

11th July 2016

Stephanie Hopkins
Ministry of Primary Industries
118 Vickerman Street
Port Nelson

Dear Stephanie,

Please find outlined below my response to your request for a peer review of the work you have commissioned NIWA to undertake to assess benthic effects of relocation of salmon farms in the Marlborough Sounds.

The two reports in combination present a comprehensive baseline assessment of the conditions at nine potential aquaculture farm sites in the Marlborough Sounds, providing in Part 1 a clear characterization of the benthic conditions at each site and outlining any specific ecological features of interest or significance, and in Part 2 an evaluation of the likely benthic footprint using the hydrodynamic and particle tracking model DEPOMOD and an assessment of likely feed input scenarios for each site. In addition, where the DEPOMOD software has suggested there is potential for adverse impact i.e. where the benthic footprint suggests that the effect exceeds the prescribed ecological stage (ES) or where the footprint has the potential to impinge on areas of particular ecological significance the authors have suggested alternative options, based on changes in either the feed input scenario or orientation such that the level of stocking would potentially result in a more acceptable ecological output. The study has been sensibly constructed, well conducted and the interpretation is sound. The report is for the most part well written and easy to understand, with some minor English and grammatical errors that can easily be addressed in subsequent drafts (I understand that this draft was produced in some haste). I have a number of relatively minor comments and suggestions to make on the content and have outlined these separately below. I believe the document will prove a valuable resource for assessment of proposed developments in the region.

Specific Comments or Points for Clarification:

Executive Summary (Part 1)

- There is a comment in the executive summary (Part1; Page 9) that suggests that the fact that scallops are relatively abundant at the Richmond South (106) site may be an issue in relation to commercial/ recreational fishing interests. I'd suggest this may need some clarification, as it seems to suggest the potential for either an adverse interaction or conflict of interest. Perhaps, some additional information to explain i) whether this is in area which is already an established or commonly fished ground or ii) whether there is any evidence of salmon farming adversely affecting scallop fisheries (especially beyond lease boundaries) might help. This could be included along with the information on this particular site, or alternatively as an entirely separate section that specifically discusses potential areas of conflict/ concern.
- Part1; Page 9 – there is also a comment in the description of the Moyukina site that describes the presence of “the ecologically important giant kelp (*Macrocystis pyrifera*)”. For the benefit of the broader community it might be valuable to explain somewhere in what way the giant kelp might be considered “ecologically important”. As noted in the previous point, it might be useful to put value statements such as this in context. For example, if there is a concern that some ecological asset or habitat might be compromised or lost it would be good to know how special, unique or rare that asset/ habitat is (e.g. what proportion of the particular environment in the Sounds the “at risk” habitat represents), this would allow the reader to make a more informed judgement.

Introduction (Part 1)

- The introduction is brief and to the point, outlining the aims and objectives of the study and analyses very clearly.
- In the introduction it is stated that the surveys and analyses are designed “to describe the benthic ecological features, to predict the depositional footprint from the farming activity and to identify benthic features that could be affected by the proposed activity”, the information provided comprehensively addresses the first two points. However, it is the last point that is most likely to cause concern with stakeholders, and I think it is important when identifying benthic features that could be affected by the proposed activity to ensure that this is done objectively and consistently. I was not entirely clear from reading the introduction whether it was within the scope of the NIWA study to provide context along with the assessment of interaction, i.e. additional information that would enable the reader to better understand the nature and significance of that interaction (see earlier comments). Perhaps MPI could provide some guidance here.

Methods (Part 1)

- The methods are clear and well presented. My only comment here might be that it could be useful to include, as a reference, a table in the methods somewhere outlining the various criteria used to establish particular standards/ conditions i.e. defining the current flows associated with particular categories, the sediment sizes and substrate classifications used in the study, and the

various infaunal categories/ enrichment stages and how those relate to the different sediment and community classifications.

Results (Part 1)

