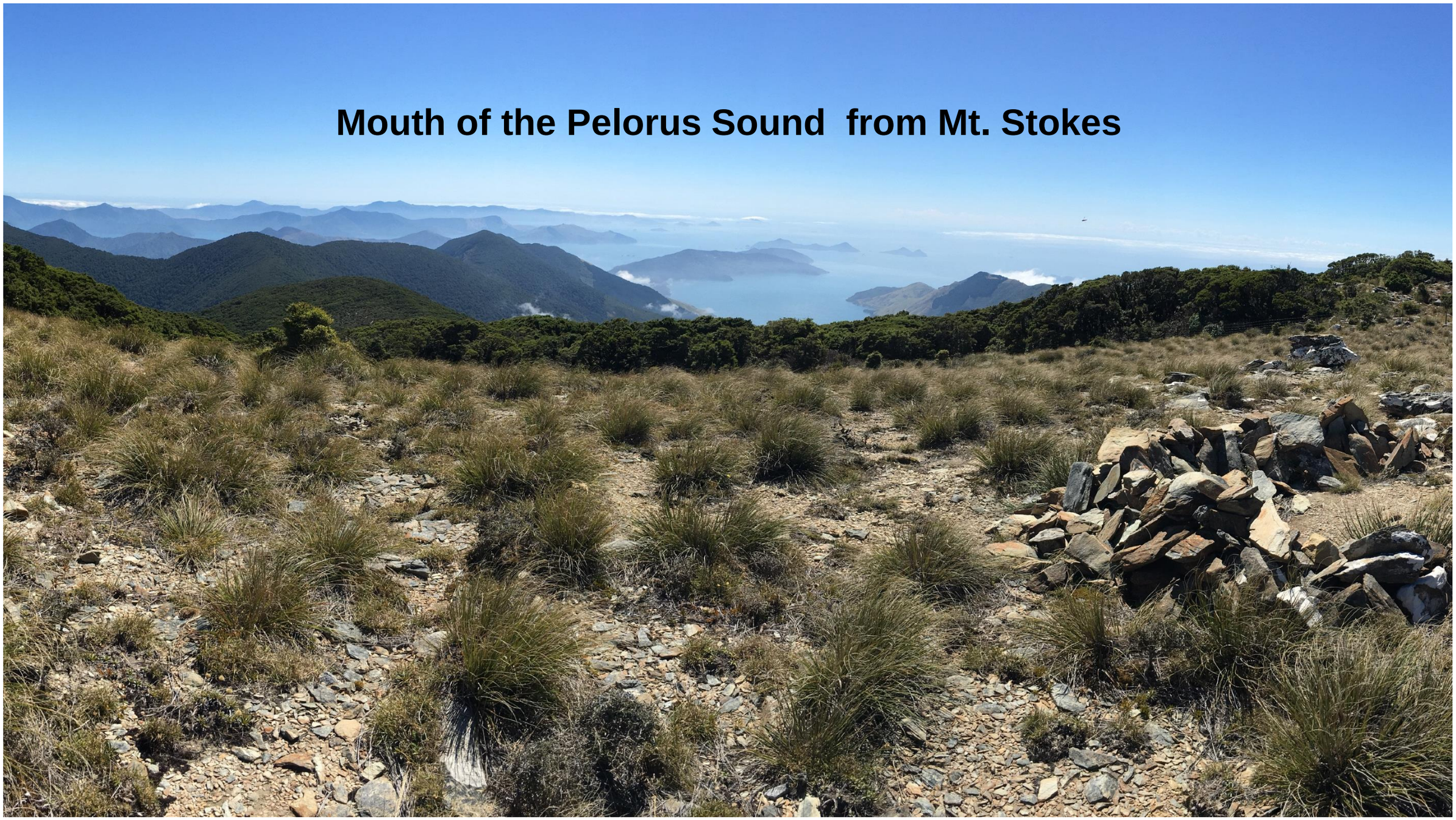


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- Perspective.

- I am not anti-aquaculture. I love salmon. I commend salmon to my patients for eye health. NZKS have many fine products.

- Mr. Lees and his team from MPI are helpful and have engaging personalities, it’s just...

- I like our environment more.

- Ministry of Primary Industries and King Salmon are proposing to relocate six salmon farms for better environmental outcomes.

- MPI’s own documents indicate “better environmental outcomes” are not possible.

