DALHOUSIE UNIVERSITY

May 27, 2022

The Honourable Steve Craig, E.C.N.S.
Minister of Fisheries and Aquaculture
1741 Brunswick Street, Suite 405
Halifax, NS, B3J 3X8

Dear Minister Craig:

Re: Nova Scotia Aquaculture Science Advisory Committee Science Advice on the Bayswater Beach Study (NSASAC-2021-01)

On behalf of the Nova Scotia Aquaculture Science Advisory Committee (the Committee), please accept this submission of Science Advice on the Bayswater Beach study as outlined in the April 28, 2021 report titled, *Investigating Concerns of Marine Finfish Aquaculture Impacts at Bayswater Beach Provincial Park, NS*.

On August 16, 2021, the Committee received the Request for Science Advice from the Department of Fisheries and Aquaculture on this matter and began its review. Additional information regarding current velocity data for Aspotogan Harbour was requested by the Committee and provided by the Department on September 27, 2021.

The Committee met on October 29, 2021 to discuss the findings of the report, request and review any supplementary information, and deliver its science-based recommendations in response to the issue requiring science advice. Input was provided by all committee members and the advice has been formulated by consensus.

Please find enclosed the originating Request for Science Advice from the Department and the resulting Science Advice on the Bayswater Beach study from the Committee for your consideration.

Yours sincerely,

David Gray

Dr. David Gray
Chair, Nova Scotia Aquaculture Science Advisory Committee

Enclosures

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NOVA SCOTIA AQUACULTURE SCIENCE ADVISORY COMMITTEE
REQUEST FOR SCIENCE ADVICE

☒ NEW REQUEST **REQUEST ID#:** NSASAC-2021-01
☐ PREVIOUS REQUEST (CARRY-OVER)

Title of Request:
Investigating Concerns of Marine Finfish Aquaculture Impacts at Bayswater Beach Provincial Park, NS

REQUEST DETAILS

Issue Requiring Science Advice (to be posed as a question):
Does the committee have any recommendation(s) that may or may not suggest that further action is required to address concerns raised by residents of Bayswater, NS that a marine salmon aquaculture operation is/was the cause of odorous, black sediment at Bayswater Beach Provincial Park?

Rationale and Background Information:
The Nova Scotia Department of Fisheries and Aquaculture (NSDFA) set out to address concerns raised by residents of Bayswater, Nova Scotia that the nearby marine finfish aquaculture operation, (AQ#1006) was the source of organics decomposing on Bayswater Beach Provincial Park (Bayswater Beach), resulting in the production of black sediment and sulphurous odours. A focused sediment composition study at Bayswater Beach, Nova Scotia was initiated in November 2020. This study was conducted to characterize the composition of sedimentary organic matter (SOM) on Bayswater Beach and compare with marine sediment samples collected from underneath nearby aquaculture pens. The suite of qualitative (visual indicators) and quantitative indicators (oxidation-reduction potential, free sulfide concentration, porosity, and organic matter) used to assess seafloor sediment conditions for Nova Scotia's Environmental Monitoring Program were measured at regular intervals along two (2) transects beginning at the southwestern edge of lease AQ#1006 and extending toward Bayswater Beach. Sediment samples collected from Bayswater Beach and the marine environment were analyzed for carbon and nitrogen isotopes (^{13}C, ^{15}N) at the Queen's University facility for isotope research (QFIR) laboratory in Kingston, Ontario. The beach area was also investigated from a geomorphological and limnological perspective to provide further insight into possible sources of

SOM on Bayswater Beach.

Visual and geochemical analyses performed by NSDFA suggest that discernable environmental impact resulting from aquaculture related organic deposition was relatively low in the area adjacent to and immediately surrounding AQ#1006. Evidence of environmental impact, based on the parameters assessed, was seen to dissipate with increasing distance from the lease boundary, suggesting that the transport of organic materials resulting from finfish production is limited to a relatively small area around AQ#1006. Comparison of stable C-N isotope signals in SOM collected from the beach and near-lease benthos suggest that the organic materials found at these environments do not appear to share a common source. Historical, visual, and geomorphological assessments of the beach and its surrounding area offer the suggestion that SOM accumulation on the beachfront may be influenced by input from the connected Bayswater Pond and significant levels of macrophytic algae present locally.

