

**BEFORE THE MARLBOROUGH SALMON FARM RELOCATION ADVISORY PANEL**

**UNDER** the Resource Management Act 1991  
**IN THE MATTER** of Regulations under s360A of the Act  
**AND** A discussion document from the Ministry for Primary Industries  
2017/04

**STATEMENT PREPARED IN RESPONSE TO THE SECOND MINUTE OF THE MARLBOROUGH SALMON  
FARM ADVISORY PANEL BY**

**GRAEME ANDREW SYDNEY TAYLOR, DEPARTMENT OF CONSERVATION,  
IN RELATION TO THE EVIDENCE OF EXPERTS OF THE EFFECTS ON KING SHAGS**

1. My full name is Graeme Andrew Sydney Taylor.

### **Qualifications and experience**

2. I have a Master of Science degree in Zoology from Canterbury University (1985). I have 37 years of experience working in the field of ornithology and biodiversity management and research.
3. I am a Principal Science Advisor for the Department of Conservation (DOC) in the Science and Policy group. I have been employed by DOC since 1987.
4. My role in DOC has covered a wide range of responsibilities from animal pest management to endangered species research plus managing the national bird banding and marking office. I have been DOC's leading seabird advisor for the past 20 years. I have worked on over 30 species of seabirds during that period, including leading the research to assist in the recovery of the critically endangered Chatham Island taiko and endangered Chatham petrel programmes.
5. In the past 10 years my work programme has covered the tracking of 15 species of seabirds to assess annual movement patterns and marine habitat use. I monitor a range of burrow nesting seabird populations and provide national advice on the methods used to assess population size and monitor trends in seabird populations. I was a co-convenor of the national red-billed gull census project (2014-16) and have assisted with the monitoring of king shag populations since 2015.
6. I have written or co-authored more than 100 scientific papers, books and book chapters plus many internal reports, mostly on seabird research or monitoring topics. I am also the New Zealand government and Oceania representative on the Scientific Council of the United Nations Convention on the Conservation of Migratory Species (CMS).
7. While I am familiar with past and recent research on New Zealand King Shag (*Leucocarbo carnunculatus*), have visited their breeding sites in the Marlborough Sounds in the 1980s and peer reviewed the King Shag Management Plan prepared by Rob Schuckard required under the previous EPA plan change process, I have not made a particular study of this species.

### **Code of conduct**

8. I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses (set out in the Environment Court's Consolidated Practice Note, 2014).
9. This evidence is within my area of expertise, except where I state that I am relying on what I have been told by another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

### **Evidence reviewed**

10. I reviewed the initial drafts (30 August 2016 and 5 September 2016) of Dr David Thompson's report "Seabirds – potential salmon farm relocations in the Marlborough Sounds – update of existing report" as included in the technical documents assembled by MPI in support of this proposed regulation and accompanying draft

plan change. My peer review of Dr Thompson's report was also presented with the supporting documentation.

11. I have now also reviewed the evidence of Dr Paul Fisher lodged with the comments of the Royal Forest and Bird Protection Society of New Zealand (written comment 0587) and Mr Rob Schuckard lodged with the comments of Friends of Nelson Haven and Tasman Bay Inc and Kenepuru and Central Sounds Residents Association Inc (written comment 0598). Dr Fisher's and Mr Schuckard's comments in respect of the New Zealand Coastal Policy Statement, nutrient enrichment effects and harmful algal blooms are outside my area of expertise.
12. For the purposes of this statement I have not reviewed the reports by Dr David Taylor (Cawthron – "Review of benthic assessment reports") and Mr Paul Taylor ("Effects on pelagic habitat and fish fauna") that were lodged with the application. I reviewed a summary of those reports in November 2016 prior to lodgement. Those reports deal in part with the effects of the proposed salmon farms on the prey of King Shag. Those effects are not within my area of expertise.

