coast North Island; proposed Clifford Bay ferry terminal; proposed Granity offshore coal terminal; proposed Pegasus Bay marine farms; and proposed Tasman Bay marine farms,. I am currently undertaking an ecological risk assessment of the hoki fishery which is New Zealand's largest commercial fishery. This work includes assessing the impacts on all ecosystem components affected by the target hoki fishery, including other fishes, seabirds, marine mammals and the seabed.

4. I have appeared as an expert witness on fisheries matters before the Environment Court, the District Court, the High Court and the Waitangi Tribunal.

5. I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Consolidated Practice Note 2006 (updated in 2011) and I agree to comply with it. I have complied with in the preparation of this evidence.

BACKGROUND INFORMATION

6. I was engaged by Port Otago Limited (POL) in 2007 to provide fisheries technical advice in relation to the feasibility studies that led to Project Next Generation. I was subsequently engaged to provide fisheries assessments in relation to Project Next Generation. Reports I prepared or contributed to the preparation of for POL and which are part of the consent documentation are:

- Boyd, R.O. (2008) Fisheries resources in Otago Harbour and on the adjacent coast. Report for Port Otago Limited. December 2008. 41p.
- James, M., Probert, K., Boyd, R., Sagar, P. (2009) Biological resources of Otago Harbour and offshore: assessment of effects of proposed dredging and disposal by Port Otago Ltd. NIWA Client Report 2008-152. August 2009. 87p.
- James, M., Boyd, R., Probert, K. (2010) Information on key species of interest to Ngai Tahu – Supplementary paper for Next Generation Project May 2010. 29p.

SCOPE OF EVIDENCE

7. I have been asked by POL to prepare evidence on the fishery related issues associated with Project Next Generation, including:

a. The fisheries environment and fisheries habitats found in Otago Harbour and on the adjacent coast.

b. The fish and shellfish fauna of Otago Harbour and coastal Otago.

c. Recreational, commercial and customary utilisation of fish and shellfish resources of the area.

d. Areas of importance to fish spawning and juvenile fish.

e. Habitats and diet of fish.

f. Effects of the project on fisheries.

g. My responses to submitters.

8. I will summarise the findings of the report I prepared for POL and will supplement that with additional information aimed at assisting understanding of the nature of fishery resources and their potential interaction with the habitats likely to be impacted by POL's proposal. I will also update data on the commercial fishery and provide some additional contextual information.

EXECUTIVE SUMMARY

9. The waters of Otago Harbour and the adjacent coast support a diverse array of fish and shellfish resources.

10. The Otago fish and shellfish fauna is made up of species that are common throughout central New Zealand waters.

11. In Otago, sheltered harbours and protected inshore waters tend to be the areas where the greatest number of eggs, larvae and juvenile fish of many inshore species are found.

12. Based on the distribution of fish eggs on the Otago coast, spawning of inshore fish species occurs all along the Otago coast. There is no evidence of discrete spawning areas of common species at or adjacent to the areas to be dredged within Otago Harbour or at the proposed inshore or offshore disposal sites.

13. Otago Harbour has what is believed to be the largest population of the cockle *Austrovenus stutchburyi* in New Zealand. This is currently being experimentally harvested at two sites under a special permit issued to Southern Clams Limited under the Fisheries Act 1996 for research purposes. The special permit allows the sale of the experimentally harvested cockles notwithstanding that commercial harvesting of cockles in Otago Harbour is otherwise prohibited under Fisheries Regulations.

14. Recreational, commercial and customary fisheries occur throughout Otago, including within Otago Harbour and along the open coast. These fisheries harvest common and abundant species that are widespread on the continental shelf all along the east coast of the South Island. The taking of fish is managed under the 1996 Fisheries Act with a wide range of management measures in place for

commercial, recreational and customary harvesting including such controls as quotas, gear restrictions, and seasonal closures.

15. Within Otago Harbour as a whole, effects of the dredging including suspended sediments and sedimentation on fish and shellfish resources will be localised and minor. This conclusion is based on the expected concentration and distribution of suspended sediments and any resulting sedimentation reported in the hydrodynamic modelling presented in Dr Bell's evidence.

16. The loss of fisheries habitat and in particular of cockle habitat within Otago Harbour will be minor.

17. The effects of dredged material disposal at Site A0 will not be significant, and have been well mitigated by the site selection process.

18. On the open coast localised effects on benthic fauna on which fish feed at the disposal site A0 and to the immediate north are not significant to the very wide distribution of coastal fishery resources and fishing effort and the availability of similar habitats where fish may feed throughout the continental shelf on the Otago coast and to the north.

19. Most of the effects will be confined to the period of dredging and disposal but have been minimised by careful design of the new channel alignment, the proposed dredging strategy and the selection of disposal sites. Effects on fisheries resources from the use of POL's *New Era* for incremental capital dredging will be very small and will affect a very small area around the dredge and disposal sites. Some effects from the use of a large contract dredger will be greater and will extend over a larger area within Otago Harbour and north of disposal site A0.

20. Overall, effects of the proposed dredging and disposal on fishery resources and fishing in coastal Otago will be minor whether it is undertaken by a large contract dredger or POL's *New Era*. This conclusion is based on the wide coastal distribution fish stocks and the correspondingly widely distributed fisheries for these species along the east coast of the South Island. I believe that the draft consent conditions and proposed environmental management plan address all of the relevant issues associated with potential effects on fisheries.

THE PROPOSAL

21. My evidence relates to the Project Next Generation proposals to:

    a. deepen and widen by dredging the Otago Harbour channel, swinging areas and berths, and

    b. dispose of dredge material at sea.

THE SITE AND ITS CONTEXT

22. The proposal affects the following areas. Within Otago Harbour the shipping channel up to and including the swinging area at Port Chalmers will be dredged. On the open coast outside Otago Harbour the dredged material will be disposed of at four locations: three disposal sites currently consented for the disposal of maintenance dredgings lying in shallow inshore waters between Heyward Point and the Harbour entrance, and one new offshore site A0 centred at a point approximately 6.3 kilometres northeast of Taiaroa Head in a depth of about 27 metres.

23. In a fisheries context, the dredging and the disposal sites are very different.

24. Otago Harbour is a large, shallow enclosed body of water and is one of four large harbours on the east coast of the South Island. The main harbour channel is subject to strong tidal flows. Substrates within the harbour are mostly fine sand and silts that are frequently mobilised by wind, waves and tidal flows so that Otago Harbour waters are often turbid. Although the waters of Otago Harbour are enclosed, its shallow nature means that a significant proportion of Harbour waters are flushed out and exchanged on each tidal cycle.

25. The marine environment within both upper and lower Otago Harbour has been extensively modified by human development over many years including dredging, significant areas of reclamation of the foreshore, the training wall, the Mole and various shoreline works, many of which are not associated with the port's activities. The swinging basin, harbour channel and harbour entrance where the proposed dredging will occur have all been modified by previous

capital dredging works and there is ongoing maintenance dredging of the shipping channel to maintain access to the port.

26. The proposed disposal sites all lie on the open coast. The three current maintenance disposal grounds are relatively close to the coast in nearshore waters lying off Heyward Point and Aramoana. The sites at Heyward Point and Aramoana are in form of small sand hills. Nearshore sediments in these areas are predominantly medium to fine sands.

27. The new disposal site A0 lies near the distal end of the 'Peninsula Spit' as described by Dr Single. A0 is 2 km in diameter and covers an area of about 3.1 km^2. Fine sands dominate the sediments of this general area with very fine sands and silts dominating the central region of Blueskin Bay.

EVIDENCE

THE FISHERIES ENVIRONMENT

28. In this part of my evidence I briefly describe the environmental features of Otago Harbour and the Otago coast that shape the fisheries resources and fishing activities of the area. A more detailed description of the physical characteristics of the sites is provided in the evidence of Dr Single.

29. Otago Harbour is one of only a handful of large sheltered marine harbours in southern New Zealand, although there are a number of smaller sheltered inlets and harbours on the northern and southern sides of Otago Peninsula with similar habitats. 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.

30. Other than the main shipping channel, most of Otago Harbour is less than 3 m deep at low tide with extensive areas of the harbour exposed at low tide. The Harbour's seabed is predominantly sandy with some areas of muddy sands in sheltered areas. The seabed community is made up of a mosaic of different seafloor habitat types (Paavo & Probert 2008). The harbour also contains limited areas of rocky shores and shallow rocky reefs.

31. Overall, the relatively large size of Otago Harbour with its shallow, sheltered waters, extensive intertidal flats and varied seabed habitat types makes it a valuable shallow water habitat for many kinds of fish and shellfish. The variety of shallow water habitats, including areas of seagrass beds, provides refuge for small and juvenile fishes. Adult and juvenile fishes of a number of coastal species enter the harbour on each tidal cycle to forage for food.

32. Outside Otago Harbour the open coast is varied. Stretches of rocky shores are interspersed with sandy surf swept beaches. Near Otago Peninsula, the continental shelf is mostly relatively shallow and gently sloping out to the shelf edge at about 20 – 30 km from shore. Much of the seabed outside of the near shore environment is comprised of soft sediments. North of Otago Peninsula, Blueskin Bay is more sheltered than other parts of the Otago coast due to the protection from prevailing southwest winds that the peninsula provides.

33. 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. These types of habitats are typical of those found along the east coast of the South Island.

