Hon Stuart Nash LLM, MMgt, MForSc

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MIN18-0878

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Dear Simon

Thank you for your correspondence of 29 March 2018 regarding a Ministry Response to Climate Change issues outlined in the environmental report *Our atmosphere and climate 2017*. This provides an opportunity for me to summarise past, current and future work that the Ministry has or is commissioning, as well as staff involvement in climate change initiatives in the marine environment.

You stated in your letter that:

> *Our atmosphere and climate 2017* contained information on current and potential future impacts of climate change on New Zealand's marine ecosystems, and notes that *"ocean acidification and warming may cause widespread harm to marine ecosystems, for example, by reducing the survival and growth rates of marine species, extending or reducing the range of species, and modifying habitats. The impacts could occur across New Zealand's entire ocean area, with implications for biodiversity, marine-based industries such as commercial fishing and aquaculture, and Māori customary practice."*
>
> These impacts may signal changes in the future abundance and distribution of commercially and culturally important marine species. They may also expose New Zealand's ocean and coastal areas to increased risks from invasive pests and outbreaks of disease, with potential implications for aquaculture, commercial and customary fisheries.

I agree that these issues are important and are likely to intensify in the future. Responses to the questions you posed (in bold below) take account of these points.

What work has the Ministry undertaken to assess and address the risks posed by ocean acidification to New Zealand's aquaculture and fisheries sectors?

1. The Ministry has commissioned several research projects to assess and address the risks posed by ocean acidification to New Zealand's fisheries and aquaculture sectors. Work that has been completed or is underway includes:

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- Experimental studies on the effects of ocean acidification and temperature changes on a range of biodiversity and QMS and aquaculture species including paua, oysters, mussels, biogenic habitats, rhodolith beds, deep sea corals, corallines, seaweeds, snapper behaviour, Antarctic shallow water ecosystems, and plankton productivity;
- Mapping of current deep sea coral habitat and projected changes in calcium saturation horizons in the deep sea; and
- Involvement in, and partial funding for, the MBIE-funded "*Coastal Acidification: Rate, Impacts and Management (CARIM)*" project to investigate the responses of shellfish and juvenile snapper to ocean acidification. The programme also incorporates data from long-term monitoring (beginning in 1998 for some sites) under the New Zealand Ocean Acidification Observing Network (NZOA-ON), which is led by NIWA in conjunction with several partners.

2. Ministry staff are also members of the International Alliance to Combat Ocean Acidification, and have participated in several national and international conferences and workshops on ocean acidification and other ocean-related climate change effects and including:

    - A New Zealand-United States Workshop on ocean acidification changes and potential effects on the aquaculture industry held in Nelson in 2013. A report (T.L. Capson and J. Guinotte (2014) *Future proofing New Zealand's shellfish aquaculture: monitoring and adaptation to ocean acidification. New Zealand Aquatic Environment and Biodiversity Report No. 136. 42 pp*) was produced from this workshop;
    - Annual ocean acidification workshops held by ocean acidification science community;
    - Presentations and participation at Pacific International (PICES) workshops in 2008, 2015, and 2018; and
    - Presentations to local audiences at New Zealand Marine Science Society annual conferences.

What work has the Ministry undertaken to assess and address the biosecurity risks that climate change poses to New Zealand's aquaculture and fisheries sectors?

3. The Ministry is aware that climate change may pose biosecurity risks to New Zealand aquaculture and fisheries sectors. MPI manages new incursions of pests and diseases through its biosecurity system, which includes monitoring and surveillance in the marine area. It is driven not by climate change, but by the desire to manage risk appropriately and maintain our biosecurity status. The Biosecurity Direction Statement 2025 released in 2017 aims to strengthen New Zealand's biosecurity system to ensure it continues to protect against pests and diseases. It explicitly recognises climate change and its potential impacts on biosecurity, including in the marine environment.

4. Two key vectors for the arrival of potential marine marine pests in New Zealand waters are ballast water from vessels arriving from overseas and vessel biofouling. While not specifically linked to climate change, the following two standards will enable the Ministry to minimise potential marine biosecurity risks:

    - An Import Health Standard: Ballast Water from All Countries, the most recent version of which came into effect in September 2017; and
    - A Craft Risk Management Standard for Vessel Biofouling released in May 2018.