- Example of “mission creep.”

- Recent Supreme Court decision. Environmental Defence Society and Sustain Our Sounds v. New Zealand King Salmon.

- Three farms allowed, one declined.

- Maximum the Environment can absorb.

- Which means this process is nothing more than contempt of court dressed up in a suit and a tie.

- Dan Lees:
- “The community have said additional salmon farms are not appropriate in the Marlborough Sounds. We have to manage the farms we do have.”

# Nitrogen Levels and Adverse Marine Ecological Effects from Aquaculture

New Zealand Aquatic Environment and Biodiversity Report No. 159

N.D. Hartstein
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# Modelled water column effects on potential salmon farm relocation sites in Pelorus Sound

*Prepared for Ministry for Primary Industries*

*18 October 2016*

- John Key :“The key challenge for for New Zealand King Salmon was gaining flexibility to move their farms more regularly to help with the environmental impact. Salmon farms are hugely profitable. The hectare returns from salmon farms is (sic) thousands of times greater than dairy farming. We want aquaculture farms to be successful. We need to work on that taking into account the wishes of the community.”

- The former prime minister appears to be advocating NOMADIC AQUACULTURE where NZKS is allowed to desecrate not only the environment but also the local flora and fauna by their industrial scale farming then move on to ruin more of our outstandingly beautiful region.

- Options to expansion?
- Stay with the currently permitted production.
- NZKS actually adhere to consents and required environmental monitoring.
- Farm offshore or in onshore contained areas.

- Grant Rosewarne: M Ex 10/4/2017.

- “Costs will generally be higher offshore because of the expensive infrastructure required and the higher cost of harvesting, feeding and net cleaning.”

- “Organic matter from salmon is benign.”

- On many occasions. The seafloor is mud.

he importance of the site.

s beneath: Life below the surface in Waitata Reach.

a said he believed Ngati Kuia's objections were predicated on the cultural significance of the site, and the iwi's history
sociation with Pelorus.

- Offshore/onshore farming costs are borne by NZKS.

- Inshore, the costs are borne by the local environment. Breaking our eggs to make their omelette, and leaving the mess for us.

- Which part of the following information from MPI's own data indicate Mr. Roswarne's supposed benignity?

- Mark Gillard, NZKS, in a letter to MDC: “Implementation of best management practice for seabeds was a challenge that would be solved by 2024”

- Dan Lees, MPI, “It is not acceptable to wait until 2024 to implement best practice guidelines across all the farms”.

- Marlborough Express 9/5/16

- Three Marlborough Sounds salmon farms in spotlight after failing to meet environmental guidelines.

- Cawthron noted pollution under pens and seabed enrichment, caused by fish waste falling on the seabed and uneaten fish food.

- Aren’t we lucky its so benign?

- Cawthron:

- Farms at Forsyth Ruakaka and Otanerau met the terms of their resource consents but were still not running in a way that enables them to meet the agreed best management practice guidelines.

- Clay Point had a minor non compliance for exceeding permitted enrichment levels.

- Crail Bay despite being described as 2 sites designated for replacement are non existent. (I think the last time fish from this farm were caught were by the Neills of Crail Bay when there was a big salmon escape following farm damage about 2011)....

- Still included in data given by NZKS to NIWA for baseline studies - Crail 1 and 2 1645 tonnes/feed May 2017-Oct.2018 ?????

- MDC’s Peter Jerram. “If this was a land based operation it would be called overstocking. We call it running hot.  When the enrichment gets too high it fouls the environment. Effectively there are too many animals on each site. If this was a dairy farm operation it would be shut down.”

- Jerram questioned if there was room in the Sounds to move farms into high flow sites. Shifting farms to Tory Channel would **“spread the problem over a bigger area.”**

- Cawthron:
- Otenerau: “Excessive enrichment - major alert response under the guidelines and forcing the company to improve enrichment levels within two years.

- Cawthron:
- Ruakaka: Both pens stations’ sediment chemistry had deteriorated and sulphide levels were extremely high, minor alert, management response

- Cawthron:

- Forsyth Bay. “Poor performance/ Excessive enrichment. Seabed under the salmon pens heavily polluted and almost devoid of life.”

- Low flow? Open to Waitata Reach and Allen Strait. Certainly at least as open as Waihinau, which despite being slated for relocation is apparently not yet a concern wrt benthic pollution.