34. However, in a fisheries context, it is necessary to consider both the dredge and disposal sites within the overall coastal area that local fish and shellfish populations occupy.

35. Although habitat type is a key factor in the distribution of fish and shellfish, the aquatic environment within which they are found and can freely move about in means there are no clear boundaries to their populations. Fishes are highly mobile. Many fishes found within Otago Harbour are transients, moving in and out with each tidal cycle. However, some fishes would remain in the Harbour's channels at low tide. On the open coast most fish species show seasonal movements over considerable distances which may be associated with seasonal feeding patterns or reproduction. Movements may be inshore/offshore or along the coast.

36. Therefore, fish presence and abundance at any given location, whether within Otago Harbour or on the open coast, tends to be highly dynamic. This is particularly so where the benthic habitat is relatively

flat and uniform, unlike rocky shores and sea beds where many microhabitats exist and where some fishes may be resident year-round. Sessile species such as shellfish that are attached to the seabed or live as adults within the substrate have larval forms that occur in the plankton and so their young are transported as they drift with the currents, making these species also mobile over time.

THE FISH AND SHELLFISH FAUNA OF OTAGO

Species Composition

37. Knowledge of the fish and shellfish fauna of Otago Harbour and coastal Otago comes from a variety of sources. This includes more than a century of research and study on marine species through the Portobello Marine Laboratory and knowledge gained through the Otago commercial fishery and related Ministry of Fisheries' research programmes. Much of the knowledge of many of fisheries resources throughout New Zealand is documented and summarised in the annual Ministry of Fisheries Plenary Reports (Ministry of Fisheries, Science Group (Comps.) 2009a, 2009b). Two Plenary reports are published each year (May and November) covering all of the managed species. These documents total more than 1200 pages. These together with other literature on New Zealand and Otago fish and shellfish fauna (Graham 1953, Ayling & Cox 1982, Paulin *et al.* 1989) show that the fish and shellfish fauna of coastal Otago is comprised of species that are both widespread and common throughout similar environments in central and southern New Zealand.

38. My report prepared for POL (Boyd 2008) lists nearly 200 species of fish and shellfish known to occur in Otago coastal waters. However, this should not be considered as a necessarily "complete" list of all species likely to be present. In that regard, the New Zealand Inventory of Biodiversity, Volume One (Gordon 2009) lists 1174 known species of fishes in New Zealand and notes that about 20 new species of fish are being discovered each year.

Species Distribution

39. The majority of New Zealand's fishes are widespread with distributions that include both North and South Island coastal waters, including Otago. Inshore or coastal species are those that inhabit waters out to the edge of the continental shelf at about 200 m depth. Within this inshore or coastal area there are three broad types of habitats, each with a characteristic fauna: rocky shores and deeper reefs; the flatter uniform sand and silty seafloor which usually extends out to the edge of the continental shelf; and the pelagic zone which incorporates the waters that lie well above the bottom up to the surface.

40. Typical fauna of the rocky shores and reefs are paua, rock lobsters and blue cod and in deeper waters the hapuku. These species occur throughout New Zealand, although paua and blue cod are most abundant around the South Island.

41. Typical continental shelf fauna of the sand and mud seafloors include many of the well known commercial demersal (bottom dwelling) species such as flatfishes, elephant fish, various sharks, red cod, skates, and gurnard, and in deeper waters the ling. All of these species are abundant throughout New Zealand although there is some variation in areas of highest abundance.

42. Pelagic or off bottom species found in Otago waters include barracouta, jack mackerels, sprats, and squid and again these species are widely distributed in New Zealand waters. Some species such as barracouta and red cod are pelagic some of the time and demersal at other times.

43. In summary, both scientific studies and fishery data indicate the following:

    a. There is a diverse fish fauna in Otago Harbour and coastal Otago.

    b. The fauna is predominantly comprised of common and abundant species that are present in similar habitats throughout much of the central and southern regions of New Zealand.

    c. The cockle population in Otago Harbour is believed to be the largest in New Zealand although there are substantial

populations in all of New Zealand's large tidal harbours and smaller but important populations in the other harbours around Otago Peninsula.

d. There are no special habitats or unusual features of the Otago coast or marine environment that are unique in fisheries terms.

44. The fact that the fish and shellfish fauna of the Otago area are comprised of common and widespread species is expected as the Otago coast is comprised of typical inshore habitats, is not isolated by geography from either the north or the south, and the waters along the eastern shelf of the South island are linked by the Southland current.

UTILISATION OF OTAGO FISHERY RESOURCES

RECREATIONAL FISHERIES

45. The most detailed source of information on recreational fishing within Otago Harbour and on the adjacent coast comes from a diary survey of recreational anglers undertaken for the Ministry of Fisheries in 1998 (Bell 1998). The survey area incorporated all of Otago Harbour and the adjacent coastal area from Heyward Point to Hoopers Inlet. A total of 498 recreational fishers maintained a detailed diary of their fishing over a full 12 month period, recording a total of 6020 fishing trips.

46. Key results from Bell (1998) are as follows:

a. 75% of all fishing trips were made in the summer months of December to March with most of the remaining trips in November and April (Figure 1)

b. 58% of all trips involved using a rod/line from a boat and 39% a rod/line from shore with less than 4% using other methods (Figure 2)

c. More than 88% of all fishing trips targeted salmon, 5% targeted blue cod and the remaining 7% targeted other species (Figure 3)

d. Although salmon was the most frequently targeted species, barracouta and blue cod were the main fishes caught with salmon comprising only 10% of the fish catch (Figure 4)

e. Cockles and mussels made up the bulk of shellfish harvested, followed by tuatua and paua (Figure 5).

47. Diarists also recorded the areas they fished. Figure 6 shows the number of trips and percentage of all fishing trips by diary zone. Figure 7 shows a computer generated graphic of the distribution of fishing effort targeting salmon and Figure 8 shows the number of salmon caught by diary zone.

48. In summary, Bell's (1998) diary survey shows that the salmon fishery in and around the harbour entrance and along the shipping channel is a major focus of recreational fishing effort in Otago Harbour in the summer months.

49. Fishing for other species in the harbour is mainly focused on shellfish gathering and flounder fishing. 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.

50. Bell's (1998) study did not include waters north of Heyward Point outside of Otago Harbour. The Ministry of Fisheries has conducted a number of regional and national recreational fishing surveys with the purpose of estimating recreational harvests by quota management area (QMA) (Teirney *et al.* 1997, Bradford 1998, Boyd & Reilly 2004). QMAs include much larger areas than coastal Otago. However, Fisher & Bradford (1998) analysed catch and effort results from the 1996 national survey by fishing zone. The Otago zone in the national surveys covered the coast from Waitaki River to Tokomairiro River and will have included fishing in Otago Harbour as well as on the open coast. In descending order, salmon, butterfish, blue cod and flatfish were the most targeted finfish species and blue cod, flatfish, sea perch, dogfish, wrasses, salmon and red cod were the main finfish species caught with the blue cod catch more than 10 times the next most caught fish. Cockles, oysters, paua and mussels were the main shellfish species harvested.

51. A small number of charter vessels for recreational fishers have traditionally operated from Karitane and Moeraki and occasionally from Otago Harbour concentrating mainly on blue cod and groper but also targeting rock lobster and paua when conditions are suitable.

52. While the 1998 Bell survey of recreational fishing in and around Otago Harbour is dated, anecdotal information indicates that there have been no significant changes in recreational fishing patterns since that time. Salmon remains a major focus of recreational fishing effort within Otago Harbour and blue cod remains the finfish species of most interest on the open coast. Within all of harbours of Otago Peninsula, cockles and flatfish are important species and paua and rock lobster are important along rocky coastlines on the open coast.

COMMERCIAL FISHERIES

Background

53. Commercial fishery catch data and fisheries research programmes on commercial species are collected on a scale that is appropriate to the distribution of fish stocks and fisheries on them. Most fish stocks and fisheries occur over large areas of the coast. With the exception of some shellfisheries, data is not available on a local scale for areas as small as Blueskin Bay or the immediate vicinity of the proposed disposal site A0. Describing Otago's present commercial fisheries in the area of the POL application areas therefore relies on research undertaken on the wider fishery and knowledge of the relevant fisheries research information collected on the fish stocks involved. There is no single source of useful information and both the scientific literature and the fishery specific data are derived from a wide variety of sources.

54. Almost all New Zealand commercial fisheries are now managed through the quota management system (QMS) based on individual transferable quotas and where individual operators must hold annual catch entitlements (ACE) in order to fish. There are different quota management areas for different species. Separately from the QMS and quota management areas, the Ministry of Fisheries also requires commercial fishers to report their catches by fishery statistical area on detailed catch effort fishing returns. A variety of different forms are in use depending on the fishery and the level of detail varies depending on the catch return form in use for each fishing method. Statistical areas in which catch and effort data are recorded also vary according to the species.

55. Figure 9 shows the quota management areas for flatfish – one of the main inshore commercial fishes targeted by trawlers in coastal Otago. Under the QMS, vessels fishing for FLA3 (flatfish) in Otago can fish anywhere in the FLA3 quota management area for their FLA3 ACE. Flatfish under the QMS includes 8 separate flatfish species including the soles, the flounders, brill and turbot which are managed together as a species group. Soles and sand flounder make up most of the Otago flatfish catch.

