

**Closing remarks – Prof. Peter G. Beninger**  
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Re-statement of position

In my professional opinion, the Port Authority's Biofilm Report (Biofilm Dynamics during 2018 Northward Migration) can in no way be construed as evidence that there will be little to no impact of RBT2 construction on the biofilm dynamics of Roberts Bank. Two obvious reasons are:

- 1) The impossibility of asserting the absence of an effect – basically, it is not possible to investigate every potential aspect of the problem, and therefore impossible to evaluate the effects of unevaluated aspects.
  
- 2) The impossibility of predicting the long-term future with certainty. The history of environmental management is replete with examples of such failures (e.g. the collapse of managed cod stocks on the East Coast, the collapse of managed salmon fisheries on the West coast).

Response to the Proponent's Biofilm Session closing comments

- 1) Sampling problems – I underscored the fact that the Proponents did not use proper spatial statistical methods in their sampling design, and were thus unable to ascertain that they captured the underlying spatial distributions – and therefore, that they had adequately estimated biomasses. In their Closing Comments at the end of the Biofilm session, the Proponents stated that over the course of several years, they had sampled 'hundreds' of locations, and that they were therefore confident that they had adequately captured the spatial distributions. Such a statement could only be correct if they had sampled a much larger number, at all sampling scales, all at the same time. This was obviously not the case. Since the sampling design is the foundation upon which rests the entire study, the credibility of all results issuing from the study is greatly diminished.
  
- 2) NHST problems – As outlined in my written and oral presentations, this was not an experimental study, so the multiple use of the NHST approach in the Biofilm report was inappropriate, again diminishing its credibility. Beyond this fundamental problem, the Proponents claimed, in their closing remarks, that

they had made judicious use, and interpretation, of p-values. This is not the case, as outlined in my written report. In addition, the Proponents asserted that they abundantly highlighted effect sizes in their Biofilm report; I challenge them to provide evidence for such a claim. I found less than 5 such examples, only 2 of which were direct references to effect size. A 'statistically significant' or 'insignificant' difference simply does not equate with a biologically significant or insignificant difference. The lack of proper biological contextualization renders such conclusions essentially meaningless.

- 3) The proponents simply did not address the possibility that WESA require, and seek, nutrients other than carbohydrates and PUFA in the biofilm. We therefore cannot know whether other mudflats can provide such nutrients. Recent examples of extremely narrow food requirements for successful shorebird reproduction should give us great pause in our conclusions about food availability (Santos et al 2019, Waterbirds 42: 198-204).
  
- 4) The mudflat knowledge base – having published the first textbook on Mudflat Ecology in 2018, I am in a position to judge the current depth of the knowledge base in this field. Despite the Proponent's claim that they have added substantially to this base (especially in view of the credibility issues which I have brought forward), I can state with confidence that our understanding of mudflat ecosystem functioning is in its infancy. This is not a mature scientific field, in contrast to forest ecology, for example. In a nascent scientific field of study, it is dangerous (and indeed foolhardy) to affirm that we understand it well enough to make confident predictions which entail species- or ecosystem – level effects.

**Conclusion:** I believe that any truly independent, knowledgeable scientist reading these remarks will arrive at the conclusion I made in my written and oral report to the Panel: despite the Proponent's closing remarks, their Biofilm Report cannot be taken as evidence of little or no effect of RBT2 on Roberts Bank mudflat or biofilm dynamics, which are essential for the short and long-term survival of the WESA population.