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

AFFIDAVIT OF PAUL MICHAEL SAGAR
ON BEHALF OF PORT OTAGO LIMITED
14 April 2011

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I, **PAUL MICHAEL SAGAR**, of Christchurch, Scientist, swear:

INTRODUCTION, QUALIFICATIONS & EXPERIENCE

1. My full name is Paul Michael Sagar. I have a Bachelor of Science in Botany and Zoology and a Master of Science in Zoology, both from the University of Canterbury.

2. I am a member of the Ornithological Society of New Zealand, the British Ornithologists' Union, American Ornithologists' Union, Royal Australasian Ornithologists' Union, New Zealand Ecological Society, International Wader Study Group, and Australasian Wader Study Group.

3. From 1978 to 1992 I was employed as a scientist with the Fisheries Research Division of the Ministry of agriculture and fisheries. Since 1992 I have been employed by the National Institute of Water & Atmospheric Research Limited as a scientist. During my employment with both organisations I have undertaken research into a range of environmental impact studies involving birds in marine, estuarine and freshwater environments. I have considerable experience, over nearly 40 years with the study of seabirds (including population dynamics and foraging movements of Adélie Penguin, Rockhopper Penguin, Antarctic Tern, and various albatross, shearwater and petrel species) in New Zealand and elsewhere. In addition, I have made a major study of the distribution and numbers of shorebirds in New Zealand and completed a long-term study of the population dynamics of Pied Oystercatchers. The results of these studies have been published in over 30 scientific papers in refereed New Zealand and international journals, plus contributions in several books. Some references relevant to the current project are listed in Appendix 1.

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

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BACKGROUND INFORMATION

5. I have been involved in the following work in relation to Port Otago Limited's Project Next Generation:

   a. A desk-top review of the occurrence and distribution of marine and estuarine birds from Otago Harbour, Taiaroa Head and the nearshore environment and the likely effects of the proposed dredging and discharge of sediment on these birds;

   b. An observational survey was carried out in March 2008 to examine foraging behaviour of wading birds through a complete tidal cycle in the vicinity of the Aramoana Ecological Area and to assess the significance of roosting sites on high shell banks in the vicinity of Port Chalmers. These areas were identified by the Department of Conservation as important areas that needed further work. The results of this field work are reported in Sagar (2008);

   c. A summary of this review (pp. 22-23) and results of the survey (Appendix 1) were incorporated into the description of the existing environment and the assessment of environmental effects on the environment (pp. 40-42 and 50-51) in the Assessment of Environmental Effects.

6. I have prepared my statement of evidence in reliance on this work, in particular, together with general background information, resources and knowledge relevant to my area of expertise.

7. I have also reviewed the reports and statements of evidence of other experts giving evidence on behalf of Port Otago Limited relevant to my area of expertise, including:

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a. Bell, R.G.; Hart, C. (2008). Offshore ADCP deployments (Otago Peninsula) for Port Otago dredging programme. *NIWA Client Report HAM2008-178*;

b. Bell, R.; Oldman, J.; Beamsley, B.; Green, M.O.; Pritchard, M.; Johnson, D.; McComb, P.; Hancock, N.; Grant, D.; Zyngfogel, R (2009). Port Otago dredging project: Harbour and offshore modelling. *NIWA Client Report HAM2008-179*;

c. Bell, R.G.; Reeve, G. (2010). Sediment plume dispersion modelling: Comparison of a larger dredger and the *New Era*. *NIWA Client Report HAM-2010-119*;

d. James, M. (2011). Statement of evidence of Mark Richard James on behalf of Port Otago Limited;

e. .James, M.; Probert, K.; Boyd, R.; John, A. (2007). Summary of existing ecological information and scoping of further assessments for Port Otago dredging project. *NIWA Client Report HAM2007-156;*

f. James, M.; Probert, K.; Boyd, R.; Sagar, P. (2009). Biological resources of Otago Harbour and offshore: assessments of effects of proposed dredging and disposal by Port Otago Ltd. *NIWA Client Report HAM2008-152.*

SCOPE OF EVIDENCE

8. I have been asked by Port Otago Limited (POL) to prepare evidence in respect of the effects of Project Next Generation on the existing seabird and shorebird communities. In my evidence I discuss:

a. Background information on the seabirds and shorebirds reported from Otago Harbour and the adjacent coastal area;

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b. Identification of potential adverse effects of project Next Generation on seabirds and shorebirds of Otago Harbour, Taiaroa Head and the nearshore area;

c. Responses to issues raised by submitters in respect of the Project Next Generation; and

d. Conclusions.

EXECUTIVE SUMMARY

9. Within Otago Harbour the birdlife is dominated numerically by gulls, waders (such as oystercatchers and godwits) and shags whilst outside the harbour shearwaters, terns, penguins, gulls and albatrosses predominate. Of these, three (Grey-headed Mollymawk, Black-billed Gull and Black-fronted Tern) are considered to be nationally significant, while further 12 are of conservation concern.

10. There is a large body of information available, extending over several decades, about the abundance and occurrence of birds within the harbour and the adjacent coast. This shows that the abundance of each species varies with season and between years. Relatively few birds breed within the harbour or along the adjacent coast, and so those that do not are usually absent from the area during their various breeding seasons.

11. Within the Harbour, most birds feed either from the surface waters (e.g., gulls and terns), intertidal flats (e.g. gulls and waders), or underwater (e.g., shags). Off the adjacent coast, birds feed from the surface waters (e.g., gulls, terns and albatrosses), midwater (e.g., shearwaters and Blue Penguins), or close to the bottom (e.g., Stewart Island Shag and Yellow-eyed Penguin).

12. Potential adverse effects from dredging and disposal of dredged material will vary according to the type of vessel used and the feeding strategy of the birds. In my opinion, incremental capital dredging using

the smaller *New Era* dredge is unlikely to have any discernible adverse effects against a background of natural variation on any of the birds in the area under consideration. This is based on the estimate that except in the immediate vicinity of the disposal site the suspended sediment concentrations predicted would not be expected to affect planktonic animals (food for seabirds and fish) and will be below the level set in the Port of Melbourne case to protect birds such as terns and gannets (25 mg/l).

13. Major capital dredging will result in higher suspended sediment concentrations at the proposed A0 disposal area, and disposal of the seabed will smother benthic communities, until they are recolonised. Seabirds may be adversely affected if the sediment plume reduces their ability to see their prey and reduce the abundance of their prey in the area because fish, squid and crustaceans will tend to avoid the affected area. However, most seabirds found in the area off Otago feed well offshore (e.g., Sooty Shearwater and Northern Royal Albatross) or are predominantly bottom feeders at depths over 40 m (e.g., Sooty Shearwaters and Yellow-eyed Penguins), and so the affected area represents a relatively small proportion of their foraging area.