56. Figure 10 shows the general statistical areas for which catch and effort data is collected from inshore vessels fishing for wetfish species. Fisheries statistical area 24 (FSA24) includes waters from Oamaru to Taieri Island and well offshore. A vessel trawling for flatfish in Blueskin Bay would report his area of fishing as FSA24 on his fishing return. FSA24 is within the FLA3 area.

57. Figure 11 shows the CRA7 (Otago) quota management area for rock lobsters and rock lobster statistical areas 920 and 921 which include most, but not all of the CRA7 fishery.

58. Figure 12 shows the PAU5D quota management area for paua.

59. As can be seen from Figures 9-12, the scale at which most fisheries are managed and data collected is very large compared to the areas described in POL's consent applications. This reflects the widespread distribution of fish species and fish populations. It means that fisheries data on a local scale is generally not available unless there has been detailed research on a particular part of the coast. There has been little site specific research on commercial fisheries undertaken in Otago waters by the Ministry of Fisheries. Most of the research knowledge that is available comes from research on these resources and the species concerned that has been undertaken throughout New Zealand and in other coastal areas over the past 50 years.

60. Commencing 1 October 2007, inshore trawlers have been required to report the start position of each trawl on their fishing returns but there is no information on the direction taken from the start point. This information is available under the Official Information Act but the data is not publicly available at a scale useful for the purposes of this assessment. Confidentiality requirements relating to information provided on commercial fishing returns means that the Ministry of

Fisheries summarises the information in 6 minute grid squares (approximately 6 X 6 nautical miles) and not at all if the data for a particular time period, species and grid relates to less than 3 vessels. Combined with the fact that the direction of the trawl is not known and that an average trawl covers more than 9 nautical miles (• 3 hours at • 3+ knots) there is a loss of almost all of the potentially useful information at a scale relevant to the POL application. Accordingly, I have not requested this information from the Ministry for my assessment.

61. Under the Fisheries Act 1996, there are comprehensive national and regional fisheries management measures in place that include the Quota Management System for commercial fisheries, daily personal quotas for recreational fishers, fishing method, gear and area restrictions for recreational and commercial fisheries and protection for customary fisheries. Appendices 1 and 2 attached to my evidence give details of local Otago fishing regulations governing commercial and recreational fishing respectively that are additional to national or regional regulations on quotas, methods, seasons etc.

62. Local area restrictions affecting Otago commercial fishing include closures to commercial paua and kina fishing along some stretches of the Otago coast and the closure of Otago Harbour to all commercial shellfishing except rock lobster, oysters and crabs. Under the Fisheries Act 1996 The East Otago Taiapure has been established in the inner part of Blueskin Bay. Taiapure are areas of special significance to Iwi for food or spiritual purposes and have a management committee charged with making recommendations to the Minister of Fisheries on their management. As a result of recommendations from the East Otago Taiapure management committee, regulations banning the taking or possession of cockles and paua from parts of the Taiapure were introduced in 2010.

63. In 2009, new fisheries regulations were introduced to protect Hector's dolphins along the entire east coast of the South Island. These regulations now prohibit all trawling (except using a low headline-height trawl net) within 2 nautical miles of high water mark and prohibit all set netting within four nautical miles of high water mark between Clarence River and Slope Point.

Otago's Commercial Fisheries

64. Most of what we know about Otago's coastal fishery resources comes from information derived from the commercial fishery.

65. There is a long history of commercial fishing in coastal Otago with the development of the fishery closely linked to the growth in the population in the early to mid 20th century. Industrialisation of the fishery commenced with steam trawling in the early 20th century. Development of the fishery peaked in the decade following the declaration of New Zealand's exclusive economic zone in 1978.

66. As a result of economic influences and progressive rationalisation within the New Zealand seafood industry as a whole, the commercial fishing industry in Otago coastal waters has evolved over the past two decades into two distinct components. One is a relatively small local fleet of inshore vessels and fishers domiciled in Otago ports that predominantly fish local waters year round. They concentrate on three species or species groups; wetfish (mainly trawling but also cod potting, set netting and lining), rock lobster (potting), and paua (diving). The second component consists of larger vessels (almost all trawlers) operated mostly by larger companies out of other ports that fish all along the east coast of the South Island, including Otago waters from time to time.

67. Separately from the conventional commercial fisheries listed above, one company, Southern Clams Limited, conducts a commercial cockle harvesting operation, now based entirely in Waitati Inlet. Previous commercial harvesting of cockles from Papanui Inlet by the same company has ceased due to ongoing water quality problems.

68. The annual harvest of cockles exceeds the catch of any other single species in FSA24. Commercial seaweed (the bladder kelp *Macrocystis pyrifera*) harvesting has recently been approved on the east coast of the South Island including in Otago waters. It is not yet clear where along the coast the bulk of this new harvest will occur.

69. The report I prepared for POL in 2008 (Boyd 2008) provides detailed tables of the commercial catches on the Otago coast. A report prepared for Otago Regional Council (Beentjes & Cole, 2002) and that

the Regional Council will have on its files provides additional information on commercial fishing in the Otago Regional Council marine coastal boundaries. Little change in commercial fishing in the area has taken place since then. The estimated commercial catch of all species (excluding rock lobster and paua) in FSA024 over the three year period 2004–05 to 2006–07 averaged more than 3,600 tonnes annually[1] (Boyd 2008). Cockles accounted for 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 account for the remaining 8.5% of the total catch (Figure 13).

70. Bottom trawling took 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 (Figure 14). There was an average of more than 2,600 vessel days fished by all methods in FSA24, with bottom trawling accounting for nearly half of the total vessel days.

71. The catch composition of the smaller inshore commercial vessels that fish mainly on the continental shelf inside 200 m depth is somewhat different than the overall catch. A range of fishing methods is used. Trawling accounts for most of the catch, but cod potting, lining and set netting are also employed.

72. Figure 15 shows areas of foul ground (rocky seabed) along the Otago coastline. Areas of foul will tend to be areas where rock lobsters are found and areas with no foul are where trawl vessels may be able to operate. The static methods of cod potting, lining and set netting can take place over both foul and soft seabed.

73. Flatfish is a major target for inshore trawlers. In Otago, the main flatfish species harvested are (in descending order of catch) lemon sole, New Zealand sole (also known as common sole or English sole)

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[1] In the course of preparing this evidence I have checked more recent commercial catches for the years 2008-09 and 2009-10 and there is little change in the annual catch of the main species for these most recent two years compared to the data presented in the tables in my 2008 report.

and sand flounder, but some greenback flounder and brill are also caught. Other important species include spiny dogfish, rough skate, red cod, elephant fish, school shark, gurnard and rig. Ling is targeted in deeper waters on the continental slope. A recent report characterising the flatfish fishery in the FLA3 area (Beentjes & Manning, 2010) indicates that flatfish are most commonly targeted between about 8 to 15 m depth, and not deeper than 50 m, that most vessels that target flatfish by trawl tend to make trips of only one to two days, and that flatfish can only be trawled on soft or sandy bottoms because of the nature of the trawl gear used. Beentjes & Manning (2010) also summarised research trawl survey findings that show distinct depth ranges for flatfish species. Sand flounder inhabit the shallow coastal areas inside 10 m depth, New Zealand sole occur predominantly in 10 to 30 m depth and lemon sole distribution extends from 10 m to deeper waters. They also found evidence of large fluctuations in annual abundance of these three flatfish species.

74. The rock lobster arguably supports the most valuable inshore commercial fishery in Otago waters. Since 2000, catches from the Otago rock lobster fishery were in the range of 90 to 136 tonnes annually until the 2010-2011 fishing year (ending 31 April 2011) which showed a significant drop in catch due to low catch rates and a reduced quota. The Minister of Fisheries has just announced a further reduction in the CRA7 quota to 75.7 tonnes that will apply for the 2011-12 fishing year. Historically, between half and two-thirds of the Otago rock lobster catch comes from north of Otago Peninsula – almost all of this coming from Karitane northward. Multipurpose inshore vessels have always been a feature of the Otago inshore fishery and some of the vessels that fish for rock lobster in the winter months switch to wetfish for the summer when the rock lobster season is over.

75. There is a relatively small commercial paua fishery in the area around Otago Peninsula. The paua fishery around Otago Peninsula is part of the PAU5D stock under the QMS. The PAU5D area includes the coast from the Waitaki River to the Waiau River. Paua statistical areas are very much smaller than those used for wetfish and this provides more fine scale detail on the most productive paua producing areas.

76. Due to confidentiality requirements, data on the most recent annual catches in some of the statistical areas around Otago Peninsula are withheld by the Ministry of Fisheries because too few fishers operate in the area. However, total catches over the past 9 years are available because enough years and vessels are involved to meet the confidentiality test. The distribution of catches for the years 1995 to 2010 in all of PAU5D is shown in Figure 16.

77. A more detailed view of the paua statistical areas is shown in Figure 17 and the catch data for the areas around Otago Peninsula and to the north for the past 15 years are given in Table 1.

78. From Table 1, the annual commercial paua harvest around Otago Peninsula in paua statistical areas H35 to H37 (Wickliffe Bay in the south to Heyward Point in the north) has averaged 1,325 kg per year in the past 15 years (19,873 kg total) but with most of this coming from south of the Otago Harbour entrance (i.e., area H35). Average daily catch rates reported for the PAU5D fishery for the period 2000 to 2004 (the most recent data published) ranged from 108 to 120 kg per diver day Ministry of Fisheries, Science Group (Comps.) (2009a), which suggests that the average annual catch of 1,325 kg of paua from Wickliffe Bay to Heyward Point likely involves about 11-12 diver days annually.