### **Matters Agreed**

13. I agree with the following points made by both Dr Fisher and/or Mr Schuckard;
  - King shags are endemic to the Marlborough Sounds (occur nowhere else in the world).
  - The International Union for Conservation of Nature threat classification is "Vulnerable to extinction" and under the New Zealand Threat Classification System the species has the status "Nationally Endangered". This means the species is considered threatened with extinction due to its low population numbers, the limited area of occupancy (usually considered to be the nesting habitat of seabirds) and limited extent of occurrence (foraging range at sea).
  - The total population of King Shags is likely to be less than 1000 birds and more than 800. The most recent full population census in February 2015 identified 839 birds.
  - The 2015 census used aerial photography from a fixed wing aircraft conducted on the same morning to count birds at all known roosts prior to their departure to sea to feed. This was the first time this census method was used for King Shag monitoring.
  - There has been no regular census of King Shag colonies in the past. The previously used boat-based census methods were made on different days and were likely to underestimate the size of the total King Shag population due to the unknown extent of movement of birds between roost sites and the difficulty in seeing all parts of the elevated colonies from a boat.
  - The birds are sensitive to human disturbance and this and other factors (such as financial constraints] has limited the research of the species.
  - Due to past problems with counting King Shags, there is no evidence that the population is increasing.

- The majority of the birds breed on five colonies spread around the outer Marlborough Sounds.
- Duffers Reef, in outer Pelorus Sound, is one of the two largest breeding colonies.
- It is not known to what extent birds move between colonies as no banding or marking studies have been done on this species.
- Similarly, there is nothing known about how long King Shags live, annual survival or recruitment rates, or annual breeding success. Nor is there any detailed information on the timing of the annual breeding cycle or whether birds can lay second clutches if nests fail early in the season.
- Shags are diurnal species that forage for food by day and roost on land at night.
- These birds are heavy bodied with short and broad wings. This means they can fly only limited distances each day to locate food. Their anatomy is designed to cope with short periods of flapping flights and long periods of swimming on the sea and making deep dives to the seabed in search of prey.
- Shags have well developed vision for feeding underwater but require daylight and good water clarity to locate prey species hiding amongst mud, shingle, rocks and kelp on the seabed.
- Most dives are likely to be below 50m water depth but some similar shag species can dive as deep as 95m.
- The long necks and long hooked bills of shags allow them to catch and swallow large fish species.
- King Shags mainly feed on a range of bottom dwelling fish species and their main diet is flat fish including “witch flounder”.
- King Shags prefer water depths of <50m, forage mainly south and west of colonies and up to 25 km from colonies.
- The King Shags foraging habitat is no longer pristine. It has been modified by a wide range of human activity including trawling, scallop dredging and occupation of space by aquaculture activities and shell drop from mussel farms. Additionally, changing land use in the catchments (farming and forestry) will have altered the nature and extent of freshwater inputs into the marine environment. All these cumulative effects may have altered the food availability and potential foraging zones of the King Shag.
- I agree with Mr Schuckard in paragraph 99 that King Shags are not known to use Tory Channel. Therefore, the proposed salmon farm (#156) in that inlet should not be considered a risk to King Shags.
- I agree with Mr Schuckard in paragraph 105 that the King Shag Management Plan was part of the requirement by the Board of Inquiry to overcome uncertainty while allowing two new farms to proceed with adaptive management.

## Matters not agreed

14. I do not agree with the following points made by Dr Fisher:

- “That it is not possible to say that the NZ King shag population is stable” (paragraph 117 of evidence)

Reason: while I agree with Dr Fisher that the King Shag population model indicates the population may be experiencing a slight decline (Dr Fisher evidence para 117), this model is not based on any demographic data from the King Shag population (such information is currently unavailable) but instead is interpolating from similar species. There is no clear evidence that the King Shag population is stable, increasing or declining. Regular counts of both breeding and non-breeding birds will be needed to develop a population trend for his species.