14. Some species, such as Blue Penguins, shags and gulls may feed in the disposal area and along with some fish species that feed on plankton or benthic biota may be affected in the immediate area, for several years, and so may have to forage more widely during and immediately following major capital dredging.

15. The species of most concern during major capital dredging is the Blue Penguin. This species is likely to feed in the proposed A0 disposal area and to have a more restricted foraging range than other species. The most sensitive time would be during the chick-rearing stage (the core period of which is October-December inclusive), when the parents need to find food not only for themselves, but also for their 1-2 chicks. Consequently, any reduction in their foraging ability could result in them providing insufficient food to their chicks, resulting in reduced breeding success. Such an outcome is only of potential

concern during the period of major capital dredging and will have no long term or population level effects.

16. In a wider sense, mitigation measures related to potential effects on seabirds that I have recommended include managing the dredging operation where possible to avoid the critical part of the recruitment and breeding period for birds over spring and summer at Aramoana and off Taiaroa Head. This will also help mitigate impacts on benthic biota in the region if they were to occur. It is also proposed that when godwits are foraging on the intertidal flats at Aramoana in February and March that capital dredging is only undertaken when tidal height is above half-tide.

THE PROPOSAL

17. My evidence relates to the Project Next Generation proposal to:

a. Deepen, widen and dredge the Otago Harbour channel, swinging areas and berths;
b. Dispose of dredge material at sea;
c. Construct a wharf extension and fishing platform.

EVIDENCE

18. **Existing environment**

18.1 There is an extensive body of information available about the numbers and diversity of birds that utilise Otago Harbour and the adjacent offshore marine environment, some of the earliest being that of Dr L.E. Richdale, who completed internationally renown studies of seabirds on Otago Peninsula commencing more than 70 years ago (e.g. Richdale 1939, 1950, 1957). More recent information comes primarily through the studies completed by the Ornithological Society of New Zealand (e.g., Sagar et al. 1999; newsletters of the Otago Region Ornithological Society of New Zealand), Department of Conservation and University of Otago. Several of these studies provide information over several decades, and so allow changes over time to be

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assessed. For example, members of the Ornithological Society of New Zealand (OSNZ) divided the Harbour into seven areas and completed monthly, high-tide counts of birds in 1977-78, 1987-88 and 2009-2010.

18.2 All these studies show that Otago Harbour and the adjacent offshore marine environment support a diverse array of birdlife, including one nationally critically, two nationally endangered, six nationally vulnerable species, and six species in decline (Table 1). Consequently, these areas are at least of national importance for the birdlife that they support.

Table 1. Bird species of special conservation status found in the Otago region. (After Miskelly et al. 2008 and based on criteria detailed in Townsend et al. 2008).

Common name	Taxon	Conservation status
Grey-headed Mollymawk	*Thalassarche chrysostoma*	Nationally critical
Black-fronted Tern	*Sterna albostriata*	Nationally endangered
Black-billed Gull	*Larus bulleri*	Nationally endangered
Banded Dotterel	*Charadrius bicincta*	Nationally vulnerable
Caspian Tern	*Sterna caspia*	Nationally vulnerable
White-fronted Tern	*Sterna striata*	Nationally vulnerable
Red-billed Gull	*Larus novaehollandiae scopulinus*	Nationally vulnerable
Yellow-eyed Penguin	*Megadyptes antipodes*	Nationally vulnerable
Stewart Island Shag	*Leucocarbo chalconotus*	Nationally vulnerable
Hutton's Shearwater	*Puffinus huttoni*	At Risk – Declining
Flesh-footed Shearwater	*Puffinus carneipes*	At Risk – Declining
Sooty Shearwater	*Puffinus griseus*	At Risk – Declining
Southern Blue Penguin	*Eudyptula minor minor*	At Risk – Declining
South Island Pied Oystercatcher	*Haematopus finschi*	At Risk – Declining
Pied Stilt	*Himantopus himantopus leucocephalus*	At Risk - Declining
NZ Black-browed Mollymawk	*Thalassarche impavida*	Naturally uncommon
Northern Royal Albatross	*Diomedea sanfordi*	Naturally uncommon
Erect-crested Penguin	*Eudyptes sclateri*	Naturally uncommon
Black Shag	*Phalacrocorax carbo novaehollandiae*	Naturally uncommon
Little Shag	*Phalacrocorax melanoleucos brevirostris*	Naturally uncommon

18.3 Each bird species has its own habitat requirements and these determine just where they occur in the area, and so some species occur just within Otago Harbour, others within the coastal area, and others in all areas (Table 2).

OTAGO HARBOUR BIRDLIFE

19. ***Species composition and numbers***

19.1 Within Otago Harbour, the birdlife is dominated numerically by gulls (primarily black-backed gulls and red-billed gulls), waders (primarily South Island Pied Oystercatchers, Variable Oystercatchers, and Bar-tailed Godwits), shags (primarily Little Shags, Black Shags and Stewart Island Shags), waterfowl (mainly Mallards, Black Swans and Paradise Shelducks) and terns (primarily White-fronted Terns, Black-fronted Terns and Caspian Terns). (Otago Region OSNZ monthly newsletters 2009-2010).

19.2 The abundance of most of these bird species varies markedly with the time of year. For example, during the period August-December most South Island Pied Oystercatchers are away breeding on farmland and riverbeds, and so numbers counted in Otago Harbour decline from the 1000+ birds present at other times of the year to 200-300 (Sagar et al. 1999; Otago Region OSNZ monthly newsletters 2009-2010). Similarly, Bar-tailed Godwits breed in Alaska during the northern summer, and so numbers in Otago Harbour during the period March-September are usually much lower than during the period October-February (Sagar et al. 1999; Otago Region OSNZ monthly newsletters 2009-2010).

19.3 In addition to variation in numbers within a year there are variations between years and where counts are continued over several years it may be possible to detect a trend in numbers. Within Otago Harbour the starkest example of this is the endemic Black-billed Gull which breeds on braided rivers and moves to coastal areas after breeding. Counts of this species in the Harbour during the period December-June (which is usually after the breeding season) have declined from over 14,000 birds during March 1977/78 to no more than 16 birds

during April 2010 (Otago Region OSNZ newsletter); the main causes of such a decline in numbers are attributed to changes in land use and predation at their breeding sites (Miskelly et al. 2008) a phenomenon that exists for many of our bird species.

COASTAL OTAGO BIRDLIFE

20. ***Species composition and numbers***

20.1 Thirty-four species of seabirds have been recorded from or are likely to occur frequently in Otago coastal waters (Sagar et at. 2002). This report showed that the birdlife is dominated by shearwaters (primarily Sooty Shearwater, also known as muttonbirds), Fairy Prions, albatrosses (mainly Northern Royal Albatrosses and Buller's Albatrosses), penguins (mainly Yellow-eyed Penguins and Southern Blue Penguin), shags (mainly Stewart Island Shags, Spotted Shags and Black Shags), gulls (primarily Black-backed Gulls and Red-billed Gulls), and terns (primarily White-fronted Terns, Black-fronted Terns and Caspian Terns).