79. No catch has been recorded in H38 and data for H39 and H40 (up to Cornish Head) is withheld. It is likely the catch in H39 and H40 is very small as a portion of the coastline in these areas is closed to commercial paua harvesting.

80. Figure 17 and Table 1 show that the main paua catch north of Otago Peninsula comes from the extensive reefs and rocky shoreline around Shag Point and Moeraki.

81. In respect of Otago Harbour itself, my research and discussions with industry indicates that there is presently no commercial fishing taking place within Otago Harbour. By Regulation all commercial shellfishing except for rock lobster, oysters and paddle crab is prohibited in Otago Harbour. This could change in the future but I am not aware that the Ministry of Fisheries has any active proposals in this regard. Southern Clams Limited was granted a special permit issued under s67 of the Fisheries Act 1996 in 2010 to investigate the cockle resource in Otago

Harbour with the stated aim[2] of being able to commercially harvest cockles from Otago Harbour in the future. Under the special permit Southern Clams Limited is able to sell cockles they are harvesting experimentally. From discussions with Ministry of Fisheries I understand the special permit expires on 31 August 2012 with a potential for an extension or renewal for a further 2 years.

82. Overall, the wetfish fishery in FSA24, including Blueskin Bay and the waters around Otago Peninsula, is part of a continuous coastal fishery that extends all along the eastern seaboard of the South Island. If we look at the commercial catch in all of the statistical areas from Canterbury to Southland, the species mix is very similar. Catches in FSA24 make up between 5% and 15% of the total inshore catch of each of the main species caught from Canterbury to Southland. Figures 18–22 illustrate the distribution of commercial catches of the three main flatfish species, elephant fish and blue cod caught by inshore vessels. These species are typical of the wetfish catch all along the east coast of the South Island. It shows that the Blueskin Bay fishery is a relatively small part of the fishery in FSA24 which in turn is part of a larger fishery extending along the entire east coast of the South Island.

83. The same situation exists for the rock lobster and paua fisheries which occur wherever there are suitable habitats along the east coast of the South Island.

84. However, on a regional level, the fishery in Blueskin Bay is very important to the survival of the smaller vessels that fish out of local ports, especially the small trawlers. These vessels are mostly too small to venture further afield. Many of these vessels supply the local Dunedin market and their economics are based on access to local fishing grounds. I discuss the potential impact on these small local vessels later in my evidence when I respond to fisheries matters raised by submitters.

CUSTOMARY FISHERIES

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[2] Southern Clams Limited submission on POL resource consent application (submitter 135)

85. In my 2008 report for POL (Boyd 2008) Port Otago I outlined the findings of the Waitangi Tribunal's Ngai Tahu Sea Fisheries Report (Waitangi Tribunal 1992) in respect of the significance of Otago's fisheries resources to Ngai Tahu. My report indicated that the information on customary fisheries would be revised after further consultation. A supplementary report that I subsequently co-authored (James *et al.* 2010) provides detailed information on the habitats, diets and tolerances of fish and shellfish species of particular interest to Ngai Tahu.

86. Te Rünanga o Ötäkou (Inc) applied for a Mätaitai for all of Otago Harbour in 2008 (excluding certain port activity areas) based on its traditional and current importance as an area for customary food gathering and kaitiakitanga. The Minister of Fisheries has not yet made a decision in respect of the application.

87. Tables 2 and 3 summarise the information on distribution, habitats and diets of the shellfish and fish species of key importance to Ngai Tahu.

Table 2. Distribution, habitat and diet of key shellfish species of interest to Ngai Tahu.

Species	Distribution	Main locations (Otago)	Habitat	Diet
Tuaki (cockle)	Throughout New Zealand on sheltered shallow softshores particularly in harbours, inlets and estuaries.	Large populations on sandflats of Otago Harbour, Waitati Inlet and Papanui Inlet. Largest populations in harbour found in intertidal area opposite Acheron and Tayler Points, around Aramoana and Harwood.	Mostly found in muddy sand from 10 cm water depth down to 6-8 m below littoral zone. Flourish between low and mid-tide levels. Can tolerate 0-85% fine mud/silt but prefers <10%. Condition reduces at SS of 3-400 mg/l. Can survive deposition of at least 3 cm.	Lives close to sediment surface and uses short siphons to feed on microphytobenthos and particulate red algae and *Ulva* or sealettuce in Otago region. Growth found to be higher where there is good water movement eg mouths of inlets/harbours.
Pipi	Throughout New Zealand but mostly on protected beaches, bays and estuaries as well as harbours	Pipi recorded as part of fine sand community in Otago Harbour, especially in areas of low organic detritus. Populations known to exist at Aramoana and other scattered locations.	Found below the surface on sandy flats, prefers areas with coarse shell/sand habitats with good water movement and little silt (<5%). Found intertidally and subtidally down to 10-12 m. Condition and feeding reduces at SS above 75 mg/l. Strong burrowers and can survive deposition of over 10 cm.	Pipi have longer siphons than cockles. They extract microscopic algae (diatoms, flagellates) and organic material from a range of sources in the overlying water.
Tuatua	Throughout New Zealand, but *P. donacina* on sandy beaches of eastern South Island such as Otago region. Generally considered a surf species.	Populations recorded near Aramoana and occasionally in recent surveys on northern side of channel from Acheron Point to Tayler Point and subtidally south-east of Port.	Below the surface on open beaches. Mostly found subtidally on open beaches in the surf zone. Little information on effects of sediments available for this species.	Tuatua have long siphons that can extend up to 3 cm through sediment. Like other suspension feeders they feed on microscopic algae and organic material in the overlying water.

Table 3. Distribution, habitat and diet of key fish species, rock lobster and paua.

Species	Distribution and Habitat	Diet	Locations
Sand flounder *Rhombosolea plebeian*	NZ wide. Sandy seabeds in coastal waters out to about 100 m depth.	Benthic invertebrates (e.g. polychaetes, crustaceans, echinoderms).	Abundant in the northern harbours, Hauraki Gulf, Firth of Thames, Tasman Bay and on the east coast of the South Island including Blueskin Bay and south of Otago Peninsula.
Common (NZ) sole *Peltorhamphus novaezeelandiae*	NZ wide. Demersal. Sand and muddy seabeds out to about 100 m depth.	Benthic invertebrates (e.g. polychaetes, crustaceans, echinoderms).	Abundant in open coastal waters around the West and East coasts of the South Island, including Blueskin Bay and south of Otago Peninsula.
Lemon sole *Pelotretis flavilatus*	NZ wide. Demersal. Sand and muddy seabeds out to about 100 m depth.	Benthic invertebrates (e.g. polychaetes, crustaceans, echinoderms).	Abundant in open coastal waters around the West and East coasts of the South Island, including Blueskin Bay and south of Otago Peninsula.
Greenback flounder *Rhobosolea tapirina*	NZ wide and Australia. Demersal. Silty sand substrates from estuaries and inshore waters down to 100 m depth. Juveniles occasionally entering rivers.	Benthic invertebrates (e.g. polychaetes, crustaceans, echinoderms).	Mainly found on east coast of South Island including Otago coastal waters but not abundant anywhere in its distribution.
Black flounder *Rhombosolea retiaria*	NZ wide. Demersal. Mud to sand seabeds, mainly coastal lakes, brackish or fresh waters with access to the sea. Also recorded from coastal waters to 50m.	Benthic invertebrates (e.g. polychaetes, crustaceans, echinoderms).	Not abundant but most common in fresh water lakes and lagoons NZ wide (e.g. Lakes Ellesmere and Onoke) but also found in small numbers in rivers and estuaries, including rivers such as the Kakanui in Otago.
Yellow belly flounder *Rhombosolea leporina*	NZ wide. Demersal. Especially protected harbours and estuaries with sand to mud seabeds but also shallow coastal waters down to about 50 m.	Benthic invertebrates (e.g. polychaetes, crustaceans, echinoderms).	Most abundant in the northern North Island harbours with some freshwater influence. Not abundant in the South Island but found in many estuaries and harbours such as Taieri mouth.

