BEFORE THE MARLBOROUGH SALMON FARM RELOCATION ADVISORY PANEL

IN THE MATTER: SECTION 360A OF THE RESOURCE MANAGEMENT ACT 1991

AND

IN THE MATTER: A PROPOSAL TO AMEND THE MARLBOROUGH SOUNDS RESOURCE MANAGEMENT PLAN TO ENABLE THE RELOCATION OF UP TO SIX EXISTING SALMON FARMS

SUMMARY OF THE EVIDENCE OF ROB SCHUCKARD

FOR

FRIENDS OF NELSON HAVEN AND TASMAN BAY &

KENEPURU AND CENTRAL SOUNDS RESIDENTS ASSOCIATION

1. This document is briefly accentuating and/or highlighting aspects presented in the STATEMENT OF EVIDENCE OF ROB SCHUCKARD dated March 2017.
2. In 2013, the Board of Inquiry consented two new farms in the Waitata Reach of 10,000 tonnes of the applied for 24,000 tonnes of salmon feed. These developments need to be initiated through adaptive management. The Supreme Court concurred that this approach of adaptive management reflected in both the plan and the consent conditions, was consistent with a proper precautionary approach. The precautionary approach was required to overcome uncertainties and shortcomings in the evidence presented at the time of application.
3. The new 2017 proposal for relocation of farms (the proposal) seeks an additional 23,000 tonnes of feed in addition to the consented 10,000 tonnes. These excessively high additional feed levels are inconsistent with the approach of adaptive management prescribed by the Board of Inquiry and confirmed by the Supreme Court. The proposal stretches the hydrodynamic models beyond their original scope and purpose, particularly in the Pelorus Sound.
4. The proposal will introduce uncertainties in coastal management beyond the precaution that was required to promote sustainable management for consenting two new farms by the Board of Inquiry. The uncertainty also relates to effects of increased salmon farming on

the well-being of the King Shag and its feeding environment. In particular, those King Shags breeding on Duffers Reef and feeding in Waitata Reach will be affected by anthropogenic developments that are significantly more compared to what the Board of Inquiry was considering.

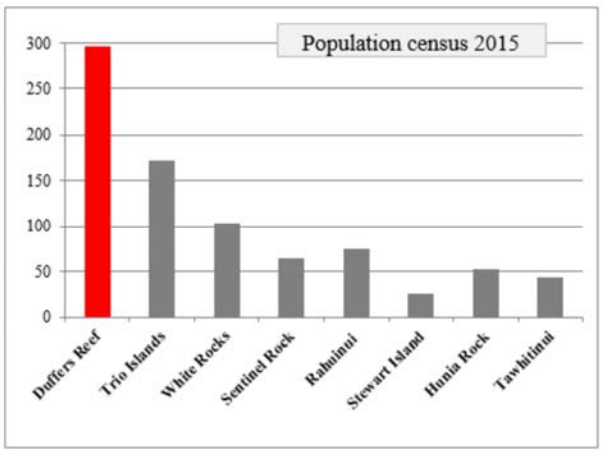
5. Uncertainties created with the relocation proposal do not give effect to Policy 11 of the New Zealand Coastal Policy Statement 2010 to protect indigenous biodiversity. For King Shag in particular, the proposal does not avoid adverse effects of the activity of salmon farming on (a):

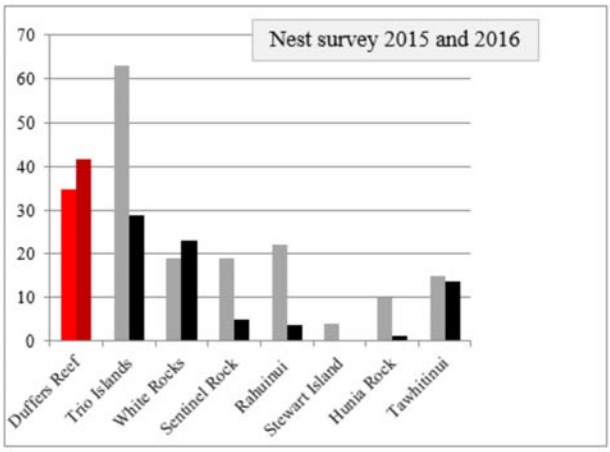
> (i) indigenous taxa that are listed as threatened[5] or at risk in the New Zealand Threat Classification System lists;
> (ii) taxa that are listed by the International Union for Conservation of Nature and Natural Resources as threatened;
> (iii) indigenous ecosystems and vegetation types that are threatened in the coastal environment, or are naturally rare[6];
> (iv) habitats of indigenous species where the species are at the limit of their natural range, or are naturally rare;
> (v) areas containing nationally significant examples of indigenous community types; and
> (vi) areas set aside for full or partial protection of indigenous biological diversity under other legislation; and

