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All written comments received on the MPI salmon relocation proposal, grouped according to surname/business/organisation/Iwi name.

Written Comment No:0587

Subject	**RE: Proposal for potential relocation of salmon farms in the Marlborough Sounds - Forest & Bird submission**
From	Sally Gepp
To	aquaculture submissions
Cc	Peter Anderson; Jennifer Miller; Debs Martin
Sent	Tuesday, 28 March 2017 11:41 a.m.
Attachments	<<Proposal for potential relocation of salmon farms in the Marlborough Sou....pdf>>

Dear sir/madam,

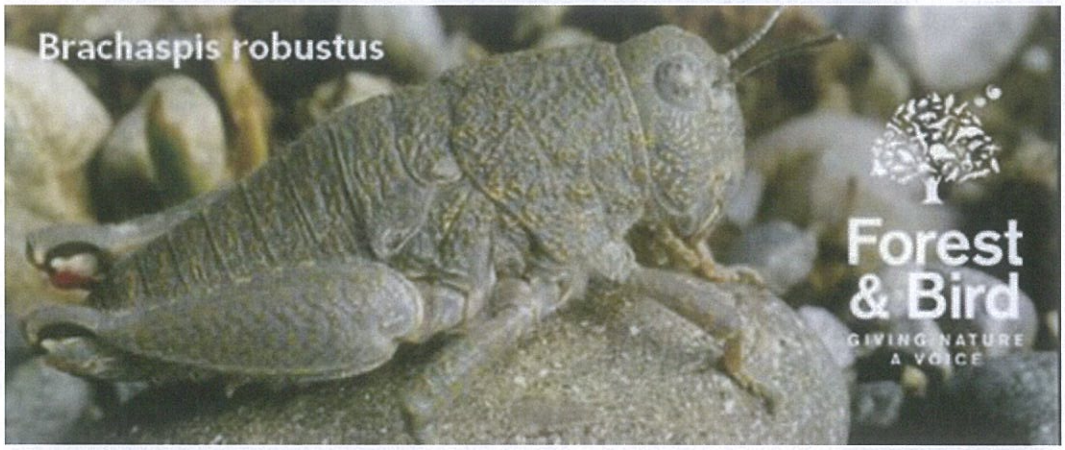
There was an error in paragraph 4(c) of the submission lodged by Forest & Bird yesterday. The attached version of the submission has corrected the error by changing one word ("declined" to "granted"). Please could you replace the version filed yesterday with this version.

Thanks

Sally Gepp
Solicitor

Royal Forest and Bird Protection Society of New Zealand Inc.
M: [redacted]
DD
www.forestandbird.org.nz

Please note that my normal work hours are Monday, Tuesday, Thursday and Friday between 8.45 am and 2.45 pm.



From: Sally Gepp
Sent: Monday, 27 March 2017 2:48 p.m.
To: 'aquaculture.submissions@mpi.govt.nz'
Cc: Peter Anderson; Jennifer Miller; Debs Martin

Written Comment No:0587

Subject: Proposal for potential relocation of salmon farms in the Marlborough Sounds - Forest & Bird submission

Dear sir/madam

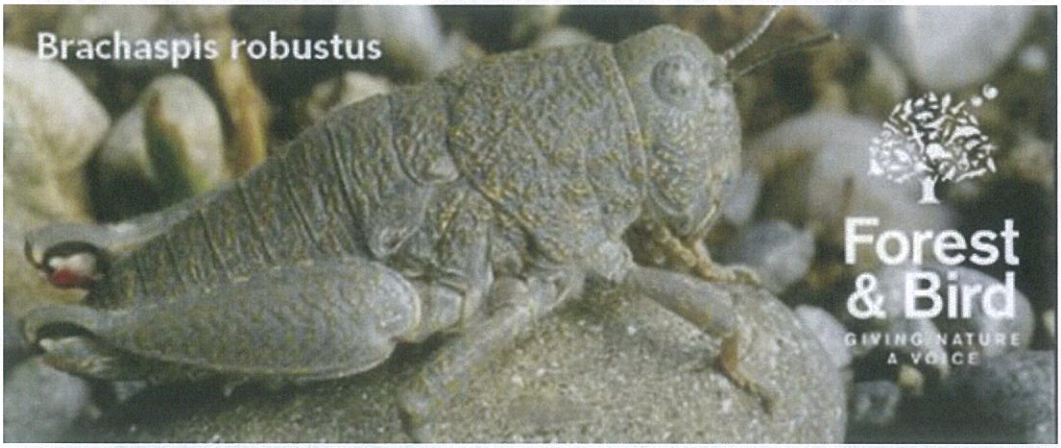
I enclose a submission by the Royal Forest & Bird Protection Society of New Zealand Inc on the Salmon Farm Relocation proposal, along with a statement by Dr Paul Fisher in support.

Please acknowledge receipt.

Sally Gepp
Solicitor

Royal Forest and Bird Protection Society of New Zealand Inc.
M: [redacted]
DD: [redacted]
www.forestandbird.org.nz

Please note that my normal work hours are Monday, Tuesday, Thursday and Friday between 8.45 am and 2.45 pm.



Written Comment No:0587

Proposal for potential relocation of salmon farms in the Marlborough Sounds

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Submission by the Royal Forest and Bird Protection Society of New Zealand Inc

27 March 2017

Royal Forest and Bird Protection Society of New Zealand Inc
PO Box 266
Nelson
[redacted]
Contact person: Sally Gepp

Introduction and summary of submission

1. This submission by the Royal Forest and Bird Protection Society of New Zealand Incorporated (Forest & Bird) concerns the Ministry for Primary Industries' proposal to amend the Marlborough Sounds Resource Management Plan to provide for the establishment of new salmon farms in areas of the Marlborough Sounds where they are presently prohibited, and to provide for the disestablishment of some other salmon farms. Thank you for the opportunity to submit on this proposal.

2. Forest & Bird is an independent community-based conservation charity, established in 1923. Its mission is to be a voice for nature, on land, in fresh water, and at sea, on behalf of its 70,000 members and supporters. Volunteers in 50 branches carry out community conservation projects around New Zealand. Forest & Bird has been involved in resource management processes around New Zealand for many years, at the national, regional and district level.

3. Forest & Bird wishes to be heard in support of its submission. It intends to present legal submissions and call evidence including on the effects of the proposal on seabirds. Attached to this submission is a statement by avifauna expert Dr Paul Fisher. If expert witness conferencing occurs, Forest & Bird seeks to have Dr Fisher included in such conferencing.

4. Forest & Bird opposes the proposal on the following grounds:

    a. Use of s360A to provide for new salmon farms in currently prohibited locations goes beyond the power of the provision and is inappropriate when there is a current Schedule 1 plan review occurring.

    b. The proposal would enable new farms in locations where they will have adverse effects on threatened species, habitat of species at the extent of their natural range, outstanding landscapes and features and areas of high or outstanding natural character, contrary to the NZCPS and relevant RPS provisions. Section 360A may not be used to override the RMA requirements, and the amended plan must give effect to higher order planning documents.

    c. The proposal is to provide for salmon farming as a restricted discretionary activity, but the matters to which discretion is restricted are so narrow that the activity is essentially a controlled activity for which consent must be granted (with respect to key effects on matters such as threatened species, landscape values and water quality in most locations).

    d. It is not appropriate to specify that there will be no public submission process for resource consent applications which by definition concern a matter of national or regional significance, and which will impact on matters of national importance including significant habitat of indigenous fauna, outstanding natural landscapes, outstanding natural features and the natural character of the coast.

Use of the regulation provision

5. Section 360A of the RMA provides:

> Regulations amending regional coastal plans in relation to aquaculture activities
> (1) The Governor-General may, by Order in Council, amend provisions in a regional coastal plan that relate to the management of aquaculture activities in the coastal marine area.
> (2) An amendment made under subsection (1)—
> (a) becomes part of the operative plan as if it had been notified under clause 20 of Schedule 1; and
> (b) must not be inconsistent with, and is subject to, the other provisions of this Act (for example, subpart 1 of Part 7A); and
> (c) may be amended—
> (i) under this section; or
> (ii) in accordance with Schedule 1; or
> (iii) under any other provision of this Act.
> (3) In this section and sections 360B and 360C, amend provisions includes—
> (a) omitting provisions (whether other provisions are substituted or not):
> (b) adding provisions.

6. The use of s360A is limited to amendments to insert or omit provisions in a regional coastal plan that *relate to the management of aquaculture activities* in the coastal marine area. The RMA distinguishes between occupation of the CMA for aquaculture, and management of aquaculture where occupation is provided for. Considered in light of the scheme of the RMA, the provision is not intended to enable changes to provide for occupation of the CMA by new salmon farms where they are currently prohibited.

7. The use of s 360A avoids the Schedule 1 plan change/review process. Marlborough District Council is currently reviewing the Sounds Plan, with the provisions regulating marine farming still subject to review. If the proposed changes are appropriate, they could be made in a properly integrated manner through that review.

8. A key difference between the two processes is that the use of s360A does not provide for merits appeals to the Environment Court. In recent years, the Courts have recognised the need to protect the outstanding values of the Marlborough Sounds and have declined a number of aquaculture proposals, including by New Zealand King Salmon. The use of s360A to provide for new salmon farms via a process that does not preserve the public's right of appeal to the Environment Court is opposed. This move appears particularly cynical at a time when there is a plan review underway. It is also a significant waste of public money to undertake this process to change an existing, dated plan that is already under review, where the change might not be adopted and incorporated into the proposed Marlborough Environment Plan.

9. Prerequisites to using s360A are that the Minister must be satisfied that:

    a. the proposed regulations are necessary or desirable for the management of aquaculture activities in accordance with the Government's policy for aquaculture in the coastal marine area; and

b. the matters to be addressed by the proposed regulations are of regional or national significance; and

c. the regional coastal plan to be amended by the proposed regulations will continue to give effect to—

i. any national policy statement; and

ii. any New Zealand coastal policy statement (NZCPS); and

iii. any regional policy statement; and

10. In addition, any amendments made must not be inconsistent with, and are subject to, the other provisions of the RMA.

11. As no s32 analysis has been provided, the public is required to assess the detailed changes proposed on their face, and on the basis of the associated technical reports, without the benefit of understanding how the matters set out above are considered to be satisfied. This is not good practice in terms of the consultation process.

Necessary or desirable in accordance with the Government's policy for aquaculture

12. We understand that s360A refers to the Government's Aquaculture Strategy and 5 year plan. The proposal does not accord with the Aquaculture Strategy, in particular:

a. The principle that "Government should only intervene where we add value and where industry and others cannot act alone." Regional planning that is already underway in Marlborough provides the appropriate opportunity for industry to be heard on appropriate aquaculture locations. Government intervention is not necessary.

b. The concept that Government will "Work with regional councils to ensure planning to identify opportunities for aquaculture growth, including through identifying new growing areas in appropriate places and provisions to enable better use of existing space." Rather than working with Marlborough Council as part of the Plan Review process, the Minister proposes to use the s360A power to directly amend the Plan.

c. The Strategy does not identify use of s360A as an element of the Aquaculture Strategy.

The matters to be addressed by the proposed regulations are of regional or national significance

13. The matters to be addressed by the proposed regulations are of regional and national significance in terms of several matters of national importance, including their impacts on threatened species' habitat and outstanding natural landscapes and natural character areas.

14. This underlines the inappropriateness of amending the Sounds Plan to specify that when resource consents for the new salmon farms are considered, public input is expressly excluded.

Give effect to New Zealand Coastal Policy Statement and Marlborough Regional Policy Statement

15. In *Environmental Defence Society Inc v New Zealand King Salmon*[1] the Supreme Court considered the New Zealand Coastal Policy Statement's place in the context of the Resource Management Act 1991. The Court held that the NZCPS is:[2]

> ... an instrument at the top of the hierarchy. It contains objectives and policies that, while necessarily generally worded, are intended to give substance to the principles in pt 2 in relation to the coastal environment. Those objectives and policies reflect considered choices that have been made on a variety of topics.

16. It is a document which "reflects particular choices".[3] The notion that decision-makers are entitled to decline to implement aspects of the NZCPS if they consider that appropriate in the circumstances "does not fit readily into the hierarchical scheme of the RMA".[4] The fact that the RMA and the NZCPS allow regional and district councils scope for choice does not mean that the scope is infinite. The requirement to "give effect to" the NZCPS is intended to constrain decision-makers.[5]

17. The Supreme Court made the following statements of law relating to the requirement to give effect to the New Zealand Coastal Policy Statement:

    a. " "Give effect to" simply means "implement". On the face of it, it is a strong directive, creating a firm obligation on the part of those subject to it."[6]

    b. "The implementation of such a directive will be affected by what it relates to, that is, what must be given effect to. A requirement to give effect to a policy which is framed in a specific and unqualified way may, in a practical sense, be more prescriptive than a requirement to give effect to a policy which is worded at a higher level of abstraction."[7]

    c. The various objectives and policies in the NZCPS "are expressed in deliberately different ways. Some policies give decision-makers more flexibility or are less prescriptive than others. They identify matters that councils should "take account of" or "take into account", "have (particular) regard to", "consider", "recognise", "promote" or "encourage"; use expressions such as "as far as practicable", "where practicable", and "where practicable and reasonable"; refer to taking "all practicable

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[1] Above, n1.
[2] *King Salmon* at [152].
[3] *King Salmon* at [90]
[4] *King Salmon* at [90]
[5] [91]
[6] [77]
[7] [80]

steps" or to there being "no practicable alternative methods". ... Obviously policies formulated along these lines leave councils with considerable flexibility and scope for choice. By contrast, other policies are expressed in more specific and directive terms, such as policies 13, 15, 23 (dealing with the discharge of contaminants) and 29. These differences matter."[8]

d. "When dealing with a plan change application, the decision-maker must first identify those policies that are relevant, paying careful attention to the way in which they are expressed. Those expressed in more directive terms will carry greater weight than those expressed in less directive terms. Moreover, it may be that a policy is stated in such directive terms that the decision-maker has no option but to implement it."[9]

e. In the context of s 5(2)(c) and Policies 13 and 15 of the NZCPS, " "avoid" has its ordinary meaning of "not allow" or "prevent the occurrence of"".[10]

f. "...what is meant by the words "avoid adverse effects" in policies 13(1)(a) and 15(a)? This must be assessed against the opening words of each policy. Taking policy 13 by way of example, its opening words are: "To preserve the natural character of the coastal environment and to protect it from inappropriate subdivision, use, and development". Policy 13(1)(a) ("avoid adverse effects of activities on natural character in areas of the coastal environment with outstanding natural character") relates back to the overall policy stated in the opening words. It is improbable that it would be necessary to prohibit an activity that has a minor or transitory adverse effect in order to preserve the natural character of the coastal environment, even where that natural character is outstanding. Moreover, some uses or developments may enhance the natural character of an area."[11]

18. Essentially, the position since the *King Salmon* decision is that where there are relevant directive provisions in a higher order policy document, plan provisions are no longer framed by reference back to the provisions of Part 2 of the RMA (except in cases of incomplete coverage, uncertainty of meaning or invalidity) but must strictly implement the directive provisions.

19. The statements of law in *King Salmon*, which focussed on Policies 13 and 15, are equally applicable to implementation of Policy 11 of the NZCPS which is framed in even more directive terms. That is, in Policy 11, "avoid" means "prevent the occurrence of" adverse effects. That was the approach adopted in *RJ Davidson Family Trust v Marlborough District Council*[12] in considering Policy 11.

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[8] [127]
[9] [129]
[10] [96]
[11] [145]
[12] [2016] NZEnvC 81 at [162]. Under appeal, but not in respect of the interpretation of policy 11.

20. Those statements are also applicable to the requirement to give effect to the Marlborough Regional Policy Statement, although given the age of the RPS it does not itself adequately implement the NZCPS, which should be preferred in the event of a conflict.

21. Other key provisions of the NZCPS relevant to this proposal are Policy 3 (precautionary approach), Policy 8 (aquaculture) and Policy 4 (integration).

Avifauna

22. The proposed salmon farms will have adverse effects on seabirds, in particular New Zealand King Shag which is a threatened (Nationally Endangered) species. The proposed farms are all within the Extent of Occurrence of King Shag, which is significant habitat in terms of s 6(c) and a Policy 11(a) matter. King Shag are benthic feeders, and the loss of foraging habitat from the salmon pen footprint in addition to wider impacts of water quality changes on benthic fauna and prey species will adversely affect this species and their habitat. In addition to the direct displacement of NZ king shags from foraging areas, there will be a decline in foraging efficiency. Other effects such as attracting nuisance predatory gulls to farms, disturbance of foraging habitat and prey from boat activity, artificial underwater lighting could potentially result in further adverse effects on the NZ king shag. The MPI avian experts have considered this impact in isolation from the cumulative effect of other marine farming and fishing occurring in the Marlborough Sounds.

23. Two other seabird species, the fluttering shearwater and Australasian gannet occur in significant numbers, along with groups of other seabirds that will potentially be affected by the proposal.

24. Any positive effects associated with decommissioning some existing sites will take years to materialise due to the time taken for the benthic environment to recover.

25. Forest & Bird relies on the statement by Dr Paul Fisher provided with this submission.

26. The proposal does not avoid adverse effects on threatened indigenous taxa (Policy 11(a)) and on habitats of indigenous species where the species are at the limit of their natural range (Policy 11(a)(iv)). As such it does not give effect to Policy 11 of the NZCPS or proposed MEP Policy 8.3.1 which requires avoidance of adverse effects on threatened species.