Barracouta *Thyrsites atun*	All oceans worldwide. Pelagic, schooling. Inhabits waters on continental shelves or around islands.	Predator. Feeds on pelagic crustaceans cephalopods and small fishes like anchovy and pilchard	Abundant and widespread throughout New Zealand including the continental shelf along the Otago coast.
Blue cod *Parapercis colias*	NZ wide. Demersal. On or near rocky seabeds to 150 m depth.	Small fish and crabs.	Most abundant in Southland and Chatham Islands but also an important species in Otago.
Blue moki *Latridopsis ciliaris*	New Zealand wide and southern Australia. Demersal. Over rocky and sand seabeds to 100 m.	Small benthic animals including polychaetes, crustaceans, echinoderms, molluscs.	Migrate annually to the upper east coast of the North Island to spawn. Found along the east coast of the South Island, including Otago
Butterfish *Odax pullus*	SW Pacific waters. Shallow inshore waters along the coastal fringe where rocks and brown algae are abundant.	Herbivore, preferentially feeding on brown algae. Animals in stomach contents are probably incidentally ingested with the algae.	Widely distributed throughout New Zealand but more abundant from Cook Strait south including Otago.
Hapuku *Polyprion oxygenios*	Circumpolar in southern hemisphere waters. Deepwater species. Adults demersal on rough ground from the central shelf to deeper waters. Juveniles are pelagic and occur in surface waters.	Predator. Feeds on barracouta and pilchards, in addition to various bottom-dwelling fish.	Widely distributed throughout New Zealand including Otago.
Ling *Genypterus blacodes*	Southern hemisphere. Demersal. Adults over mud and rocky seabeds in deeper waters of continental shelf and slope to 1000 m depth, juveniles in shallower coastal waters.	Predator. Feeds mainly on crustaceans such as Munida and scampi and also on fish.	Widely distributed in deep waters on the shelf edge throughout New Zealand including Otago.
Red cod *Pseudophycis bacchus*	SW Pacific waters. Demersal. Mainly over soft muddy or sandy bottoms, most abundant in 200-300 along the continental shelf but may also be found in shallower waters.	Feeds primarily on small fishes, cephalopods, crabs and other crustaceans.	Abundant and widely distributed throughout New Zealand but most abundant on the South Island east coast including Otago.
Red gurnard *Chelidonichthys umu*	Indo West Pacific. Coastal waters over sandy seabeds.	Crustaceans, cephalopods, small fishes.	Widely distributed throughout New Zealand. Abundant on the east coast of the South Island, including Otago.

Tarakihi *Nemadactylus macropterus*	Indo Pacific. Adults demersal on the continental shelf and upper slope to depths of 450 m. Juveniles tend to live near shallow reefs.	Polychaete worms, crustaceans, molluscs and echinoderms.	Tarakihi spawn in summer and autumn in several areas around New Zealand. The three main spawning grounds identified are Cape Runaway to East Cape, Kaikoura to Pegasus Bay, and the west coast of the South Island. Present along the Otago coast
Trumpeter *Latridopsis lineata*	Southern hemisphere. Over rocky reefs and seabeds.	Crustaceans, cephalopods, small fishes.	Most common around the southern half of the South Island including Otago but found as far north as the Bay of Plenty.
Red rock lobster (crayfish) *Jasus edwardsii*	NZ wide and southern Australia to 200 m depth. Widespread around all rocky coastlines.	Diet consists of small organisms with a preference for shellfish, crabs, seaweeds, small fish and sea urchins. Also a scavenger.	Abundant on all rocky coastlines around New Zealand. In Otago, found on all rocky shores but most abundant along rocky shorelines north of Blueskin Bay and south of Taiaroa Head.
Paua *Haliotis iris*	NZ wide. Rocky shores and reefs to 15 m depth.	An herbivore that feeds exclusively on unattached (drift) and attached macroalgae.	Widespread around all rocky shores but most abundant south of the middle of the North Island. Abundant along rocky shorelines and headlands of Otago.

88. The effects of dredging and disposal on fish and shellfish species, including the species above that are of interest to Ngai Tahu are dealt with later in my evidence

AREAS OF IMPORTANCE FOR INSHORE FISH SPAWNING AND JUVENILES

89. My 2008 report (Boyd 2008) and the supplementary report (James *et al.* 2010) summarises what is known about areas of importance for spawning, egg laying and juveniles. The published literature indicates 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. Otago

Harbour and the other smaller inlets around Otago Peninsula are typical of such areas.

90. Research by Roper & Jillett (1981) on larval, juvenile and adult flatfishes in Otago waters found that juvenile flatfishes were concentrated in finite nursery areas in the inlets of Otago Peninsula or very shallow waters of Blueskin Bay. Larvae of some flatfish species were found in Otago Harbour. The research found a strong depth–size relationship of the common flatfish species with juveniles in shallow waters and inlets and small adults in the shallow near–shore waters.

91. The available evidence from a number of studies suggests that adult flatfish feed and spawn on the open coast and that tidal currents bring some of the flatfish eggs and larvae into all of the Otago Peninsula harbours, including Otago Harbour, with the harbours important as nursery grounds.

92. A study of the distribution of planktonic eggs of marine fishes on the Otago coast by Robertson (1980) enabled the description of the spawning seasons and spawning areas of a number of inshore fish species. Egg distributions for two species, lemon sole and blue cod, are illustrated in Figures 23 and 24 respectively. Overall, Robertson (1980) found that the eggs of most species were widely distributed on the Otago coast, with spawning mainly occurring in the spring. Vertical samples found the eggs of most species were concentrated near the sea surface although sole eggs were found throughout the water column.

HABITATS AND DIET OF FISH

93. My supplementary report on key species of interest to Ngai Tahu summarises information on the habitats and diets of a number of inshore fish and shellfish species that I have summarised earlier in Tables 2 and 3 of my evidence. Those key species of interest to Ngai Tahu include all of the most important commercial and recreational species in Otago except the Chinook salmon which is an introduced species. In this section of my evidence I will therefore add only a few additional observations concerning the wider picture of fish habitats and diets

94. Cockles, pipi and tuatua all occur in Otago Harbour. All three species are abundant throughout New Zealand and are typical bivalve shellfish that filter their food from the water column. While their specific habitat preferences and environmental tolerances are slightly different, cockles and pipi in particular are adapted to living in harbour environments that are frequently very turbid. Tidal waters warm somewhat as they flood exposed sand banks on each tidal cycle and this enhances phytoplankton growth that bivalve shellfish species feed on.

95. The literature on fish diets indicates that most species are opportunistic feeders. For example, flatfish species feed on a range of benthic organisms such as polychaetes, small crustaceans, echinoderms and molluscs. Research has shown that in any given area they occupy, their specific diet tends to be the most abundant species of these types that are present in that area. Other species show similar dietary patterns, feeding on the most abundant food sources available to them. The introduced Chinook salmon is a predator, feeding mostly on small pelagic fishes such as sprats, pilchards and anchovies.

96. Paua occur on rocky habitats in the sublittoral zone on the exposed open coast. The move over short distances but on a sufficiently limited scale that they can be considered sedentary (Ministry of Fisheries, Science Group (Comps.) 2009a) Paua graze on brown and red macroalgae and appear to preferentially feed on drift algae rather than attached plants (Cornwall *et al.* 2009). Paua are adapted to relatively high salinity open coastal waters characterised by relatively low suspended sediment levels, although they tolerate episodic storm events that generate higher turbidity and lower salinity that may persist in coastal areas for several days. Paua are found on the Otago Harbour mole which is subject to turbid waters from Otago Harbour.

97. The rock lobster is mainly found on the open coast but is known to occur on rocky habitats within Otago Harbour. It is both a scavenger and a predator of small marine organisms in its preferred habitat.

EFFECTS ON FISH AND SHELLFISH

98. Potential effects on fish and shellfish of the POL applications include both direct and indirect effects.

99. By direct effects I mean the mortality of adult, juvenile, larval or egg stages that may be the result of elevated suspended sediment levels released during the dredging and at the time of disposal or mortality arising from the settlement of the suspended sediment on fish and shellfish on the seabed.

100. By indirect effects I mean the effect on fish or shellfish from dredging and disposal activity affecting their behaviour and any loss of habitat or loss of benthic organisms on which fish may feed. Such effects can range from temporary displacement of mobile fishes due to disturbance through to a permanent loss of habitat or feeding area.

101. The evidence of Dr Bell presents the results of modelling of sediment deposition within Otago Harbour and on the open coast and the evidence of Dr James discusses the effects of sediment deposition on benthic organisms. I adopt their evidence to assist me form my view on the impacts of the Next Generation project upon fish.

102. James *et al.* (2009) describes and discusses the effects of the proposed dredging and disposal on all ecological components, including fish and shellfish. There is additional information on effects in James *et al.* (2010). I will first summarise the potential effects on fish and shellfish and then I will comment on how these effects might vary depending on the proportion of the dredging carried out by New Era and by a large contract dredger.

103. Adult and juvenile fishes are adapted to avoid disturbances and will take flight from the immediate area where the dredger is operating and at the disposal site when each load of dredged material is released. Thus, they are able to avoid direct mortality arising from the periodic high suspended sediment levels in the immediate vicinity of these sites. However, larval fishes and very small juvenile fishes will have limited ability to flee from elevated levels of suspended sediment.

104. Bell *et al.* (2009) indicates that most of the sediment from dredging based on the large contract dredger will be discharged at depth and that the highest depth averaged suspended sediment concentrations

(SSC) of over 100 mg/L will mainly be confined to the area of the channel, channel margins and side channels.

105. Appleby and Scarratt (1989) summarised a number of studies that have assessed the effects of suspended sediments on fish. Most fish eggs and larvae do not show a significant effect until concentrations get above 500 mg/l and adult fish can tolerate at least 2000 mg/l for extended periods before mortality occurs. Tidal reaches of Otago Harbour that flatfishes utilise as a nursery area will receive <10 mg/l of suspended sediments from the operation of the large contract dredger, well below the level that fish eggs, larvae and adult fishes are known to tolerate. A detailed literature review (Anchor Environmental 2003) from studies in the last 30 to 40 years of the effects of suspended sediments on the various life stages of finfish, molluscs and crustaceans indicates that acute lethal effects are very low at suspended sediment levels below 500 mg/l for all species combined. Acute sub-lethal effects are very low at suspended sediment levels below 22 mg/l. Although the Anchor Environmental (2003) literature review is of data compiled from species found elsewhere throughout the world, many of those species are related to Otago species or are species inhabiting similar ecological niches to those found in coastal Otago. Accordingly, I consider those results to be generally applicable to the present consent applications.