The proposal does also not avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on (b):

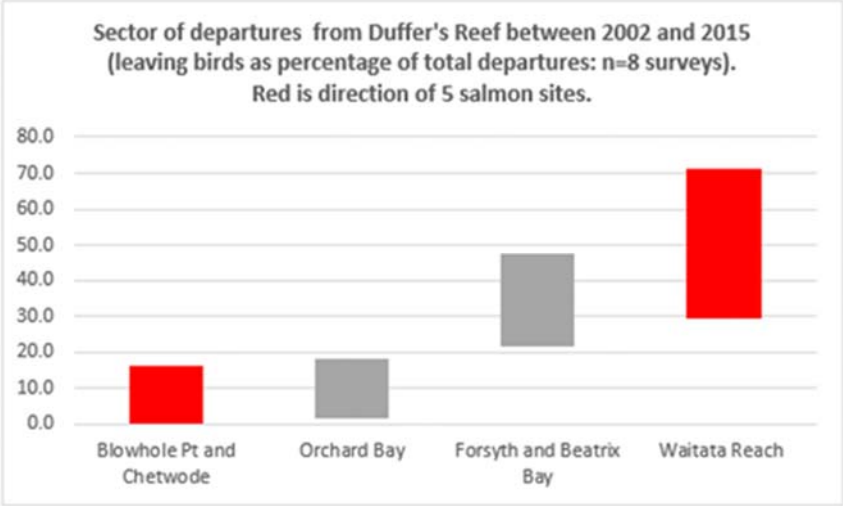
> (i) areas of predominantly indigenous vegetation in the coastal environment;
> (ii) habitats in the coastal environment that are important during the vulnerable life stages of indigenous species;
> (iii) indigenous ecosystems and habitats that are only found in the coastal environment and are particularly vulnerable to modification,
> (iv) habitats of indigenous species in the coastal environment that are important for recreational, commercial, traditional or cultural purposes;

6. This proposal has the potential to interfere with (confound) King Shag management in the environment of the Pelorus Sound (and the Waitata Reach in particular) that are beyond the precaution imposed in consents by the Board of Inquiry.
7. Duffers Reef is the most significant colony of King Shags. Both North Trio Island and Duffers Reef host up to 61% of all nests of the species.