27. Policy 3 NZCPS requires that a precautionary approach is adopted towards proposed activities whose effects on the coastal environment are uncertain, unknown or little understood but potentially significant adverse. Given the small population of NZ king shag and the potential for significant adverse effects on it from additional occupation of the CMA by aquaculture, Policy 3 requires that before any new salmon farms are provided for, the importance of the site to King Shag, and that they can thrive despite the loss of this habitat is demonstrated.

Landscape and natural character

28. Placement of a new salmon farm at any of the proposed sites will decrease their landscape value, which constitutes an adverse effect (as Hudson Associates accepts). The Blowhole Point North and Blowhole Point South sites are within areas identified as Outstanding

Natural Features (ONF) and within an Outstanding Natural Landscape (ONL). It is not appropriate to assess effects on these landscapes only at the scale of the entire ONL such that "the potential relocation proposal will have a less than minor effect on these values due to the expansiveness of the overall landscape context" (Hudson Associates). Adverse effects on the ONF and ONL are contrary to Policy 15(a) and pMEP Policies 6.2.1 and 6.2.2.

29. The Richmond Bay South and Horseshoe Bay sites are adjacent to terrestrial sub areas identified as having high or very high natural character values. A new salmon farm in either location is likely to have significant adverse effects on the natural character of the adjacent areas, contrary to Policy 13(1)(b) and Marlborough Sounds RPS Policy 8.1.6 (preserve the natural character of the coastal environment) and MSRMP Policy 1.1(avoid adverse effects on areas of the coastal environment predominantly in their natural state and where natural character has not been compromised).

30. The cumulative effects of views of multiple salmon farms in Pelorus Sound and Waitata Reach also constitute adverse effects on landscape and natural character which may be significant, contrary to Policies 13 and 15.

Marine mammals

31. The Cawthorn and Associates report on marine mammal impacts does not adequately address the cumulative effects of multiple salmon farms and other forms of aquaculture, as well as other non-aquaculture pressures on marine mammals (e.g. fisheries bycatch, vessel strike, tourism, and noise).

32. There may be additional indirect effects of the salmon farms on marine mammals as a result of altered water quality and/or benthic habitats.

33. Effects on marine mammals have not been assessed adequately to be confident that there will not be adverse effects in terms of Policy 11 and proposed MEP Policy 8.3.1.

Water quality

34. Predictions of impacts on water quality rely heavily (almost exclusively) on modelling. The Cawthron peer review raises important unanswered questions about the extent to which the modelling is fit for purpose. The Cawthron report noted that the sensitivity of phytoplankton to additional nutrients is at the core of the model results, and that the models are being stretched beyond their original scope and purpose, particularly in the Pelorus Sound:

    a. For Queen Charlotte Sound, the future predicted sustainable feed level (PSFL) scenario represents almost a doubling of the current level of feed inputs. For Pelorus Sounds, a three-times increase in total feed inputs is proposed for the first stage of development, and the proposed long-term increase in annual feed inputs for Pelorus Sound (up to 23,700 tonnes of feed) represents almost a seven-fold increase on the existing level of input (3,500 tonnes). The peer reviewer consider that it appears that the models for both Sounds are being used to predict responses to substantial feed increases far beyond the levels for which they were validated (i.e. the existing feed levels).

b. Modelled changes in total N responses across Queen Charlotte Sounds and Pelorus Sounds were small, but the peer reviewer note that the modelled changes relate to 'existing' maximum consented feed inputs whereas actual current feed inputs are significantly less. This means that a larger biological change can be expected (e.g. in concentrations of chlorophyll-a).

c. While the modelled changes are small, field-based experiments have noted up to an eight-fold increase in chlorophyll-a over four days for some months.

35. The Cawthron report also observes that as regular harmful algal blooms occur in the QCS region, any increase in feeding in the area would need to be carefully monitored. This should also occur alongside appropriate staging and management responses to manage the risk of algal blooms or other undesirable effects.

36. The consultation document[13] says that supporting information will be gathered and made available during consultation but as far as Forest & Bird is aware this has not occurred.

37. Accordingly, Forest & Bird is not yet in a position to comment on water quality impacts, other than to say that:

a. The proposal has potential adverse water quality effects, including heightened chlorophyll concentrations, changes in phytoplankton and zooplankton and increased occurrence of harmful algal blooms, which has consequent impacts on marine life.

b. We agree with the limitations in the modelling identified by the Cawthron peer reviewer.

c. It is not clear that the proposal will maintain water quality as required by Objective 1 NZCPS or that significant adverse effects on ecosystems and habitats from discharges are being avoided as required by Objective 23(1)(d) NZCPS, or that MRPS Objective 5.3.2 and pMEP Policy 13.2.1 are implemented.

Aquaculture

38. The proposal provides for aquaculture and attendant benefits on people and communities' economic wellbeing. However, this will only be consistent with Policy 8 NZCPS if the locations where aquaculture is provided for are appropriate. The Supreme Court in *EDS v New Zealand King Salmon*[14] held that Policy 8 "recognises the need for sufficient provision for salmon farming in areas suitable for salmon farming, but this is against the background that salmon farming cannot occur in one of the outstanding areas if it will have an adverse effect on the outstanding qualities of the area."

Integration

39. By spot zoning particular locations as suitable for aquaculture without undertaking a region-wide assessment, the MPI proposal does not provide the type of integrated management of

[13] MPI Discussions Paper 2017/04 page 49
[14] [131].

natural and physical resources in the coastal environment envisaged by Policy 4 NZCPS. Policy 4 provides support for Forest & Bird's interpretation of the scope of the s360A power; that it relates to management of aquaculture but not to providing for occupation of CMA space by aquaculture.

Detail of the proposed Plan changes

9.2 Issue

40. The wording proposed to be inserted into 9.2 does not describe an issue and is not appropriate to an issue statement.

Policy 9.2.1.1.17

41. The amended policy does not implement the Sounds Plan Objective 9.2.1.1 and is inconsistent with policies 9.2.1.1.1 and 9.2.1.1.6.

Policy 9.3.2.1.12

42. The adequacy of this policy will depend on the ability to monitor the effects of salmon farming on water quality. The inadequacies in the modelling undertaken for the AEE are described above.

Chapter 35 Rules

43. The matters to which discretion is restricted are so narrow that applications for salmon farms are essentially controlled activities for which consent must be granted. Consent could not be declined due to:

    a. Water quality impacts, other than at Tio Point.

    b. Effects on landscape or natural character.

    c. Effects on indigenous biodiversity including NZ king shag and marine mammals.

44. While NZ king shag and marine mammals are referred to as topics for which a management plan can be prepared, this means that effects on these matters could at best be mitigated through a management plan but not avoided by declining consent. This conflicts with the NZCPS.

45. Rule 35.3.3.3 specifies that applications will not be publicly notified. Before recommending regulations under s360A, the Minister must be satisfied that the proposal is of national or regional significance under s 360B(2)(C)(ii). Providing for new salmon farms as a non-notified activity is not consistent with their status as nationally or regionally significant activities. It is also inappropriate because the proposed salmon farms will have potential adverse effects on matters of national importance including the habitat of threatened species and outstanding natural landscapes and features.

46. Significant activities with the potential for adverse effects on a common resource should be publicly notified at the resource consent stage. The proposal is contrary to the RMA

principle of participatory decision-making. A decision not to notify an application is an exception to the general policy of the Act that better substantive decision-making results from public participation.[15]

47. Key details of the proposed farms are not known at this stage, in particular design details that will affect the visual impact of the farms. The scale of some impacts and the sensitivity of the receiving environment are also unknown, such as whether the NZ king shag species is stable or declining, where further information will to become available following a 2018 survey. These are matters that the public is entitled to take an interest in and to wish to comment on. It is not correct to say that the public have had the chance to submit on this s360A proposal, and therefore do not need to submit again when key aspects are as yet unknown.

Chapter 35B.1 Preamble

48. It is not clear which section 5 of the Act is being quoted in this part of the plan, when Part 2 of the Act is given effect to in the coastal environment by the NZCPS. The inserted wording in 35B.1 is inappropriate for that reason, but also because it assumes that the only options are relocating farms, or operating them in their existing location with inevitable adverse environmental effect.

Sally Gepp

Royal Forest and Bird Protection Society of New Zealand Inc

[15] *Discount Brands Ltd v Westfield (New Zealand) Ltd* [2005] NZSC 17, [2005] 2 NZLR 597 at [25].

Written Comment No:0587

Proposal for potential relocation of salmon farms in the Marlborough Sounds

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Statement of Paul Richard Fisher (Avifauna) in support of submission by the Royal Forest and Bird Protection Society of New Zealand Inc

27 March 2017

Royal Forest and Bird Protection Society of New Zealand Inc
PO Box 266
Nelson
[redacted]
Solicitor acting: Sally Gepp

Contents

Qualifications and Experience

1. My full name is Paul Richard Fisher. I have a BSc (Hons) Science and the Environment degree (1992, Leicester Polytechnic, UK) and a PhD in Ecology (2001, Manchester Metropolitan University, UK). During my undergraduate degree I took a placement year working as a student research assistant in the Protected Areas Data Unit of the International Union for Conservation of Nature (IUCN) World Conservation Monitoring Centre. My honours research project assessed sexual dimorphism, size at fledging and survival rates of wandering albatross (*Diomedea exulans*), based at the British Antarctic Survey (Cambridge, UK). As an undergraduate I trained as a C Permit Bird Ranger, participating in a number of ornithological studies and expeditions.

2. I have over 25 years' experience studying seabird, marine mammal and fish ecology. Some of this research has included studies in aquaculture areas, assessment of effects from tidal generators, windfarms and offshore seismic surveys for the petroleum industry. I have first-hand experience studying the New Zealand king shag and other seabirds in the Marlborough Sounds while employed as a Scientist with the Department of Conservation

and through trialling various survey techniques for monitoring key wildlife species in aquaculture areas (Admiralty Bay). I have presented evidence as an expert witness (avian ecologist) for Marlborough District Council and Friends of Nelson Haven and Tasman Bay Inc. I have a working knowledge of regional council planning and environmental reporting requirements. I am currently employed by Nelson City Council as a Water Quality Scientist

Background

3. New Zealand King Salmon has resource consents for 11 salmon farms within the Marlborough Sounds. Salmon farming results in organic matter accumulating on the seafloor and nutrient enrichment of the water column. These effects are greater in lower-flow areas, and this limits farm productivity. There are six consented salmon farms in lower-flow areas. Farms that are compliant with their original consents will have difficulty to comply with the newly developed guidelines for benthic impact[1] while maintaining economic viability. The Minister proposes relocating some or all of the six lower-flow farms to sites deemed suitable where the water is deeper and has higher flows to reduce nutrient enrichment to the seabed and other adverse effects within the footprint of the farms. Plan Changes will be required for all proposed sites being in or overlapping the Coastal Management Zone One where aquaculture is currently prohibited.

4. The Ministry for Primary Industries (MPI) sought opinions from Thompson, D (2016), Taylor, P. (2016) and Taylor, G (2016) on the adverse and potential cumulative effects from the proposal on seabirds and their marine habitat and prey. This comment provides an appraisal of the seabird technical reports, highlights relevant information and issues not addressed in the reports, and sets out my conclusions on the effects of the relocation proposal on seabirds.

[1] Keeley, N. *et al.* 2014. Best Management Practice Guidelines for salmon farms in the Marlborough Sounds: Benthic Environmental Quality Standards and Monitoring Protocol. Final 2014.

Summary of opinion

- The Marlborough Sounds has a unique marine ecosytem that attracts a high diversity of seabirds, including oceanic species that are normally found further offshore and is recognised as a site of global significance for seabirds.
- The NZ king shag is the only endemic species in the Marlborough Sounds and categoried by IUCN as Vulnerable to extinction. The NZ king shag foraging area is significant, based on IUCN criteria for defining the extent of habitat to maintain the species and because of its susceptibility to adverse effects from human activities and natural events.
- The extent of the Marlborough Sounds Important Bird Area (IBA) marine is defined by the NZ king shag foraging area, which is part of a network of global sites representing seabird biodiversity hotspots.
- The proposed relocation of six salmon farms will overlap and potentially have a direct adverse effect on the habitat and prey availability of the NZ king shag. Two other seabird species, the fluttering shearwater and Australasian gannet occur in significant numbers, along with groups of other seabirds that will potentially be affected by the MPI proposal.
- The status of the NZ king shag population stability remains unclear because of infrequent monitoring over the last 50 years and there are no measures of population regulating parameters to assess the long term population trend.
- Recent aerial surveys of total birds at colonies and counts of occupied nests over the winter breeding season, show a ~40% population decline in breeding pairs between 2015 and 2016 and shift in numbers of breeding pairs between the two largest colonies at Duffers Reef and North Trio island.
- The proposed relocation of salmon farms will have an adverse effect in terms of displacement of NZ king shag birds from foraging areas and potential declines in foraging efficiency. Other effects such as attracting nuisance predatory gulls to farms, disturbance of foraging habitat and prey from boat activity, artificial underwater lighting could potentially result in further adverse effects on the NZ king shag.
- The cumulative NZ king shag marine foraging habitat loss from marine farms and disturbance of habitat from benthic trawling has not been fully quantified. The existing marine farms already modify a significant proportion, up to 10% of the NZ king shag foraging habitat, at a bay-scale in areas close to the proposed relocation sites.
- Policy 11 of the NZCPS requires decision-makers to protect indigenous biological diversity in the marine environment by avoiding adverse effects of activities on threatened species and their habitats.

- Policy 11 of the NZCPS also recognises the importance of protecting the wider marine ecosystem values required to meet the needs of threatened seabird species and habitats at different stages of their lives or breeding season. These include maintaining unmodified marine areas, and recognise the connectivity between coastal and marine habitats for wide ranging seabirds.
- The MPI seabirds review has omitted a number of key papers describing the population of the NZ king shag, the significance of the Marlborough Sounds for seabirds and research on foraging behaviour that provides insights in to foraging strategies, and significance of maintaining foraging areas. The MPI assessments have largely ignored the cumulative effects from marine farming and status of threatened species and their habitats with respect to the NZCPS.
- The NZ king shag is sensitive to disturbance, which has to date resulted in very little research on this species and hindered the lack of knowledge of its basic ecology required for conservation management. The fragmented (relict) distribution and low genetic diversity of the NZ king shag is a significant issue that needs to be addressed by conservation management to ensure the continued survival of this population.
- This review of information has highlighted the lack of appropriate monitoring of seabird distributions and their associated prey resource in the Marlborough sounds, with most monitoring targeting the receiving environment to meet resource consent discharge conditions.
- Whilst there have been positive steps to initiate more research on the NZ king shag through an industry-council-research partnership approach there is insufficient information to set a baseline to measure and quantify effects on seabirds and their habitat and prey.
- In conclusion the MPI proposal to relocate salmon farms to existing NZ king shag foraging areas associated with roosting and breeding sites is not consistent with the direction of the NZCPS Policy 11. There is a need to take a precautionary approach primarily to avoid adverse effects from human activities and preserve marine habitat for NZ king shag foraging areas but also to maintain the unique seabird assemblages that occur within the Marlborough Sounds. This approach is consistent with NZCPS Policy 3 and would mean not progressing with this proposal until appropriate monitoring and supporting information is gathered as part of a marine spatial plan and integrated monitoring programme to adequately assess effects.

Significance of Marlborough Sounds for seabirds including the NZ king shag

Global conservation status of New Zealand seabirds

5. New Zealand has the greatest diversity (~40% species) of seabird species in the world, with 85 breeding species, of which 36 species are endemic; seabirds that breed nowhere else in the World (Forest & Bird 2014). Whilst a high proportion of seabird breeding colonies on land are afforded some protection, their marine habitat where they spend the majority of their lives is largely unprotected. Seabirds occupy all of the world's marine area, and have evolved to take advantage of particular niches.

6. Larger seabirds (including albatross, shearwaters and cormorants) typically lay small clutches of 1-2 eggs and parental investment to raise chicks to fledging spans long periods (months), making seabirds susceptible to adverse environmental conditions from natural and anthropogenic effects. Both in terms of exposure to short-term stochastic events (e.g. storms washing away nests and chicks) and longer-term chronic effects (e.g. declines in marine productivity and prey availability from oceanic or climate change over long periods, such as El Niño), with a low breeding propensity to recover from declining populations.

7. The spatial distribution of seabirds at sea and their prey resource varies over time. Their foraging range may extend over hundreds or thousands of kilometres, incorporating offshore and coastal habitats to account for the seasonal variability in their prey resource and reduce competition from other marine predators, amongst other factors.

Marlborough Sounds Important Bird Area

8. The Marlborough Sounds has a unique marine ecosytem that attracts a high diversity of seabirds, including oceanic species that are normally found further offshore.

9. The Marlborough Sounds Important Bird Area (IBA)[2] encompasses 1,358 km^2 of marine space based on the foraging range (25 km) and bathymetry (50m) of the NZ king shag. This defined area includes breeding colonies and marine habitat considered critical for conserving the threatened NZ king shag population and significant numbers of other

[2] Forest & Bird (2014). New Zealand Seabirds: Important Areas for New Zealand Seabirds. Sites at sea: seaward extensions, pelagic areas. The Royal Forest & Bird Protection Society of New Zealand, Wellington, New Zealand. 90 pp.

seabirds, in particular fluttering shearwaters feeding within the sounds and immediately offshore (Appendix 1: Forest & Bird 2014).

10. Seabird habitat is defined here as the space and ecosystem services that are required to maintain the population. This includes suitable habitat for breeding, feeding and maintenance behaviours associated with colonial seabird populations including courtship and breeding on land, roosting, preening, loafing, washing close to the colony and open marine space for congregations of post breeding and juvenile birds.