- But, at Waihinau: (March 13, 2015 M Ex)

- “Millions lost after warm seas kill salmon”

- Grant Rosewarne. “multimillion-dollar problem to solve...no primary pathogen...( ***none of 300 salmon diseases present internationally in NZ: M Ex June 10 2015***) ...feed changes no help after successive years of high mortality...we will have to re-assess our site utilisation.”

- Pelorus temperatures unsuitable 3 months per annum. Climate change and disease risk increase.

- Rickettsiae identified at Waihinau and in Scallops at nearby Ketu Bay.

- Rickettsia are intracellular parasites, spread by arthropod vectors (lice) or seabirds.  Same Gram-family as chlamydia and Q fever.  Tx. Tetracyclines/Chloramphenicol. These drugs are teratogenic.

- Caged fish are an incubator. Biosecurity risks then present for the Mussel industry.

- Pathogenically similar to viruses. Sulphonamides are contraindicated, tx: tetracyclines and chloramphenicol.

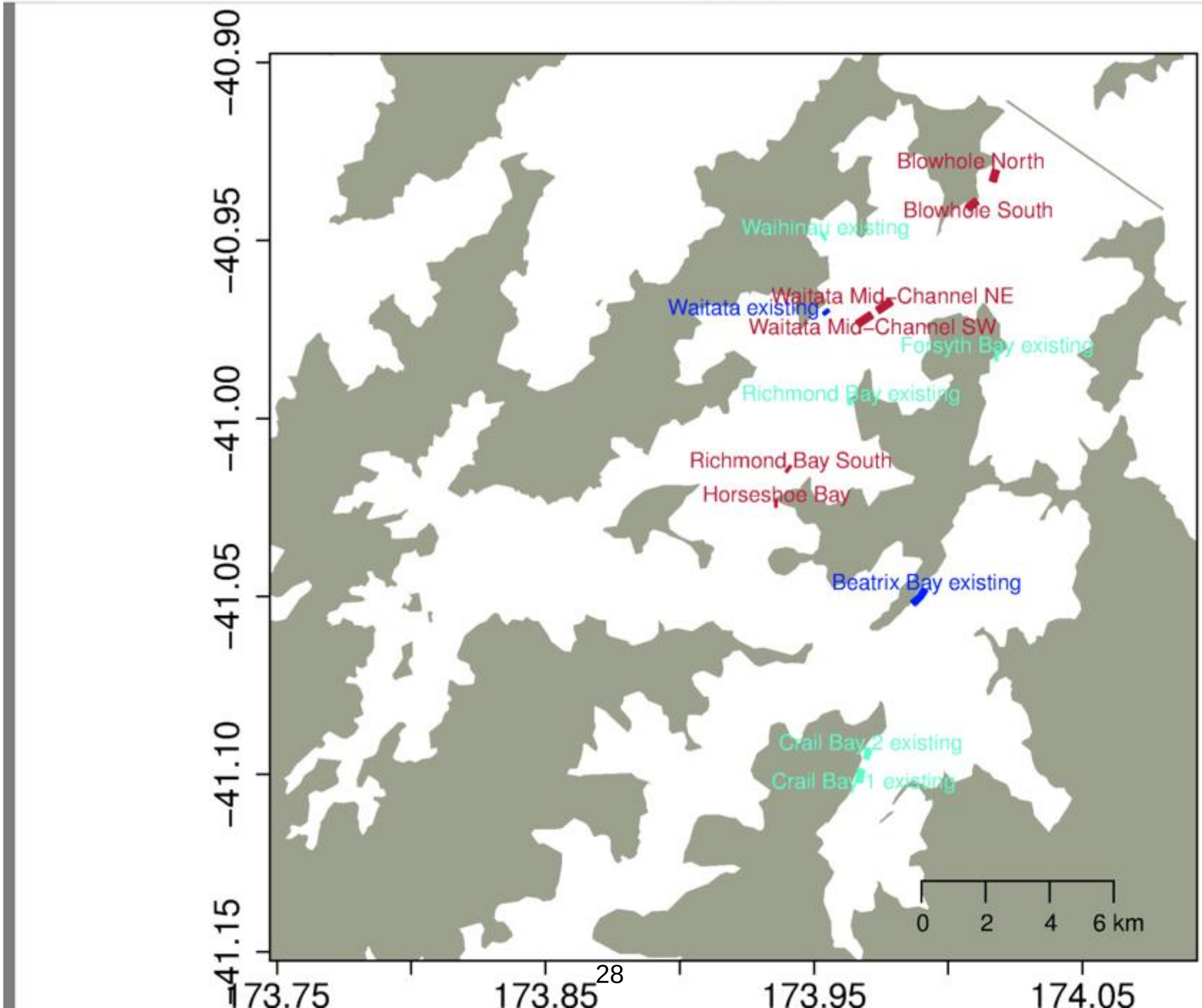
- Environmental sustainability?