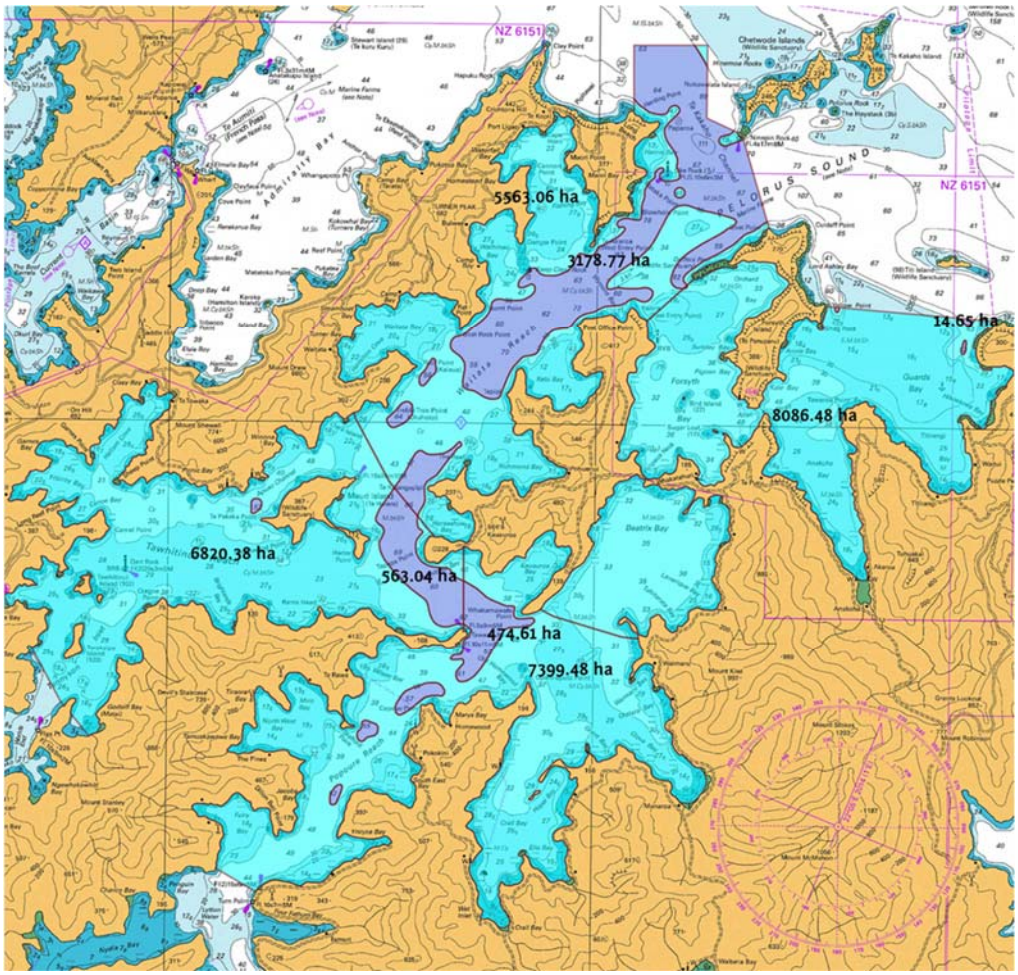


8. Most King Shags from Duffers Reef feed within the Waitata Reach, in particular within the range of up to 12km and up to 25 km from the colony. The area up to 12 km from Duffers Reef is selected for the relocation of salmon farms.



9. The Waitata Reach, including the bays on either site, are not a pristine environment. Mussel farming in this area has been developed in most bays and salmon farming has recently been expanded with an additional two farms.

10. In the Waitata Reach and adjacent bays up to 12km from Duffers Reef (just north of Maud Island and incorporating Horseshoe Bay) 5,563 ha of water is up to 50m deep. Waters of these depths are most used by King Shags to forage. About 3,179 ha is deeper than 50m.
11. In the area of 0-50m, about 303 ha is consented for about 57 marine farms. Seabed effects from mussel farms are most pronounced directly beneath farm sites and up to 20-50 m outside the lines. It is estimated that the mussel farm footprint in the area of the Waitata Reach, up to 12km from Duffers Reef, to be about 600 ha.



12. Apart from the Mid Waitata Reach proposed salmon farm, all other farms are close to or in the 0-50m depth range of King Shag feeding habitat. The footprint of Waitata, Richmond, Blowhole North, Blowhole South, Richmond and Horseshoe Bay combined is about 105ha.

The Mid Waitata Reach proposal has a benthic footprint of about 45 ha in water deeper than 50m. If the whole area of 5563 ha was randomly used by King Shag as feeding area, the proposal will add to a benthic effect of Enrichment Stage 3.0 and higher to a total of 705ha or 13% of the King Shag feeding area in the Waitata Reach feeding area. However, the slow but incremental impact of significant nitrogen loading into the water column as a result of increased salmon farming will have a further impact on the benthic environment of the remaining feeding area through increase of water turbidity and lower water clarity and a higher chance of the increase of nuisance and/or toxic algae.