In my opinion counts of this species need to be made at sufficiently regular intervals to overcome the normal background fluctuations generated by global climate influences such as the Southern Oscillation cycle (El Nino/La Nina) as well as seasonal extremes in weather related events (e.g. cyclones and winter storms). Counts made every three years as proposed in the King Shag Management Plan are not sufficient to detect if variability in the king shag population is related to normal changes in sea temperatures due to global climate patterns or from extreme weather events recently affecting nesting activity at some or all sites. Such background influences are likely to mask any potential effects from the proposed marine farming activities unless population counts are made at all the main King Shag colonies each year.

I recommend annual monitoring of the entire breeding population during winter and a post-breeding census each summer as the minimum standard for this species. Additional on-site monitoring of groups of nests by time-lapse cameras would considerably enhance our understanding of this species breeding biology and provide details on timing of foraging activity (nest changeovers and feeding of chicks) and breeding success.

15. I do not agree with the following points made by Mr Schuckard:

- “That one of the major threats to King Shag conservation management is the relict distribution and low genetic diversity” (Paragraph 35)

Reason: I have not seen the draft genetics paper that Mr Schuckard refers to but I am aware that no sampling of genetic material has occurred from birds at the known breeding colonies. The sensitivity around disturbing birds has prevented any sampling happening to date. In my opinion it is only conjecture that King Shags have low genetic diversity. A study conducted on the critically endangered Chatham Island taiko by PhD student Hayley Lawrence found that the species was genetically diverse despite having a population of fewer than 200 birds. Therefore, without adequate sampling of live birds, I don't think we can assume low genetic diversity is a risk for this species.

To overcome this situation, there should at some stage be a project to collect blood and feather samples from chicks at the main breeding colonies. Also by applying individually unique colour bands (alphanumeric bands) to samples of well grown chicks would allow us to assess if there is gene flow occurring between the colonies as the young birds recruit to the breeding populations.

- Mr Schuckard compared the precautionary approach adopted by the BOI and stated that “ Whether this precaution is reflected in a more than doubling of the feed levels in Waitata Reach is missing from Mr Taylor’s analysis.” (Paragraph 106).

Reason: I was asked to review Dr David Thompson’s assessment of the risks to King Shags from moving existing salmon farms situated at low flow sites to potential new high flow sites. This did not include analysing the proposals for any changes in the quantities of salmon feed over time at the new sites. While I have no direct expertise on water quality issues or their possible effect on fish life, I did express concerns in my peer review about the uncertainty over any changes in water quality as a result of enhanced nutrient levels at the new sites and how ocean current dispersal of these nutrients might impact on the wider habitat used by King Shags. Knowing that King Shags are a visual feeder and rely on clear water to locate prey, I felt that changes in water turbidity over time may be a risk to this species. Regular monitoring of the King Shag populations and the use of adaptive management to reduce environmental impacts would be a possible way to manage any new risks.

### **New Zealand King Salmon Ltd proposed amendments to the plan change**

16. I have been made aware of amendments to the plan change in the draft regulation sought by New Zealand King Salmon Ltd. These amendments include suggested changes to feed discharge increments, timing of feed increase steps and requirements relating to feed composition and nutrient monitoring and reporting to While these matters are not within my area of expertise and I do not know what the effect of these amendments, if accepted, may be on King Shags I do note that Dr Taylor’s report that I peer reviewed was informed by water column modelling undertaken by his colleagues at NIWA (Broekhuizen and Hadfield) for the feed discharge standards of the proposed plan change.
17. If the feed discharge standards are to be increased or various monitoring parameters changed then I would need the advice of water column and benthic experts before I could state whether those changes would be likely to have an effect on King Shags.
18. I stated in the conclusion to my 8 December 2016 peer review of Dr Thompson’s report: “I agree with the NIWA report that there is still a level of uncertainty about whether 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.” In the absence of expert water quality advice to the contrary I am concerned about any increase or change to the feed discharge standards.

Signed

Graeme Taylor

Dated 08 May 2017