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Newfoundland and Labrador Region | Science Response 2019/029

REVIEW OF GRIEG NL SEAFARMS AQUACULTURE SITING BASELINE ASSESSMENTS FOR THE RED ISLAND BAY MANAGEMENT AREA IN PLACENTIA BAY

Context

Grieg Seafarms NL (GNL) has applied to the Province of Newfoundland and Labrador (NL) for three new aquaculture site licences within the Red Island Bay Management Area (BMA) in Placentia Bay, located on the south coast of Newfoundland (Figure 1). As per the Canada-NL Memorandum of Understanding on Aquaculture Development, the NL Department of Fisheries and Land Resources has forwarded these applications to Fisheries and Oceans Canada (DFO) for review and advice in relation to DFO's legislative mandate. These applications are supplemented by information collected by the proponent as required under the Aquaculture Activities Regulations (AAR).

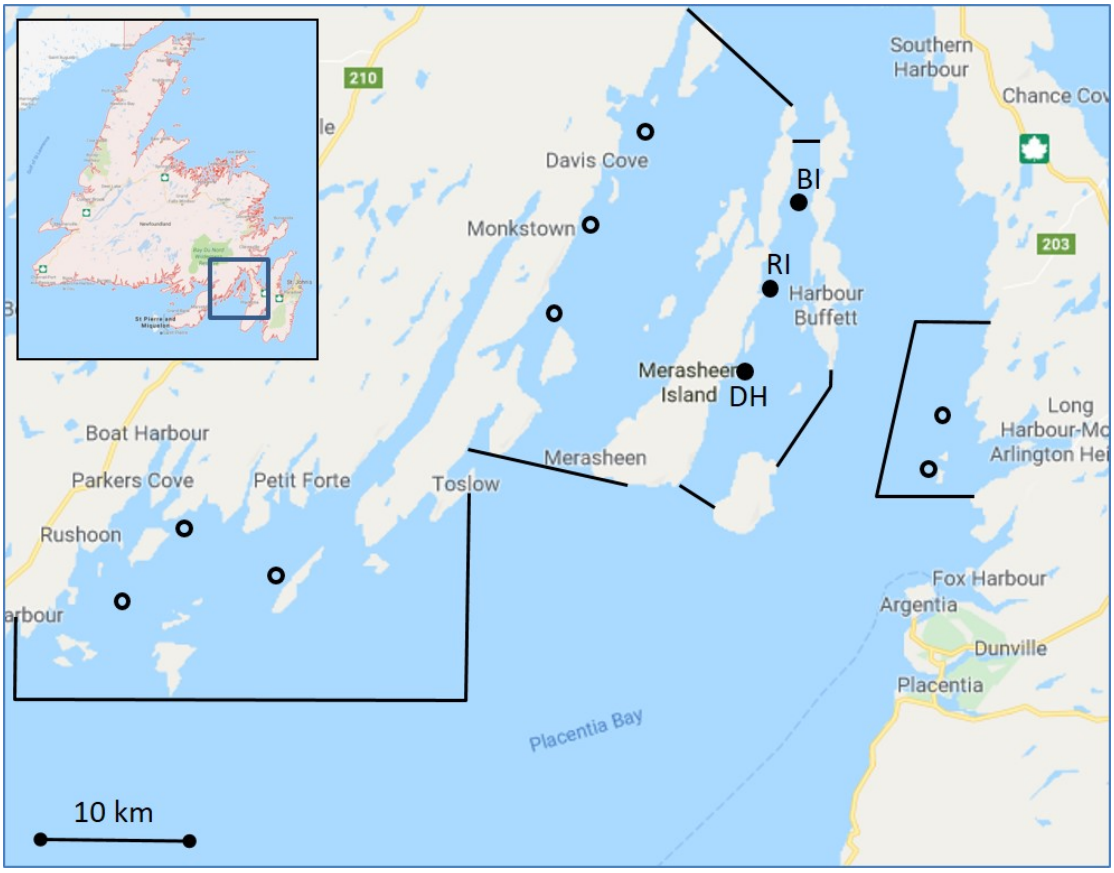

Figure 1: Location of the proposed aquaculture sites within the Red Island Bay Management Area in Placentia Bay, Newfoundland (solid circles). DH-Darby Harbour, RI-Red Island, BI-Butler Island. Open circles represent the locations of proposed aquaculture sites that will be reviewed at a later date. Straight black lines delineate BMAs.