Dolphins are a common occurrence in the Pelorus Sound. (File photo) - DALE GUTHRIE

- NIWA:

- “ ‘Relocate’ is used as a convenient shorthand. The annual feed load limits at the potential new sites that we have been asked to consider are often larger than those of any of the sites which the relocated farms ‘replace’. ”

- Inputs considered from 25-300% above current levels - up to an extra 65 tonnes/day.


−40.90
−40.95
−41.00
−41.05
−41.10
−41.15
173.75
173.85
173.95
174.05
Blowhole North
Blowhole South
Waihinau existing
Waitata Mid−Channel NE
Waitata existing
Waitata Mid−Channel SW
Forsyth Bay existing
Richmond Bay existing
Richmond Bay South
Horseshoe Bay
Beatrix Bay existing
Crail Bay 2 existing
Crail Bay 1 existing
0
2
4
6 km

- “Pelorus Sound has a marked estuarine circulation. Fresher (lower density) near-surface water tends to flow outward to Cook Strait. Saltier (denser) near sea bed water tends to flow inward from Cook Strait....ammonium stemming from  from the decaying fish faeces and uneaten feed (both of which sink rapidly to the seabed) tends to flow toward the inner part of Pelorus Sound.”

- “Thus any particulate - biomass increases induced by the farm - derived nitrogen will often be greatest some distance away from the source farm”.

- Describes: ammonium, nitrate, organic detritus (several classes) phytoplankton (as nitrogen and as chlorophyll) and zooplankton

- For chlorophyll read algae.

- All of the scenarios yield higher Pelorus Sounds concentrations of total nitrogen.

- During the summer....the farm derived ammonium is quickly consumed by algae.

- Changing the location of the farms has little impact upon and particulates nitrates in the immediate vicinities of the farms.

- Algal blooms kill with:
- Neurotoxins (like sarin gas).
- Light reduction.
- Oxygen deprivation.