13. Most seabirds are visual hunters and thus strongly affected by light levels while pursuing prey. Depth utilization by diving shags is deeper around midday compared to earlier or later in the day. Light limited foraging patterns have been recorded by blue-eyed shags (*Phalacrocorax atriceps*) to be between -0.3 and 2 log10 lx. (0.5 and 100 lux)[1].
14. The dynamics between light, nitrogen and phytoplankton presents complexities determining the "limiting substrate" to control and/or reduce eutrophication. The limiting substrate might not be a nutrient at a certain time but could be light. The Pelorus system can exhibit very low nitrogen concentrations, predominantly in surface waters of embayments in summer. Small increases in phytoplankton in low nitrogen systems (like the Sounds) can greatly compress the range available for deep diving blue eyed shags. Impact on foraging for epibenthic fishes can be profound. E.g. for a change in chlorophyll level from 1 mg/m^3 to 2 mg/m^3 the available depth range for King Shag could shrink from 52m to 37m.
15. Individual fidelity to a particular foraging area is reported for a number of shag species including the Crozet Shag (*Phalacrocorax melanogensis*). This may help increase foraging efficiency through memorization of the bottom's topography and the habits of its fauna. Such a strategy may considerably reduce search time among marine benthic top predators (especially by individuals of resident species) by enhancing the predictability of prey location for a given individual[2].

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[1] Wanless, S., Finney, S.K., Harris, M.P. and McCafferty, D.J. 1999. Effect of the diel light cycle on the diving behaviour of two bottom feeding marine birds: the blue-eyed shag *Phalacrocorax atriceps* and the European shag *P. aristotilis*. Mar. Ecol. Prog. Ser. 188:219-224.

[2] Cook, T.R., Cherel, Y., Tremblay, Y. 2006. Foraging tactics of chick-rearing Crozet shags: individuals display repetitive activity and diving patterns over time.

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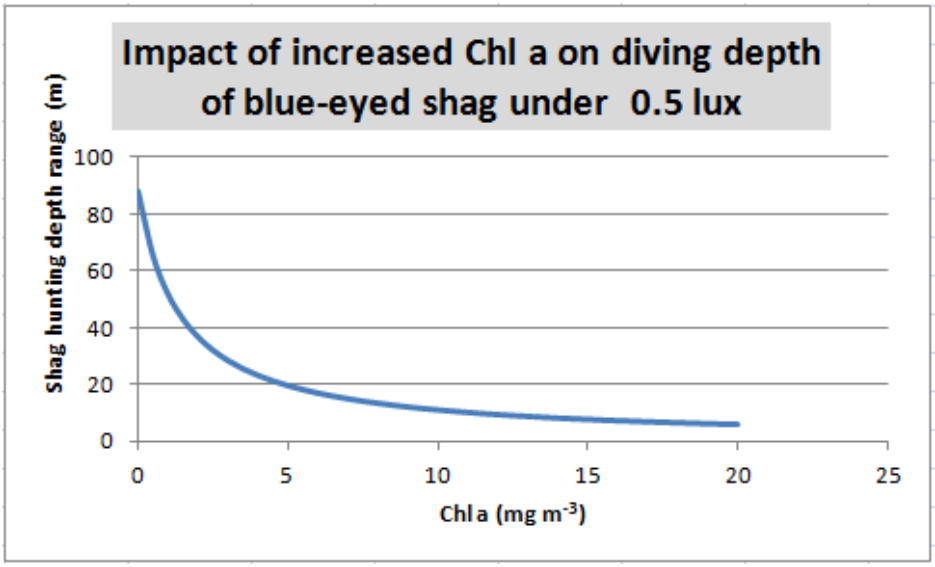
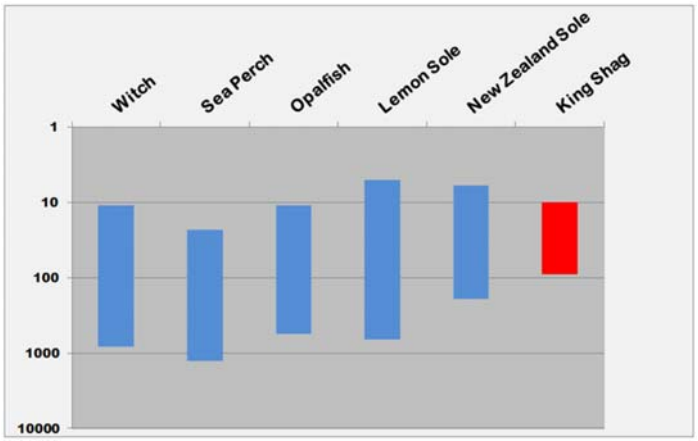