20.2 The occurrence and abundance of some of these seabirds varies seasonally. For example, sooty shearwaters arrive in New Zealand waters from the northern hemisphere in September and breed here until May, when they depart northwards. Similarly, Black-fronted Terns breed on braided riverbeds during our spring and summer then move to coastal areas to feed during the remainder of the year.

21. **General habitat requirements of birds**

21.1 Each species of bird has particular conditions under which they prefer to live. Thus, some species are found primarily outside the harbour whilst others occur only within the harbour (Table 2). In addition, within each of these areas each species has a preferred habitat where they feed (Table 3). For example, wading birds, such as Banded Dotterels and Bar-tailed Godwits, primarily feed in intertidal areas within the harbour and terns feed in surface waters by flying along and then plunge diving to about 1 m depth in open water both within the harbour and nearshore whilst shearwaters fly in nearshore and offshore areas

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and take food from the surface or by diving to over 40 m depth (Table 3).

21.2 All of the birds are visual feeders i.e. they detect their prey by sight.

Table 2 Primary foraging areas and distribution of bird species of special conservation.
Nearshore = up to 15 km, Offshore >15 km

Common name	Otago Harbour	Nearshore	Offshore
Grey-headed Mollymawk			Yes
Black-fronted Tern	Yes	Yes	
Black-billed Gull	Yes	Yes	
Banded Dotterel	Yes		
Caspian Tern	Yes	Yes	
White-fronted Tern	Yes	Yes	
Red-billed Gull	Yes	Yes	
Yellow-eyed Penguin		Yes	
Stewart Island Shag		Yes	
Hutton's Shearwater		Yes	Yes
Flesh-footed Shearwater		Yes	Yes
Sooty Shearwater		Yes	Yes
Southern Blue Penguin	Yes	Yes	
South Island Pied Oystercatcher	Yes		
Pied Stilt	Yes		
NZ Black-browed Mollymawk		Yes	Yes
Northern Royal Albatross		Yes	Yes
Erect-crested Penguin		Yes	Yes
Black Shag	Yes	Yes	
Little Shag	Yes		

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Table 3 Primary habitats favoured for feeding by bird species of special conservation.
Surface waters = surface to 1 m depth

Common name	Intertidal	Surface waters	Midwater	Bottom
Grey-headed Mollymawk		Yes		
Black-fronted Tern		Yes		
Black-billed Gull	Yes	Yes		
Banded Dotterel	Yes			
Caspian Tern		Yes		
White-fronted Tern		Yes		
Red-billed Gull	Yes	Yes		
Yellow-eyed Penguin				Yes
Stewart Island Shag				Yes
Hutton's Shearwater		Yes	Yes	
Flesh-footed Shearwater		Yes	Yes	
Sooty Shearwater		Yes	Yes	
Southern Blue Penguin		Yes	Yes	
South Island Pied Oystercatcher	Yes			
Pied Stilt	Yes			
NZ Black-browed Mollymawk		Yes		
Northern Royal Albatross		Yes		
Erect-crested Penguin			Not known	Not known
Black Shag			Yes	Yes
Little Shag				Yes

EFFECTS OF DREDGING AND DISPOSAL ON BIRDLIFE

22. ***Effects of dredging on birdlife in the harbour***

22.1 Dredging activities are such that the following issues need to be assessed:

a. removal of intertidal invertebrates as a food source due to widening of the channels;

b. settlement of sediments in intertidal areas, and so affecting the productivity of invertebrate prey;

c. increasing turbidity levels throughout the harbour;

d. removal of roosting sites; and

e. disturbance of breeding and feeding birds by the dredge and blasting.

22.2 I will discuss each of these in turn:

22.2.1 *Removal of intertidal invertebrates due to widening of channels:*

a. The level of any impact on birds that feed in the intertidal zone through reduction in feeding habitat will depend upon the proportion of area lost as a result of channel widening and the time taken for sessile (fixed in location) animals to recolonise disturbed areas.

b. The estimated intertidal area that is likely to be directly impacted under this proposal is about 0.8 ha (about 8,000 m^2), most of which is in the upper harbour near Port Chalmers. With a mean surface area of 46 km^2 at spring high tides, the affected area represents a very small proportion of the total and I do not consider it to be significant

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c. In addition, disturbance of the substrate by dredging will remove areas of invertebrate prey in the short term. It is estimated that smaller polychaete worms are likely to recolonise in a matter of months, with large molluscs and other sessile invertebrates taking longer as outlined by Dr James. Again, I do not consider this to be significant.

22.2.2 *Settlement of sediments in intertidal areas and effects on the productivity of invertebrate prey:*

a. Overall, the degree and duration of any adverse effects from dredging activity in Otago Harbour on fish and shellfish resources in intertidal areas, and hence potentially the birds that feed upon them, will depend on the duration of dredging, the quantity and particle size of material to be removed and the dispersion of suspended sediments as they settle out of the water column.

b. Bell et al. (2009) and Bell & Reeve (2010) provide details of the proposed dredging operation and modelling of suspended sediments. A mid-size trailing suction hopper dredge vessel is proposed to undertake the majority of dredging to deepen the shipping channel. In such vessels a suction pipe, which terminates in a draghead, is lowered to the seabed and operates very much like a vacuum cleaner. Sources of turbidity as a result of this dredging operation are from the draghead and from the ship's propellers, which also produce high-energy water movement. However, most of the material loosened and put into suspension by the draghead will be sucked into the ship's hopper and a relatively low volume of loosened material is estimated to be put into suspension by the ship's propellers (Bell et al 2009).

c. Sediment plume modelling shows that suspended sediment concentrations will be higher towards the seabed and lower towards the surface, and so there would be only limited opportunities around high tide periods for the deeper layers of

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suspended sediment plumes to disperse onto adjacent intertidal flats. Also, dispersion of sediment plumes is likely to be dominated by material being transported up and down the main channels by tidal currents rather by more dispersive or spreading processes (Bell et al 2009; Bell & Reeve 2010).

d. Modelling indicates that deposition of suspended sediments into intertidal areas and increases in turbidity are likely to be at levels sufficiently low to avoid disruption to intertidal communities that form the predominant prey of species of conservation concern, such as Pied Oystercatcher, Bar-tailed Godwit and Banded Dotterel.

e. The proposed *New Era* dredging operation is likely to increase suspended sediment concentrations in intertidal areas, mostly only reaching 20 mg/L, with some limited areas adjacent to the channels of up to 50 mg/L (Bell & Reeve 2010). Therefore, they are unlikely to significantly impact the filtering ability of intertidal invertebrates such as cockles, other bivalves and polychaete worms. In addition, most of the eastern parts of the Lower and Upper Harbour would be subject to neglible or no deposition (Bell & Reeve 2010) and deposition in areas such as the Aramoana Ecological Area are predicted to be less than 1 mm over the entire dredging period (James et al 2009), and so are highly unlikely to have significant adverse effects on the intertidal benthic communities.