106. There will be some loss of cockles that lie immediately adjacent to the channel margins and the swinging basin due to the removal of these intertidal areas by dredging. However, the area involved is very small (8,000 m^2) compared to the total intertidal cockle habitat in the lower Harbour. In my opinion, this will not impact the availability of cockles for recreational or customary cockle gatherers. There is likely to be some loss of pipi beds along the harbour channel edges as this species is typically distributed close to the low water mark in lower harbour channels. In time (2-4 years) I would expect any pipis beds that are lost to re-establish. Similar habitats will exist once dredging is completed and the channel edges where pipis or other shellfish such as tuatua are found are naturally dynamic due to waves and tidal currents shifting the sands. The location of pipi beds frequently shifts as channel margins change shape over time. I have seen pipi beds

regularly come and go in northern harbours such as Whangarei Harbour.

107. It is possible, but unlikely in my view, that the movements and migration of fishes within the harbour channel may be affected by the sediment levels associated with dredging activity. Dredging activity will not be continuous and any confinement of fish movements to the harbour channel occurs only toward low tide. Fish will either wait to move through the actively dredged area until the dredger leaves to dispose of each load, or will move away from the channel itself and pass up or down the harbour by going around the affected area.

108. The effect of sediment deposition on benthic species, such as shellfish like the cockle is dealt with in the evidence of Dr James. Therefore I will only discuss the consequential or indirect effects such as the potential loss of benthic organisms that are food items for fishes as a result of sediment deposition.

109. Excluding the main harbour channels, the areas predicted to receive the most deposited sediment are the intertidal banks opposite Port Chalmers, Portobello Bay, Te Rauone Beach to Harwood, and Quarantine Island to Latham Bay (Bell *et al.* 2009). Outside of the main harbour channel, less than 6% of the harbour is predicted to receive 6mm or more deposited sediment. Any loss of Otago Harbour benthos as a result of sediment deposition will be mainly confined to these areas, together with the harbour channel and channel margins. The evidence of Dr James discusses the predicted recovery of the benthic fauna from sedimentation.

110. The affected benthic areas will start to be re-colonised from the adjacent areas almost immediately the dredging ceases and dredging will only affect a small area of the channel at any one time. Fish may be initially attracted to feed on biota disturbed by dredging but otherwise are likely to avoid the high turbidity and disturbance close to the dredging whilst it is taking place.

111. There is a potential for local fish deaths when blasting of rock takes place as part of the dredging programme. However, there are a number of proven methods to avoid or mitigate this potential mortality. Resident species such as rock lobster can be removed by divers if enough are present to be considered useful or necessary.

Immediately prior to blasting sonic devices can be used to scare fish away from the affected area. The proposed environmental management plan addresses these matters.

112. Overall, relatively small areas of benthic habitat in Otago Harbour will be impacted by dredging. Paavo & Probert (2008) found that the lower Harbour is a comprised of a patchwork of intertidal habitats and that concluded that the effect of dredging is unlikely to eliminate any habitat types or create new ones. The affected areas will be re-populated by the benthic fauna present in surrounding areas. Fish will move to other areas of Otago Harbour to feed while the benthic fauna in affected areas recovers. Recovery of benthic fauna in the areas surrounding dredging activity will start as soon as dredging is completed in each area of the harbour channel. Any effects on fishery resources in Otago Harbour will be minor and short term and there will be no long term effects.

113. As outlined earlier in my evidence, the fish and shellfish populations found in Otago Harbour and on the open coast are distributed over very wide coastal areas. The disposal site A0 and the area north of it where sediments will spread is a small fraction of the habitat occupied by the demersal species found there. The modelling undertaken by Dr Bell predicts an accumulated deposition of fine sands and silt of 20 cm over an area of up to 11 km^2 over 120 days under the large dredger scenario. A0 is 3.1 km^2 in area. My calculations indicate that the area of Blueskin Bay within the 30 m depth contour between Taiaroa Head and Cornish Head is approximately 200 km^2. This is only a fraction of the continental shelf area occupied by coastal demersal species.

114. There will be a short to medium term loss of the benthic organisms that fish feed on at and to the north of the disposal site A0, but in my opinion the overall effect on the fisheries resources concerned will be no more than minor. Fishes will shift to other areas to feed while the effect of the disposal on the seabed benthos lasts. The present abundance of exploited species such as the flatfishes is well below their pre-exploitation levels – as a general indication, sustainably fished populations are typically about 20% to 50% of their pre-exploitation biomass. In my opinion the current population sizes of the exploited species found in Otago waters are unlikely to be food limited.

115. I will now discuss the variations in possible dredging. POL's consent applications indicate that dredging is likely to be partly undertaken by *New Era* over a period of a few years, including disposal of some low silt content dredged material at the existing maintenance dredging disposal sites, followed up by a large contract dredger finishing the job.

116. Dredging by *New Era* significantly reduces the scale and intensity of most of the impacts of dredging at any one time, but spreads them over a longer period of time. For example, Bell & Reeve (2010) found that SSC concentrations in Otago Harbour from the use of *New Era* will be at least ten times less and that both elevated SSC levels and sediment deposition will be less and more confined in area than from a large contract dredger. Although the effects will occur over a longer period of time, fewer benthic organisms will be affected by high suspended sediment levels and by sediment deposition, especially in areas away from the channel margins. Overall, although there will be a longer period of dredging through the use of *New Era,* any impacts on benthic fauna and therefore any consequential effects on fishery resources within Otago Harbour from dredging, will be less than from a large contract dredger.

117. By using *New Era* some of the dredged material will be disposed of at the existing maintenance disposal grounds, reducing the total quantity of material to be disposed of at A0. Bell & Reeve (2010) also found that SSC levels from disposal by *New Era* at A0 would be significantly lower. Disposal at A0 would be spread over a longer period of time using *New Era* although the total quantity of silt released at A0 would remain similar. There is a trade off between extending impacts of disposal over a longer period of time at A0 and the length of time over which disposal extends. However, with less material disposed at A0 in total and at any one time by *New Era*, the benthic communities on which fish feed in the vicinity of Blueskin Bay are likely to be less impacted, even if the disposal is spread over a longer time period.

118. Deposition of dredged material from by *New Era* at the existing maintenance disposal sites as part of the capital dredging works will be predominantly sand. As the present maintenance disposal sites are already impacted by disposal, there should be minor additional effects, if any, on benthic fauna at or in the vicinity of those sites from

the use of *New Era.* I would expect no fisheries effects over and above any existing impacts from disposal of maintenance dredging at these sites. To my knowledge no such effects on fisheries from the present disposal of maintenance dredging have been identified.

119. In summary, it is my opinion that the use of *New Era* for some of the dredging programme will reduce potential impacts on fishery resources at A0 and the adjacent area, with the reduction depending on the proportion of the capital dredging programme that is undertaken by *New Era*.

120. However, whichever dredging technology is used I am satisfied that the effects on customary, recreational and commercial fisheries would be temporary and no more than minor.

121. Overall, my opinion is that the effects of the deposition on fisheries resources that feed on benthic fauna in Blueskin Bay will be no more than minor under any combination of dredging and disposal by the large contract dredger and/or *New Era* given the mobility of fish and the small proportion of the overall fisheries habitat that will be affected. Effects are likely to be even less from greater use of *New Era*.

RESPONSES TO SUBMISSIONS

122. This part of my evidence responds to issues raised by submitters.

123. The Ministry of Fisheries' submission (submitter 124) raises a number of issues that I wish to address. I will deal with two specific matters first. The submission states that the assessment is out of date in respect of commercial cockle harvesting in Papanui Inlet and in Otago Harbour. In respect of Papanui Inlet, Boyd (2008) (submitted as part of the consent documentation) notes that cessation of commercial cockle harvesting in Papanui Inlet had ceased as a result of sanitary water quality problems. In respect of Otago Harbour, a special permit issued to Southern Clams Limited in July 2009 allows the sale of cockles harvested from two experimental areas in Otago Harbour. This permit was issued after consent documentation for this project was lodged. In my opinion, such sale of cockles from Otago Harbour under a special permit issued under s.97 of the Fisheries Act 1996 as part of research into a potential fishery is quite different from

commercial harvesting. As noted earlier in my evidence, commercial shellfishing (except for rock lobster, oysters and crabs) is prohibited in Otago Harbour under current Fisheries Regulations (see Appendix 1).

124. The Ministry of Fisheries' submission notes that indirect effects of the POL proposal are difficult to predict. I acknowledge that biological systems within which fish and shellfish populations exist are extremely complex and that as a consequence it is difficult to quantify effects precisely. It is difficult to predict even the direct or indirect effects of harvesting fish on other parts of the marine ecosystem. However POL's AEE together with the hydrodynamic modelling has considered all of the specific points in the Ministry's submission concerning spatial variation, type of sediments, methods of dredging and so on. I consider that there is sufficient information from the modelling and other research and the scientific literature to allow me to have confidence in my assessment of the potential impacts on fish and shellfish resources. Monitoring to confirm the modelling predictions and to assess impacts on biota will provide confirmation or otherwise of the fate of sediments and any predicted biological impacts. I agree with the Ministry's submission that monitoring will be important to confirm predicted effects and have recommended that this be undertaken. I also note that it forms part of the conditions of consent proposed by the applicant.