5. Other relevant initiatives include:

    - An evaluation of the potential for non-native organisms that have already been detected in New Zealand waters but are are currently relatively benign to proliferate if ocean characteristics change; and
    - An investigation of future pests that could arrive in New Zealand and the likely impact they may have on the fisheries and aquaculture sectors.

What work has the Ministry undertaken to assess and address the risks posed by shifts in the abundance and distribution of commercially and culturally valuable marine species?

6. The Ministry is aware of the large changes in abundance and distribution of fish species in other parts of the world, most notably on the east coasts of the United States and Canada, and the southeast coast of Australia including Tasmania. Fisheries New Zealand and NIWA are maintaining contact with our Australian colleagues to monitor their response to the southward extension of the East Coast Australian current into Tasmania, and are analysing temperature and current data to determine whether there are likely to be any effects to New Zealand.

7. Last summer the Ministry noted the increased abundance of kingfish in areas in the south of the South Island where they have tended to be rare in the past. Fisheries New Zealand is currently consulting on a modest increase in the Total Allowable Catch for kingfish in these areas.

8. Fisheries New Zealand is also sharing data, collected under several contracts, surveying black petrel populations (assessed as New Zealand's most at-risk seabirds from commercial fishing in New Zealand waters) with a global review of the impact of marine heatwaves on seabird breeding success.

9. The Ministry has also commissioned, or is planning to commission, several projects to examine whether, and to what extent, change is occurring:

    - In 2009, the Ministry commissioned an analysis of correlations between fish abundance and ocean conditions for a range of species; and

- As of June 2018, the Ministry has initiated the purchasing of research on:
  - The risks posed by shifts in the abundance and distribution of commercially and culturally valuable marine species; and
  - Changes in physical, chemical, and biological components of sealion populations in the Sub-Antarctic islands.

What work has the Ministry undertaken to assess and address the risks posed to fisheries and aquaculture infrastructure posed by the changing frequency of severe weather events?

10. An ongoing project on Climate Change Risks and Opportunties for marine fisheries was initially commissioned by the Ministry in 2014, with some work already completed. The risks of extreme weather events such as marine heatwaves, flooding events, and storms are emerging issues for fisheries and aquaculture.

11. The Ministry's aquaculture team is also actively involved in investigations of the feasibility of offshore aquaculture and the impact of storms.

Has any work been done to assess the costs of these risks?

12. The costs of these risks cannot currently be assessed because the Ministry does not have sufficient information to determine the magnitude or implications of potential changes. However, through attendance at overseas conferences and the formation of informal international networks, the Ministry has stayed abreast of methodologies and projections being undertaken by other countries.

To what extent has the Ministry accounted for the cumulative impacts of climate change in employing information to improve the resilience of the fisheries management system?

13. This is a new area of work in which Ministry staff have been involved, primarily through participation in the Cumulative Effects project funded through the Sustainable Seas National Science Challenge.

More broadly, what is the Ministry's strategic approach to dealing with adaptation across the aquaculture and fisheries sectors?

14. Climate change and its attendant effects such as warming ocean temperatures, modified ocean currents, and ocean acidification have been considered in the Ministry's fisheries research planning processes, as well as collaborations and discussions with other government departments, research institutes, iwi, the fishing and aquaculture industries, and other entities for several years. As early as 2006, the Ministry incorporated a climate change objective into the MPI Marine Biodiversity Programme to meet MPI commitments to the New Zealand

Biodiversity Strategy. Climate change objectives will also be incorporated into a refreshed version of the Aquaculture Strategy due out later this year.

15. The aquaculture team is also liaising with the Cawthron Institute about its work on selective breeding of shellfish for temperature tolerance, with NIWA on mitigation of the effects of ocean acidification, and with the aquaculture industry about their efforts to breed temperature-tolerant salmon.

16. However, the Ministry is not yet at the stage of formulating a comprehensive strategic approach to dealing with adaptation across the fisheries and aquaculture sectors. Rather, the Ministry is focussing on collating current scientific information into a form that enables strategic planning to take place, as well as commissioning new research to fill knowledge gaps.