22.2.3 Increasing turbidity levels throughout the harbour:

a. The dredging operation will have some potential effects on fishery use of the harbour because fish are likely to avoid high suspended sediment levels. In turn this could have an effect on the birds that feed on fish, such as shags and Blue Penguins. Gulls and terns are most likely to be affected by any reduction in the abundance of small fish due to reduced ability of the birds to see fish and invertebrate prey because of turbid water.

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In addition, little blue penguins also feed in the harbour, particularly around the entrance and could be affected if suspended sediment levels are increased there.

b. The turbidity levels predicted to result from the proposed dredging operations are within the natural range reported from Otago Harbour (James et al. 2009). Consequently, the level of any impact depends upon whether the dredging operation extends the duration of high suspended sediment levels that are avoided by small fish, and so both reduce the availability of prey to the birds and inhibit the ability of birds to see their potential prey.

c. In the Port of Melbourne situation 25 mg/l and 17 NTU ambient suspended sediment concentrations were set as the thresholds to protect Crested Terns (*Sterna cristata*) and Australasian Gannets *Morus serrator* (the same species that occurs in New Zealand). The predicted levels of on the intertidal flats of the Aramoana Ecological Area and other intertidal areas during dredging would only exceed this level for less than 0.5% of the time.

d. Most areas would be subjected to turbidity levels below that recommended in the Port of Melbourne case to protect seabirds, as indicated by the modelling study of Bell et al. (2009). I do not consider the minor exceedance of this level to be of any consequence here.

22.2.4 Removal of roosting sites

a. Roosting sites are usually used during high tides, when many birds are unable to feed because water covers their potential prey. Such sites are important for providing refuge from terrestrial predators and disturbance.

b. Large numbers of birds use the sand islands and shellbanks opposite Port Chalmers for roosting at high tide (Sagar 2008;

James et al. 2009). Other locations in the lower (outer) harbour are also used for roosting (Hamel 1991), but the removal of any sand islands opposite Port Chalmers during the proposed dredging operation could have a negative impact on the birds that use the harbour. Consequently, it is recommended that if any such islands are removed, then new island roosting sites should be created. An example of the utility of creating artificial roosting sites is at nearby Andersons Bay Inlet where a roost was built in June 2009 and is now used by a variety of wading birds and gulls (Otago Region OSNZ Newsletter February 2011).

22.2.5 *Disturbance of breeding and feeding birds by the dredge and blasting*

a. The main effects on birds of the proposed dredging could be excessive noise, lights and the occurrence of large vessels. However, birds in the harbour are acclimatised to regular ship movement and maintenance dredging and showed no response to ship movements during observations at the Aramoana Ecological Area (Sagar 2008).

b. Likewise, surveys before and after blasting by Port Otago Limited at the Beach Street Wharf, Port Chalmers, in 1993 documented the presence and effects on shags over the three-month operation. The report (Stewart 1993) concluded that marine birdlife appeared to be totally unaffected by the blasting.

c. Potential direct effects of dredging include disturbance of breeding and feeding birds through the presence of the dredge in the vicinity of breeding or feeding birds. The Department of Conservation has identified potential disturbance to feeding Bar-tailed Godwits in the Aramoana Ecological Area as species and location of particular concern in this respect. Avoiding dredging in the Aramoana area when godwits are preparing for their migration would eliminate entirely any potential impacts on birdlife, if they were to occur. Therefore, the following condition (consent 2010.193, condition 9)

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has been agreed in discussions between Port Otago Limited and the Department of Conservation and has been included in the consent conditions recommended and published by the Otago Regional Council in March 2011. Specifically, condition 9 states :

> *If the migratory population of godwits are* (sic) *present and feeding in the immediate area of the Aramoana sand flats shown in Appendix 5* (sic) *of this consent, during the period 1 February to 31 March of each year that Incremental Capital Works or Major Capital Works in the vicinity of the Aramoana sand flats are to be undertaken only when the tidal height is above half-tide (>1.0 metre above Chart Datum), except with the approval of the Consent authority in consultation with the Department of Conservation.*

d. In addition, of particular concern are Blue Penguins breeding at Pilots Beach and Otekiho Reserve; the core breeding season of this species extends from September to February (Marchant & Higgins 1990).

e. However, conditions 7 and 8 recommended and published by Otago Regional Council in March 2011 state:

> 7. *The consent holder shall not undertake Incremental Capital Works or Major Capital Works in the area adjacent to Taiaroa Head, and shown in Appendix 5* (sic) *of this consent between 20 December and 10 January of the following year (inclusive).*
>
> And
>
> *8. The consent holder shall not undertake Incremental Capital Works or Major Capital Works in the area adjacent to Taiaroa Head, and shown in Appendix 5* (sic) *of this consent, between 1 October and 30 November and 1 January and 14 February of each year, except with the approval of the Consent authority in consultation with the Department of Conservation.*

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f. Therefore, these two conditions combined restrict dredging in theses areas over most of the breeding period of Blue Penguins. In addition, it is my understanding that dredging would not be undertaken during a 3-week period in December-January (to allow undisturbed recreational use of Otago Harbour), and so would further mitigate any potential effects.

g. On the basis of my experience with both the species of concern, I believe that these conditions are more than sufficient to avoid impacts that may have otherwise occurred during dredging operations.

EFFECTS OF DISPOSAL OF DREDGED MATERIAL ON BIRDS

23. Previously, constraints mapping and modelling indicated that disposal of dredged material NE of Taiaroa Head would have the least impact on a range of activities. Subsequently, the preferred disposal area was narrowed to Site A0 (about 6.5 km NE of Taiaroa Head) where the potential for disposal material to impact on Blueskin Bay, the northern Otago coastline and Otago Peninsula, fisheries, and an area of unique bryozoan communities would be minimised (James et al. 2009). Consequently, I have based my assessment of potential effects of disposal at Site A0.

24. Disposal of the dredged material at this site could have a number of potential short- (up to several months) and long–term (>1 year) effects on birdlife in the region. In particular, these are:

a. reduced ability of birds using vision to detect prey through a decrease in water clarity;

b. a reduction in available prey through blanketing of the seafloor by disposal material or avoidance of suspended sediments by prey species; and

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c. disturbance of breeding and feeding birds through the presence of the dredge.