Supporting Documentation (attachment or link):	
1.	Report_Apr._28_2021_-_Investigating_Concerns_of_Marine_Finfish_Aquaculture_Impacts_at_Bayswater_Beach_Provincial_Park_NS.pdf (novascotia.ca)
2.	Current velocity data for Aspotogan Harbour (Lunenburg County) provided to NSASAC on September 27, 2021 via email: https://data.novascotia.ca/browse?q=current+velocity&sortBy=relevance&tags=current+data
3.	
4.	
5.	

Timelines for Receiving Science Advice:
~~September 20, 2021~~ October 29, 2021

REQUESTING ADVICE

Name of Director (or Delegated Authority)	**Request Date**
Jessica Feindel, Manager of Aquaculture Operations	June 14, 2021
Name of Coordinator/NSDFA Staff	**Date Submitted to Committee**
Jennifer Feehan	August 16, 2021

NOVA SCOTIA AQUACULTURE SCIENCE ADVISORY COMMITTEE
SCIENCE ADVICE

REQUEST ID#: NSASAC-2021-01

Title of Request:
Investigating Concerns of Marine Finfish Aquaculture Impacts at Bayswater Beach Provincial Park, NS

SCIENCE ADVICE

Issue Requiring Science Advice (to be posed as a question):
What is the probability that beach observations made by residents of Bayswater, Nova Scotia were caused by the nearby marine finfish aquaculture operation? Does the committee have any recommendation(s) that may or may not suggest that further action is required to address concerns raised by residents of Bayswater, NS, that a marine salmon aquaculture operation is/was the cause of odorous, black sediment at Bayswater Beach Provincial Park?

Summary of Committee Review:
The Nova Scotia Aquaculture Science Advisory Committee has reviewed the report titled, *Investigating Concerns of Marine Finfish Aquaculture Impacts at Bayswater Beach Provincial Park, NS*, prepared by the Nova Scotia Department of Fisheries and Aquaculture dated April 28, 2021. The Committee met on October 29, 2021, to discuss the information in the report and request any additional information required to deliver science advice on the questions described above. During the Nova Scotia Aquaculture Science Advisory Committee meeting, members discussed supplementary observations, including oceanographic information, that were not detailed in the Bayswater report. This included information such as prevailing ocean currents, seafloor bottom profile, further details on study transects, and the movement of sulphides and organic matter towards the shore. The Committee discussed direct and indirect causes of accumulation of organic matter on beaches in general. Direct sources are advective, meaning dissolved forms or particles are carried directly to a beach, whereas indirect sources go through various organic or inorganic processes before eventually arriving to a beach. The Committee also discussed continuous and episodic causes of accumulation of organic matter on beaches. Continuous sources are persistent and ongoing, where organic matter is arriving to the beach from the water column and sediments. Episodic sources occur when matter is brought to the beach during an extreme event, such as a storm or spill, and

are infrequent. The Committee determined it was important to include these details and definitions as they informed the review.

The Committee reviewed oceanographic information from the Bayswater Beach area. It was determined that the oceanographic data indicates a predominantly alongshore current direction, which suggests there are not regular onshore advective occurrences that would result in organic matter from the aquaculture farm collecting on the beach. Additionally, hydrodynamic data and wave projections suggest that it is not likely that there would be direct transport from the farm to the beach due to the farm being situated behind Saddle Island. *The Committee concluded that due to the alongshore vector of currents at this beach and the additional information on the depths of transects from the aquaculture farm to the beach, the most probable factor expected to bring a significant amount of organic matter of any kind from the ocean to this beach would be large onshore wind waves and, or ocean swell associated with episodic weather events. In the absence of such events, a number of other sources would contribute to the organic loading of the beach, which would be comparable to other beaches around Nova Scotia and the Atlantic region.*