17. Research underway or completed to date that would inform such a strategy includes:

    - Analysis of empirical relationships between environmental variables and fish recruitment (primarily for hoki, orange roughy, rock lobster, snapper, scallops, red cod, gemfish and southern blue whiting);
    - Analysis of changes and trends in environmental and climate variables across a range of time scales that may be of relevance to fisheries management (ocean acidification and pH, sea surface temperature, the Southern Oscillation Index, and the Interdecadal Pacific Oscillation index);
    - Analysis of acoustic backscatter data (a proxy for the biomass of mesopelagic fish, which live in waters about 200-1,000 metres depth and include important prey and predators of commercial species) and its relationship to environmental variables;
    - Analysis of trends in ecosystem indices from research trawl surveys;
    - Ongoing collection of continuous plankton recorder samples from commercial fishing vessels to assess productivity and plankton changes across the Southern Ocean;
    - Scientific development of the oceans component of a Climate Change Tier 1 Statistic for MfE and Statistics New Zealand;
    - Development of a New Zealand-wide Marine Environmental Monitoring Programme metadatabase;
    - A meta-analysis of environmental variables and fish abundance, planned for the 2018/19 financial year; and
    - Updates of productivity parameters such as growth, reproductive success, recruitment and mortality, and their effects on stock assessment outcomes, planned for the 2018/19 financial year.

18. A list of relevant recent and planned projects commissioned by the Ministry is shown in the Appendix. Research reports are publically available for many of these projects.

What work has the Ministry done or is planning to do with other government agencies to address collaboration where adaptation measures may require an integrated approach?

19. Ministry staff, primarily staff from Fisheries New Zealand, have been or are involved in a number of national or regional research and management forums that consider climate change impacts, several of which have been mentioned above. These include:

- CARIM: an MBIE funded project led by NIWA partnering with Cawthron Institute and the Universities of Otago and Auckland, Iwi, MPI, the shellfish industry, regional councils, DOC and the Hauraki Gulf Forum,
- The MBIE-funded Climate Changes, Impacts & Implications (CCII) initiative, which has numerous partners including MPI, and includes a marine food webs component;
- The International Ocean Issues Working Group, led by MFAT;
- The Hauraki Gulf Sea Change Marine Spatial Plan;
- The Kaipara Research Planning Group;
- Guardians of Fiordland; and
- Kaikoura Marine Guardians.

20. Please let me know if you require further elaboration on any of these responses.

Yours sincerely

Hon Stuart Nash
Minister of Fisheries

APPENDIX: Recent and planned fisheries research projects related to climate change and ocean acidification. Costs are included where these were available.

Number	Title	Project Stage	Contract Amount
ZBD2005-05	Long-term effects of climate variation and human impacts on the structure and functioning of New Zealand's shelf ecosystems	Complete	$902,020.00
ZBD2008-11	Predicting changes in plankton biodiversity and productivity of EENZ in response to climate change		$720,160.00
ZBD2008-20	Ross Sea Ecosystem Function: Predicting the consequences of shifts in food supply	Complete	
ZBD2009-03	The vulnerability of rhodoliths to environmental stressors and characterisation of associated biodiversity		
ZBD2009-13	Ocean acidification impact on key New Zealand molluscs	Complete	
ZBD2010-41	Ocean acidification in fisheries habitat	Complete	
ZBD2011-01	Evaluation of eco-trophic and environmental factors affecting the distribution and abundance of highly migratory species in New Zealand waters	Complete	
ZBD2013-05	Ocean acidification experimental work	In Progress	$60,000.00
ZBD2014-03	Sub-lethal effects of environment change on fish populations	In Progress	$150,000.00
ZBD2014-05	Modelling the effects of ocean acidification	Complete	$75,000.00
ZBD2014-09	Climate change risks and opportunities	In Progress	$350,000.00
ZBD2016-05	Buffering eutrophication and prioritising climate change issues in coastal ecosystems	In Progress	$250,000.00
ZBD2016-10	Mapping ecosystem services across coastal and offshore habitats (High)	In Progress	$150,000.00
ZBD2017-04	Implications of ocean acidification on the capacity of carbonates in sediments to buffer eutrophication effects	In Progress	$250,000.00
ZBD2018-01	Five-year continuous plankton survey (Phase 3)	Proposed for 2018-19	$500,000.00
ZBD2018-02	Climate change, fish distribution meta-analysis	Proposed for 2018-19	$300,000.00
ZBD2018-03	Climate change and fish population parameters	Proposed for 2018-19	$250,000.00
ZBD2018-05	Ecosystem function and regime shifts in the Sub-Antarctic	Proposed for 2018-19	
ZBD2020-05	Horizon scan: climate change and fisheries	Proposed for 2020-21	
ZBD2021-02	Climate change, productivity and biodiversity	Proposed for 2020-23	$500,000.00