11. The Marlborough Sounds Important Bird Area (IBA), which is part of a network of global sites representing seabird biodiversity hotspots, includes six species of seabird and species group (large congregations of seabirds including multiple species). The proposed relocation of salmon farms will overlap and potentially have a direct adverse effect on the habitat of three qualifying Important Bird Area seabird species, including:

    a. NZ king shag (IUCN Threatened species, breeding and foraging habitat; 100% global population),
    b. fluttering shearwater (*Puffinus gavia* ,breeding and foraging habitat; 1% global population),
    c. Australasian gannet (*Morus serrator,* foraging habitat; 1% global population),

12. The Marlborough Sounds also includes a seabird species group category, congregations of other seabird species that number more than 10,000 pairs of seabirds or 20,000 individuals, e.g. including flesh-footed shearwaters (*Puffinus carnipes)*, spotted shags (*Stictocarbo punctatus), white-fronted terns (Sterna striata)* and little penguins (*Eudyptula minor*) that meet the Important Bird Area criteria.

NZ king shag Important Bird Area

13. The NZ king shag area of occupancy as described in the Marlborough Sounds Important Bird Area (IBA) report is all significant habitat for NZ king shag, given its Threatened conservation status and small population[3].

[3] Joint Statement Paul Richard Fisher & David Richard Thompson. In Environment Court ENV-2006-WLG-000057, 60, 66, 73, 81, 88, 92, 94, 97. Appeals under s.120 of the Act between Friends of Nelson Haven and Tasman Bay Inc. (Appellant) and Marlborough District Council (Respondent). 25th May 2016.

14. When considering the at sea feeding records of NZ king shags to date, the empirical sightings data support the delineation of the Marlborough Sounds Important Bird Area. However, it is worth noting that NZ king shags have been recorded feeding in depths greater than 50 m (e.g. Waitata Reach), the depth contour used to delineate the seaward boundary of the Important Bird Area. The NZ king shag foraging sightings database includes 607 500x500 m cells that have records, equivalent to a net area of (0.25 km^2 x 607 cells=150 km^2).

15. This foraging distribution does not represent the entire feeding area used by NZ king shags because not all areas of the sounds have been surveyed, with most survey effort in Pelorus Sound, from studies relating to Duffers Reef and North Trio island. Clearly, also the cells identified with foraging NZ king shags have also been occupied at different times and we have no idea on number of birds/individuals each 500m cell serves within and between breeding seasons. No relative importance is assigned to a particular cell or cluster of 500 m cells with a NZ king shag sighting – the area incorporating the distribution is equally significant using the IUCN criteria.

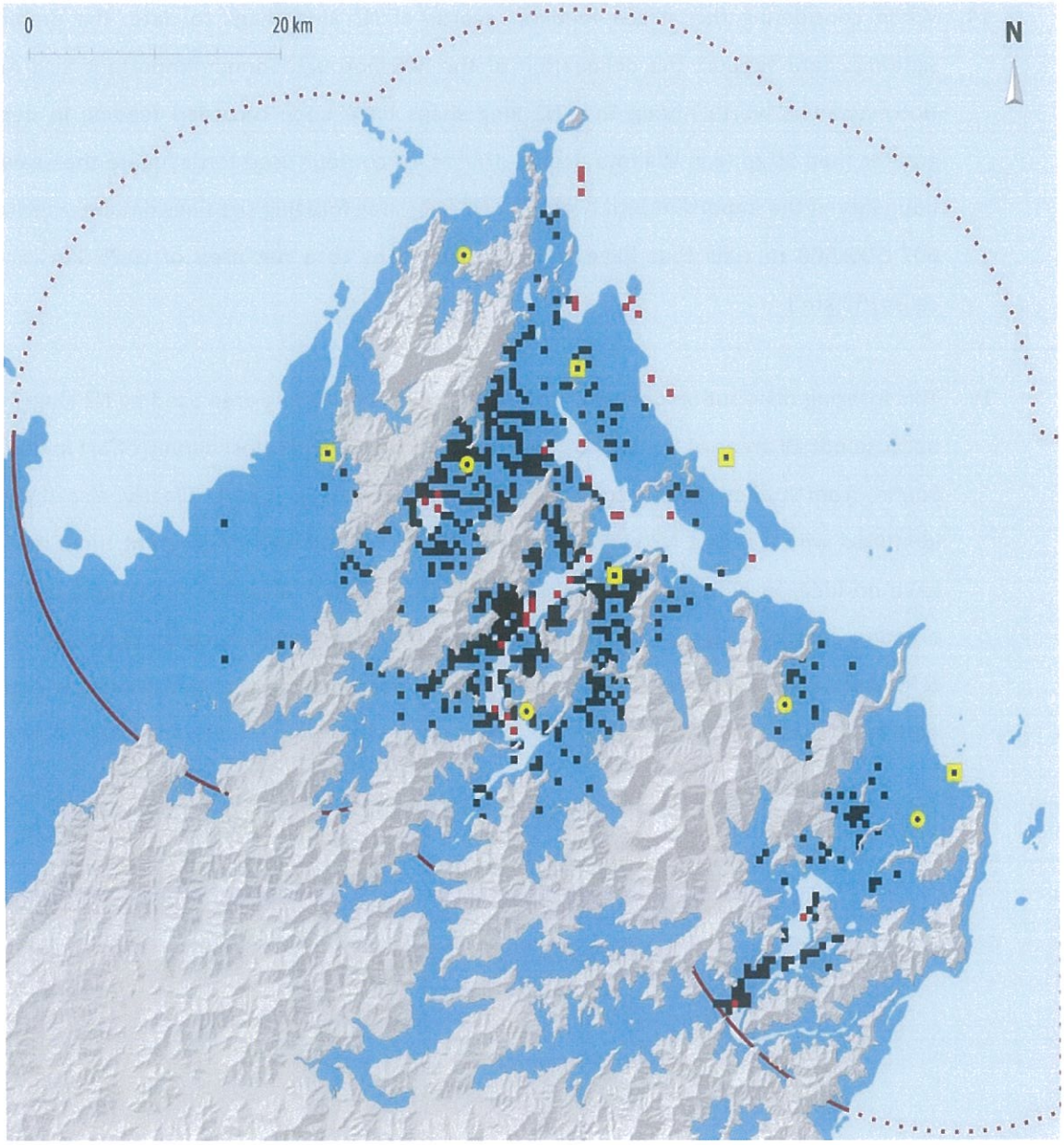

Figure 1. Distribution of foraging NZ king shags in the Marlborough Sounds

(Source: Schuckard 2017)[4]

607 grid squares (500m) where foraging King Shags have been observed: ■<50m ■>50m(5% of all grids). Red circle: 25km radius from the main colonies (>50 birds). Dark blue ≤50m: 130.000ha.

[4] Schuckard 2017, MPI Salmon farm proposal - submission on behalf of Friends of Nelson Haven and Tasman Bay Inc.

16. The Area of Significant Ecological Value (AOEV) for NZ king shag is identified in volume 2 of the Marlborough Sounds Resource Management Plan and is used for assessing Assessments of Environmental Effects for resource consent applications. These AOEVs are based on observational data collected in 1991/92. Activities that fall within the AOEV anticipate the environmental result as maintaining numbers and population distribution of species. Whilst the 1991/92 observational data are valuable, the continued use of it in planning documents is inappropriate with regard to direction from the NZCPS, supported by IUCN and IBA criteria. The IBA designation includes more recent information and extends the area of significant ecological value for the NZ king shag and also recognises the importance of seabird assemblages (biodiversity hotspots), recognised under an international framework for protecting marine biodiversity. The composite distribution map of feeding NZ king shags[5] at sea (1990-2016) confirms the marine habitat range of the NZ king shag that is used to define the Marlborough Sounds IBA.

17. When considering the at sea foraging records of NZ king shags to date, the empirical sightings data support the delineation of the Marlborough Sounds IBA. However, it is worth noting that NZ king shags have been recorded feeding in depths greater than 50 m (e.g. Waitata Reach), the depth contour used to delineate the seaward boundary of the Important Bird Area. The NZ king shag foraging sightings database includes 607 500x500 m cells that have records, equivalent to a net area of (0.25 km^2 x 607 cells=150 km^2). This foraging distribution does not represent the entire feeding area used by NZ king shags because not all areas of the sounds have been surveyed, with most survey effort in Pelorus Sound, from studies relating to Duffers Reef and North Trio island. Clearly, also the cells identified with foraging NZ king shags have also been occupied at different times and we have no idea on number of birds/individuals each 500m cell serves within and between breeding seasons. No relative importance is assigned to a particular cell or cluster of 500 m cells with a NZ king shag sighting – the area incorporating the distribution is equally significant using the IUCN criteria.

[5] Schuckard 2016, MPI Salmon farm proposal - submission on behalf of Friends of Nelson Haven and Tasman Bay Inc (~n=1,000 sightings over 25 years)

Status of the NZ king shag

NZ king shag conservation status

18. Using internationally accepted criteria for assessing threat status (IUCN 2016), the IUCN has identified the NZ king shag as **Vulnerable**, where this species is facing a high risk of extinction in the wild in the medium-term future. The species would be categorised by IUCN as **Endangered**, in the event of a decline in population size or the number of core breeding sites.

19. Within the New Zealand Threat Classification System, the NZ king shag has the second highest threatened status of **Nationally Endangered** (Robertson *et al.*, 2013)[6] This assessment is based on its small population of between 250-1000 mature individuals. The IUCN Threatened status of this bird is based on the latest IUCN criteria, which it qualifies on all counts:
    a. Area of occupancy is estimated to be less than 2,000 km^2.
    b. They are known to exist at no more than 10 localities, rendering the species susceptible to stochastic effects (e.g. infrequent, significant events) and human impacts.
    c. Population estimated to number less than 1,000 mature individuals.

20. **Area of Occupancy** is defined as the area within its extent of occurrence (see definition above), which is occupied by a taxon, excluding cases of vagrancy. The measure reflects the fact that a taxon will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats. In some cases (e.g. colonial nesting sites, feeding sites for migratory taxa) the area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon. The size of the area of occupancy will be a function of the scale at which it is measured, and should be at a scale appropriate to relevant biological aspects of the taxon, the nature of threats and the available data (IUCN 2016).

NZ king shag population stability

[6] Robertson, H.A., Dowding, J.E.,Elliott, G.P., Hitchmough, R.A., Miskelly, C.M., O'Donnell, C.F.J., Powlesland, R.G., Sagar, P.M., Scofield, R.P. & Taylor, G.A. (2013). Conservation status of New Zealand birds, 2012. New Zealand Threat Classification Series 4. Department of Conservation, Wellington. 22p.

21. Published accounts based on the numbers of NZ king shags at their colonies in the 1990's (Schuckard 2006)[7] and 2006 (Bell 2010)[8] have concluded that the population has remained stable for the last 50 years, based on estimated projections of historical counts spanning 50 years accounting for the proportion of birds absent from colonies feeding during the day.

22. Schuckard, R. (2017 unpublished) has re-evaluated the method used to affirm population stability and concluded that "many fundamental data regarding population biology are lacking to expand the *stable* population assessment beyond a simple number"; and comments further, "Historic data over a 40-year period, predating my own data set, are a very important source of information and could be helpful with today's management. However, this limited and anecdotal data set with unknown confidence intervals from different observers requires caution when applied today".

23. The NZ king shag population numbers less than 1,000 individuals, and colonies are fragmented, distributed across the Marlborough Sounds. One of the major threats of NZ king shag conservation management is the relict distribution and low genetic diversity.

24. The following information, which includes unpublished material, has not been described in the reviews by Sagar (2011) and Thompson (2016) and in my opinion does not support the assertion that the population is stable.

Historical population counts vs recent surveys

25. Mr R Schuckard (avian ecologist) has undertaken the majority of studies on the NZ king shag spanning almost 30 years, describing the population status, foraging behaviour, diet and distribution at sea, amongst other research.

26. Numbers of birds attending the Duffers Reef colony were observed to vary throughout the day with up to 40% of birds absent foraging (Schuckard 2004)[9] at any given time during daylight hours.

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[7] Schuckard, R. (2006). Population status of the New Zealand King Shag (*Leucocarbo carunculatus*). Notornis 53: 297-307.

[8] Bell M. (2010). Numbers and distribution of New Zealand King Shag (*Leucocarbo carunculatus*) colonies in the Marlborough Sounds, September-December 2006. *Notornis* 57: 33-36.

[9] Schuckard, R. (1994): New Zealand King Shag (*Leucocarbo carunculatus*) on Duffer's Reef, Marlborough Sounds. *Notornis 41*: 93–108.

27. Schuckard (2006) provided a summary of bird counts spanning 1992-2002 at NZ king shag colonies to derive the first population estimate for the NZ king shag of 645 birds (no standard error or level of confidence is provided). These counts were undertaken at first light from a small boat to count birds before they left the colony to forage. Visual counts of NZ king shags at colonies are subject to error because of poor lighting conditions, counts from a distance to avoid disturbance, observations are from a low (boat) platform and birds are densely packed and may not all be visible from one vantage point.

28. Schuckard (2006) used the observations of numbers of birds absent from Duffers Reef to estimate the percentage of birds (up to 40% of the colony) likely to have been absent from intermittent historical counts spanning almost 50 years. The timing of historical visits to colonies was approximated to have been undertaken around mid-day to allow for travel time to the colony.

29. The 1992-2002 colony counts were then used to scale different correction factors for historical counts at each respective colony based on the estimated percentage of birds absent feeding around mid-day and the assumption that historical counts for each colony were similar to present day. The correction factors for each colony have not been validated by subsequent visits to count actual birds at colonies (pre-departure) and during the day and are unlikely to hold between years of 'high' and 'low' marine productivity.

30. Bell (2010) surveyed breeding seabirds by boat over the summer and used the different correction factor for each colony (Schuckard 2006) to arrive at a population estimate of 687 birds. The historical colony counts are estimates with no confidence limits and of limited value based on the errors associated with method and approach described above. The Bell (2010) population estimate requires an adjustment of 150 birds to align with the first aerial census of the population initiated by the NZ King Salmon King Shag Management Plan.

New Zealand King Salmon King Shag Management Plan Survey requirements

31. In 2011, New Zealand King Salmon applied to the Environmental Protection Authority (EPA) to change the Marlborough Sounds Resource Management Plan to enable development of nine new salmon farms in the region. During the resulting EPA Board of Inquiry (BOI) process, issues relating to seabed and water quality effects came under particular scrutiny, and illustrated a need for a more integrated approach to environmental monitoring.

32. The NZ King Salmon King Shag Management Plan (KSMP) incorporates a NZ king shag population monitoring programme and response (Appendix 2). The response is triggered if there is an observed decline in population of 3% or more at eight colonies, with particular reference to Duffers Reef (largest colony within foraging range of Waitata Reach - Pelorus Sound). The population trigger level of 3% is based on a population model. The KSMP is a requirement of the BOI (2013)[10] for New Zealand King Salmon locating salmon farms in the Waitata Reach.

33. The first KSMP population census was flown at first light on 11 February 2015 visiting the main colonies at Duffers Reef, Trios, White Rocks, Sentinel Rock, Rahuinui, Stewart Is, Hunia Rock and Tawitinui. The aerial survey yielded 839 birds (including juvenile fledglings less than one year old), with the Duffers Reef colony holding 36% and the Trios colony 21% of the total population count. Previous population estimates of 645-687 birds are not comparable to the aerial count of 839 birds because of the different survey methodologies.

34. The census of the NZ king shag population is scheduled every three years as part of the New Zealand King Salmon King Shag Management Plan (2015), subject to an assessment against the previous (baseline) survey. The next survey is due in February 2018, which will be the first opportunity to assess the census data in a consistent manner. At that point, there will be two comparable data points available to inform a view as to whether the NZ king shag population is stable (although further surveys over time will be needed to confirm this).

King shag population model

35. The NZ king shag population model (Mackenzie 2014)[11] was provided for the NZ King Salmon King shag Management Plan. The model indicates a steady but slight decline in population based on estimated mortality rates and counts from Schuckard (2006) that are subject to sampling errors (i.e. do not account for birds moving between colonies or roosts between boat visits)and should be treated with caution. There are no regular census counts from 2002 to present day to model the population with confidence over this period.

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[10] BOI (2013). Decision Document – Appendix 9 – 13 March 2013 – Condition 10 & 11
http://www.marlborough.govt.nz/Services/Property-File-Search.aspx
Decision Document - Appendix 10 – 13 March 2013 – Condition 10 & 11
http://www.marlborough.govt.nz/Services/Property-File-Search.aspx

[11] Mackenzie, D.I. (2014). Population modelling and monitoring of King Shags. Proteus Wildlife Research Consultants. Report written for the King Shag Management Plan as part of the consent process by New Zealand King Salmon Inc. to operate two new salmon farms in the Waitata Reach.

DOC aerial surveys of breeding pairs

36. Historical records suggest that relatively small numbers of birds breed in any year across all colonies, ranging from a minimum of 70 to maximum of 166 pairs based on boat counts between the years 1992-2002 (Schuckard 1994; 2006). In 2015, a mean count of 187 nests occupied with chicks was derived from 3D photographs of colonies taken from a DOC aerial survey (Schuckard et al. 2015)[12]. The photographs of occupied nests were assessed by three observers to provide a mean count, because there is some subjectivity in assessing whether nests have chicks present or not. In 2016, DOC undertook a second aerial survey of occupied nests from 2D photographs. The July 2016 count of nests with chicks estimated a mean of 117 chicks (range 114-121 occupied nests), indicating a ~40% decline in occupied nests with chicks between years (Schuckard *et al. in prep*). Neither survey is included in the review by Thompson (2016).

