



LIVING OCEANS

***Tenacibaculum maritimum*: The “Smoking Gun”?**

Presentation to the Standing Committee on Fisheries and Oceans

March 24, 2021

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Living Oceans Society**

***Tenacibaculum maritimum*: The “Smoking Gun”?**

text includes excerpts from **ATIP A-2020-01561-DSP** where indicated

Description and context:

Two days before Minister Jordan issued her decision to close Discovery Island salmon farms, a major new scientific discovery was communicated up the chain of command in DFO. It is entirely uncertain how far it got, or what information was actually communicated. Had the Minister been told of this new development and properly advised of its significance, she would have known that salmon farms in the Discovery Islands had failed the test that Justice Cohen proposed for them in 2012: the risk of disease pathogens emanating from the farms poses far more than a “minimal risk of harm”.

The bacterial pathogen *tenacibaculum maritimum*, which commonly causes mouth rot disease in farmed Atlantic salmon, was one of the nine assessed by DFO’s CSAS process, which concluded with “high uncertainty” that it was “unlikely” that juvenile salmon could become infected with it; and with “reasonable uncertainty” that it would have only a “negligible” effect on population abundance and diversity. Both conclusions are now proven wrong; *t. maritimum* may be the ‘smoking gun’ (or one of several) that Justice Cohen could not find during his commission.

	Risk of outbreak on Atlantic salmon farm	Risk of exposure of juvenile sockeye salmon	Risk of infection of juvenile sockeye salmon	Risk of exposure of adult sockeye salmon	Risk of infection of adult sockeye salmon	Severity of impacts on abundance of Fraser River sockeye	Severity of impacts on diversity of Fraser River sockeye
Tenacibaculum maritimum	Reasonable certainty (Very likely)	Reasonable certainty (Very likely)	High uncertainty (Unlikely)	Reasonable certainty (Very likely)	Reasonable uncertainty (Very unlikely)	Reasonable uncertainty (Negligible)	Reasonable uncertainty (Negligible)

A summary of the DFO CSAS risk assessment for tenacibaculum maritimum

Dr. Kristi Miller-Saunders attempted to inform senior management of DFO on **December 15, 2021**, about new modelling that points out a strong correlation between mouth rot disease on salmon farms in the Discovery Islands and reduced survival of Fraser River sockeye. Analysing wild salmon samples taken along the migration route between 2008 and 2018, her team proved that juvenile salmon were definitely being infected with *t. maritimum* as they passed through the Discovery Islands. Her department’s new modelling of that data shows population-level impacts (**87.9% reduction in smolt survival**) to Fraser sockeye, as well as reduced fitness in coho, Chinook and sockeye that also amounts to a population-level impact.

An earlier paper¹ from the Strategic Salmon Health Initiative demonstrated that *t. maritimum*—and some dozens of other pathogens—are routinely present on salmon farms; *t. maritimum* is the most commonly found bacterium and is present in both hatcheries and netpens.

¹ Andrew Bateman, et al, Descriptive multi-agent epidemiology via molecular screening on Atlantic salmon farms in the northeast Pacific Ocean, *Scientific Reports* (2021)11:3466. Accessed online March 23, 2021 at <https://www.nature.com/articles/s41598-020-78978->

excerpts from ATIP A-2020-01561-DSP

From: Miller-Saunders, Kristi <Kristi.Saunders@dfo-mpo.gc.ca>

Sent: Tuesday, December 15, 2020 1:54 PM

To: MacDougall, Lesley <Lesley.MacDougall@dfo-mpo.gc.ca>; Candy, John <John.Candy@dfo-mpo.gc.ca>

Cc: Lowe, Carmel <Carmel.Lowe@dfo-mpo.gc.ca>; Paylor, Adrienne <Adrienne.Paylor@dfo-mpo.gc.ca>; Webb, Allison <Allison.Webb@dfo-mpo.gc.ca>

Subject: FW: Tenacibaculum findings from the SSHI

FYI these documents represent the results from our Tenacibaculum research that that [REDACTED] and I have been discussing with Zac and Derek since last September. They are relevant to our risk framework pertaining to farms in the Discovery Islands and sockeye salmon, but note that our models have revealed population-level associations with survival and condition with this agent more broadly for Chinook, coho and sockeye salmon. The briefing note document provides a lay description of our findings, while the technical summary provides a detailed description of the models and results. We will be turning this around into a peer reviewed manuscript in the new year, but wanted you to be aware of the findings well in advance.

Happy to discuss further.

Thanks,

s.19(1)

Kristi

Excerpt from Dr. Miller's lay description of the findings:

The best model describes a scenario in which sockeye salmon smolts are subject to *T. maritimum* infection from both background and salmon-farm sources. Contributions from Discovery Island farms dwarfed those from other farming locations, and farm-source infection pressure peaked at 12.7 times background infection pressure.