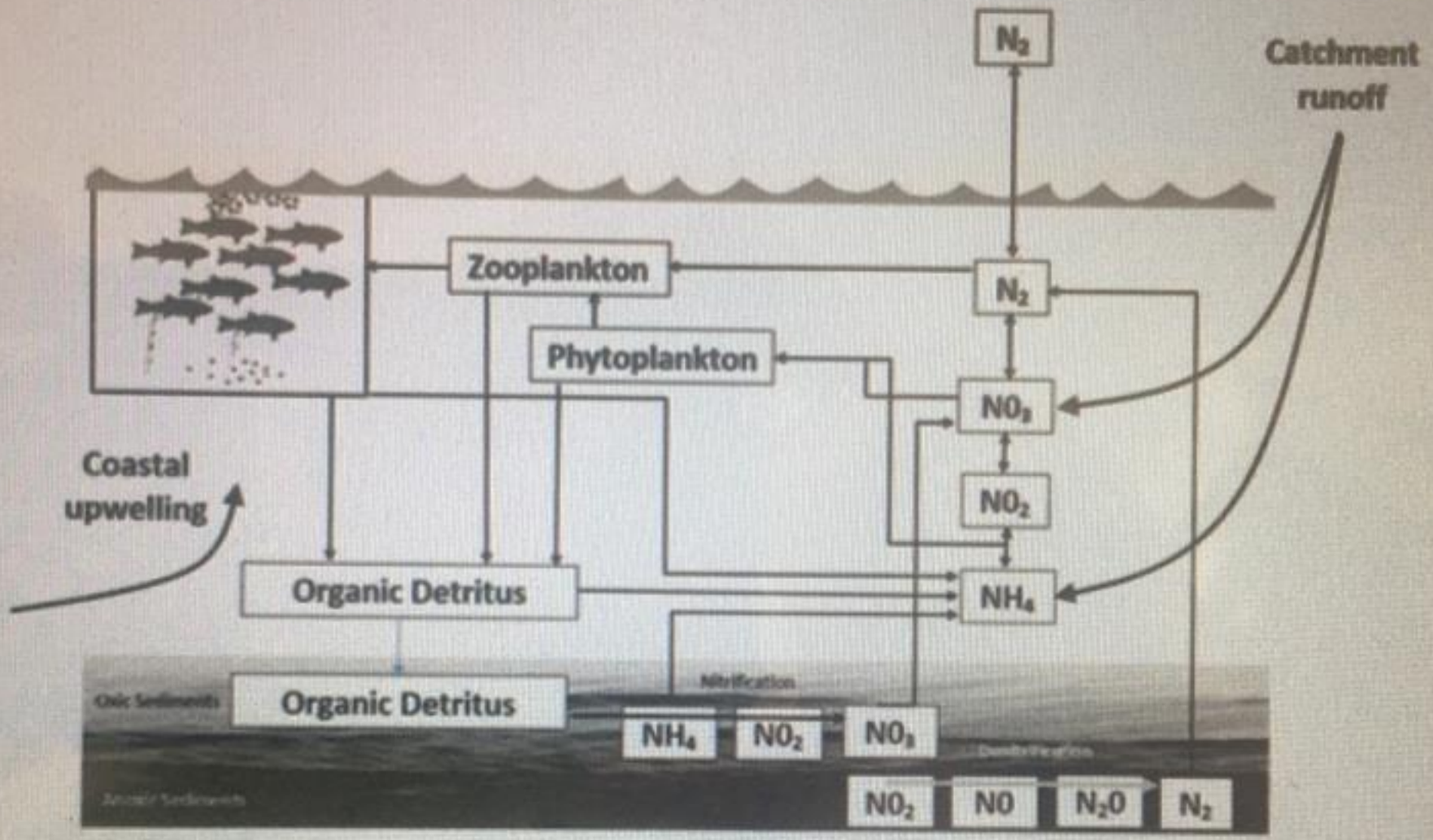



**Figure 1: Schematisation of the main Nitrogen processes relating to aquaculture. See Glossary (Section 9) for details of components.**

Where data was not found in the literature for the net effect of mussel production for an area on the nitrogen budget it has been assumed to be nitrogen neutral. Technically they do remove some nitrogen from the embayment but the release of ammonium (through faeces and pseudo faeces excretion) means that it is very difficult to quantify their true net loss or gain to the system in terms of feedback to primary production (Lehane & Davenport 2002; Jeffrey et al. 2006).

**Table 10: Summary of Nitrogen loading for Queen Charlotte Sound from Gillespie et al. (2001) and references therein.**

| Rivers | Groundwater | Wastewater | Ocean flux* | Denitrification | Aquaculture |
|---|---|---|---|---|---|
| 867 | 0 | 9 | 350 | -367[a] | 868 (finfish)<br>-12 (mussel farm) |

**Table 11: Summary of Nitrogen loading for Pelorus Sound from Gillespie et al. (2001) and references therein.**

| Rivers | Groundwater | Wastewater | Ocean flux* | Denitrification | Aquaculture |
|---|---|---|---|---|---|
| 580 | 0 | 0 | 200–4200[*] | -465 | 336 (finfish)<br>-266 (mussel farms) |

* Net ocean flux refers to Dissolved Inorganic Nitrogen (DIN).

## 2.9 Site Description - Huon River and D'Entrecasteaux Channel, Tasmania, Australia

The Huon River is the fourth largest river in Australia and drains into the D'Entrecasteaux Channel and the Tasman Sea (Figure 14). The Huon River system is similar geo-morphologically and

- “Within Pelorus, the far field changes are most prominent in the central and inner parts (Tamaki Strait and more especially Mahau Sound and Kenepuru Sound). In some simulations, noticeable changes also arise in the coastal environs around the mouth of Pelorus Sound (e.g. Admiralty Bay and Port Gore)”.

- Mid Kenepuru is 50 km distant. (>250 m. described as the change boundary in EQS)

- Current algal (chlorophyll) levels since July 2012 (MDC monitoring) exceeding 5mg per cubic metre

- 542 measurements in Pelorus (<1%)

- 1 positive Mahau, 1 positive Kenepuru in 41 tests, (5%). Measures not take at predicted problem zones.