37. Based on the 2015 KSMP NZ king shag aerial census of 893 birds, about 45% of the population attempted to breed in 2015, compared to 28% in 2016. The decline in breeding pairs in 2016 was particularly noticeable in the colonies around D'Urville Island, including Rahuinui, Stewart Island and North Trio but also at Sentinel Rock and Hunia Rock (Schuckard *et al. in prep*).

38. DOC surveys of NZ king shag colonies in 2006 and 2007 found that numbers of nests and chicks can vary considerably at a colony over the space of a few weeks, making it difficult to interpret the productivity of the population based solely on annual counts (Fisher & Boren, 2012). For the North Trio colony, Bell's (2010) survey on 2 December 2006 found 19 chicks and 30 nests compared to the DOC survey five weeks later (Fisher & Boren 2102) on 12 January 2007 of 3 chicks and 14 nests. The colonies at Rahuinui Island and Sentinel Rock both had 8 nests in October 2006 but no nests were present in January 2007, when 44 and 45 birds were recorded on each island respectively (Fisher & Boren 2102).

39. Annual numbers of fledglings and nests indicate significant variation in productivity, which aligns with marine productivity over a short period that data are available for. Peaks in marine productivity (particulate nitrogen) occurred in 1998 falling to a minimum in

[12] Schuckard, R., Melville, D.S.M, Taylor, G.. 2015. Population and breeding census of New Zealand King Shag (*Leucocarbo carunculatus)* in 2015. *Notornis* Vol 62:209-218.

2001/2002, followed by a recovery in marine productivity post 2002 (Zeldis *et al.* 2008)[13]. The NZ king shag productivity for the number of occupied nests and fledglings (recruitment) data is difficult to interpret based on the short time series available and no knowledge of how the proportion of breeding birds present at Duffers Reef and other colonies might have changed between years.

40. Historical counts indicate that the Duffers Reef colony had high occupied nest counts in 1959 (n=80 occupied nests) and 2013 (n=76 occupied nests), with fewer nests through intervening decades (range=30 to 37 occupied nests between 1992 and 2002). The number of adults at the colony remained similar between the period 1992-2000, 2002 and 2006, however the number of occupied nests was the lowest recorded in 2002 (n=16 occupied nests), when marine productivity was at a minimum.

Distribution of NZ King shag colonies

41. The majority (85%) of NZ king shags are distributed across five distinctive colonies, Duffers Reef, North Trio Islands, White Rocks, Rahuinui Island and Sentinel Rock (Schuckard et al. 2015). These larger breeding colonies are considered to be mutually exclusive being ~20 km or more distance apart flying over sea, close to the outer range for foraging for this species (Schuckard 2006b)[14]. There is no reliable information on the movement of birds between colonies, or to what extent this occurs.

[13] Zeldis, J.R., Howard-Williams, C., Carter, C.M. & Schiel, D.R. (2008). ENSO and riverine control of nutrient loading, phytoplankton biomass and mussel aquaculture yield in Pelorus Sound, New Zealand. *Marine Ecological Progress Series*, 37:131-142.

[14] Schuckard, R. (2006b). Distribution of New Zealand King Shags (*Leucocarbo carunculatus*) foraging from the Trio Is and Stewart I colonies, Marlborough Sounds, New Zealand. *Notornis*, 53: 291-296

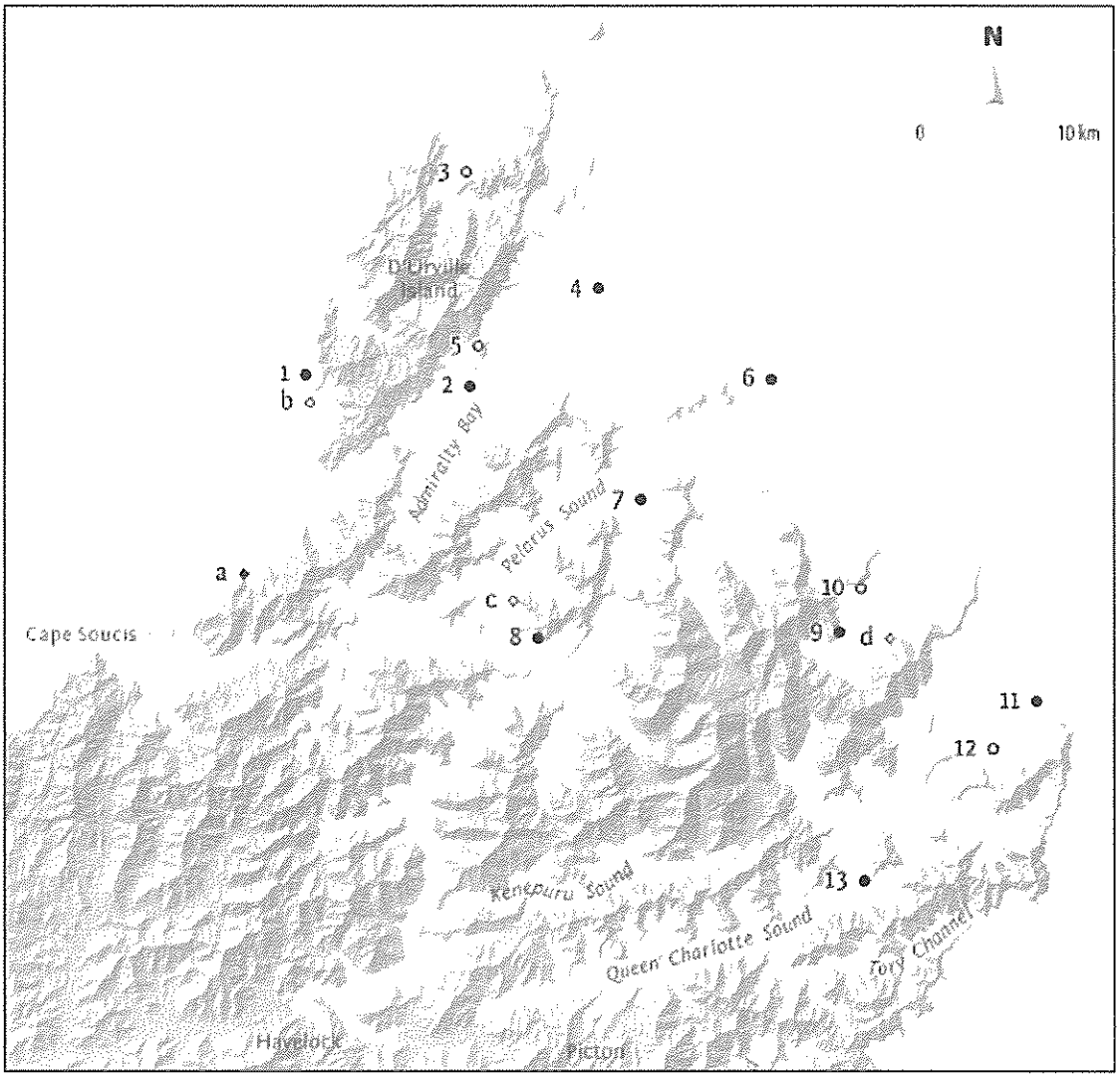

Figure 2. Location of breeding (number) and roosting (letter) sites of NZ king shags in the Marlborough Sounds recorded since 1951 (open symbol - abandoned, closed symbol – active breeding colony). 1 – Rahuinui Island, 2- Stewart Is, 3 - Squadron Rocks, 4 – North Trio, 5 – D'Urville Peninsula, 6 – Sentinel Rock, 7 Duffers Reef, 8 – Tawitinui, 9 – Hunia Rock, 10 – Taratara, 11 – White Rocks, 12 – The Twins, 13 – Blumine Island; a – Pahkorea Point, b – Hapuko Rock, c – Te Kaiangapipi, d – Blackhead Rock. Source Schuckard et al. (2015).

42. The smaller colonies including Squadron Rocks, Taratara and The Twins and others have all been recorded as colonies in the last 30 years. The reasons for satellite colonies (roosts and new breeding colonies) forming are not known – natural expansion, movements in response to changes in prey resource, intra-specific competition for nest sites, birds exploring new territories or to escape tick infestations of regularly used breeding sites are all potential explanations (D. Melville pers comm. 2017). However, the satellite colonies

potentially extend the breeding and foraging range of the species, and provide some resilience to localised disturbance and complete colony failure (e.g. from predation or disease) as well as maintaining genetic diversity through recruitment of offspring from satellite birds to the large colonies.

43. Furthermore, there needs to be provision to preserve unmodified foraging areas and nesting sites to accommodate the expansion of new colonies for roosting or breeding, e.g. the Rahuinui colony was first recorded in 1996, abandoned in the winter of 2000 and recolonised in the summer of 2001, remaining an active colony to present day (Table 1). Hunia Rock and Tawhitinui have also remained occupied and sustained breeding colonies.

	First record	Abandoned	Occupied again
Squadron Rocks	April 2003 and October 2006	Status unknown	
Hapuka Rock	9th July 2000	March 2001	
Rahuinui Island	September 1996	9th July 2000	March 2001
Blumine Island	2000	Summer 2001/2002	
Taratara Point	10th December 2006	Around April 2012[1]	
Hunia Rock	18th June 2013[2]		
TeKaiangapipi	Probably in 1960's, earliest number 3rd February 1982	About 1992	
The Twins	23th September 2006	Status unknown	
Tawhitinui	Winter 2012		

Table 1. Summary of occupancy dates for NZ king shag satellite colonies (data source R. Schuckard)

Assessment of adverse effects

Importance of seabird marine habitat

45. The Marlborough Sounds is of global significance for seabirds and accordingly recognised as an Important Bird Area (IBA) based on the presence of six qualifying seabird species, including NZ king shag (IUCN Threatened species), and congregations of seabirds species group (more than 10,000 pairs of seabirds or 20,000 individuals) that will be most affected by this proposal because of their overlap in marine habitat where marine farming, fishing and effects from other anthropogenic activities occur.

46. Seabirds spend the majority of their time at sea, where they feed and undertake maintenance behaviours required for life support. Whilst, their main breeding colonies are protected, their feeding habitat at present is not managed sustainably or even recognised as significant. Seabird populations are an integral part of our marine and coastal areas on land and sea (Forest and Bird 2014).

47. The proposed site(s) for relocation of the five salmon farm sites in Pelorus Sound overlap with the foraging range of NZ king shags breeding at Duffers Reef, North Trio and Sentinel Rock, which together constitute ~64% of the world population. Foraging NZ king shags have been recorded within the vicinity of the proposed relocation sites in Pelorus Sound (Schuckard unpublished composite map of NZ king shag foraging records). The potential Blowhole Point North site would be located 3km from Duffers Reef, 500m closer than the nearest existing salmon farm site in Forsyth Bay. Duffers Reef is presently the largest colony in terms of numbers of birds; however, the North Trio has the largest number of breeding pairs (Schuckard et al in prep.; DOC aerial survey 2016). No NZ king shags have been recorded in the Tory Channel, which may be due to its geographic isolation (NZ king shags do not generally fly over land), less favourable conditions in terms of energetic cost for foraging (e.g. high tidal races) and/or lack of survey effort.

48. The Marlborough Sounds Important Bird Area (IBA) encompasses 1,358 km^2 of marine space based on the foraging range and depth of the NZ king shag considered critical for conserving the population and significant numbers of fluttering shearwaters feeding within the sounds and immediately offshore.

49. It is important to note that this area, defined by IUCN as the Area of Occupancy (AOO), includes areas where NZ king shag and other seabirds will not regularly feed because of seasonal or annual variability in prey abundance and at times because of limited foraging opportunities through reduced prey availability from natural environmental conditions (e.g. stormy weather) or anthropogenic activities (e.g. disturbance of seabed from benthic trawling for flatfish). This marine habitat is significant for the threatened NZ king shag given its small and fragmented population and dependency on the colonies found only in the Marlborough Sounds.

50. One of the major threats of King Shag conservation management is the relict distribution and low genetic diversity

Exclusion of marine habitat and prey from existing habitat modification

51. Any assessment of the extent of effects on NZ king shag foraging habitat needs to take into account the impact of existing modification. There are approximately 600 consented marine farms (mainly mussel) in the Marlborough Sounds that extend over a surface area of 3, 000 ha (equivalent to 30 km^2)[15]. This surface area does not account for additional surface area potentially lost between ribbon development farms, the expansion of farms with tide/drift, loss of open space below the farms and the footprint/zone of effects in the water column and seabed habitat from point discharges of shell drop and feed resulting in enrichment and modification of benthic habitats.

52. The consented surface area of marine farms occupies at least 2% of the marine area defined by the Important Bird Area. Most of the consented marine farms occupy the shallow (10-40 m depth) coastal margins within 200 m of the coast. NZ king shags partly forage within 200 m of the coast that is subject to marine farm development. The relative importance of this shallow coastal habitat to NZ king shag at various stages of its life and as a prey resource is not known. The shallow coastal habitat is a finite resource where incremental loss of open marine space and benthic habitat to marine farms is likely to be considerably greater than 2% of the total coastal habitat and therefor more than a minor adverse effect on the NZ king shag.

53. NZ king shags are not considered pelagic or opportunistic feeders that would take prey near the surface (e.g. from bait-ball aggregations with dolphins and other seabirds such as spotted shags and gulls *pers obs*). Whether mussel farms exclude NZ king shags through the

[15] Marine Farming Association figures http://www.marinefarming.co.nz/

physical structure of the submerged lines reducing the open marine space and ability of birds to access the seabed and benthic prey, or through unsuitable modification to the benthos habitat where benthic fish prey hide, and changes in benthic assemblages has yet to be determined. Organically enriched seabed below salmon and mussel farms creates unfavourable habitat for NZ king shag prey and for foraging strategies used by NZ king shag. This is supported by the observation that less than one percent of foraging NZ king shags have occurred within or around marine farms (Schuckard 2016 unpublished NZ king shag foraging sightings database; Fisher & Boren 2012).

54. Given the poor vision of diving shags (Martin 2011[16]; White et al. 2007[17]), physiological and energetic constraints of diving to the seabed and returning to the surface; manoeuvring through the underwater structures and moorings of farms would also increase dive durations and energetic costs and potentially limit the search area and pursuit of prey.

55. In assessing the total area potentially impacted by salmon farms, it is relevant that the potential effects on the water column, seabed and shifts in community assemblages are assessed.

Nutrient enrichment

56. The proposal to relocate salmon farms to new sites also includes increases in feed levels (Knight 2014)[18] that will likely result in nutrient enrichment effects potentially over a greater area of the seabed and wider marine environment through dispersal in the water column at the high flow sites. The proposed feed levels are tested beyond the boundaries of the applied model for sustainable feed levels. The increase in feed levels is inconsistent with those set as consent conditions as a result of the Environmental Protection Agency Board of Inquiry, which reflected a precautionary approach based on the presence of the threatened NZ king shag and lack of information to assess effects[19] .

Harmful algal blooms

[16] Martin, G.R. (2011). Through birds eyes: insight into avian sensory ecology. *Journal of Ornithology* DOI 10.1007/s10336-011-0771-5.
[17] White CR, Day N, Butler PJ, Martin GR (2007) Vision and Foraging in Cormorants: More like Herons than Hawks? PLoS ONE 2(7): e639. doi:10.1371/journal.pone.0000639
[18] Knight B. (2014). Peer review of the Marlborough Sounds Biophysical Model Predictions. Prepared for Ministry for Primary Industries. Cawthron Report No. 2923. 19 p.
[19] Anon. (2013). Board of Inquiry: New Zealand King Salmon Requests for Plan Changes and Applications for Resource Consents. Appendices 9 and 10 - Final Conditions for consent for Waitata and Richmond.

57. Indirect effects from increased nutrient loads may result in harmful algal blooms that have the potential to result in significant adverse effects that can result in mass mortalities of seabirds and marine mammals. These adverse effects on seabirds and marine mammals have occurred elsewhere but not in New Zealand waters to date (e.g. Lessard et al. 2012)[20]

Biosecurity

58. Introducing salmon farms to new locations that presently do not have marine farms has the potential to introduce biosecurity risks that may have adverse effects on threatened seabirds, seabird assemblages and the habitat or prey of seabirds.

Disturbance from marine farms attracting nuisance seabirds

59. Marine farms attract large gulls, particularly around harvest time for salmon and mussel farms (NZKS 2014)[21]. The Southern black-backed gull will opportunistically take NZ king shag eggs and small chicks if parents are disturbed from their nests (Nelson 1971[22]; Cook 2015, Affidavit[23]). Small NZ king shag colonies may be more susceptible to predation from gulls than the large colonies. Roycroft *et al.* (2004)[24] also commented that mussel farms may affect distributions of Laridae (gulls) at a local scale in certain seasons, based on their study observing a large increase in numbers of gulls at farm mussel sites in spring, coupled with the simultaneous decrease in numbers at control sites.

Disturbance from boats

60. Butler (2003) reported that it is well established that NZ king shags are vulnerable to boat disturbance by boats approaching too close to nesting birds, and this led DOC to propose marine buffer zones of 1000 m around all breeding colonies. Buffer zones of 300 m around roosting sites at Te Kaiaingaipipi and White Rock, were also proposed (Davidson *et al.* 1995). However, Taylor (2000)[25] recommended that small boats should not approach NZ

[20] Lessard, E.J., RaLonde, R., Rensel, J.E.J., Strutton, P.G., Trainer, V.L., Tweddle, J.F.. 2012. Harmful algal blooms along the North American west coast region: History, trends, causes and impacts. *Harmful Algae* 820:1-27.