On June 21, 2019, DFO's Regional Aquaculture Management Office of the Ecosystems Management Branch in the NL Region requested that DFO Science undertake a review of the three site applications within the Red Island BMA. The request was to determine if the predicted benthic effects, as demonstrated by the output of the depositional model used by the Proponent and based on visual benthic observations, are consistent with the scientific knowledge of the potential impact of this operation. These proposed aquaculture sites would be the first to farm Atlantic Salmon in Placentia Bay. The review of eight additional GNL site applications within the three other BMAs (Figure 1) will be completed at a later date.

A draft Aquaculture Siting Framework was recently developed to guide the scientific review of proposals for new or amended marine finfish aquaculture sites in Atlantic Canada. This Framework was first utilized by the NL Region in 2019 to assess 13 proposed Atlantic Salmon aquaculture sites on the south coast of Newfoundland during a Canadian Science Advisory Secretariat (CSAS) NL Regional Peer Review process. The limited timeline for the current Science Response Process prevented the use of the Aquaculture Siting Framework, precluding a comprehensive scientific review.

This Science Response Report results from the Regional Science Response Process of July 17, 2019, on the Review of Grieg NL Seafarms Aquaculture Siting Baseline Assessments for the Red Island Bay Management Area in Placentia Bay.

Background

Grieg Seafarms NL's Placentia Bay Atlantic Salmon Aquaculture Project, which included 11 sites and a hatchery, had been previously reviewed through two previous DFO CSAS processes (DFO 2016, 2018). In 2016, a CSAS Science Response Process was held to review the NL Regional Introductions and Transfers Committee's Risk Assessment on the Proposed Use of European-strain Triploid Atlantic Salmon in Marine Cage Aquaculture in Placentia Bay, NL (DFO 2016). This review considered the genetic, ecological, and disease risks to wild populations.

In 2018, a CSAS Science Response Process was held to review the Environmental Impact Statement (EIS) for Grieg's proposed Placentia Bay Atlantic Salmon Aquaculture Project (DFO 2018). The project was released from further environmental assessment by the NL Department of Municipal Affairs and Environment on September 5, 2018.

The Proponent submitted licence applications for three sites within the Red Island BMA, located in the inner portion of Placentia Bay, Newfoundland. The current process is intended to answer the following question:

- *The proponent has used a depositional model to predict the extent of biochemical oxygen demanding (BOD) benthic deposition on the proposed aquaculture sites. Given the fish and fish habitat identified by the proponent within the proposed leased boundaries, what is the significance of this deposition to the biodiversity within the lease areas?*

Analysis and Response

Oceanographic Measurements

Current data were collected and analyzed following the Norwegian Standard (NS 9415:2009), which has not been validated within the Newfoundland context. Currents were measured by Acoustic Doppler Current Profilers (ADCP) and single-point current meters at various depths of

the water column for approximately 40 days at the three proposed sites, with near-surface and subsurface currents measured during the winter and summer, respectively. As a result, they could not be combined to provide a full description of the vertical water column structure.

Although the data provided were consistent with the AAR guidance, prescriptive regional specific guidelines would provide a more informative dataset. The observed currents do not capture the seasonal variability, which is important in the region. Although freshwater input was mentioned, its impact on ocean currents was not considered. Measurement and description of currents, temperature, and salinity in the full water column for winter and summer would provide a thorough understanding of the seasonal variability and vertical structure at the proposed aquaculture sites.

The reported tidal currents and non-tidal currents from the ADCP data at 25 m depth are questionable. The spikes in measured currents and subsequent scatter plots reported at this depth suggest potential errors with the retained data. It was unclear if the harmonic analysis was able to fully resolve the tidal constituents included, given the short duration of data collection. It is suggested that further quality assurance/quality control (QA/QC) be completed for these datasets.

Given the short timeframe over which currents were measured, the accuracy of the 10-year and 50-year current estimates is questionable. The report should also clarify whether the estimated 10-year and 50-year values were used for any calculations throughout the assessment.

Flow and Deposition Modelling

In the present application, a three-dimensional flow model based on Delft3D-Flow (2018), was used to calculate water circulation and further assess waste deposition around the proposed sites.

The nesting approach with high spatial resolution in the vicinity of the aquaculture sites was appropriate, although additional information regarding the model lateral open boundary condition for the outer model would be informative. It was unclear if non-tidal sea level and currents were considered on the open boundary and whether the impact of the inshore Labrador Current on the Placentia Bay circulation was properly included.

The description of the surface boundary forcing was lacking. The report would have benefited from additional information on the spatial and temporal resolution of the atmospheric forcing (winds, air pressure, heat flux) and whether wind forcing sufficiently represents the orographic effect in the vicinity of the aquaculture sites.