The best model highlights that apparent *T. maritimum* prevalence need not be high to cause substantial mortality. The best-fit parameters indicate a high mortality rate and relatively low recovery rate in infected individuals, producing the decline in prevalence as fish migrate past the Discovery Islands (Figure 3). Infection in the model resulted in an 87.9% reduction in smolt survival by the end of the annual migration window, despite low average infection prevalence in the sockeye population through space and time. The maximum population-wide prevalence predicted at any time in the migration was 1.2%, and the maximum prevalence predicted by the model at any spatial location was 8.9% (Figure 3). This counter-intuitive mismatch between infection prevalence and associated mortality is, in part, due to external-source infection pressure, whereby the sockeye population itself did not have to sustain and transmit the infection internally. We note, however, that we were unable to resolve the relative role of mortality versus recovery from infection, as our best model did not significantly differ from versions without recovery (likelihood ratio test, $p=0.82$) or without infection-induced mortality (likelihood ratio test, $p=0.42$). Nonetheless, the model illustrates that *T. maritimum* has the potential to cause impact far greater than its apparent prevalence.

...

Our models raise realistic and serious concerns about farm-origin transmission of *T. maritimum* to Fraser River sockeye salmon and population-level impacts to Chinook, coho, and sockeye. As with any statistical findings, there remains uncertainty in our model results, but it is the bulk of evidence, rather than any one particular model, that should give pause. Taken together, results from wild-salmon screening within the SSHI highlight *T. maritimum* as one of the most likely candidates for population-level impacts on wild populations, and present evidence that infections in Fraser River sockeye may originate from salmon-farm sources, especially in the Discovery Islands region. Given knowledge about the depressed state of Fraser-River sockeye stocks, the evidence we have presented suggests extreme caution and further research are required.

Dr. Kristi Miller-Saunders' description of the new SSHI study for advice to the Minister:

Weekly Input: Briefing Note To Minister & MinO Briefing Schedule – December 2, 2020

Provide a short description of the issue. (1 sentence max.) Association of bacterial infection (<i>T. maritimum</i>) fish farms and migration of Fraser River Sockeye	Provide a short overview of the issue: what is it; why is this coming forward now (e.g. what is the departmental implication); key dates; actions taken or planned by the Department (including but not limited to the drafting of memorandum, meetings with stakeholders or other government officials). If a MINO briefing is requested, indicate why one is needed now. (4 bullets, 1 line each max. Spell out acronyms in first usage.)
	<ul style="list-style-type: none"> • There is recent and new evidence that the bacterial pathogen <i>Tenacibaculum maritimum</i> shed by farmed salmon may pose more than a minimal risk to migratory sockeye salmon. • Of 39 agents tested, <i>T. maritimum</i>, the causative agent of the disease mouthrot on farms, was the most strongly associated with active salmon farms as determined from a recent environmental-DNA study. • Population-level models based on surveillance data for 25 pathogens in Chinook, coho, and sockeye salmon identified <i>T. maritimum</i> as the top marine-transmitted agent consistently associated with depressed marine survival and reduced body condition • Spatial epidemiological models identify salmon farms in the Discovery Islands as the likely dominant source of <i>T. maritimum</i> infection in juvenile migratory Fraser River sockeye.

Dr. Carmel Lowe, Regional Director of Science, takes issue with the language “more than minimal risk” and instructs Dr. Miller to revise:

From: Lowe, Carmel
Sent: Wednesday, December 16, 2020 1:14 PM
To: Miller-Saunders, Kristi ; Candy, John ; MacDougall, Lesley
Subject: RE: Tenacibaculum findings from the SSHI

Kristi,
The first bullet is misleading as it suggests a formal risk assessment was conducted which I don't think was the case here? Please take another look/revise this.

Thanks
Carmel

Dr. Miller's revised version:

Provide a short description of the issue. (1 sentence max.) Association of bacterial infection (<i>T. maritimum</i>) fish farms and migration of Fraser River Sockeye	Provide a short overview of the issue: what is it; why is this coming forward now (e.g. what is the departmental implication); key dates; actions taken or planned by the Department (including but not limited to the drafting of memorandum, meetings with stakeholders or other government officials). If a MINO briefing is requested, indicate why one is needed now. (4 bullets, 1 line each max. Spell out acronyms in first usage.)
	<ul style="list-style-type: none"> • There is recent and new evidence that farmed salmon in the Discovery Islands is the dominant source of transmission of a pathogen negatively impacting survival of migratory sockeye salmon. • Of 39 agents tested, <i>Tenacibaculum maritimum</i>, the causative agent of the disease mouth rot on farms, was the most strongly associated with active salmon farms as determined from a recent environmental-DNA study. • Population-level models based on surveillance data for 25 pathogens in Chinook, coho, and sockeye salmon identified <i>T. maritimum</i> as the top marine-transmitted agent consistently associated with depressed marine survival and reduced body condition in all three species. • Spatial epidemiological models identify salmon farms in the Discovery Islands as the likely dominant source of <i>T. maritimum</i> infection in juvenile migratory Fraser River sockeye.