[21] New Zealand King Salmon (2014). Ngamahu, Richmond and Waitata marine farms. Wildlife Nuisance Management Plan. Prepared by Resource Environmental Management Ltd. 11pp.

[22] Nelson, A. (1971). King Shags in the Marlborough Sounds. *Notornis* 18: 30-37.

[23] Cook, T (2015). R.J. Davidson Family Trust vs Marlborough District Council. Affidavit Statement. JWM-122256-26-233-V1:JHB

[24] Roycroft D., Kelly T.C., Lewis L.J. (2004). Birds, seals and the suspension culture of mussels in Bantry Bay, a non-seaduck area in southwest Ireland. *Estuarine, Coastal and Shelf Science*, 61: 703-712.

[25] Taylor, G.A. (2000). Action plan for seabird conservation in New Zealand. Part A. Threatened Seabirds. *Threatened Species Occasional Publication No. 16.* Department of Conservation, Wellington.

king shag colonies closer than 100 m. Sagar (2011) commented that neither Davidson or Taylor reported the basis of their recommendations, and so it is assumed that they were not based on scientific studies but anecdotal observations".

61. Lalas (2001) observed that NZ king shags cease foraging when approached within 200-300 m and would escape by diving when a boat approached with 50-100 m. The diving response, rather than flying was interpreted as behaviour to enable foraging around their original location in a shorter time once the boat had passed. However, the diving response could also be explained by minimising energy as NZ king shags are poorly adapted to flying and require considerable effort to arise from the sea as a rapid response.

62. The effects of disturbance from boats approaching colonies during the breeding season and on foraging success of NZ king shags at sea are an unknown but both potentially adverse effects that need to be considered and quantified in an assessment of effects.

Disturbance from lighting

63. The potential adverse effects on seabirds from substantive underwater lighting of salmon farm pens are unknown on groups of seabirds (discussed further with review of MPI reports). The lighting on large vessels can disorientate seabirds and migrating birds and cause them to land and remain for some time until recovered, which is an adverse effect[26].

Loss of foraging habitat and prey availability from benthic trawling

64. Dredging for scallops[27] and benthic trawling for flatfish within Marlborough Sounds Important Bird Area occurs in the open marine area where marine farm structures are not present, and includes bays that were historically known as spawning grounds e.g. lemon sole (*Pelotretis flavilatus)* spawning in Beatrix Bay (DoC 1990)[28]. The MPI fisheries catch per unit effort data has low resolution and may not reflect the full extent of this activity, such that it is difficult to estimate the scale of effect on the marine habitat or flatfish prey resource that contribute to the NZ king shag diet. The level of disturbance to NZ king shags from the trawl boats is limited to the period of fishing activity; however, the disturbance to

[26] Gaskin, C. (2014). Hearing Topic 10 – RPS Heritage and Special Character. Statement of primary evidence for the proposed Auckland Unitary Plan. Prepared for the Environmental Defence Society Inc. and Royal Forest and Bird. Submission 4735 and 4848.

[27] Commercial and recreational scallop dredging is temporarily banned in the Marlborough Sounds and parts of Tasman Bay to promote a sustainable fishery. www.mpi.govt.nz/document-vault/12534

[28] DoC (1990). Coastal Resource Inventory: First Order Survey, Nelson/Marlborough Conservancy. Preece, J & Davidson, R.: (editors)

benthic communities would expect to be longer lasting and as yet an unquantified adverse effect.

Changes in prey availability and foraging efficiency

65. The potential relocation sites for five salmon farms in Pelorus Sound are within the foraging distance of NZ king shags breeding at Duffers Reef (the main colony). The potential Blowhole Point North site would be located 3km from Duffers Reef, 500m closer than the nearest existing salmon farm site (Forsyth Bay). These sites would also be within foraging range of NZ king shag breeding at North Trio and Sentinel Rock, which together constitute ~64% of the world population.

66. The NZ king shag breeds at the northern extent of the nutrient-rich sub-Antarctic oceanic zone between the subtropical and Antarctic convergence. It is likely that the blue-eyed *Leucocarbo* shags (of which NZ king shag is one) have evolved to occupy a particular seabird niche, through resource partitioning to reduce competition from other higher marine predators. This is supported by the variability in sexual size dimorphism (body size determines dive duration and depth) even between distinct colonies of the same population and commonality in targeting a particular prey resource (Cook *et al.*, 2013; Wanless & Harris 1983[29]).

67. The distribution and density of fish prey is of great interest because the foraging efficiency of shags is most strongly influenced by the availability of prey. Even a small reduction in prey density will prevent birds meeting their energy requirements. A reduction of prey density of only 25% can result in minimal search time increasing by 50%-100% (Grémillet & Wilson 1999)[30], which can result in an adverse effect for the individual bird and breeding pair.

68. Food availability is an ultimate factor determining breeding success, and species have evolved evolutionary stable strategies (e.g. facultative brood reduction) to respond to variability in food availability and to maintain condition for breeding attempts in more favourable times. Food availability can vary in terms of prey abundance, composition, catchability, and quality (calorific value), all of which ultimately impact on breeding success. For example, the persistence of Macquarie Island shag (*Phalacrocorax albiventer*

[29] Wanless, S. & Harris, M.P.. (1993). Use of mutually exclusive foraging areas by adjacent colonies of Blue-eyed Shags (*Phalacrocorux atriceps*) at South Georgia. *Colonial Waterbirds* 16: 176-I 82.
[30] Grémillet, D.& Wilson, R.P. (1999). A life in the fast lane: energetics and foraging strategies of the great cormorant. *Behavioral Ecology* 10: 516-524.

purpurascens) mate-pair bonds and nest site retention was attributed to variability in prey density, which consisted solely of benthic fish (c.f. NZ king shag prey), resulting in higher breeding failure during periods of food shortage (Brothers 1985)[31].

69. Cook *et. al.*, (2008[32]; 2013) found that Crozet shags (*Leucocarbo melanogenis*) consistently used the same range of dive depths such that repetitive individual dive habits could point to the existence of food patches which, are localised and predictable in time and space. For other blue-eyed shags, patchiness of benthic resources would mean that prey can have a shallow or deep distribution, depending on the local ecological conditions associated with the colony.

70. The benthic flatfish prey of NZ king shags cannot be detected from the surface of the sea, hiding for most of the time in soft sediment to avoid predators. Displacement of birds from local foraging areas (within range of their colony) due to modification of the open water column (e.g. turbidity from salmon feed or plankton bloom response) and seabed in the vicinity of marine farms is likely to affect foraging efficiency of NZ king shags, and potentially be a significant adverse effect on the individual, breeding pairs and colony within the zone of effects.

71. Furthermore, whilst flatfish species are considered commonly widespread, they have variable seasonal spawning and recruitment to coastal areas over time, which is greatly influenced by large scale oceanographic drivers that influence marine productivity, larval dispersal and likely to affect the seasonal availability of fish prey for the NZ king shag.

Cumulative effects

72. We do not know what the carrying capacity of the Marlborough Sounds is in terms of spacing and density of marine farms, commercial and recreational fisheries and how this is influenced by changes in climate and marine productivity from large scale oceanographic processes and episodic sediment and nutrient discharges from land, via the Pelorus River.

73. Whether the extent of existing and proposed modification of marine habitat is sustainable at the Bay scale or wider Sounds scale has yet to be demonstrated. The present net area of marine farms is double the net foraging area of NZ king shags based on sightings of

[31] Brothers, N.P. (1985). Breeding biology, diet and morphometrics of the Macquarie Island Shag, *Phalacrocorax albiventer purpurascens,* at Macquarie Island. *Australian Wildlife Research* 12: 81-94

[32] Cook, T.R., Lescroel, A., Tremblay, Y., Bost, C-A. 2008. To breathe or not to breathe? Optimal breathing, aerobic dive limit and oxygen stores in deep-diving blue-eyed shags. *Animal Behaviour*, 2008, 76: 565-576

individuals to date. Whilst we cannot make direct comparisons between these figures, for reasons mentioned above, it provides a magnitude of scale to visualise adverse effects.

Assessment of effects with regard to the NZCPS

Avoiding adverse effects on threatened species and habitats of indigenous species

74. Policy 11 of the NZCPS requires decision-makers to protect indigenous biological diversity in the marine environment by avoiding adverse effects of activities of activities on particular taxa, habitats and ecosystems, including indigenous taxa that are listed as threatened in the New Zealand Threat Classification System,[33] and habitats of indigenous species where the species are at the limit of their natural range.[34]

75. Seabird habitat is defined here as the space and ecosystem services that are required to maintain the population. This includes suitable habitat for breeding, feeding and maintenance behaviours associated with colonial seabird populations including courtship and breeding on land, roosting, preening, loafing, washing close to the colony and open marine space for congregations of post breeding and juvenile birds.

76. The NZ king shag area of occupancy as described in the Marlborough Sounds Important Bird Area (IBA) report is all significant habitat for NZ king shag, given its Threatened conservation status and small population.

77. Ecological assessments under the proposed Marlborough Environment Plan use the Ecological Significant Marine Sites[35] (ESMS) as a supporting document to identify important species and habitat in the Marlborough Sounds. The ESMS does not recognise or include any marine habitat specifically for the threatened NZ king shag, and so do not identify all areas to which NZCPS Policy 11(a)(iv) applies.

Impacts on NZ king shag population stability

78. The recent 2015 population census and breeding survey for 2015 and 2016 has provided the first reliable assessment of the entire population. The 2015 breeding survey reported 187 breeding pairs, however, the number of breeding pairs with occupied nests declined by almost 40% in 2016. This significant variability in breeding success/chick mortality

[33] Policy 11(a)(i)
[34] Policy 11(a)(iv)
[35] Davidson, R., Duffy, C., Gaze, P., Baxter, A., DuFresne, S., Courtney, S. & Hamill, P. (2011). Ecologically significant marine sites in Marlborough, New Zealand. Co-ordinated by Davidson Environmental Ltd for Marlborough District Council and Department of Conservation.

observed between years needs to be assessed over a longer time frame. The species is susceptible to losing nests and chicks breeding over the winter at exposed nest sites close to the sea.

79. The NZ king shag population numbers less than 1,000 individuals and nests in remote and generally difficult to access colonies on stacks and promontories. Further, the species is sensitive to disturbance, which has to date resulted in very little research on this species and hindered the lack of knowledge of its basic ecology required for conservation management. One of the major threats of NZ king shag conservation management is the relict distribution and low genetic diversity[36], which has significant implications for the survival of the only endemic species of the Marlborough Sounds. The Environment Court have recently noted that the assumed "stable" condition of a threatened species is no reason for comfort by stating[37]:

> *"However, when a taxon is reduced to less than 1,000 individuals on the planet, because of the risk of stochastic events, waiting for a reduction in population is no longer regarded as an appropriate trigger for protecting the taxon".*

80. There is a need to take a precautionary approach to preserve marine habitat for foraging areas and coastal nesting sites to maintain existing colonies and accommodate the expansion of new colonies for roosting or breeding to promote conservation measures and population stability. This proposal to relocate salmon farms to existing NZ king shag foraging areas within potential roosting and breeding sites is not consistent with the NZCPS Policy 11.

81. It is certain that NZ king shag feeding habitat will be lost beneath five of the proposed salmon farm relocation sites. The proposed relocation sites will have an adverse effect on the NZ king shag in terms of displacement from its foraging area because of habitat modification, including changes in the water column, benthic and epibenthic communities that have the potential to result in declines in foraging efficiency. This is inconsistent with the NZCPS Policy 11(a)(i), (ii), and (iv) for the threatened NZ king shag because the proposed activity does not avoid adverse effects, which have yet to be quantified.

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[36] Rawlence, N. J., Till, C. E., Easton, L. J., Spencer, H.G., Schuckard, R., Melville, D.S., Scofield, P., Tennyson, A. J. D., Rayner, M., Waters, J.M., Kennedy, M.. Human-driven extinctions and range contraction in the endemic New Zealand King Shag complex. (*in prep.*).

[37] R.J. Davidson Trust v Marlborough District Council [2016] NZEnvC 81[285]

82. Thompson (2016) concluded his statement with "Such gaps in knowledge of the biology of the species [NZ king shag] may reduce the confidence with which some environmental effects may be predicted. However, this is not the case with this application, where the salmon farms and associated activities do not enter critical distances from roosting sites and breeding colonies and the extent under the salmon farm is so small in relation to the overall foraging habitat area. Thus, these proposed Plan Changes are likely to have insignificant environmental effects on NZ King Shags and other seabirds".

83. Assessing each development alone will result in incremental loss of threatened species habitat and ecosystem services, contributing to a decline in ecosystem health and natural character, which constitutes an adverse effect on Policy 11, in particular (a)(i),(ii),(iv) (for NZ king shag) and (b)(ii),(v),(vi) (for seabird habitat defined within the Marlborough Sounds IBA).

84. Allowing ongoing encroachment into the foraging habitat of NZ King Shag will not *avoid* adverse effects on NZ king shag and their habitat. Policy 11 requires such habitat encroachment and alteration to be avoided in order to protect indigenous biological diversity in the coastal environment. This will add to the potential vulnerability of the NZ king shag, which is already classified as 'nationally endangered' and 'threatened'. Policy 11 of the NZCPS (2010) lends no support to adding further risk to an indigenous species that is already threatened and nationally endangered.[38]

85. The alteration of the benthic environment and displacement from foraging areas needs to be seen in the context of the existing mariculture and commercial fisheries, with net cumulative impacts on the foraging habitat of NZ king shag.

Increase in organic enrichment

86. The seabird review of effects was based on there being no change in the number or area of farms relocated. However, the proposal will result in a 58% increase in organic feed levels for Pelorus Sound in areas where marine farms are prohibited and 3% reduction for Queen Charlotte Sound, compared to the maximum level consented by the EPA BOI, under the framework of the New Zealand King Salmon Management Plan.

[38] See the discussion in RJ Davidson Family Trust v MDC [2016] NZEnvC 81 at [161] to [169] and [196] to [210] and [275] and following

87. It is recognised that any relocated sites will require: (i) implementation of staged adaptive management, (ii) that the proposed net *first stage feed levels* for Pelorus and Queen Charlotte Sounds are similar to or below existing BOI consented levels, and that (iii) the magnitude of the proposed Pelorus Sound increase is comparable to the existing level of feed inputs into Queen Charlotte Sound. These pre-requisites do not however qualify a net increase in feed levels without appropriate consideration of the King Shag Monitoring Plan and monitoring in place to appropriately assess and quantify risks from the actual and potential effects on the environment from allowing the activity.

88. The occurrence of harmful algal blooms, already present in the Sounds may be exacerbated by increase in dissolved nutrients from residual organic feed dispersed in the water column. The scale of this effect is unknown; however, the dinoflagellate-algae produced foam destroys the waterproof layer of seabird feathers, restricting flight and results in mortality through hypothermia[39].

89. The adverse effects resulting from increasing nutrient loads to the marine habitat in Pelorus Sound has not been appropriately assessed or quantified. The direct adverse effects (e.g. potential shift in benthic communities to anaerobic state and algal blooms) have not been quantified with respect to the threatened NZ king shag, wider seabird community and Marlborough Sounds indigenous habitat and prey resource. The increased nutrient load potentially constitutes an adverse effect contrary to Policy 11(a)(i), (ii), and (iv) (for NZ king shag) and (b)(ii), (v), and (vi) (for seabird habitat defined within the Marlborough Sounds IBA).

Human disturbance to seabirds

90. There are several human activities that may have adverse effects on the NZ king shag and other seabirds that include boat traffic approaching and disturbing birds at colonies and roosts and temporarily displacing birds and prey from foraging areas. Other potential effects associated with management of salmon farms include extensive underwater lighting and increases in predatory nuisance birds during harvest (discussed in more detail in the MPI- Seabirds review). Assessing each proposed site with respect to the distance to the nearest NZ king shag breeding or roosting colony provides no assurance or confidence that cumulative effects have been considered adequately. There have been no scientific studies

[39] Shumway, S.E., Allen, S.M., Boersma, P.D. 2003. Marine birds and harmful algal blooms: sporadic victims or under-reported events.? Harmful Algae Vol. 2, issue 1:1-17.

to quantify these potential effects on the NZ king shag. Any disturbance that results in a decline in breeding success through disturbance at the colony or foraging areas constitutes an adverse effect contrary to Policy 11(a)(i), (ii), and (iv) (for NZ king shag).

Foraging habitat and prey availability

91. Tracking individuals of other blue eyed *Leucocarbo* shags species (similar to NZ king shag) using satellite telemetry show that some colonies have defined foraging areas and dive profiles, such that search cues for prey are learned, conferring energetic advantages. There are considerable energetic advantages for individuals to learn cues for catching particular prey and become familiar with habitat of their preferred prey. If individuals or groups of birds associated with NZ king shag colonies establish preferences for prey species or foraging area the assumption that birds can move elsewhere habitat and prey may be available does not hold because the alternative foraging could be less efficient.

92. Small declines in foraging efficiency through changes in prey species availability and catchability can have significant adverse effects by increasing energy budgets, particularly during the breeding season when energy requirements and type of prey/calorific value are critical to breeding success. Displacement of birds from "established" foraging areas and prey species assemblages from relocation of salmon farms may result in less efficient foraging and lower breeding success for breeding pairs. This constitutes an adverse effect on the threatened NZ king shag, which is inconsistent with NZCPS (2010) Policy 11(a)(i), and (iv).

Cumulative effects

93. There has been no thorough assessment of cumulative effects from all marine farms and commercial fisheries on the threatened NZ king shag and other seabirds, e.g. such as quantifying the disturbance and loss of benthic habitat from mussel farms, scallop dredging and benthic trawling for flatfish that occur in the Pelorus and wider sounds. Those activities cumulatively impact on king shag foraging habitat, contrary to Policy 11(a)(i), and (iv).