25. Schooling fish, squid and swarm-forming crustaceans such as *Munida gregaria* and *Nyctiphanes* species are the principal prey of seabirds off the Otago coast. Consequently, disposal of dredge material that affects these prey species could also have flow-on effects to seabirds by reducing the abundance or distribution of food available to the birds and the ability of the birds to detect any prey that are present.

26. A sediment plume will develop in the water column as each load of dredged material is released at the disposal site. Initially, at least, surface-layer suspended sediment concentrations in the top 30% of the water column will be considerably small than for the bottom layer because the discharge hopper in both *New Era* and the larger Major Capital Dredge is about 5 m below the surface (Bell et al. 2009). At the disposal area the near-surface suspended sediment concentrations for all silt classes from *New* Era are predicted to be in the range 7-11 mg/L above background concentrations (Bell & Reeve 2010). In the more concentrated bottom-layer, predicted suspended sediment concentrations will be 47-57 mg/L above background concentrations from *New Era*.

27. Sediment plume modelling by Bell et al. (2009) and Bell & Reeves (2010) indicate that the finer sediments in this plume will be dispersed away from the site by any prevailing water currents and winds at the time of disposal and may cause a short term reduction of water clarity, depending on where the plume disperses. Such effects would be limited to the duration of dredging and disposal, but could, in theory at least, affect all seabirds close to the A0 disposal site that use vision to find their prey. The extent of the area influenced by the offshore sediment plume is similar for both *New* Era and Major Capital Dredging (Bell & Reeve 2010). However, the concentrations of suspended sediments are low enough (<20 mg/l) once you get a few kilometres away from the disposal site that they would not, in my opinion, affect foraging by seabirds.

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28. Also, the main sediment plume disperses to the north rather than towards Taiaroa Head and the Otago Peninsula where a number of rare and endangered birds nest and raise their young. Although the fringes of the sediment plumes from both types of dredging will reach Otago Heads during light NNE winds, the excess suspended sediment concentrations for all silt classes will be no more than 0.6 mg/L (Bell & Reeve 2010), and this will be discernible especially against a background of natural environmental variation.

29. Because several species may be affected by the potential effects of a reduced ability to see prey and a reduction in the abundance of prey in the area affected by the disposal of dredged material, I will discuss these on a species by species basis, rather than discussing each potential effect separately as I did for Otago Harbour.

29.1 *Grey-headed Mollymawk*

29.1.1 The critically endangered Grey-headed Mollymawk breeds only on Campbell Island in the New Zealand region, is rare off the Otago coast and is considered to forage mainly off the continental shelf, over deep (>500 m) water (Marchant & Higgins 1990), and so is highly unlikely to be directly affected by disposal of dredge material.

29.2 *Northern Royal Albatross*

29.2.1 The one mainland breeding colony of Northern Royal Albatrosses is situated on Taiaroa Head, Otago Harbour. The location of the breeding colony, high on the promontory, ensures that it will not be affected directly by dredging activity. Monitoring of the feeding grounds of the Northern Royal Albatross has shown that waters within 100 km of the breeding colony were extremely important for the albatrosses (Waugh et al. 2005). However, a large amount of foraging also occurred in areas much farther offshore and birds spent multiple

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days at sea and travelled over large distances when searching for food (2-19 days at sea, travelling on average 2000 km). Consequently, because of the ability of the birds to forage over such a large area and mostly obtaining food right at the surface, potential impacts to the albatrosses due to dredging and dredged material disposal, if they were to occur, are likely to be minimal and confined to when they are traversing the disposal site and immediately downstream.

29.3 *Sooty Shearwater*

29.3.1 Sooty Shearwaters breed in colonies on Otago Peninsula (Sagar et al. 2002). They feed mainly on small fish, squid, krill and other small crustaceans and collaborative research that I have been involved in clearly shows that birds from these colonies and from islands south of Otago Peninsula forage widely, obtaining their food by diving to depths of over 40 m and have the ability to cover large areas of ocean rapidly. Figure 1, taken from some of my research, shows the tracks of 28 Sooty Shearwaters during the breeding season (October-May).

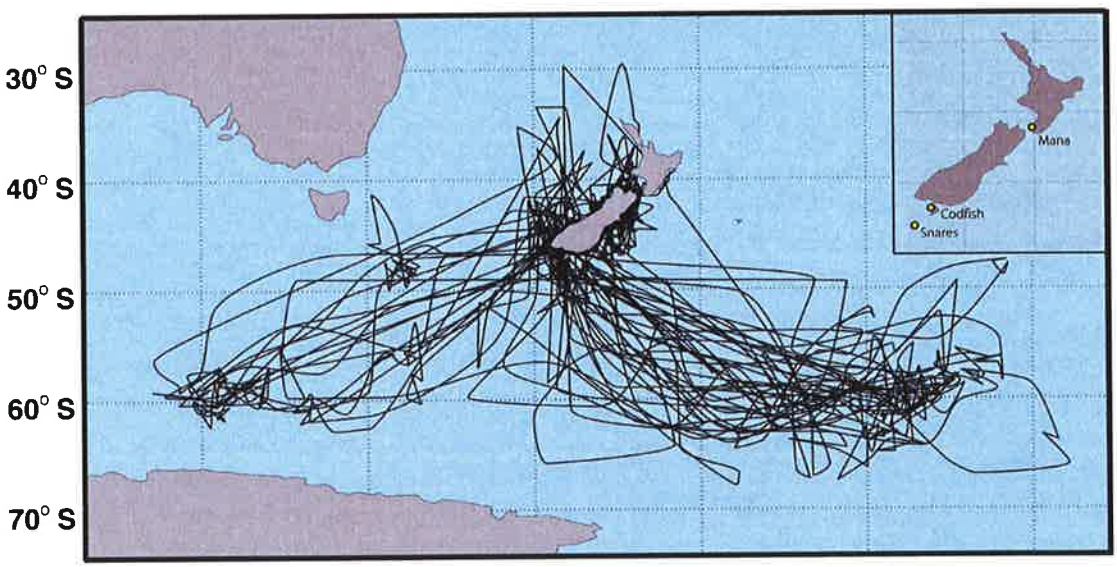

Figure 1: Tracks of individual foraging trips made by 28 different Sooty Shearwaters during the breeding season (September-April) (from Shaffer et al. 2010)

29.3.2 These tracks show that Sooty Shearwaters travel widely when foraging for food and that the proposed A0 disposal area occupies a minute fraction of the total foraging area available. All albatrosses, petrels and shearwaters reported from A0 disposal area similarly travel over extensive areas when searching for food, and so are highly unlikely to be affected by disposal of dredged material in this area.

29.3.3 The spatial distribution of Sooty Shearwaters flying or sitting on the sea off the Otago Peninsula documented in surveys in 1994-96 (O'Driscoll et al. 1998) indicated that the area of the proposed A0 disposal site is likely to be used by the birds as a route to deeper water, but a number of birds were also observed to either be resting or feeding in the vicinity of the site. Therefore, feeding and passage in the vicinity of the disposal site and immediately downstream could be affected during the actual disposal operation, but the ability of these birds to cover large areas of ocean rapidly should ensure that they are not adversely affected by the disposal of dredged material.