Further refinement of the model would be needed for computation of deposition at the farm sites using the modeled currents. Throughout the assessment of each proposed site there were discrepancies between modelled currents and observed results for the same time periods. Limitations in the model dynamics, parameterization, open boundary conditions, and atmospheric forcing were not discussed in the licence applications. In addition, previous oceanographic studies pertaining to water circulation in Placentia Bay (e.g., Hart et al. 1999, Ma et al. 2012 and 2017) were not referenced.

Additional information on the methods used to calculate benthic deposition at the proposed sites and whether resuspension was integrated in the depositional model should be included in the licence applications. Furthermore, validation of model outputs through field sampling is recommended post-production.

Benthic review

In the applications, the benthic habitat review was based on published multi-beam sonar survey with sub-bottom profiler (Shaw et al. 2011) and identified three main seascapes with associated biota for the proposed sites. Video footage and associated information on substrates and benthic descriptors of flora and fauna were also provided in summary tables; however these data were not discussed in the licence applications and information on sampling methodology was not included.

The video footage was insufficient to characterize benthic habitat and biota at the proposed aquaculture sites. The use of a 100 m grid sampling design, as per the AAR, would provide the spatial interpolation required to characterize benthic habitat and diversity.

Habitat Classification

Among the habitat/substrate seascapes identified in Shaw et al. (2011), three were observed at the proposed sites: deep-water bedrock, sub-littoral bedrock, and deep-water muddy; whereas, submitted interpretation of video footage classified the substrate as hard and soft. Given the differing habitat classifications, details on habitat categorizations and related methodology should be included in the description of the sites, as these are complementary to, and more site-specific than, Shaw et al. (2011). A comparison of the two seascape classifications would be needed to validate the multi-beam output.

A map of the video data locations overlaid on the multi-beam data should be included in the reports to determine if the locations are representative of the differing benthic physical and biological characteristics as required by the AAR.

Biota Classification

Within the licence applications, consolidated data regarding the fish and fish habitat survey as required by the AAR, were not provided. Biota descriptions focused on published data from Shaw et al. (2011), which is considered limited in comparison to the information required for a review of the benthic environment. The biota included in Shaw et al. (2011) was restricted to generalized information on the presence of sea anemones, tube/borrow openings, for deep-water bedrock; infauna of annelids and bivalves, gastropods, Snow Crab and shrimp for deep-water muddy and attached infauna lithothamnion (coralline algae), seaweed, etc. for sub-littoral bedrock seascapes; it was assumed that all substrate and benthic communities were similar per seascape. However, some video footage did not always correspond with the inferences made using Shaw et al. (2011) that are not site specific. In some cases, video revealed the presence and density of brittle stars, sand dollars, burrowing anemones, and soft corals. This highlights the fact that the description as per Shaw et al. (2011) is not comprehensive. The supplementary tables provided, summarizing the video footage, should be adequately integrated into the bottom sample descriptions (Section F) of the licence application.

These supplementary tables were based on drop video images, with the primary function to groundtruth the multi-beam survey that was used to characterize benthic fish habitat. Density estimates could not be achieved due to the lack of a reference scale. A description of the methodology, including information pertaining to spatial scale, sample size, and camera resolution was lacking. The method of data collection was inadequate for determining biodiversity compared to the methods outlined in the AAR. The limited number and quality of images prevented a thorough benthic characterization.

Groundfish eggs, larvae, and juveniles were not considered within the licence applications, despite published literature indicating their presence in the vicinity of this BMA (e.g., Gregory and Anderson 1997, Robichaud and Rose 2001, Bradbury et al. 2003, Snelgrove et al. 2008). Additional published literature which outlines the presence of other species and benthic-linked life-history stages within the BMA, such as Capelin, Lobster, and adult groundfish should be considered and discussed (e.g., O'Brien et al. 1998, Sjare et al. 2003, Ramey and Snelgrove 2003, Lawson and Rose 2000, Mello and Rose 2005).

Conclusions

The limited timeline afforded to the subject matter experts prevented the use of the draft Aquaculture Siting Framework for the current CSAS process and precluded a comprehensive scientific review.

The description of model methodology and evaluation of the flow model results are insufficient. Further refinement and validation of the model is needed for computation of deposition at the farm sites using the modeled currents.

The video footage provided was insufficient to characterize benthic habitat and biota. A more thorough video survey as per the AAR guidelines is recommended. It is also recommended that video footage summary tables be included in the licence applications. The habitat classification and related methodology should be included in the description of the sites, as they are complementary to, and more site-specific than, Shaw et al. (2011).

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