94. A thorough assessment of adverse effects on the NZ king shag cannot be undertaken without direct observations of foraging trips and dives that incorporate a sufficient sample size to represent the population. Other key drivers such as marine productivity and flatfish stocks are required as baseline information, in terms of seasonal/annual recruitment of juvenile fish, surveys of spawning areas and habitat requirements, and effects at various

(vulnerable) stages of flatfish lives (e.g. effects of nutrient enrichment on fish larvae recruitment and survival and planktonic communities).

95. Overall, it is likely that marine farms and commercial fisheries represent considerably more loss of habitat to the Marlborough Sounds Important Bird Area than the 2% habitat loss represented by consented marine farms alone. There is a certain but unquantifiable direct cumulative adverse effect on seabirds from the loss of open marine sea surface, water column and benthic habitat utilised by these birds. While there may eventually be recovery of the benthic environment in the existing salmon farms, which will at some stage represent regained habitat, this is likely to take several years.

96. The extent of the cumulative adverse effects from this proposal in addition to existing impacts cannot, based on the available information, be assessed with any certainty. A number of adverse effects highlighted above cannot be avoided, which is inconsistent with the NZCPS Policy 11(a)(i), (ii), and (iv) for the threatened NZ king shag. The recent Davidson vs Marlborough District Council Environment Court case and High Court decision considered that a cumulative loss of 11% NZ king shag marine habitat at a Bay-scale would have an adverse effect that was likely and more than minor (though less than significant). It is feasible that the potential cumulative effects of this proposal, in addition to existing modifications

Precautionary approach

97. Although an important habitat for seabirds, there is relatively little formal protection of the marine habitat in the Marlborough Sounds. A precautionary approach to further salmon and mussel farm development within Marlborough Sounds is warranted, in accordance with the NZCPS Policy 3, until there is some confidence in quantifying adverse effects for Policy 11 species and habitats at risk and ensuring sustainable management of marine and coastal resources. This will require a more integrated monitoring and research effort designed to provide a better understanding of the Sounds ecosystem, including the higher marine seabird food web inter-relationships and their resource requirements, that represent threatened and key wildlife habitat and species assemblages.

Review of MPI evidence – Seabirds technical reports

98. I have reviewed the following peer reviewed reports for seabirds provided by MPI in support of its assessment of ecological effects on seabirds for salmon farm relocation proposal:
    a. Thompson, D. (2016) Seabirds – Potential Salmon Farm Relocations in the Marlborough Sounds – Update of Existing Report: Sagar (2011). 16pp, Dec 2016, NIWA.[40]
    b. Taylor, G. (2016) Comments on the NIWA seabird reports assessing issues with relocation of salmon farms in Marlborough. 4pp, 8 Dec 2016, DOC.
    c. Taylor, P. (2016) Statfishtics – Effects of salmon farming in the Marlborough Sounds on the prey of New Zealand king shag, *Leucocarbo carunculatus*. 14pp, Sept 2016.

99. I have also considered the other relevant ecological information provided by MPI, including technical reports reviewing the potential effects on the benthic (seabed) habitat and an overview of ecological effects of aquaculture. [41]

Scope of comments

100. This statement provides an assessment of the seabird technical reports provided by MPI in terms of scope, methodology, significance of the areas affected and assessment of effects specifically for seabirds.

101. The assessment of effects on seabirds examines the proposal's consistency with the New Zealand Coastal Policy Statement (2010), in particular, Policy 11 Indigenous Biological Diversity (Biodiversity).

102. The NZ king shag is dealt with separately to other seabirds because it is the only endemic species in the Marlborough Sounds (i.e. found nowhere else) and therefore has a restricted range and specific habitat requirements that are defined by the Marlborough Sounds marine and coastal environment.

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[40] Sagar (2011). Assessment of potential environmental effects of the proposed NZ King Salmon expansion on seabirds, with particular reference to the King Shag. Prepared for New Zealand Salmon. 28pp

[41] http://www.mpi.govt.nz/news-and-resources/consultations/marlborough-salmon-relocation/#technicalreports

Thompson, D. (2016). Seabirds – potential salmon farm relocations in the Marlborough Sounds

103. The scope of the Thompson (2016) review was to provide an update to an earlier review by Sagar (2011) in light of recent publications on New Zealand king shag, and to comment on the proposal to relocate up to six existing farms. The review of publications cites published literature from Fisher & Boren (2012)[42], Kenny & Spencer, (2014)[43] and an unpublished New Zealand Salmon King Shag Management Plan (2015)[44].

104. The review *does not* include the Important Bird Areas (2014) publication, the latest NZ king shag population census totalling 839 birds (Schuckard et al. 2015), research on the blue-eyed shag *Leucocarbo* comparative foraging ecology by Cook et al. (2013)[45] or the genetic study of the Stewart Island shag by Rawlence et al. (2016)[46].

105. Thompson's (2016) key conclusions from the literature were that: (i) the NZ king shag population has remained relatively stable at "about 650 individuals" and information indicates that it has been at this level for several decades, and that the proposed salmon farms and associated activities do not enter critical distances from roosting sites and breeding colonies; (ii) the proposed Plan Changes are likely to have insignificant environmental effects on NZ king shags and other seabirds because the extent of area under salmon farms is so small in relation to the overall foraging habitat.

Important Bird Areas

106. Both Sagar (2011) and Thompson (2016) were contributors to the Important Bird Areas (IBA) for New Zealand Seabirds: Sites at sea; seaward extensions, pelagic areas (2014) (the IBA Report)IBA Report.

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[42] Fisher, P.R. & Boren, L.J. (2012). New Zealand King Shag *(Leucocarbo carunculatus)* foraging distribution and use of mussel farms in Admiralty Bay, Marlborough Sounds. *Notornis*, 59:105-115.

[43] Kennedy, M. & Spencer, H.G. (2014). Classification of cormorants of the world. *Molecular Phylogentics and Evolution*, 79: 249-257

[44] NZ King Salmon King Shag Management Plan (2015). Unpublished report available online from NZKS

[45] Cook T.R., Lescroe¨, I.A., Cherel, Y., Kato, A., Bost, C-A (2013). Can Foraging Ecology Drive the Evolution of Body Size in a Diving Endotherm? PLoS ONE 8(2): e56297. doi:10.1371/journal.pone.005629

[46] Rawlence, N. J., Paul Scofield, R., Spencer, H. G., Lalas, C., Easton, L. J., Tennyson, A. J. D., Adams, M., Pasquet, E., Fraser, C., Waters, J. M. and Kennedy, M. (2016), Genetic and morphological evidence for two species of *Leucocarbo* shag (Aves, Pelecaniformes, Phalacrocoracidae) from southern South Island of New Zealand. *Zool J Linn Soc*, 177: 676–694. doi:10.1111/zoj.12376

107. Thompson (2016) and cited publications do not refer to the IBA report. This is a significant omission because the IBA report concludes that the Marlborough Sounds qualifies as a site of global importance for seabirds, using IUCN criteria, comprising six 'trigger species'[47] and a species group category (including species not listed as individual species).

108. Sagar (2011) provides a systematic list of seabirds of conservation concern occurring in the eastern Cook Strait and the Marlborough Sounds and general summary of feeding behaviours. However, it does not reflect the importance of the Sounds environment as a whole for significant numbers of seabirds that congregate in groups that include rafts (e.g. fluttering shearwaters) and feeding assemblages (shearwaters, gannets, shags and gulls) in open water within bays and sounds.

Schuckard et al. (2015)

109. This publication provides an update for the distribution of breeding colonies and roost sites since 1951 and first population census by aerial survey for the KSMP (discussed earlier in this statement).

Cook et al. (2013)

110. The Cook *et al.* (2013) paper is of direct relevance to the review of NZ king shag foraging ecology, habitat and prey preferences because it provides a comparison of foraging behaviours and habitat preferences across several *Leucocarbo* populations and species and a model for estimating the foraging depths based on body size linked to sexual dimorphism (physiological constraints) observed in this group of cormorants.

Rawlence et al. (2016)

111. Rawlence *et al.* (2016) used genetic analysis to show the two lineages of Stewart Island shag (*Leucocarbo chalconotus*) represent two separate species, which we now recognize as the Otago shag (*L. chalconotus*), and the Foveaux shag (*Leucocarbo stewarti*). This publication is of relevance because it clearly delineates the NZ king shag from other species, and exemplifies the genetic isolation (and vulnerability) of small populations over short geographic scales, through adaption and dependency on their local marine environment. One of the major threats of King Shag conservation management is the relict distribution and low genetic diversity.

[47] Trigger species – these are species that meet threshold numbers for global IBA criteria

King shag conservation status

112. Sagar (2011) and Thompson (2016) have not fully acknowledged the IUCN criteria (IUCN 2016) for assessing the status of threatened species and implications for defining the extent of habitat based on the extent of occurrence over the species' range.

Evidence as to whether NZ king shag population is stable.

113. Both Sagar (2011) and Thompson (2016) reviewed published counts of birds and nests at colonies to comment on population stability, based on information summarised in Schuckard (2006)[48] and Bell (2010), and consider that the NZ king shag population of about 645 birds is "stable" (remaining at low numbers). In my opinion, that conclusion is not sound as it has not considered the most recent population census by Schuckard et al. (2015), the errors associated with previous population census by boat summarised in this statement.

114. Sagar (2011) commented on observations of breeding attempts outside of the usual colonies e.g. southern tip of Bluemine Island, Queen Charlotte Sound, a small rock island south of Victory Island, off D'Urville Island (Schuckard 2006) and at Taratara (Bell 2010), concluding that sites (satellite) may be used for breeding occasionally, supporting the comment by Nelson (1971[49]) that sites of colonies can change over time.

115. The potential importance of the smaller 'satellite' colonies has not been discussed or recognised by Sagar (2011) and Thompson (2016) with regard to the demographics, persistence of the population and long term stability of the population.

116. Sagar (2011) concluded that there were significant gaps in the knowledge of NZ king shag biology, that still remain today, "Despite the conservation status of the NZ king shag most of the information about it comes from anecdotal observations or short term studies. Therefore, there remain extensive and significant gaps in our knowledge of the biology of the species. Currently, information about such basic life history parameters as the timing of breeding are incompletely known. In particular, information is required about population parameters (such as adult mortality rates, breeding success, age of first breeding, and nest

[49] Nelson, A. (1971). King shags in the Marlborough Sounds. *Notornis* 18: 30-37.

site fidelity) and variations in foraging areas and diet both within seasons and between years".

117. Based on the above information, much of which is not referenced in Thompson (2016), I do not consider that it is possible to say that the NZ king shag population is stable. The previous boat counts of total birds at colonies cannot be used to determine the long term *"stability"* of the population because the count does not reflect the number of breeding pairs, successful breeding attempts or age and sex ratio of birds, the latter reflecting the number of potential breeding pairs that may greatly influence the productivity of the population as a whole and long term trend. Based on the 2015 and 2016 DOC surveys of breeding pairs it appears that the number of breeding pairs and breeding success can vary significantly between colonies between years. The NZ king shag population model indicates that the population may well be experiencing a slight decline. A precautionary approach to potential adverse effects is therefore warranted until we have adequate monitoring information.

Disturbance from predatory birds

118. Sagar (2011) and Thompson (2016) do not comment on the potential for marine farms to attract large gulls, particularly around harvest time for salmon and mussel farms (NZKS 2014)[50]. Small NZ king shag colonies such as Tawitinui could be more susceptible to egg predation from gulls if concentrations of gulls increase with existing marine farms and expansion of salmon farms closer to breeding colonies.

Disturbance from boats

119. Butler (2003) reported that it is well established that NZ king shags are vulnerable to boat disturbance by boats approaching too close to nesting birds. Thomson (2016) noted that previous recommendations (ranging from 100 m, 300 m to 1,000 m) for buffer zones around NZ king shag colonies did not report the basis of their recommendations, and so it is assumed that they were not based on scientific studies but anecdotal observations. Thompson (2016) recommended that the Plan Change Zones at Papatua and Waitata relocation sites should include a buffer zone of at least 100 m at the roosting colonies, with no activities associates with these proposed salmon farms occurring within the buffer zones. I agree with Thompson (2016) that buffer zones around colonies are required to

[50] New Zealand King Salmon (2014). Ngamahu, Richmond and Waitata marine farms. Wildlife Nuisance Management Plan. Prepared by Resource Environmental Management Ltd. 11pp.

avoid disturbance, particularly during the breeding season. The extent of the buffer zone needs to reflect the types of vessels and speeds, and the fact that new roosts and breeding colonies may become established close to existing marine farms.

120. The significance of effects of disturbance from boats approaching colonies during the breeding season and on foraging success (discussed below) of NZ king shags at sea are an unknown but both potentially adverse effects.

Disturbance from lighting

121. Observations at NZ king shag colonies suggest that birds return to roosts and breeding colonies each day to roost overnight and depart at first light to foraging areas (Schuckard 2004; Fisher & Boren 2012). Sagar (2011 and references therein) notes the rock shag (*Phalacrocorax megallanicus*) and imperial shag (*P. atriceps*), a close relative of the NZ king shag, can be absent from the colony for up to 70% of the night coinciding with half-full or nearly full moon, potentially foraging. Further that bottom dwelling fish are more likely to avoid the light, and therefore if NZ king shag do forage at night are unlikely to feed around farms and be affected. The potential effects of artificial lighting on NZ king shag and other seabirds cannot be quantified without further study. The lighting on large vessels can disorientate seabirds and migrating birds and cause them to land and remain for some time until recovered.

Nutrient enrichment

122. Taylor, G. 2016) also commented on the uncertainty of potential effects from changes in turbidity and organic enrichment from the relocated farms, concluding his statement: "I agree with the NIWA report that there is still a level of uncertainty about whether the higher flow currents at the new sites will influence changes in water quality over a wider area of the Marlborough Sounds. It remains uncertain how any potential changes in water turbidity or nutrient levels might impact on seabirds or fish stock near the proposed farms...."[51]

[51] Taylor, G. (2016) – Comments on the NIWA seabird reports assessing issues with relocation of salmon farms in Marlborough. 4pp, 8 Dec 2016

123. Other adverse effects on the wider ecosystem (far-field effects) through dispersal, such as increased nutrient discharge from the salmon farms have not been fully assessed with regard to seabirds, their habitat requirements and prey. I agree with Taylor, G. (2016)) that uncertainty remains as to how potential changes in water turbidity and nutrient impacts might affect seabirds and fish stock near proposed farms.

Harmful algal blooms

124. None of the MPI – Seabird reviewers have commented on the potential adverse effects of increased nutrient loads promoting harmful algal blooms, which can result in significant adverse effects leading to mass mortalities of seabirds and marine mammals.

125. The respective seabird technical reports largely deal with issues in isolation. This may have been partly due to the narrow brief to update the Sagar (2010) report. Comments such as "threatened species have relatively large distributions and are relatively abundant. For these reasons, the proposal to relocate up to six salmon farms within the Sounds is very unlikely to have anything other than a negligible and unmeasurable effect on seabirds generally" need to be qualified further.

Taylor P. (2016) Effects of salmon farming on the prey of NZ king shag

126. Taylor, P. (2016) reviewed the published literature available on the prey species of NZ king shag, concluding that the diet comprised a number of mainly flatfish species that was strongly dominated by the flatfish witch (*Arnoglossus scapha*). The review included a feeding study on NZ flatfish species from Wellington harbour, as well as benthic reports for the potential relocation sites prepared by NIWA and the Cawthron Institute, to investigate the possible impacts of the proposed site relocations on the prey of flatfish, and ultimately on NZ king shag.

127. Taylor, P. (2016) concluded that the proposed relocation sites would have no adverse effect on the NZ king shag because many potential prey items of witch and the other fish prey species of NZ king shag are available at areas close to the proposed relocation sites and elsewhere within the Sounds. Taylor, P. (2016) also concluded that any reduction in prey availability to NZ king shag from farm relocation was also likely to eventually be offset by habitat recovery below and near to vacated existing farm sites. The exact time to full

recovery of existing lower-flow sites is not known but most likely to occur over a timeframe of several years.

128. The Taylor, P. (2016) review is based on limited published information of diet remains that span over 50 years from a handful of sites. The assessment of diet may therefore not be representative of the population as a whole or reflect changes in marine productivity, fish assemblages and stocks and habitat that may have occurred in the intervening decades through natural oceanographic/climate variability and anthropogenic activities.

129. More recent studies by Schuckard et al., have yet to be published and extend the range of benthic and epibenthic prey items through wider sampling and because of advances in methods to identify digested prey items and improved biomass relationships with otolith ear bones of fish.

130. Whilst some of the unpublished diet analysis by Schuckard et al. indicates differences in prey assemblages that may reflect differences in prey preferences between birds and particular foraging areas; there is insufficient information to define the spatial scale or foraging site fidelity of individuals or colonies. Furthermore, it is not known whether individual birds return to familiar foraging areas, and to what extent this confers a foraging efficiency as in other shag species (e.g. Cook et al. 2006)[52].

131. If NZ king shag preferentially forage in particular areas, the impact of habitat loss of those areas will be greater than the percentage area of loss would indicate. The importance of the proposed salmon farm sites for NZ king shag foraging has not been adequately assessed by the MPI reports.

Foraging behaviour and habitat use

132. The Taylor, P. (2016) review is inadequate in thoroughly assessing adverse effects from the proposed relocation of salmon farms to NZ king shag foraging areas that may result in changes in prey availability and foraging behaviour because of changes in the environment, e.g. fish may be present but not available because of increases in turbidity from nutrient enrichment that may affect NZ king shag foraging search cues and ultimately foraging efficiency or displacement from familiar foraging areas.