- Mahau/ Kenepuru are sensitive to increase.

- “we infer that, relocation - and expansion of the fish farms is unlikely to induce frequent exceedances of the 3.5 mg cu.m threshold”.

- But. Consent conditions forbid (an unspecified) statistically significant change towards a eutrophic state from a natural oligotrophic/mesotrophic state .

- Remember: Baselines erroneous (Crail Bay)

- Baseline data comes from MDC measurements indicates Mahau and Kenepuru are vulnerable.

- Baseline data interpretation underestimates risk because it includes non-existent “feed loads” to Crail Bay.

- The model may be valid but the conclusions are faulty as a consequence.

- “There is a clear positive (near linear) correlation between the total feed load and the resultant (total nitrogen) concentration increment”.

- “benthic denitrification rates can become suppressed when organic loadings to the seabed become too high”.....if over a sufficiently large fraction of the region...positive feedback loop exacerbates the progression towards eutrophy”

- Remediation (recovery) of the seabed is a two stage process:

- Chemical, where the accumulated waste is mineralised, and only when this is complete,

- Biological remediation. “Biological remediation may never completely occur.”

- Page 70 “our model does not consider dissolved oxygen, but does consider chlorophyll and organic detritus which will consume oxygen as it decays”.

- Importance of oxygen can be demonstrated by placing a plastic bag over your head.

- Nutrient load applied if all consents granted:
- Equivalent to untreated sewage from 180,000 people (Rob Shuckard).

- Fallowing:

- Dr. Dan Diggles: Each farm area should be separated from neighbouring areas by 45 km. (Disease/Environment remediation).

- All farms within an area fallowed every third year.

- production 20k/20k/0k tonnes or 20/10/10 or do NZKS want another region?

- Environmental degradation from salmon farming in the Marlborough Sounds is factually established .

- The “relocation” and “like for like” semantics are alternative facts to achieve expansion.

- Dan Lees:  Waitaria drop in, “there is nowhere else to farm salmon.”

- None of the alternative scenarios will lead to **frequent** breaches of water quality threshold (risk relative to nutrient load)

- “If  adverse changes in water quality within the innerparts of Pelorus should be minimised...**all of the alternative scenarios are unacceptable**”.

- MPI as a government agency already has a treaty partner which has been denied aquaculture sites in CMZ1 zones.

- NZKS is a majority overseas owned entity.

- Ignoring Iwi in the event of approving NZKS applications is like taking your mistress to the dance while your wife stays  home to do the dishes.

- Sharks:  Attracted to but unable to access salmon, what impact on migratory species (dolphins/snapper) running the Waitata gauntlet? Local fish populations? King Shags? Mussel farm divers?

- Loss of tourism/ scenery/ amenity/ landscape/ navigation and cultural values.

- Impact on Mussels/ Scallops/ Clean green reputation of exports.

- Disease/ Fallowing / Antibiotic resistance.

- Perceived benefit to the economy:
- See the analysis by Trevor Offen which contradicts the more optimistic (wildly inaccurate?) studies commissioned by NZKS.

- The proposed expand/test/monitor process is akin to blowing up a balloon.

- In the event of environmental disaster: NZKS has a month to sort out a written plan and four months to take action.

- Too skewed towards NZKS.

- If NZKS (and MPI) are so confident they are not impacting the environment, they should have no problem posting bonds.

- These bonds should quantify impacts across all potential adverse effects.

- They should be large enough to be an incentive to develop true sustainability.

- This is a nexus.

- Protect the Sounds for future generations or be the architects of their environmental degradation and ecologic demise.

- Decision to develop cannot be undone.

- One way or the other,  history will record what we collectively, and you particularly do here long after we are gone.

- Only if you can individually look in the mirror and say this (ab)use of the resource would be permissible in Wellington or Waitemata harbours can you allow it.

- Realistically you should just close sites not meeting agreed conditions.

- I regret to say I am afraid this process is window dressing a predetermined outcome.

- Aquaculture **is** desirable. If NZKS and MPI were to enlist Tangata Whenua and the public to move to LBCC-RAS (land based closed containment water recirculating aquaculture systems), I would advocate for, invest in, and applaud their success.

- Initial set up cost offset by more efficient production. (B-9 fertiliser sales will rocket).

- MPI, NZKS, NIWA and Cawthron have the brains and talent. Use them constructively.