29.4 *Penguins*

29.4.1 Both Yellow-eyed Penguins and Blue Penguins breed on Otago Peninsula and are likely to forage at some stage within the proposed A0 disposal zone. An increase in the concentrations of suspended sediments and disruption of benthic communities and associated food sources in this zone could mean that birds would have to forage over larger distances than usual.

29.4.2 Following a study of the foraging movements of Yellow-eyed Penguins that were breeding at Oamaru, Mattern (2007) concluded that they showed very consistent foraging patterns at all stages of the breeding cycle and foraged almost exclusively at the seafloor and targeted specific areas that featured reefs or epibenthic communities. Mattern (2007) further concluded that Yellow-eyed Penguins find it difficult to react quickly to a sub-optimal food situation and overall show a specialisation for a consistent benthic environment.

29.4.3 Yellow-eyed Penguins lay eggs in September and these hatch after 39-51 days incubation; chicks fledge in mid-February and are completely independent of their parents (Marchant & Higgins 1990). Breeding success of Yellow-eyed Penguins has been shown to be related to foraging time. Thus, breeding birds that later failed undertook longer trips during incubation than did birds that bred successfully. Therefore, any increase in foraging time brought about by an inability to see prey because of increased concentrations of suspended sediments or a reduction in prey abundance resulting from disruption of benthic communities by an accumulation of sediments could reduce breeding success of Yellow-eyed Penguins.

29.4.4 However, Yellow-eyed Penguins tend to forage on small fish such as sprat, red cod, silverside, blue cod, which they obtain mostly at depths greater than 40-80 m and up to 160 m (Moore & Wakelin 1997; Moore 1999). Figure 12.24 in Bell et al. (2009) shows that disposal site A0 lies in depths of 25-30 m, and so Yellow-eyed Penguins are likely to occur mostly well offshore from this area. Consequently, they are unlikely to be affected by *New Era* or Major Capital Dredging.

29.4.5 Tracking of Blue Penguins in Western Australia revealed that during the breeding season the birds foraged almost exclusively within 15-20 km of the colony, where waters were a maximum of 17 m deep (Klomp & Wooller 1988). Here they fed on a variety of surface schooling fish, squid and crustaceans (Klomp & Wooller 1988; Wienecke et al. 1995). Consequently, although Klomp & Wooller (1988) did not determine whether foraging range or depth was more important in determining where the penguins foraged, the fact that they fed on schooling fish, squid and crustaceans, which tend to swim in mid- or near-surface waters, indicates that foraging range was more important. In other words, the penguins are limited primarily by how far they can swim in a day and still return to their breeding colony at night, and only secondarily by how deep they are able to dive for food.

29.4.6 Subsequent studies of foraging of the penguins by Cannell & Cullen (1998) and Ropert-Coudert et al. (2006) found that the birds leave their breeding site and move into deeper water during the day and reverse the process towards evening, indicating that the penguins needed light to forage efficiently.

29.4.7 The proposed A0 disposal area lies about 6.5 km off Taiaroa Head where the water is 25-30 m deep (Figure 12.24 in Bell et al. 2009), and so is within the foraging range but deeper than depths used by Blue Penguins in the Western Australia study.

29.4.8 Therefore, if Blue Penguins in New Zealand forage in a similar manner, any increase in the turbidity of the water off Taiaroa Head, brought about by a prolonged increased concentration of suspended sediment could potentially reduce the foraging ability of the penguins by decreasing their ability to see prey or by potential prey avoiding the area of increased turbidity, and so becoming unavailable to the penguins.

29.4.9 This would be most important during the chick-rearing stage (the core period of which is October-December inclusive), when the parents need to find food not only for themselves, but also for their 1-2 chicks. Consequently, any reduction in their foraging ability could potentially result in them providing insufficient food to their chicks, resulting in reduced breeding success.

29.4.10 Nevertheless modelling of the suspended sediment concentrations and the associated plume arising from disposal by the *New Era* dredge (Bell & Reeves 2010) indicates that this method will have minimal effect on background levels, and so should not have any impact on the foraging efficiency of Blue Penguins.

29.4.11 Suspended sediment concentrations and the associated plume arising from disposal by the much larger Major Capital Dredge are

more likely to affect Blue Penguin foraging by both reducing their ability to see prey and by potential prey avoiding the more turbid area.

29.4.12 Any such effect will be confined to the breeding season that Major Capital Dredging occurs in, and has no long term or population level implications.

30. *Shags*

30.1 Four species of shag inhabit Otago Harbour and the adjacent coastline. Howlett Point is the only mainland breeding location of the Stewart Island Shag. The Otago population of Stewart Island and Spotted Shags represents about 20% of the species around New Zealand.

30.2 The diet of these shags was has been analysed, allowing the foraging areas of the birds to be deduced from the habits of their prey (Lalas 1983). Black and Little shags generally forage close to shore in shallow water feeding on small fish (mostly yellow-eyed mullet, thornfish, and red cod for Black Shag and cockabullies, flounder and sole for Little Shags). Stewart Island and Spotted Shags feed up to 15 km offshore, mainly on small fish with Stewart Island Shags feeding on cockabullies, flounder and sole, and Spotted Shags feeding on the deepwater ahuru, and sprats, gudgeon and red cod. Little Shags and Stewart Island Shags are considered to be demersal (bottom) feeders, Spotted Shags pelagic (water column) and Black Shags both demersal and pelagic.

30.3 Although vision has a primary role on the foraging of shags recent research (White et al. 2008) shows that their underwater visual acuity is poor, in other words they do not detect their prey at great distance and pursue it. Instead, shags primarily forage by detecting their prey at

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close-quarters, perhaps by flushing it from the seabed, and then they lunge (by rapidly extending their long neck) at the escaping prey.

30.4 Consequently, such hunting behaviour is unlikely to be affected by any reduced visibility due to increased concentrations of suspended sediments at the A0 disposal site. However, as discussed in the evidence of Dr James, disposal of material by the Major Capital Dredge is likely to interrupt habitats and feeding grounds of fish species that make up the majority of the diet of Otago shag species, and so reduce the abundance of prey species, but only for a finite period and only in a small area relative to the total foraging area available.

30.5 Although the effects of disposal of material by the Major Capital Dredge are likely to affect only a relatively small proportion of the total foraging area of most species, it is possible that the foraging efficiency of Stewart Island Shags could be affected. This is because they have a more restricted foraging range, and so Major Capital Dredging during their core breeding season (September-January, Lalas 1983) could result in reduced breeding success because the parents were unable to find sufficient fish to feed their chicks. As with the Blue Penguins, any such effect will be confined to the breeding season that Major Capital Dredging is undertaken and has no long term or population level implications.