[52] Cook, T. R, Cherel, Y., Tremblay, Y. (2006). Foraging tactics of chick-rearing Crozet shags: individuals display repetitive activity and diving patterns over time. *Polar Biology* 29: 562–569.

133. To date there has been no direct study of NZ king shag foraging behaviour using, for example, satellite or dive loggers to track foraging trips of individuals required to assess habitat use. This is mainly because of the threatened status of the species, concerns about the potential disturbance resulting from catching birds, and cost. However, proven technology now exists, and has been used successfully on other shag species (e.g. underwater selfies of foraging shags, Gómez-Laich *et al.* 2015[53], GPS tracking to determine foraging range and extent of marine habitat, Soannes et al. 2016[54]).

NZ king shag foraging depths

134. The Thompson (2016) and Taylor, P. (2016) review did not assess the effects of habitat exclusion at relocation sites on NZ king shags with respect to the morphology and physiological adaptions of the blue eyed Leucocarbo shags, which potentially imposes differential selection pressures on habitat and prey availability between male and female birds.

135. Schuckard (2006b)[55] found that 7% of birds from the Trios colony foraged in water depths greater than 50 m, however the majority were between 20-40 m, consistent with other studies of blue-eyed shag species. Cook *et al.* (2013) derived indicative body size/dive depth correlation curves that provide the respective **mean** foraging depths of 44m and 52m for male and female NZ king shag (based on body size/mass for male and female is 2.7 and 2.5 kg; Marchant & Higgins 1990)[56].

136. The NZ king shag foraging records extend to areas greater than 60 m depth in the Pelorus mid channel - Waitata Reach where one of the salmon farms is proposed to be relocated. Other *Leucocarbo* shags with similar foraging and dive ranges to the NZ king shag e.g. the

[53] Gómez-Laich A, Yoda K, Zavalaga C, Quintana F (2015) Selfies of Imperial Cormorants (*Phalacrocorax atriceps*): What Is Happening Underwater? PLoS ONE 10(9): e0136980. doi:10.1371/journal.pone.0136980

[54] Soanes, L.M., Bright, J.A., Angel, L.P., Arnould, J.P.Y., Bolton, M., Berlincourt, M., Lascelles, B., Owen, E., Simon-Bouhet, B., Green, J.A. 2016. Defining marine important bird areas: Testing the foraging radius approach. *Biological Conservation*, 2016, 196, 69

[55] Schuckard, R. (2006b). Distribution of New Zealand King Shags (*Leucocarbo carunculatus*) foraging from the Trio Is and Stewart I colonies, Marlborough Sounds, New Zealand. *Notornis*, 53: 291-296.

[56] Marchant, S. & P.J. Higgins (eds) (1990). *Handbook of Australian, New Zealand and Antarctic Birds. Volume 1: Ratites to Ducks.* Oxford University Press, Melbourne. ISBN 0-19-553244-9, 875pp.

Kerguelen shag (*Leucocarbo verrucosus*) have been recorded to depths of 94 m, using dive loggers (Watanabe et al. 2011)[57].

137. In the wider Sounds, depths greater than 50 m may only be within the foraging niche of larger male NZ king shags. The importance of the mid channel reaches to seabirds within the Important Bird Area are not known because of lack of systematic surveys within the Marlborough Sounds. It is likely that smaller females forage at shallower depths than males because of their shorter dive durations associated with body size and physiological differences between the sexes (Cook et al. 2013).

138. Taylor, P. (2016) concluded that the proposed relocation sites would have no adverse effect on the NZ king shag because many likely prey items of the witch flatfish and the other fish prey species of NZ king shag are available at areas close to the potential relocation sites and elsewhere within the Sounds. I do not agree that the adverse effects on the NZ king shag prey would be mitigated by the availability of other fish prey close to the potential relocation sites and elsewhere in the Sounds. The review by Taylor, P. (2016) has not fully considered the cumulative effects or foraging ecology of the NZ king shag and implications for foraging efficiency and breeding failure.

Disturbance and modification to the benthic foraging habitat of NZ king shag

139. Taylor, P. (2016) assessed the commercial fishing effort for benthic trawling of flatfish, to explore whether it could explain the lower occurrence of the flatfish witch in a number of largely anecdotal studies on the diet of the NZ king shag. This was based on a study of NZ king shag foraging in Pelorus Sound, where 90% of the prey items comprised of witch (Lalas and Brown 1998)[58]. The Taylor review did not assess the disturbance and temporary loss of NZ king shag benthic habitat from trawling.

140. Commercial flatfish trawls typically occur in open water (e.g., mid bay) along the flat shelf of the bay. This activity disturbs benthic fish habitat in the open water, mainly in water depths greater than 20 m away from reefs. The potential impacts on NZ king shag foraging

[57] Watanabe, Y, Y., Takahashi, A., Sato, K., Viviant, M., Bost, C-A.. 2011. Poor flight performance in deep diving cormorants. *The Journal of Experimental Biology* 214: 412-421.

[58] Lalas, C.& Brown, D. (1998). The diet of New Zealand King Shags (*Leucocarbo carunculatus*) in Pelorus Sound. *Notornis*, 45: 129-139.

areas are compounded by mussel farms occupying and modifying near shore benthic habitat and commercial flatfish fisheries impinging on the open water benthic habitat.

141. Analysis of trawl fishing targeting flatfish provides some information on the distribution of commercial flatfish species with respect to NZ king shag colonies in the sounds. However, there is scant recent data available on the commercial fishing effort of flatfish species found in the NZ king shag diet. Trawl fishing over 2007-2010 for flatfish in the Challenger fishery shows the majority of trawling off D'Urville Island and the outer sounds, with 1-5+ annual trawl events reported each year for the Pelorus area (Figure 3; MPI 2015).

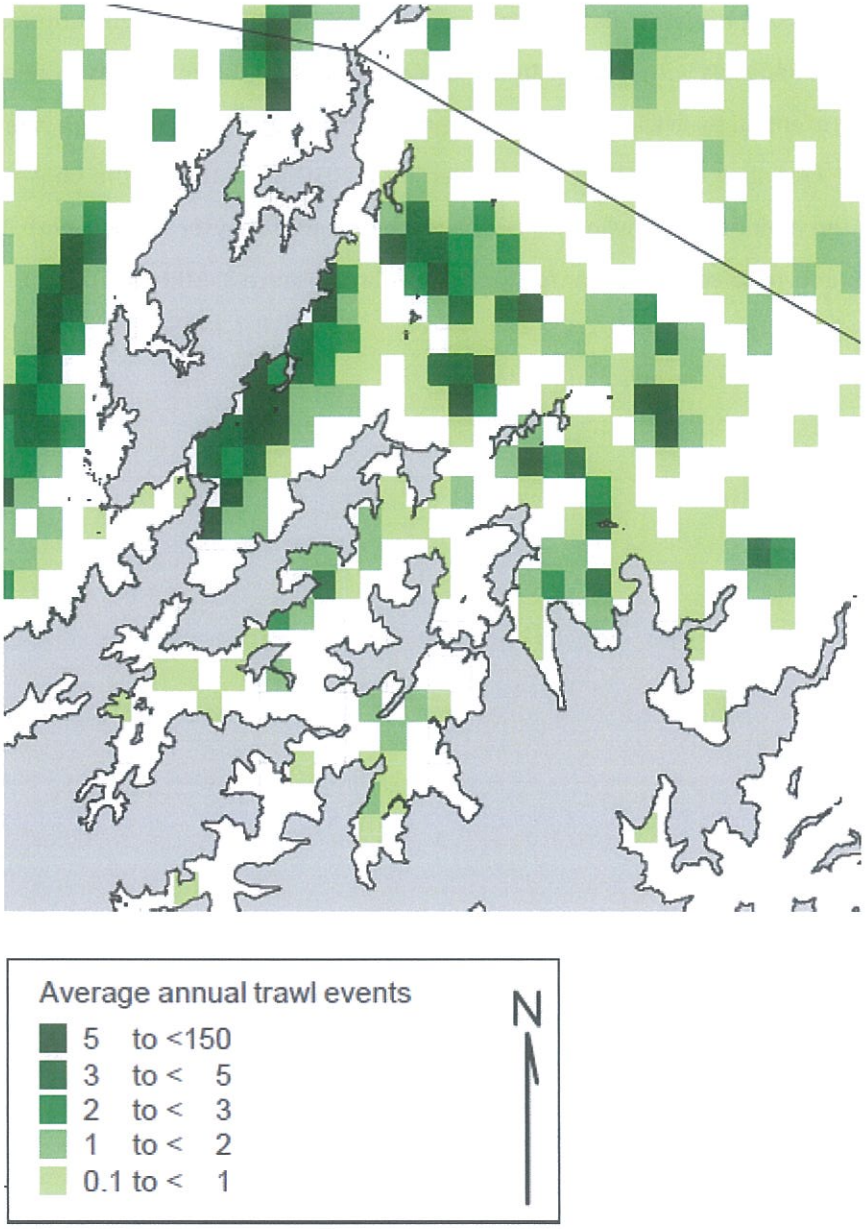


Figure 3. Trawl fishing over 2007-2010 for flatfish in the Challenger fishery (1 nautical mile grids; original map source from MPI 2015)

142. A proportion of the fish prey found to date in the King Shag diet, including Witch, is not targeted by commercial fish, but caught as bycatch. The extent of commercial trawl fisheries in the sounds is indicative and used to show the general spatial patterns of this fisheries activity. The level of disturbance to NZ king shags from the trawl boats is limited to the period of fishing activity; however, the disturbance to benthic communities would expect to be longer lasting.

Integrated Marine and Coastal Monitoring Programme - information gaps

143. This statement has highlighted the limited data sets describing seabirds at sea distribution for NZ king shag and other seabird species of international significance that can be used to map survey effort and distributions of seabirds over time in the Marlborough Sounds. What information we do have identifies the Marlborough Sounds as a site of global significance for seabirds, based on IUCN significance criteria (IUCN 2016).

144. Most seabird surveys to date in the Marlborough Sounds (Appendix 3) have been species focused, undertaken over different periods or used inconsistent methods that have meant the results from surveys cannot be compared or quantified by effort or area surveyed (e.g. for density). Concurrent information describing prey distributions is also required during seabird at sea surveys to relate seabird densities to prey availability.

145. Thompson (2016) also noted in his review of Fisher & Boren (2012) that NZ king shag distributions shifted over varying temporal scales, based on 38 replicate transects through Admiralty Bay, over the year study, i.e. individual sightings do not reflect the true extent of foraging area. The review concluded that the study provides a valuable framework with which to explore NZ king shag-at-sea distributions and abundances, and how these shift over time through an annual cycle elsewhere in the species' range (i.e. wider Marlborough Sounds).

146. Marlborough District Council (MDC) has a coastal monitoring strategy that identifies the need to collect high quality data to assess the State of the Environment and the effects of human activities for the marine and coastal area (Tiernan 2012)[59]. A key information gap identified by the strategy was a lack of SOE monitoring data to establish baseline conditions for the Marlborough Sounds. MDC also recognises that the recently passed Environmental

[59] Tiernan F 2012. Coastal Monitoring Strategy, Marlborough. MDC Report No. 12-101, July 2012. 10p.

Reporting Act 2015 makes environmental reporting mandatory for the first time in New Zealand.

147. MDC have since developed a broad-scale SOE monitoring programme that provides contextual monitoring data to support the consent-related point discharges from marine farms (Figure 4). However, most of this effort is toward the receiving environment to assess nutrient enrichment and primary production for models, with less emphasis on key marine biodiversity indicators (e.g. seabirds, marine mammals and their associated prey).

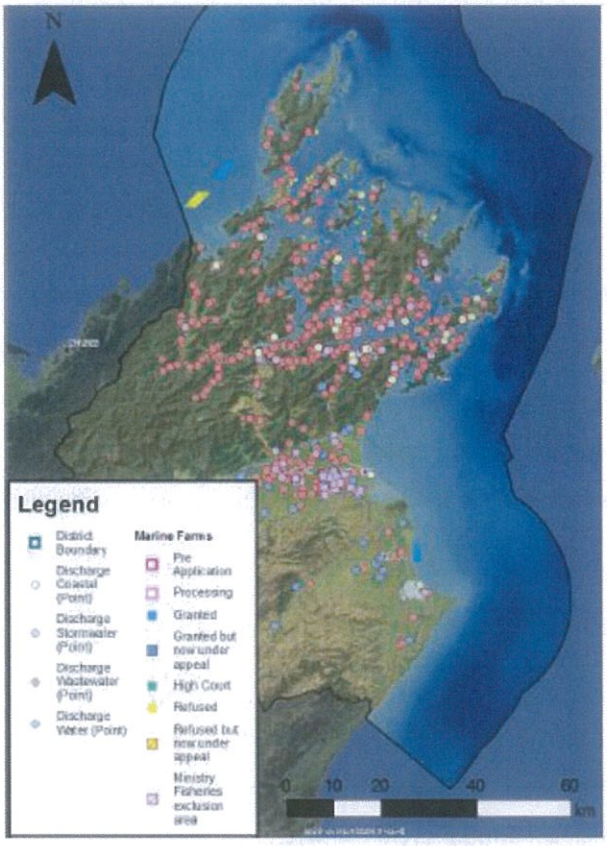


Figure 4. Discharge consents and marine farms within the Marlborough District Region and coastal marine areas. Sourced from MDC GIS online services smartmaps (Forrest *et al.* 2016)

148. MDC has already made steps to develop and implement an integrated monitoring programme for the Marlborough Sounds, as a response to regional monitoring needs that emerged following the 2011 Board of Enquiry (BOI) hearing on the development of new salmon farms in the region.

149. New Zealand King Salmon conduct regional-scale water quality monitoring and have initiated the first aerial survey of the NZ king shag population. The King Shag Management Plan currently includes terms of reference for an aerial survey of the main NZ king shag colonies every three years (i.e. Marlborough Sound wide). The next survey is due in February 2018.

150. The Cawthron Institute has reviewed integrated coastal monitoring options for the Waikato region, Nelson Bays region and Marlborough District Council (Forrest *et al.* 2016)[60], which has illustrated a number of common areas to improve monitoring and opportunities for working collaboratively with industry and other partners.

151. The King Shag Working Group was established in 2016 to share information across members, discuss further information and research requirements and opportunities for funding. The group currently has representatives from MFA, MPI, DOC, MDC, forestry industry, Sandford, NZKS and Rob Schuckard (Avian Ecologist), which provides an important opportunity to collaborate and develop appropriate monitoring and research for a NZ king shag management plan.

Conclusion

152. Whilst there has been significant progress toward an integrated approach between the aquaculture and fishery industries, councils, government agencies and non-governmental agencies in the Marlborough region, the relevant entities have yet to implement effective monitoring of marine food webs and key wildlife species. This information is required to understand the baseline required for establishing thresholds for mitigation, to enable sustainable management of the marine resource and meet the requirements of the NZCPS policies.

153. Given the lack of information available and potentially significant adverse effects on the NZ king shag a precautionary approach is warranted, consistent with Policy 3 of the NZCPS. In my opinion, a precautionary approach in this case means not progressing with this proposal

[60] Forrest B, Knight B, Barter P, Berkett N, Newton M 2016. Opportunities for an integrated approach to marine environmental monitoring in the Marlborough Sounds. Prepared for Marlborough District Council. Cawthron Report No. 2924. 43 p. plus appendices.

until appropriate monitoring and supporting information is gathered as part of a marine spatial plan and integrated monitoring programme to adequately assess effects.

Acknowledgements

154. David Melville and Rob Schuckard provided comments on a draft of this statement

Appendix 1: Marlborough Sounds Important Bird Area Seabird species

NZ M006	**Marlborough Sounds**

Location	New Zealand, northern South Island
IBA criteria (see page 14)	A1, A4ii, A4iii
Area	1,358 km²
Year of Assessment	2013

IBA trigger species:

Species	Tracking	Supporting data	Activity	IBA criteria	IUC
King Shag		Seaward extensions (25km), bathymetry (50m)	Foraging	A1, A4ii	EN
Fairy Prion		Seaward extension	Foraging, passage	A4i	LC
Fluttering Shearwater *	GLS	Seaward extension, observations	Foraging	A4i	LC
Australasian Gannet		Seaward extension (60km), observations	Foraging	A4i	LC
Black-billed Gull		Observations	Post-breeding foraging	A1, (A4iii)	EN
Black-fronted Tern		Observations	Post-breeding foraging	A1, (A4iii)	EN
Species group (multiple species not listed above)		Observations		A4iii	

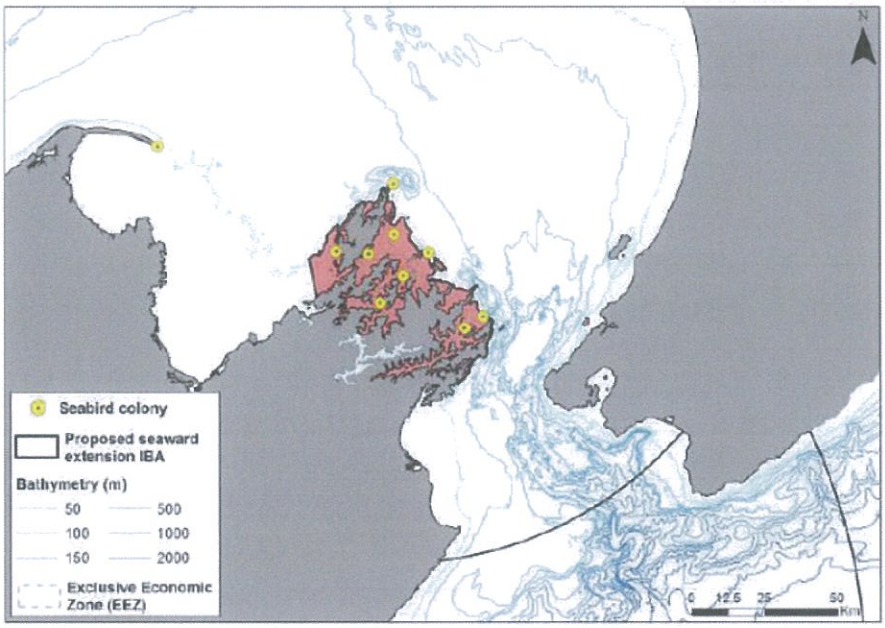
* A significant proportion of the global population of Fluttering Shearwaters breeds on islands in the Marlborough Sounds (5-10%). Large flocks are regularly seen foraging deep within the sounds and in waters immediately offshore and have been taken into account when drawing the boundaries for this IBA.