17. The aquatic visual acuity of great cormorants was measured under a range of viewing conditions and found to be unexpectedly poor[3] and comparable to unaided humans under water. The efficient hunting by cormorants involves the use of specialized foraging techniques which employ brief short-distance pursuit and/or rapid neck extension to capture prey that is visually detected or flushed only at short range (less than 1m).
18. Most, if not all prey species of King Shag are caught in the upper level of their distribution requiring deep diving capabilities. Changes in water turbidity and water clarity may change this prey-predator relationship. Attenuation is positively correlated with chlorophyll concentration (and suspended inorganic solids concentration).

[3] White, C.R., Day, N., Butler, P.J., Martin, G.R. 2007 Vision and Foraging in Cormorants: More like Herons than Hawks? PLoS ONE 2(7): 1-6.

Martin, G.R. 2011. Through birds eyes: insight into avain sensory ecology. J.Ornithology DOI 10.1007/s10336-011-0771-5.



19. Marlborough District Council has monitored water quality at seven sites in Pelorus Sound on a monthly basis since July 2012. Mean Chlorophyll concentrations at the two outermost stations in the Waitata Reach, are the lowest, the area where most King Shags from Duffers Reef feed. Mean near surface concentrations of chlorophyll a were 1.2 mg m^{-3} and 0.97 mg m^{-3} near the seabed during the summer and 1.9 and 0.9 respectively during the winter. The conditions set for the two consented new farms in the Waitata Reach in adaptive management require that there should be no increase in the frequency or duration of phytoplankton blooms (i.e., chlorophyll concentrations ≥5 mg/m^3).
20. This condition was later adapted by New Zealand King Salmon Ltd. and Marlborough District Council where they agreed to increased surveillance if chlorophyll concentrations > 3.5 mg m^{-3} are recorded in 3 sequential months.
21. The consent conditions do also not allow a change in the typical seasonal patterns of phytoplankton community structure (i.e. diatoms vs. dinoflagellates), and no increased frequency of harmful algal blooms is allowed. Some of the dinoflagellate produced foam destroys the waterproof layer of feathers that keeps seabirds dry, restricting flight and leading to hypothermia. One of these dinoflagellate *Akashiwo sanguinea* is regularly blooming in Opua Bay, Tory Channel[4]. Uncertainty about the containment and management of this dinoflagellate species should be a fundamental aspect in the management of a threatened species like King Shag.
22. Pathways to higher eutrophication provide almost impossible scenarios in terms of predicting how the balance between different phytoplankton communities respond to these changes.

[4] L. McKenzie presentation Aquaculture review meeting 3 October 2016 (NIWA, Wellington)

23. Overall, the additional fish farms as consented by the BOI are predicted to increase summertime near-surface total phytoplankton standing stocks by 5–10% relative to the existing conditions. The model suggests that they will only rarely (and locally) exceed 5 mg Chl m^{-3}.
24. The authors[5] perceive it plausible that the combination of the BOI approved farms and at least some of the moved-and-expanded farms will induce changes (increases) mounting to 10–20% over present, real-world water-quality conditions.
25. The same authors conclude that given the comparatively small differences evident between scenarios 1 ($baseline_{2016}$) and 13 (the one inducing the largest changes but not incorporating all the farms proposed), it would not generate frequent breaches of 5 mg Chl m^{-3} (or, perhaps, 3.5 mg Chl m^{-3}). They continue: "However, the simulations still suggest that all the alternative scenarios will yield a system that is (slightly) more enriched than the present one. Ultimately, much may depend upon how the phrase '*beyond that which is likely to occur naturally*' from the Waitata consents[6] is interpreted.
26. The proposal adds further risk to an endangered species that is at risk of extinction in the medium term. This proposal is not in accordance with Policy 3 of the New Zealand Coastal Policy Statement 2010.

[5] Broekhuizen, N. and Hadfield, M. 2016. Modelled water column effects on potential salmon farm relocation sites in Pelorus Sound. NIWA CLIENT REPORT No: HAM2016-012

[6] 43(e) - To not cause a statistically significant shift, beyond that which is likely to occur naturally, from a oligotrophic/mesotrophic state towards a eutrophic state.