31. *Terns*

31.1 White-fronted Terns breed in colonies on the outer coasts of Otago Peninsula, but Caspian Terns and Black-fronted Terns do not breed in the area. Thus breeding of these terns should not be affected by dredging. Fifty to seventy, and occasionally almost 200 birds, of the Nationally Endangered Black-fronted Tern roost in Otago Harbour, mostly during autumn and winter months. These birds forage in adjacent coastal waters, primarily on planktonic larvae, taken from the surface or just below the surface. The preferred prey of Caspian and

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White-fronted Terns are fish and crustaceans which they capture by plunge diving. Consequently, even though they forage over a large area, dredging and disposal could temporarily interrupt habitats and feeding grounds of all these species of tern and their prey species in the immediate vicinity of the disposal site, particularly by reducing the ability of the terns to detect their preferred prey. However, because they forage over a large area I would expect any effects on the foraging ability of terns to be insignificant when set against natural variability in planktonic prey abundance.

32. *Other species*

32.1 In addition to White-fronted Terns a number of other pelagic feeding bird species are known to use the disposal area for passage or for resting and feeding. Observations up to 14 km off the Otago Peninsula indicate that this region (including the proposed A0 disposal area) is also important for passage, resting and feeding by Black-backed Gulls, Buller's Mollymawks, Red-billed Gulls, Black-billed Gulls and Stewart Island Shags (McClatchie et al. 1989; O'Driscoll 1997; O'Driscoll et al. 1998). In this region Red-billed Gulls and Black-billed Gulls feed mostly on euphausiids (krill) while Black-backed Gulls feed mainly on fish and *Munida gregaria* (decapod). These birds often aggregate along salinity fronts where krill and other plankton can be abundant, particularly in summer when krill form swarms. The distribution of *Munida* postlarvae are very patchy and tend to be highest along the inner to middle shelf from Blueskin Bay to Moeraki. Larvae are found offshore in June/July with the post-larvae shoaling inshore over summer. Most of the pelagic feeding seabird species observed occurred throughout the ~130 km^2 area studied, with little change in seabird assemblage observed with increasing distance out to at least 14 km.

32.2 Modelling indicates that the concentrations of suspended sediments in surface waters are likely to be less than 185 mg/L (wet weight) at the disposal site itself (2 km diameter) and less than 20 mg/L at distances more than a few km to the north of the disposal site. In a similar

project to deepen the channel and dispose of dredged material in Port Melbourne the threshold set by Port of Melbourne to protect terns and gannets was 25 mg/L. Thus the levels likely to be encountered by birds foraging off the Otago coast during disposal of dredge material could have a degree of impact, but only in the very localised area around the proposed A0 disposal site and a small distance to the north, and only during disposal by the larger capital dredge (Bell et al. 2009; Bell & Reeve 2010). Direct impacts on foraging would be mostly during the disposal period itself. However, recovery of the benthic organisms in the seabed in the immediate area of disposal could take a few years, as reported in the AEE (James et al. 2009).

33. *Disturbance of breeding and feeding birds through the presence of the dredge*

33.1 In my experience birds quickly habituate to the presence of vessels at sea and may even be attracted to working vessels because these may disturb potential prey that the birds may then take.

33.2 The proposed A0 disposal area is situated about 6.5 km off Taiaroa Head, and so the dredge may distract seabirds (especially Northern Royal Albatross, penguins, and Sooty Shearwaters) commuting to and from their nests at the Head. Consequently, the following conditions recommended and published by Otago Regional Council in March 2011 (consent 2010.193) mitigate this possibility:

7. *The consent holder shall not undertake Incremental Capital Works or Major Capital Works in the area adjacent to Taiaroa Head, and shown in Appendix 5 (*sic*) of this consent between 20 December and 10 January of the following year (inclusive).*

And

*8. The consent holder shall not undertake Incremental Capital Works or Major Capital Works in the area adjacent to Taiaroa Head, and shown in Appendix 5 (*sic*) of this consent, between*

1 October and 30 November and 1 January and 14 February of each year, except with the approval of the Consent authority in consultation with the Department of Conservation.

33.3 These conditions prevent dredging close inshore to the breeding areas of the albatrosses, penguins and shearwaters at critical stages of the breeding season. In addition, disposal of material dredged from other areas of the Harbour involves normal vessel movements into and out of the Harbour, something which the birds are habituated. Consequently, it is my opinion that these conditions adequately address any concerns that may arise about potential disturbance to breeding birds.

Any potential effects of the presence of the vessel on feeding birds could be mitigated by the dredge avoiding areas where concentrations of birds are feeding.

RESPONSE TO SUBMISSIONS

34. For the sake of brevity and to avoid repetition I have grouped submissions that, in my opinion, raise the same or similar concerns.

35. **Otago Regional Council – S42A report**

35.1 The Otago Regional Council's Director of Resource Management reviewed the proposed work, the environmental setting and reports commissioned by the applicant, and statutory considerations pertinent to the proposal. In considering the latter the report concludes (para 445) that recommended conditions of consent will ensure that any actual or potential environmental effects are avoided, remedied or mitigated. The report further concludes (para 449) that the characteristics contained within the Otago Harbour and northern coastlines and have been recognised and consent conditions have been recommended to ensure effects on these values are minimised. I agree with these conclusions.

35.2 In relation to the Regional Coastal Plan for Otago, the report concludes (para. 502) that the proposal is consistent with the objectives and policies of the Plan. I agree with these conclusions.

35.3 Finally, the report recommends (para 541) that the applications be granted subject to the terms and conditions, subject to the terms and conditions set out in the draft consents included in the report of March 2011. I agree with this recommendation.

36. **Submission by Director-General of Conservation**

36.1 The submission by the Director-General of Conservation (p. 2 section 4) states significant threatened indigenous fauna are known to inhabit the Otago channel, A0 disposal area and its receiving environment, but because of a lack of detail in the Applications the Department cannot adequately assess the potential and actual adverse effects on the environment, including significant habitats of indigenous fauna.

36.2 I agree with that part of the Department's submission where it states that significant threatened indigenous fauna inhabit the Otago channel, A0 disposal area and its receiving environment. It is my understanding that Port Otago Limited and representatives of the Department have continued to meet and discuss means of addressing any adverse effects of the proposal and that these have resulted in the recommended conditions 7 and 8 (ORC March 2011) cited earlier in the body of my evidence.

36.3 I am satisfied that there is sufficient information available to assess the effects of the proposal, as set out in my evidence and in that of other witnesses.