125. Southern Clams Limited (SCL) (submitter 135) has raised concerns regarding impacts on local marine habitats and loss of cockle habitat. SCL is currently harvesting cockles under a special permit issued under the Fisheries Act 1996. I will address their concern about the loss of shellfish (cockle) habitat.

126. Discussion with Ministry of Fisheries indicates that the SCL special permit expires on 31 August 2012 and can be extended or renewed for a further two years. It allows the commercial sale of cockles harvested under the special permit and the quantity harvested under the special permit must be within their commercial annual catch entitlement.

127. As noted earlier in my evidence, the loss of shellfish habitat as a result of the POL proposal (8000 m^2) is very small compared to the total area of cockle habitat in Otago Harbour. It is also small in relation to SCL's

special permit areas. The SCL research area 1804 is shown as Figure 10 of Appendix 1 of their submission and lies near the margin of the swinging basin where some cockle habitat will be lost when the swinging basin is widened by dredging along this shore. I note from the SCL submission that research area 1804 is 80 ha in size and that SCL also has a research area 1805 of 100 ha which lies in the upper Harbour. I also note that the special permit is just that, a special permit authorising research for a limited time period. There is no presumption that commercial harvesting will be authorised in the future and in any event it will require a change of the Fisheries Regulations if it were to occur. That is not a straightforward process, and the outcome depends on consideration of a variety of matters, including those made by public submissions.

128. A number of commercial fishing industry submitters have raised issues relating to the effect on trawling, including the loss of trawl grounds, effects on sole and elephant fish, effects on spawning/breeding grounds. These submitters include Port Chalmers Fishermen's Cooperative (submitter 2), L Poulsen (submitter 32), A. Heineman (submitter 59), G Heineman (submitter 60), T. Taiaroa (submitter 71), Joan Fishing Company (submitter 119), Aurora Seafood Enterprises (submitter 131), and C. Ellis (submitter 144). A number of these submitters operate small trawlers that fish local trawl grounds in Otago waters, including Blueskin Bay.

129. My evidence has covered all of the issues raised by these submitters. No permanent loss of trawl grounds at A0 will occur, although there will be short to medium term loss of benthic species on which demersal species feed at disposal Site A0 and in an area to the north of A0. In my earlier evidence I indicated that the most affected area north of A0 (receiving more than 20 cm of total sediment accumulation under the large dredger scenario) was a relatively small proportion of the total area of habitat in Blueskin Bay inside the 30 metre depth contour. The area inside 30 metres depth does not include all of the trawled area in Blueskin Bay as trawlers fish for species such as red cod and barracouta in considerably deeper waters out to the edge of the continental shelf. Other fishing methods also fish over the area out to the edge of the continental shelf.

130. During and for a period of time after disposal ceases, I would expect that trawling at or through A0 is likely to be difficult until the deposited sediments are compacted and stabilise. This area is only 3.1 km^2 in area. While there will be some disruption to trawling at site A0 and there may also be some short term displacement of fishes from the area to the north of A0 due to the effects of sediment deposition, the total affected area is small in relation to the overall area of Blueskin Bay. Earlier in my evidence I noted that the protected waters of Blueskin Bay are important to the small local vessels that operate out of Port Chalmers and other local ports. Although the operators of these small commercial fishing vessels may face some short term inconvenience, any disturbance to their fishing grounds and fishing will be minor and there will be no permanent loss of their fishing grounds.

131. Research on the spawning of fishes indicates that while the vicinity of A0 lies within the wider area in which coastal fishes such as flatfish may spawn the spawning of coastal fish species extends over a very wide area of coastal Otago. I refer to Figures 23 and 24 of my earlier evidence as examples of the size of the area over which spawning and the dispersal of fish eggs and larvae occur. In my opinion, the effects of the dredging and disposal on fish spawning and the survival of fish eggs and larvae will be minor because the affected area is so small in comparison to the overall area in which spawning occurs. These effects will also be limited to the time period over which disposal takes place.

132. Submitters P. McGregor (submitter 18), A. Parker (submitter 19), P. Herbert (submitter 30), G. Skinner (submitter 56), B. Mullane (submitter 68), A. Coll (Jackson Bay Fishing Ltd) (submitter 112), Trustees of Tide-Song Family Trust (submitter 113), J. Raymond and I. Harrison (submitter 122), PauaMac 5 Inc. (submitter 171), and the Paua Industry Council Inc and Kina Industry Council Inc. (submitter 198) have raised a number of concerns dealing with paua, kina and kelp. These issues are mainly related to the potential for suspended sediments to affect paua by smothering of juveniles, settlement of paua larvae, effects on paua habitat, effects on kina and paua from the effects of suspended sediment on kelp, visibility for paua and kina diving and displacement of fishing effort and related matters.

133. A number of these submitters make statements on coastal processes and the modelling results concerning the fate of the sediment plume from A0. I will leave these points to the evidence of Dr Single and Dr Bell. I also leave the effects on water clarity and visibility affecting paua divers and reducing the growth of kelp along the coast to their evidence. In my opinion, the kinds of concerns expressed by PauaMac5 regarding paua growth and 'stunting' do not apply to POL's proposed dredging and disposal. Effects on paua growth are the result of environmental conditions that last for many years or decades. Paua growth is variable and paua are difficult to age but research indicates they take at least 5 years to reach the legal minimum size of 125 mm in the areas where growth rates are fastest. POL's proposed dredging and disposal and any related effects will occur over too short a period to affect paua growth in the manner suggested by these submitters in the unlikely event that there is any effect of the disposal on paua growth.

134. Visibility for divers harvesting paua and kina is important and divers normally wait for periods of calm weather and good underwater visibility to dive for these species. Earlier in my evidence I described the distribution of commercial paua harvests in the PAU5D quota management area along the Otago coast over the past 9 years. The average annual commercial paua harvest in each of the paua statistical areas is given in Table 1 presented earlier in my evidence. The average annual harvest from paua statistical area H35 (Taiaroa Head to Wickliffe Bay) is 1,622 kg and based on average daily harvest rates of 108 kg to 120 kg would take an average diver 14-15 days each year to harvest. The main PAU5D commercial harvests north of A0 are in paua statistical areas H41-H43 shown in Figure 17 of my evidence which include the coast running north from Cornish Head to Kakaho Beach. Kina harvests from the whole of FSA24 (Figure 10) are modest, averaging about 1800 kg annually for the past 20 years.

135. There is research that shows high levels of suspended sediments causes increased mortality of paua and kina larvae. Phillips & Shima (2006) explored the effect of suspended sediment on the development, survival and settlement of paua and kina larvae in a laboratory setting. They found that exposure to suspended sediment levels of 18.39 mg/L and higher had dramatic effects on larval survival

of both species compared to mortality in waters with no suspended sediments. However, the experimental levels did not appear to have strong effects on the ability of surviving larvae to settle. The levels of exposure used in the laboratory experiments by Phillips and Shima (2006) were based on the natural levels in the discharge from the Hutt River and are exposures that they considered paua and kina larvae would naturally encounter within the inner part of Wellington Harbour. A suspended sediment concentration of 18.39 mg/L is more than 40 times the predicted levels of additional suspended sediment above background levels arising from A0 reaching the coast between Taiaroa Head and Wickliffe Bay (0.41 mg/L, Bell *et al.* 2009, p. 225) and more than 260 times the predicted maximum contribution of suspended sediments along the coastal areas north of Cornish Head (0.07 mg/L, Bell *et al.* 2009, p. 225) except for short periods when light northeast winds occur.

136. The likelihood of settlement of sediment on the rocky substrates that paua and kina larvae settle is a matter covered in the evidence of Dr Bell. The preferred habitats for kina and paua are along rocky exposed shores where wave action rarely ceases. In my experience, sediment does not remain on these habitats along exposed coastlines except for brief periods of calm.

137. G Robinson (submitter 76), Karitane Fishermen's Association (submitter 105), Tania Fishing Company and Karitane Charters Ltd (submitter 121), Argo Fishing Ltd (submitter 132), New Zealand Federation of Commercial Fishermen Inc. and Port Otago Fishermen's Cooperative (submitter 194) and other submitters raise a number of wider fisheries and environmental concerns. A number of other submitters raise general ecosystem issues and some raise concerns about the effects on all fisheries. These more general fisheries concerns are based on views that the proposal to dispose of the dredged material poses a threat to fisheries and the marine ecosystem. I consider that I have largely dealt with specific fisheries impacts earlier in my evidence but will add some additional observations in addressing these broader concerns.

138. I am very aware that the area of Blueskin Bay is important to the local fishing industry, and is equally valued by recreational and customary fishers. Small commercial fishing vessels are finding it increasingly

difficult to survive economically as costs rise. This is reflected in the steady decline in the number of small coastal commercial fishing vessels throughout the country over the past 3 decades that I have been involved in New Zealand fisheries management and research.

139. I do not consider that the area is of national or regional importance as submitted by New Zealand Federation of Commercial Fishermen Inc and Port Otago Fishermen's Cooperative, although it is important to local fishers. The potentially impacted areas in and around Blueskin Bay are relatively small in comparison to the distribution of the relevant fish and shellfish stocks and their stock management boundaries. The catches of most wetfish species for the whole of FSA24 comprise between 5 and 15% of the catch along the entire east coast of the South Island. The harvest of paua in the area is small compared to the rest of the PAU5D fishery. I do agree that the area has value and like all of New Zealand's fisheries waters should be protected from environmental damage using the best information available.