Carmel Lowe ordered further reworking of the advice by others on her staff:

From: Lowe, Carmel
Sent: Wednesday, December 16, 2020 1:43 PM
To: Candy, John ; MacDougall, Lesley
Subject: ROCS - ADGT Tenacibaculum_KM.docx

Both,

Can you please take another look at this – the title seems a very POOR descriptor of the bullets. Also – it would seem important to me to clarify that the results are not yet published/peer reviewed.

Carmel

From: Lowe, Carmel
Sent: Wednesday, December 16, 2020 5:31 PM
To: Sullivan, Tarah
Cc: MacDougall, Lesley
Subject: ROCS - ADGT Tenacibaculum_KM3 (002).docx
Attachments: ROCS - ADGT Tenacibaculum_KM3 (002).docx

Thanks Lesley. Tarah - I approve this version for submission thanks!

Carmel

Provide a short description of the issue. (1 sentence max.) Unpublished results from Strategic Salmon Health Initiative propose link between Discover Island farms and bacterial infection (<i>T. maritimum</i>) in Fraser sockeye and other salmon species.	Provide a short overview of the issue: what is it; why is this coming forward now (e.g. what is the departmental implication); key dates; actions taken or planned by the Department (including but not limited to the drafting of memorandum, meetings with stakeholders or other government officials). If a MINO briefing is requested, indicate why one is needed now. (4 bullets, 1 line each max. Spell out acronyms in first usage.)
	<ul style="list-style-type: none">• Currently unpublished epidemiological models identify salmon farms in the Discovery Islands as the likely dominant source of <i>T. maritimum</i> infection in juvenile migratory Fraser River sockeye• In a recent environmental-DNA study, the detection of <i>Tenacibaculum. maritimum</i>, the causative agent of the disease mouth rot on farms, was the agent most strongly associated with active salmon farms.• Population-level models based on surveillance data for 25 pathogens in Chinook, coho, and sockeye salmon identified <i>T. maritimum</i> as the top marine-transmitted agent consistently associated with depressed marine survival and reduced body condition in all three species.• Results are beginning to be developed into primary publications.

From: Lawrie, Kirsten
Sent: Friday, December 18, 2020 6:30 PM
To: Reid, Rebecca
Subject: FOR APPROVAL: ROCS - Dec 16, 2020
Attachments: FM RD Approved - ROCS - Dec 16, 2020.docx



For your review and approval:

1. Dec 16th ROCS

Signature Type: Email Approval
Due: COB Dec 18

Topics included:

- Increasing tensions from stakeholders and First Nations within the Northern Shelf Bioregion Marine Protected Area (MPA) Network Planning Process
- Bligh Island Nootka Sound Marine Oil Spill Incident Response
- Elliot Creek/Southgate River Landslide
- Big Bar Landslide Response: update
- Unpublished Results from Strategic Salmon Health Initiative Propose Link Between Discovery Island Farms and Bacterial Infection (*Tenacibaculum maritimum* (T. maritimum)) in Fraser Sockeye and Other Salmon Species
- Release of the Draft 2020-21 Crab Integrated Fisheries Management Plan (IFMP)
- The Haida Nation has expressed concern to DFO about a “super trawler” operating off the north coast of Haida Gwaii.

Conclusion

In the course of a day, “serious and realistic concerns” that Fraser River sockeye are experiencing mortality of up to 87.9% from *t. maritimum* in the Discovery Islands, requiring “extreme caution” considering the perilous state of many Fraser sockeye populations, were watered down to “unpublished results suggest link” and “paper in progress” by senior DFO aquaculture management.

It remains unclear whether or not this advice was even given to the Minister prior to the announcement of her decision on December 17 to close salmon farms and this has serious ramifications. The evidence forms no part of the record of her decision currently before the courts hearing the judicial review applications of salmon farm companies. Those companies are seeking to overturn the decision to prevent restocking of the Discovery Island farms through an injunction application being heard as this presentation is being given; and the court will have no evidence before it of the magnitude of the risk to wild salmon if it grants the injunction.

This whole process has been repeated countless times within DFO as new evidence emerges of threats to wild salmon from the farms. The reason it keeps happening is that DFO is charged with both promoting the industry and regulating it; while protecting wild salmon. The only way they can reconcile this conflicted mandate is to point to other causes of decline of wild salmon and suppress evidence of the impacts of salmon farms.

It is accordingly of the utmost urgency that Parliament should:

- 1) amend the mandate of the Department, shifting responsibility for promotion of the industry out of DFO; and
- 2) support the Fisheries Minister to continue rapidly with the removal of the remaining salmon farms from coastal waters.