- Is it possible to provide the ADCP output/ distribution plots for current speed and direction at each of the sites as an appendix?
- Page 20, Figure 3-4 – The reference to the figures in the text do not seem to align with the images shown?
- I note that where the total abundance was greater than 5 individuals for those species collected using the epibenthic sled this has been highlighted throughout, and wondered why this level had been selected and what significance is attributed to it - this might be worth clarifying in the methods. There is an inference that abundance implies significance and whilst this may be true in some cases, in other instances the presence of particular species may be key - for instance rare and/or endangered species - I wasn't sure how these were captured in the survey methods? It may be that this is not an issue in this particular region?
- There are a number of occasions throughout the report where an increased abundance of a particular species is noted for a particular location (e.g. Page 25 – large number of shrimp-like Tanaids). For the most part the authors make no comment as to the significance of such observations, and it may not be part of the project aim to comment on the ecological significance of the fauna observed. However, as previously suggested I think that where such species make an important contribution to defining conditions at a site then some additional explanation may be required e.g. whether the species might reasonably be expected in those numbers, whether this could be associated with a spawning aggregation/ reproductive event or even whether the individuals are clearly "opportunistic".
- Similarly, "notable species/ notable features" perhaps need some additional explanation as to why they are considered "notable"; this could be part of the reference information in the methods section proposed above.
- It is noted on several occasions that scallops, paua and kina were abundant in areas and that these are important recreational and commercial species. As per the comment above and in the previous section, it might be good to outline somewhere the particular concerns with these species, or provide some greater understanding of just what might realistically be considered an adverse interaction with such species (although I appreciate that this may be overstepping the role of this particular report and is something that may be determined independently by the regulators).
- I like the way the sediment data is presented throughout this report it provides a very simple but effective mechanism to review and compare sites. The consideration of primary and secondary substratum where rock/rubble is present is useful, it provides ecological context for the fauna that would be hard to capture otherwise. The verbal descriptions of how the sediment types

change and the ecological features associated with this are very expressive however, I did wonder why you weren't able to provide continuous habitat maps based on the acoustic outputs (side scan sonar) and ground-truthed/validated using the grab and drop camera samples? Is it possible to also include these?

- The infaunal indices information is very clear, and whilst the pie chart representation of the key taxa is a simple way to see differences between sampling stations/ sites, the number of categories in many cases makes the fine scale comparison much harder, and as a result it is really only the differences between the main 2-3 taxa that are apparent. Consequently, having the data tabulated either in the main report or in appendices would enable scrutiny of the finer scale differences where warranted.
- I am intrigued about the interpretation of the baseline conditions associated with sites where farming already exists (e.g. Waitata), and think it is important to differentiate these sites (or sampling stations within sites) and even the purpose of the sampling in these circumstances - is it still a baseline?

Discussion (Part 1)

- I note in the discussion that the authors identify that much of the ecology of the Tory Channel is unique to the Marlborough Sounds. Whilst this is very important to acknowledge this I think it would be useful to also include some level of discussion as to what extent that uniqueness infers fragility/ sensitivity; if it is unique but quite robust/ resilient then perhaps there may be less concern regarding the potential for adverse interactions. Clearly this may not as yet be known, but I'd suggest that it might still be worth considering in a general sense.
- Similarly, it would be worth including some discussion regarding the functional ability of different communities/ ecologies. I note that the authors allude to the fact that muddy habitats tend to be better able to tolerate sedimentation. There is some considerable literature outlining how fine sediment communities are often well adapted to assimilate organic material and therefore you might not expect to see much change in the short-term in these ecologies with additional organic/nutrient inputs. In contrast, the communities at more dispersive sites are often not accustomed to dealing with a continual rain of organic matter, and therefore might necessarily change markedly under such conditions in order to process the additional nutrients. Both examples are evidence of natural biogenic (assimilative) processes, it is when the natural assimilative capacity is surpassed that problems can occur - finding the tipping point is not always easy. In NZ you have adopted the enrichment stage (ES) indicator approach, so some explanation of how that relates to the baseline characterisation would I think be useful.
- Page 109 – The second last paragraph on this page did not make sense to me, and seemed to be incomplete (the point of the paragraph seemed to be missing). I think this was supposed to be the statement (introduction) as to why the baseline information is important at all, but I think it needs to be expanded, perhaps including some of the information suggested in the point above.

- The discussion goes on to summarise the key ecological features of each of the sites. The authors have sought to identify “notable” features in each case, but it is not clear whether these are in fact at risk and they are all given equal importance. Perhaps some suggestion as to what the actual risks might be for each feature/ site would help to identify significant interactions (the ones with the greatest risk) and therefore better inform future management and monitoring? Again this may be beyond the defined scope of the project.
- There are some broad statements in the discussion regarding the ecological value of habitats and “notable features” (e.g. in relation to the biogenic habitat at Te Waka), some further clarification and substantiation of the significance of these habitats and a clearer characterization of the actual risk from the proposed farming activities would enable targeted and effective management actions. Again I appreciate that this may be beyond the scope of the present study.