37. **Otakou Runaka**

37.1 This submission seeks two conditions that specifically concern birdlife:

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a. Avoiding dredging during the breeding period for birds, and in the Aramoana area when godwits are preparing for their migration; and

b. The dredging of the area termed "Howlets Claim (north off Taiaroa Head) should take place outside of the periods centred on both dawn and dusk, as penguins move to and from the sea to Pilots Beach during these periods.

37.2 In response, I support the first point and this is already accounted for in the recommended conditions 7 and 8 (ORC March 2011) cited earlier in my evidence.

37.4 In respect of the second point the two draft conditions 7 and 8 (ORC March 2011) also restrict dredging over most of the breeding period of Blue Penguins. It is my opinion that these conditions adequately mitigate this concern.

38. **Aramoana Conservation Group**

38.1 This submission considers that the Aramoana Ecological Area is of regional significance for birdlife and that the applicant has not taken into account the seasonal or annual issues with regards to birdlife.

38.2 I do not agree with this, based on the analyses I have undertaken when preparing my evidence.

38.4 The Group also identifies the A0 disposal zone as a feeding area of Yellow-eyed Penguins. I agree with this, but consider that this zone comprises a very small proportion of the total foraging area of Yellow-eyed Penguins which I believe will not be adversely affected by the proposal.

39. **Yellow-eyed Penguin Trust**

39.1 This submission raises the likelihood of Yellow-eyed Penguins from Aramoana and Kaikai Beach foraging in the disposal zone with

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penguins from further afield (breeding at Bobby's Head, Shag Point and Katiti Point) possibly being affected by the sediment plume.

39.2 As already noted, It is my opinion that this zone comprises a relatively small proportion of the total foraging area of Yellow-eyed Penguins which I believe will not be adversely affected by the proposal.

39.3 In addition, the Trust requests that pre- and post-dredging monitoring of Yellow-eyed Penguin and Southern Blue Penguin foraging patterns, with suitable controls, be completed using GPS and dive loggers.

39.4 I do not agree. There is an increasing body of literature that indicates significant effects of flipper banding and the deployment of devices on penguins (e.g. Saraux et al. 2011). Consequently, deployment of such devices may have significant adverse effects on the survival of the individual monitored birds and their breeding performance.

40. **Otago Conservation Board**

40.1 **Sir Alan Mark**

40.1.1 These submissions request that a condition of any consent include halting of dredging in the vicinity of the Aramoana Ecological Area when large numbers of sea birds (sic) are feeding there i.e. from mid September to April.

40.1.2 I note that the recommended condition 9 (ORC March 2011) states:

> *If the migratory population of godwits are* (sic) *present and feeding in the immediate area of the Aramoana sand flats shown in Appendix 5* (sic) *of this consent, during the period 1 February to 31 March of each year that Incremental Capital Works or Major Capital Works in the vicinity of the Aramoana sand flats are to be undertaken only when the tidal height is above half-tide (>1.0 metre above Chart Datum), except with the approval of the Consent authority in consultation with the Department of Conservation.*

40.1.3 In conjunction with the observed lack of any reaction by any birds to passing vessels during the study of the distribution of birds feeding in the Aramoana Ecological Area (Sagar 2008) it is my opinion that the concern of the Board is adequately addressed.

41. **New Zealand Marine Sciences Society**

41.1 The submission of the Society raises a concern (p.3 point 5) that very little very little consideration has been given to the potential activities of the proposed activities on higher trophic level species, including marine mammals and seabirds.

41.2 I disagree with this statement and consider that my evidence and that of other witnesses have adequately addressed these issues.

42. **Friends of the Harbour**

42.1 This submission is concerned (p.2 para 2.7) that an assumption is made that highly mobile marine fauna such as... yellow-eyed penguins, shags and other seabirds will all be able to feed beyond the proposed disposal area.

42.2 I disagree with this conclusion. In my evidence have explained using Sooty Shearwater as an example, how species of albatross, shearwater and petrel forage over wide areas. In addition, both my evidence and James et al. (2009) acknowledge that penguins and shags and their preferred prey may potentially be adversely affected by the disposal of dredged material. However, I do not consider this to be a significant issue and is one that the recommended conditions 6 and 7 (ORC March 2011) cited earlier in my evidence deal with effectively.

42.3 With respect to feeding habits of wading birds the submission is concerned that inadequate account is taken of the seasonality, tidal cycles, weather conditions and turbidity. The submission is particularly concerned about any effects of dredging on the feeding of Bar-tailed

Godwits and coming ashore of Blue Penguins and requests that if the consent is granted that a condition be that no dredging is permitted from August to late February, nor from 5.00 am – 9.00 am and 5.00 pm – 9.00 pm.

42.4 I do not agree.

43. **Save the Otago Peninsula Inc Society**

43.1 This submission requests that if the proposal is approved then 2 conditions be imposed:

a. Alternative methods of disposing of all or part of the dredged material within the Harbour, by creating...bird roosts...

b. Dredging operations opposite Pilots Beach are not carried out during the evening and night hours when Little Penguins are gathering and crossing the channel to come onshore to their nests and go out again to feed.

43.2 As discussed in my evidence in chief, I agree with the submission regarding the creation of roosts to replace any that are removed in the area of Port Chalmers.

43.3 In respect of the second point the recommended conditions 7 - 9 (ORC March 2011), cited earlier in my evidence, restrict dredging over most of the breeding period of Blue Penguins.

44. **Dunedin Branch Royal Forest & Bird Protection Society**
Dr Peter Walker & Ms Jennifer Aimers
Naomi Wilson

44.1 These submissions raise concerns about disruption by noise, increased activity or destruction of feeding areas for a number of seabirds caused by dredging activity or disposal of dredge material.

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44.2 In response, all of these issues are discussed in my evidence and it is my opinion that the recommended conditions will properly address any adverse effects of birdlife.

45. **Drs Fisher & Davidson**

45.1 This submission raises concerns about the effects of blasting on wildlife.

45.2 In response, I consider that the surveys before and after blasting by Port Otago Limited at the Beach Street Wharf, Port Chalmers in 1993 documented the presence and effects on shags over the three-month operation. The report (Stewart 1993) concluded that marine birdlife appeared to be totally unaffected by the blasting.

46. **Jean Bretherton**

46.1 This submission requests protection of the Aramoana Ecological Area because this is important bird habitat.

46.2 I agree with the submission and in my evidence in chief I discuss why it is my opinion that dredging will not cause any discernible harm to the bird habitat in this area.

CONCLUSION

47. Provided conditions are imposed in accordance with those recommended by Otago Regional Council in March 2011 and cited in my evidence, I am of the opinion that there are no bird-related reasons why these consents cannot be granted.

SWORN at Christchurch)
By **PAUL MICHAEL SAGAR**) P.M. Sagar
this 4th day of April 2011)
before me:)

GRANT SEFTON ADAMS

A Solicitor of the High Court of New Zealand

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APPENDIX 1 – Some recent relevant publications of Paul Michael Sagar

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