140. There is no evidence in terms of a measurable loss of fisheries production or of any harm to marine ecosystems important to fish and shellfish from the earlier dredging and disposal which has disposed of large volumes of dredged material on this coast. Commercial fisheries production in Otago waters has remained relatively stable over the past century. While there have been some up and down trends in production of particular species over the decades, the long term catch trend of species such as the flatfishes, elephant fish, rock lobsters and paua is relatively stable.

141. What changes have occurred in Otago's fish and shellfish populations over recent decades are closely linked to the level of commercial catches, periods of overfishing, introduction of new management measures and known environmental conditions that influence the year to year larval survival of particular species. It is important to recognise that fish and shellfish populations are subject to a great deal of natural variation. It is the long term trends (20 to 30 years or more) that tell us the most about the long term health of our fish stocks. For this reason, and because much of my assessment is based on the hydrodynamic modelling results in Bell *et al.* (2009), it will be important to undertake monitoring aimed at confirming the modelling results of

the levels of suspended sediments, the rate of sedimentation transport from the disposal site and the long term movement and fate of these sediments. Such monitoring is a key part of the proposed EMP. The EMP monitoring will be more informative than biological monitoring because biological systems are naturally variable over time. As already mentioned, such monitoring is part of the condition of consent proposed by the applicant.

CONCLUSIONS

142. The waters of Otago Harbour and the adjacent coast support a diverse array of fish and shellfish resources. The fish and shellfish fauna is made up of species that are common throughout central New Zealand waters.

143. The fish and shellfish resources of Otago support important commercial, recreational and customary fisheries.

144. Sheltered harbours and protected coastal waters tend to be the areas where the greatest number of eggs, larvae and juvenile fish of many inshore species are found.

145. Spawning of the common fish species occurs over wide areas of coastal Otago, predominantly in the spring and early summer months.

146. Otago Harbour has what is believed to be the largest population of the cockle *Austrovenus stutchburyi* in New Zealand. This is currently being experimentally harvested under a special permit issued under the Fisheries Act for research purposes.

147. Within Otago Harbour, there will be minor adverse effects on fish and shellfish from the suspended sediments released during dredging due to the relatively small areas of benthic habitat involved and the ability of fish to move to other areas to feed.

148. On the open coast, there will be minor effects on fisheries and fishing due to the small area affected compared to the wide overall distribution of fish and shellfish and of the commercial fishery. The loss of benthic at disposal Site A0 and in the area to the north of A0 will reduce the potential food supply to fishes in the short to medium

term, with the effects on longer lived benthic organisms lasting up to several years.

149. Overall, effects on fisheries resources and on fishing will be minor and limited to the period of dredging and disposal.

150. In my opinion, there is no fisheries related reason why the POL resource consent applications cannot be granted.

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APPENDIX 1: EXTRACTS OF COMMERCIAL FISHING RESTRICTIONS OR CLOSURES RELATING TO OTAGO HARBOUR AND THE AREA AROUND OTAGO PENINSULA

EXTRACTS FROM: Fisheries (South-East Area Commercial Fishing) Regulations 1986 (SR 1986/219) (as at 01 October 2010)

3D Certain fishing methods prohibited in defined areas

(1) No commercial fisher shall use for taking fish a box or teichi net, purse seine net, Danish seine net, trawl net, or lampara net within the following waters:

(e) *Otago Harbour:* all those waters of Otago Harbour lying generally south-east of a line from the northeastern end of the Mole commencing at a point (at 45°46.34′S and 170°43.19′E) across to Taiaroa Head at a point (at 45°46.45′S and 170°43.69′E).

(1A) A commercial fisher must not use set nets of a total length in excess of 1000 m in the waters referred to in subclause (1)(e).

5 Prohibition on trawling in certain areas

(4) No commercial fisher shall use a set net in the following waters:

(a) *Upper Otago Harbour:* all those waters of the upper harbour which lie to the north and west of a line from Burns Point (at 45°53.20′S and 170°31.60′E) to a point on the low tide training wall (at 45°52.62′S and 170°31.70′E); then generally in a north easterly direction along the low tide training wall to a point (at 45°50.18′S and 170°36.08′E); then to Kilgour Point (at 45°49.96′S and 170°36.15′E):

(b) *Port Chalmers:* all those waters in the lower harbour in the vicinity of Port Chalmers which lie to the west of a line from Back Beach Point (at 45°49.21′S and 170°37.67′E), to a beacon (at 45°49.26′S and 170°37.92′E); then to the shore at Rocky Point (at 45°48.35′S and 170°37.70′E):

5AAA Trawl net fishing prohibited in certain area from Clarence Point to Slope Point

Explanatory Note: In summary this Regulation prohibits trawling within 2 nautical miles of the high water mark from Clarence Point to Slope Point.

5AAB Exemption from prohibition in regulation 5AAA

- Despite regulation 5AAA, a commercial fisher may use a low headline-height trawl net[3] in the area defined in that regulation.

5AAC Set net fishing prohibited in certain area from Clarence Point to Slope Point

Explanatory Note: In summary this Regulation prohibits all set netting within 4 nautical miles of the high water mark from Clarence Point to Slope Point although set netting is permitted within many harbours including part of Otago Harbour.

8 Closed season for rock lobster

No commercial fisher shall—

(a) take any rock lobster from the waters of the Otago Concession Area; or

(b) be in possession of any rock lobster taken from those waters; or

(c) fish using any rock lobster pot in those waters—

during the period commencing on the 20th day of November in any year and ending with the 31st day of May in the next year (both days inclusive).

10 Restrictions on taking shellfish from parts of Otago coast

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[3] Low headline-height trawl nets are defined elsewhere in the Regulations. These trawl nets are effective in catching flatfish but are not effective at catching most other species while posing low risks to Hector's dolphins. This regulation recognises the importance of shallow inshore waters to flatfish trawling.

No commercial fisher shall take from, or have in possession, any shellfish[4] (except rock lobsters, oysters, or crabs) taken from the following waters:

(a) *Waikouaiti Bay*—the waters of Waikouaiti Bay enclosed by a straight line drawn from Cornish Head (at 45°37.3′S and 170°41.6′E) to Karitane Peninsula (at 45°38.6′S and 170°40.4′E):

(b) *Seacliff*—all those waters lying within half a nautical mile seaward of the mean high-water mark between Brinns Point (at 45°40.6′S and 170°39′E) and Omimi Point (at 45°41.7′S and 170°36.7′E):

(c) *Otago Harbour*—all the waters of Otago Harbour enclosed by a straight line drawn from Heywards Point (at 45°45.4′S and 170°41.4′E) to Taiaroa Head (at 45°46.5′S and 170°43.6′E):

(d) *Otago Peninsula*—all those waters lying within half a nautical mile seaward of the mean high-water mark between Cape Saunders Lighthouse (at 45°53′S and 170°43.8′E) and the point one nautical mile south of Brighton (at 45°57.5′S and 170°18.2′E):

11D Taking of kina prohibited in certain areas

No commercial fisher shall take any kina from any of the following waters, or be in possession of any kina if it has been taken from any of those waters:

(b) *Cape Saunders to Taiaroa Heads*—all those waters lying within half a nautical mile seaward of the mean high water mark of that part of the coast between Cape Saunders Lighthouse (at 45°53′S and 170°43.8′E) and Taiaroa Head Lighthouse (at 45°46.5′S and 170°43.6′E):

(c) *Shag River (Waihemo) to Moeraki Point*—all those waters lying within half a nautical mile seaward of the mean high water mark of that part of the coast between Shag River (Waihemo) (at 45°30.4′S and 170°46.3′E) and Moeraki Point (at 45°21.5′S and 170°51.5′E).

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[4] **shellfish** includes all species of the phylum Echinodermata and phylum Mollusca and all species of the class Crustacea at any stage of their life history, whether living or dead (s2, Fisheries Act 1996)

APPENDIX 2: EXTRACTS OF AMATEUR FISHING RESTRICTIONS OR CLOSURES RELATING TO OTAGO HARBOUR AND THE AREA AROUND OTAGO PENINSULA

EXTRACTS FROM: Fisheries (South-East Area Amateur Fishing) Regulations 1986 (SR 1986/225) (as at 01 October 2010)

3D Set net prohibitions

(2) No person shall use a set net in the following waters:

(a) *Upper Otago Harbour:* All those waters of the upper harbour which lie to the north and west of a line from Burns Point (at 45° 53.20′S and 170° 31.60′E) to a point on the low tide training wall (at 45° 52.62′S and 170° 31.70′E); then generally in a northeasterly direction along the low tide training wall to a point (at 45° 50.18′S and 170° 36.08′E); then to Kilgour Point (at 45° 49.96′S and 170° 36.15′E):

(b) *Port Chalmers:* All those waters in the lower harbour in the vicinity of Port Chalmers which lie to the west of a line from Back Beach Point (at 45° 49.21′S and 170° 37.67′E), to a beacon (at 45° 49.26′S and 170° 37.92′E); then to the shore at Rocky Point (at 45° 48.35′S and 170° 37.70′E):