The Committee discussed satellite images of Bayswater Beach and observations made during benthic sampling show that the local seabed supports large beds of macroalgae (seaweed). Consideration was given to seasonal patterns of seaweed growth, during which seaweed naturally breaks off and may be transported to the shore, where it decomposes on beaches. It is important to recognize the time lag of organic decomposition, such that beach wrack (algal detritus) accumulates on beaches and persists long after the storm event. *The Committee concluded that it is common to have large amounts of seaweed deposited on beaches, including along the Atlantic coast of Nova Scotia, and this natural cycle could be responsible for observations of organic material at this beach.*

The Committee reviewed the data presented in the report regarding benthic sampling and stable isotope analysis of samples collected underneath aquaculture pens and at regular intervals along two transects extending from the aquaculture farm toward Bayswater Beach. The Committee recognized that the study adequately demonstrated that the deposition of organic material linked to the aquaculture operation is limited to seabed in the immediate proximity of the lease area, and its presence declined rapidly to background levels with increasing distance from the site. *The Committee concluded that data presented from these analyses did not demonstrate a signature from the farm on the beach, and therefore it is unlikely that the aquaculture farm is the cause of the reported organic loading and breakdown leading to the observed odour.*

Advice of Committee:

Upon review of the evidence available, the Committee has concluded that the data presented in the report are valid and relevant, and the Committee is satisfied with the scientific work completed by the Department for this study.

The consensus of the Committee on the question posed is that there is a very low probability that the presence and operation of a nearby marine finfish aquaculture lease was the cause of odorous, black sediments at Bayswater Beach reported by residents of Bayswater, Nova Scotia.

This conclusion is based on the following:

- There is no defensible scientific evidence to support the claims that a marine salmon aquaculture operation has been the direct cause of excess organic loading resulting in odorous sediment at Bayswater Beach Provincial Park.
- The scientific evidence provided does not indicate a continuous deposition of organic matter on the beach, nor does it support any conclusion of direct impact from the aquaculture farm on Bayswater Beach. This conclusion does not rule out the possibility of indirect effects, but there is no evidence of such.
- The stable isotope analysis showed that no signatures from the farm-deposited organic material were present in the samples collected at Bayswater Beach.
- Natural processes occurring at the beach and episodic weather events are most likely to affect beach conditions, including accumulations of organic material derived from terrestrial and marine sources and their subsequent decomposition.

It is noted that identifying the actual cause of the reported odour is outside the purview of the Committee; however, the Committee is supportive of future research that assesses alternative hypotheses of direct or indirect causes of the intermittent odour and expand scientific knowledge of this area. The Committee also recognizes that additional work being done on Bayswater Pond located behind the beach, could provide further information about the odorous sediment at Bayswater Beach.

The Committee advises the **Department** to complete the following additional work:

- Revise the report to update 'Figure 1' on page three so y-axis units are percent only and kilograms is removed.
- Revise the report to include information on transect depths and the depth profile from the aquaculture site to the beach.
- Revise the report to include a summary of the hydrodynamic data.
- Revise the report to include a section on 'Areas of Uncertainty' to acknowledge and/or address knowledge gaps in the information presented.

The Committee advises that this is a complex environment with many unknown, interacting variables. The Committee recommends that future reports of odorous sediment at Bayswater Beach require a better understanding of the local ecology in the Bayswater area,

and of onshore transport mechanisms along the Atlantic coast. This work could be done by various stakeholders and be shared with academic institutions and community groups who are already undertaking relevant and related studies to further the understanding of the situation at Bayswater Beach. It could include:

- Conducting a literature review of the spatial and temporal patterns of the mechanisms and patterns of delivery and deposition of beach wrack in Atlantic Canada, relating the results to Bayswater Beach.
- Monitoring nearshore hydrodynamics and sediment organic content at Bayswater Beach and other beaches near and far, with and without adjacent aquaculture operations.
- Analysis of CHN (carbon, nitrogen and phosphorous) ratios in sediment samples could provide additional data support. Although, it is noted that challenges with this approach exist due to decomposition and the passing of time.

APPROVAL

Approval Date	Name of Chair of Committee	Submission Date
May 25, 2022	Dr. David Gray	May 27, 2022