Executive Summary (Part 2)

- This is a good summary and outlines the premise to the modelling and analysis undertaken, the nature of the impacts likely to occur and how the threshold levels were determined. I have no issue with broad interpretation or the key findings, they seem entirely consistent with the data as presented.
- There is some suggestion that far field and secondary effects may need to be considered in monitoring programs, and that a range of other interactions might also need to be addressed. Whilst I agree that all of these interactions may be relevant, perhaps a first step might be to review these interactions and consider their risk potential. Resources are limited and therefore it is important to ensure that in the first instance monitoring and management are directed to areas where we are confident there are real risks, and that research efforts are focused on defining the risk associated with other interactions.

Introduction (Part 2)

- No major comments – the rationale for the modelling and analysis is well described.

Methods (Part 2)

- Note the current rose shown here is what I was alluding to in the first comment on the Results (Part 1).
- Model parameterization is clear and well described.

Results (Part 2)

- There would seem to be quite a bit of repetition of the habitat/ ecological information contained in Part 1 but if the reports are to be viewed separately then this may be necessary.

- I note that the interpretation of the Depomod outputs also includes interpretation of the likely ecological impacts/ interactions but as previously noted perhaps there needs to be some assessment as to the significance of any negative interactions. For example, on page 17 it is suggested that “scallops may be displaced from a large portion of the wider footprint”, I wonder if we might be in a position to characterize just what proportion of the total scallop bed area of the region that might represent, or even what proportion of the lease area assessed? Overall the summary of potential impacts and assessment of likely consequence would appear to be very reasonable.
- It is important to note that the modelling output is only a possible projection “best guess” at what is likely to happen, and therefore some option to use the collected monitoring data to calibrate/ validate the model would be valuable (i.e. placing the modelling in an adaptive management framework).
- The model predictions at Waitata required markedly lower feed inputs compared to the industry projected figures to provide a footprint where the ecological effect levels were within an acceptable range – this may necessarily require discussion with industry as to the viability of this lease under these revised input levels. It is also interesting to note that in this instance there were no particular ecological assets associated with the footprint at this lease. Consequently, one might ask whether potential impacts beyond the lease/ cage area under such conditions are more acceptable? A similar discussion may also be had for the Richmond South lease, although the proposed reduction in feed input level to bring about compliance in ecological condition in this case is much less.
- The modeling outputs have highlighted the proximity of reefs systems to the leases at Motukina and Te Weka Bay in particular, and begs the question as to just how resilient these reef communities might be to farm inputs. Having reefs in the direct depositional footprint of the farms has the potential to markedly alter those reef communities and the significance of that may be a function of whether these reefs are unique or particularly special (e.g. what proportion of the local habitat do they represent, what exactly would be lost if they were impacted?). Is that socially acceptable?
- The modelled outputs have suggested that there needs to be a reduced feed input for 7 of the 8 leases assessed, in some cases these levels have been significantly reduced. This might suggest that i) the modelled outputs may need to be validated, in case they are for some reason markedly over estimating the level of impact or ii) there may need to be some additional discussion and consultation with industry planners to try and identify why they might have an unrealistic expectation of the carrying capacity of these leases.

Summary and Discussion (Part 2)

- This summary provides an accurate overview of the likely changes. The area that might be considered > ES 3 and >ES 5 at each of the proposed sites is provided. It might also be useful if

this could also be shown as the proportion of the total area. It would also be useful to have some sense of what proportion of the overall “notable habitat/ ecologically important species” might potentially be compromised at each site.

- Again as noted in Part 1, this last section again includes some discussion of the potential for effects beyond the primary footprint and a suggestion of a need for monitoring of areas where the effects are unknown. I’d suggest this again highlights the need for discussion regarding what constitutes monitoring and what constitutes research. Perhaps it might be easiest to consider that the monitoring will be guided by the research, and that in the first instance some research may be required to fully establish the level of “risk appropriate” monitoring required.

General Comments:

- These surveys comprise data from a large number of different sampling approaches, it might be useful to review the resultant information with a view to establishing whether there is any redundancy in the dataset (i.e. whether all of the survey approaches and techniques are necessary to effectively characterize benthic condition).
- I had to note the sizable currents at many of the sites studied, many in excess of 30cm/s. This is interesting as it suggests that most of the sites under consideration will be highly dispersive, consequently the zone of influence would be extensive, but at a low level. What capacity might there be to consider broader scale deposition and the potential for hot spots, or to consider system-wide monitoring?

I hope this reaches you in time for your preliminary meetings, and as before I would be very happy to clarify or discuss any part of this with either yourself or the team at NIWA.

Please feel free to contact me directly if you have any further questions.

Regards,



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