Protected area	Designation	Area (km²)	Relationship with IBA
Long Island - Kokomuhua	Marine Reserve	6.19	Protected area contained within site

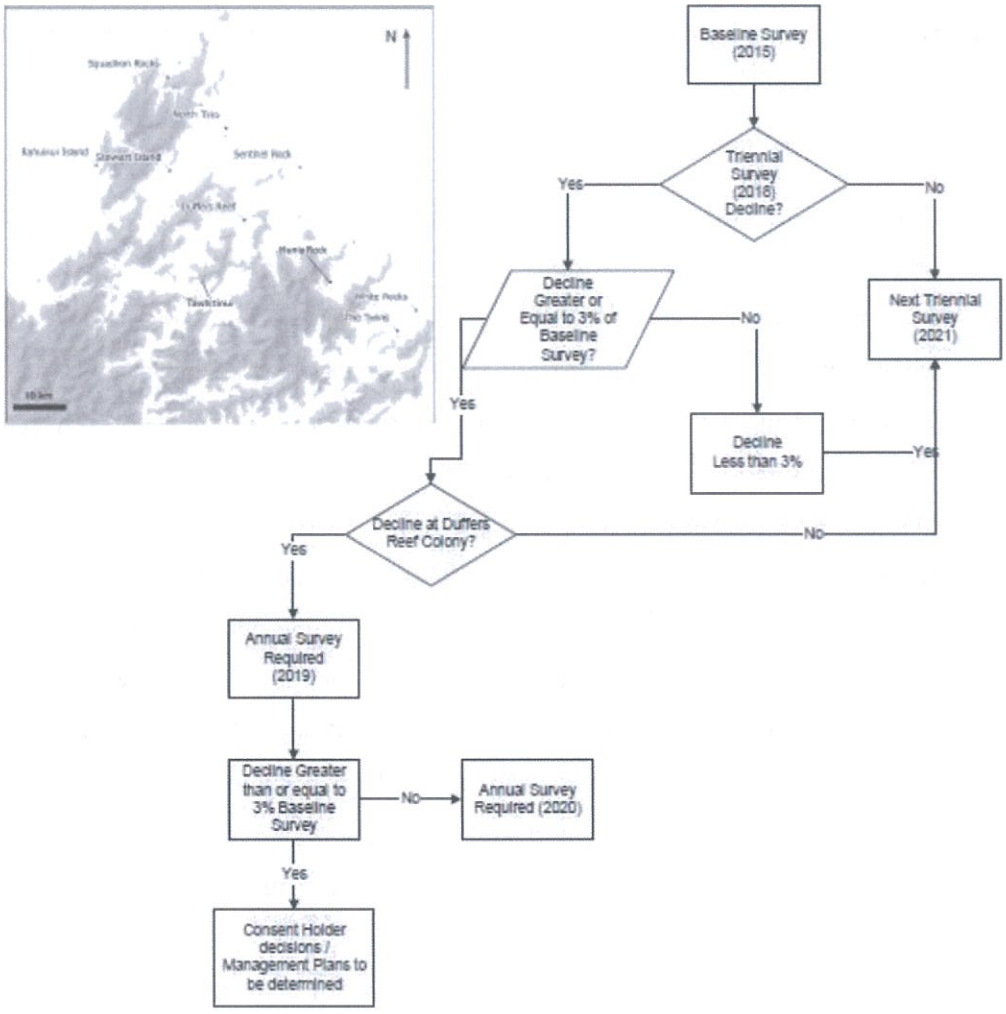
Appendix 1ii: Extent of King Shag Important Breeding Area

Based on the maximum dive depth 50 m and 25 km habitat range (Source: Forest & Bird 2014).

The seabird colony locations are for NZ King Shag.



Appendix 2 NZ King Salmon King Shag Management Plan (framework)



Appendix 3: Seabird monitoring in the Marlborough Sounds

There have been recent seabird at sea distribution surveys undertaken using line transect quantified effort methods for Tasman Bay and D'Urville. However, there has not been a comprehensive survey of seabird distributions using the line transect method for the Marlborough Sounds.

i. Seabird sightings have also been gleaned from breeding seabird colony surveys and from research studies in the Marlborough Sounds, summarised below:

ii. DOC undertook systematic line transect surveys for seabirds and marine mammals within Admiralty Bay between 2006/2007. Whilst only the NZ king shag information has been published, associated unpublished seabird information has been referred to in Fisher and Boren (2012) and Fisher (EIC 2015)[61].

iii. NIWA/Friends of Nelson Haven and Tasman Bay(FNHTB) Inc[62] have undertaken systematic aerial and boat line transect surveys of seabirds and marine mammals for Golden Bay, Tasman Bay, and Current Basin to mid-Admiralty Bay for assessing ecological effects of AWE drilling an exploratory well in Tasman Bay. Survey periods include November 2010 to January 2011 (Handley & Sagar 2011; Handley *et al.*, 2011). Repeat surveys by FNHTB have been undertaken in August 2013, November 2013, August 2014, August 2016 and February 2017 (unpublished).

iv. Systematic surveys of NZ king shags following survey routes, studies of foraging birds and flight departures from colonies (Schuckard 2006, 2012)

v. Comprehensive surveys of breeding shags have been undertaken in the Marlborough Sounds (Bell 2012).

vi. Recent GPS tracking and diet analysis of Australasian gannets from the Farewell Spit colony show birds feeding in Golden Bay and Admiralty Bay, within water depths of 50m (Machovsky-Capuska *et al.* 2013). Gannets also forage in Admiralty Bay during stormy weather (R. Schuckard *pers. comm.* 2015). However it is not clear whether the birds are targeting the more sheltered areas or prey concentrated within the bay.

[61] Fisher, P.R. (2015). Evidence in Chief. Seabirds – Admiralty Bay. Marlborough Aquaculture Ltd vs Marlborough District Council.

[62] Friends of Nelson Haven and Tasman Bay Marine Mammal and Seabird Surveys Golden and Tasman Bay unpublished reports are available at http://www.nelsonhaven.org.nz/scientific-reports-2/

Written Comments No: 0412

Subject	**Relocation submission for New Zealand King Salmon sites**
From	John Ryder
To	aquaculture submissions
Sent	Friday, 24 March 2017 5:22 PM
Attachments	<<Ministry for Primary Industries Relocation Submission.docx>>

Dear Sir/Madam,

Please find attached a submission on the relocation of Salmon Farms in the Marlborough Sounds by New Zealand King Salmon Ltd.

Yours sincerely,

John Ryder

John Ryder

[redacted], Christchurch 8141 New Zealand
[redacted] | Phone [redacted]

Ministry for Primary Industries

Submission on Relocation of Salmon Farms in the Marlborough Sounds by New Zealand King Salmon Ltd

Submitted by: John W D Ryder

[redacted] Christchurch

Contacts: [redacted]

1. I am the non-executive Chairman of New Zealand King Salmon Ltd (NZKS), a chartered accountant, Chairman of Direct Capital Ltd (a major shareholder of NZKS prior to the recent IPO) and previously joint founding shareholder and managing director of Ryman Healthcare Ltd, and a director of Michael Hill International Ltd.

2. I have the following academic qualifications: M.Com (Hons); CA; CMA.

Background

1. In the early 1900s, the King Salmon species (or Chinook) was introduced into New Zealand from the Sacramento area of North America (the McLeod River), as well as into other countries. New Zealand was the only country which was entirely appropriate for the species... and in fact it thrived, in spite of not being an indigenous species. To this end, New Zealand is now the major producer of farmed King Salmon in the world, with NZKS producing around 50% of global supply.

2. There are barriers to entry in farming the fish, as it requires cold water, which removes competition from the emerging or Asian nations. New Zealand is in a unique position as its water is not too cold (which slows growth) or too warm (which results in mortalities), as long as farms are properly sited. Bio-security issues are also facilitated with the Marlborough Sounds being the largest inland waterway in the Southern Hemisphere (and there are very few farms in comparison to other producing nations).

3. However, in earlier times when mussels - and not salmon - were the only farmed species considered by New Zealand regulations, salmon farms were positioned in sites that were less than appropriate. They had low flows and, in many instances, the sites were too warm. They were also situated close to baches and popular recreational areas.

4. The proposed relocation of salmon farms in the Marlborough Sounds will provide substantial remedies for these issues.

My Focus

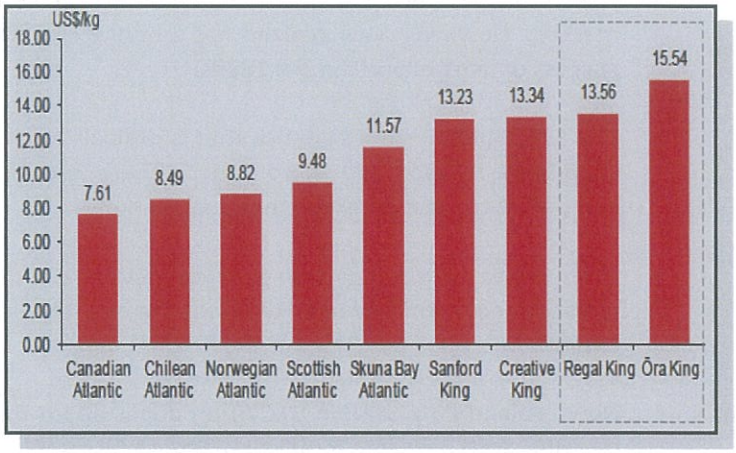
1. I am aware of the comprehensive submissions to MPI made by the management of NZKS on environmental issues and management of water space.

2. As an accountant, I will therefore focus more on the business case with regard to the unique salmon species grown by NZKS, its place in the international market, and the resulting

contribution to the New Zealand economy and employment in the Nelson and Marlborough regions.

Quality of the Product

1. Adjacent is a chart (produced in public documents for the NZKS public IPO) of prices in the New York Fish Market (April 2016) showing King salmon (generally) well ahead in pricing compared to the other major species (Atlantic Salmon) in international markets, with the NZKS brands of Regal King and Ōra King attracting the highest prices.



2. The product also attracts significantly higher prices than wild salmon.

3. NZKS has had a selective breeding programme for around 20 years (over 8 generations), with 115 families of fish and 200,000 fish traced through the system – producing salmon that are about 50% larger than the wild species.

4. It is difficult for new entrants to the market to match this quality breeding scenario.

5. King salmon is regarded as the premium salmon breed in the world, in terms of taste, nutrition, colour, fat content, Omega-3 oil, and texture. The Japanese (who know their fish) used Ōra King in the culinary Olympics in Germany last year (winning a silver medal), and nearly half of the national team's chefs offer the brand in their own restaurants. Ōra King is substantially represented in first-class restaurants across the globe.

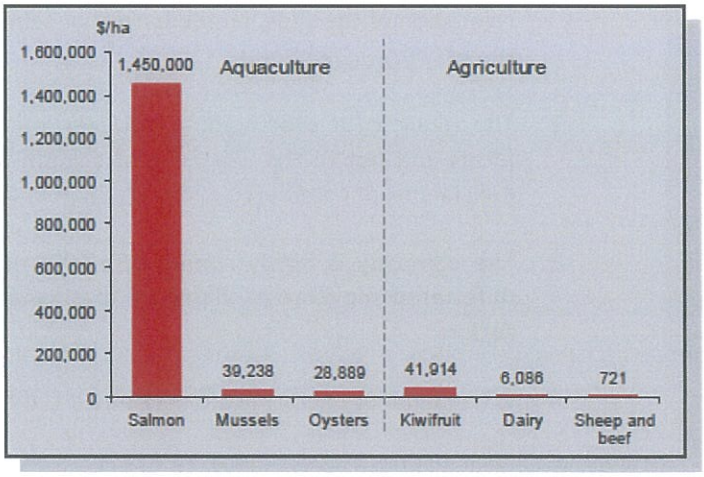
6. King salmon is the only farmed salmon species to receive the US "Best Choice" green rating of the globally respected Monterey Bay Aquarium's Seafood Watch programme.

Efficiency of Farming

1. Salmon farming is an efficient use of resources within New Zealand.

2. Adjacent is a chart illustrating the high revenue return per hectare at the farm-gate for salmon in New Zealand, in comparison to other agricultural products, and farmed seafood such as mussels and oysters.

3. They are also extremely efficient converters of feed to body mass.



Business Case

1. It is unusual for products from one country to have a particular advantage in international markets. However, New Zealand has a heritage of this in farming, dating back to the initial success of lamb exports in the 1880s.

2. The King salmon is a fragile fish that is difficult to grow. It is also not appropriate for water conditions in most other countries. There are therefore strong barriers to entry for competing companies in international markets.

3. NZKS creates a prized protein product that has a competitive advantage in a global sense. It would be economically unfortunate if the country did not foster this advantage to a serious extent.

4. New Zealand King Salmon (NZKS) produces about 6,300 tonnes of fish and $116 million in revenue, with consents to develop 3 more farms. Around 75% of additional production from new farms will go to export markets.

5. With the new farms, and the relocation of poorly sited farms, there is the potential to at least double turnover and job numbers, within a reasonable period of time.

6. Over 50% of the NZKS product is value-added - the company sells a range of product, including whole fish (47%), fillets and portions (23%) and hot and cold smoked (28%).

7. There has been an on-going cry for New Zealand agricultural businesses to add more value when exporting primary products to overseas markets. To this end, NZKS is a valuable corporate citizen.

8. Company submissions have already substantiated that the relocation of existing farms (with no new space) will substantially contribute to jobs and the economic well-being of the Marlborough and Nelson regions.

Recreation and Environment

1. There have been commentators in the media who appear to be against the possible relocation of the sites, on the basis that salmon farms and their structures should not exist in the Marlborough Sounds.

2. The request for submissions, however, relates to consideration of the *relocation* of these farms and not to the existence of salmon farming per se. It is appropriate that there is a judicial mix of commerce and recreation in an area that is owned by all New Zealanders.

3. The company is highly conscious of the need to respect the enjoyment of the area and unfettered movement of people (particularly iwi) and water crafts within this important region.

4. When a major change like this occurs it is difficult not to create some degree of dislocation.

5. However, the number of residential dwellings in Queen Charlotte Sound and Tory Channel within a direct 1 km line of sight of a salmon farm would reduce from 21 to 3; while in the Pelorus Sound there would be no residential dwellings within a direct line of sight of within 1 km.

6. There will also be additional benefits, such as reduced noise, lighting and odour effects, as well as improved water quality and management of fish health and bio-security risks. The deeper and faster flowing water in the proposed new sites would be environmentally advantageous.

7. The company is committed to accurate and efficient on-going monitoring of the environmental impact of their farms in the area.

8. It is difficult to believe that there will not be major recreational and environmental benefits to the area by the relocation of the sites. Relocation is a responsible action.

Consultation

1. The company has consulted extensively with iwi and interested parties in the community, in a genuine effort to explain the company's position and intentions with respect to the possible relocation of farms.

2. In previous arrangements, with regard to the EPA consideration of new farms, NZKS has partnered with Te Atiawa to ensure that they are long-term unaffected, and have a level of partnership in the proposed new sites. It is a permanent part of the company's policies to respect the position of all iwi.

Testimonials

1. As a non-executive (and therefore outside) director of the company, I can attest that the executives are genuine in their desire to have a balanced and environmentally beneficial outcome to this process. They fully realise the need to maintain goodwill in the region, with the people, with iwi, and with authorities such as the Marlborough District Council and the Ministry for Primary Industries. These stakeholders represent their livelihood... and the ongoing future of a dynamic company.

2. The company is 40% owned by a foreign entity. In eight years as a director I have not been aware of any instance when this shareholder (or board representatives), has suggested that NZKS compromise environmental and quality considerations, for profit. Their intentions are to be long-term shareholders, and to be respected as valuable contributors to the New Zealand society and economy. They have a history of recycling earnings back into the business.

Summary

1. There is a strong argument to say that NZKS, as an exporter of a valuable and sustainable product, with substantial added value elements, to international markets, is an important contributor to the New Zealand economy. The country and company have significant competitive advantages with the King salmon species overall, and this should be taken into account.

2. NZKS is well aware of its social, recreational, and environmental obligations. The reduction of line of sight observations of farms, and the improved environmental and bio-security elements from cold, deep water, and high flowing sites, is a major positive for the company and the users of the Sounds region.

3. My submission is for the Marlborough Sounds Resource Management Plan to be amended to enable relocation of all six existing lower flow farms, to the recommended higher-flow sites.

4. I am available to answer questions, either written or verbal, if required.

John Ryder
22/03/17