DEPOSITIONAL MODEL REVIEW – WALLACE COVE BASELINE ASSESSMENT REPORT

Context

The Proponent, Marine Harvest Atlantic Canada (MHAC), has applied to amend an existing finfish aquaculture license in Wallace Cove, Newfoundland and Labrador, which is located on the south coast of Newfoundland in Facheux Bay. The site was previously licensed to Gray Aqua Group Ltd.; the assets of which were bought by MHAC in 2018. The application seeks to expand the area of the site lease. In accordance with the Aquaculture Activities Regulations (AAR), MHAC has submitted a Baseline Assessment Report which includes predictive modelling of the dispersal of waste from site operations including the predicted contours of biological oxygen demand (BOD) at peak biomass. MHAC used DEPOMOD v2.2 (Cromey et al. 2000, 2002) to predict the effects on the benthos in the proposed expansion area.

On November 5, 2018, the Regional Aquaculture Management Office of the Ecosystems Management Branch in the Newfoundland and Labrador Region requested that DFO Science undertake a review of the Wallace Cove Baseline Assessment Report to determine if the DEPOMOD v2.2 model output is supported by current relevant scientific knowledge of local oceanographic conditions and nature of the substances that may be released at the site. Science Branch undertook a Science Response Process (SRP) for this review. The information from this scientific review will be provided to Ecosystems Management to help form part of the Department's contribution to the provincial siting decision for this site.

This Science Response Report results from the Regional Science Response Process of November 16, 2018 on the Depositional Model Validation - Wallace Cove Baseline Assessment Report.

Analysis and Response

General Comments

Overall, the company has fulfilled the AAR requirements and the report is relatively clear in terms of ocean current data collection. More details are needed to explain the methodology used and the appropriateness of the data selected for their analyses.

DEPOMOD v2.2 was run with current data taken from three depths. It is suggested that the report include additional context on why those depths were selected. The statistics and time-series of the current speed suggest some vertical structure of the currents. This should be considered in order to define different layers of water circulation, which are key to modeling dispersion. A temperature and salinity profile, accompanied with a brief description supporting the choice of ocean current depth inputs to the model should be provided to demonstrate the site-specificity of the oceanographic data used for model inputs.

The current time-series was limited (one month); however, the timing chosen by the Proponent to measure currents during annual peak feeding was appropriate. While the current AAR

requirements are met, it is recommended that the report include a discussion of the potential implications of using only 30 days of data in an environment not dominated by tides.

More details on the DEPOMOD inputs and run should be provided. For example, it was not clear whether DEPOMOD was run for a period of 22 months with repeated/looped 30 day currents time-series, or for the length of the current time-series themselves (30 days). Particle settling velocities for food pellet and fish feces should also be provided for clarity.

Specific Report Comments

Baseline Assessment Report

Page 2. Average current speeds of 3.3 cm/s to 9.6 cm/s are known to be variable in the region (e.g. DFO 2016). At a minimum, the standard deviation should be provided in the report.

Page 2. *"…the Wallace Cove site has a minimum of 191 m depth of water below the cages and this will aid in the dispersal of any feces or fouling produced by the operation."* Additional information to support this statement is requested.

Page 3. The report states that Acoustic Doppler Current Profilers (ADCPs) were deployed in 345 m of water. The range of the water column covered should be stated. Two WH300 would cover approximately 200 m, which is less than the water column at the site (345 m depth). The percentage of water column coverage should also be included in the report.

Current meter data was collected for 30 days. The data do not reflect the seasonal variability of the site which is likely to be high based on studies conducted adjacent to the area (DFO 2016). This should be discussed in the report.

Table 2. A cross-correlation analysis of currents would provide more information on the vertical current structure and would assist with the determination of depths for currents which should be used for deposition modeling. Alternatively, temperature and salinity profiles could be provided. Given the accuracy of the measurement (order of 1 cm/s for speed, one degree or more for direction), two digits precision can be misleading. It is recommended that the report round the measurements to one decimal place for the mean speed and to nearest integer for maximum speed, current direction and percent occurrence.

Table 6. DEPOMOD model inputs. An explanation of why three depths were used (15 m, 119 m, 338 m) should be provided (i.e. was this based on evidence of a three layer water structure). Also, clarification is required on why the 15 m depth was used when the report indicated the first 'good bin' at approximately 10 m. The used settling velocities (feces and pellets) should be provided in Table 6, as this is a critical parameter to simulate particles dispersion.

Table 6 does not clearly indicate how the 22-month cycle was produced. If it was assumed that the 30-day current velocity record would be representative of the 22 month period, it should be stated in the report.

Appendix A: Data Report: Current Measurements

Page 2. A single point Aquadopp current meter was used to obtain the near-bottom (+7 m) measurement. This is more than the "preferred" 5 m. A discussion of the implication should be provided.

Page 2. *"ADCPs also cannot measure within 6% of the range to surface and/or bottom, due to acoustic side lobe interference. This restriction, the water depth, as well as the nominal ranges for the 300 and 600 kHz ADCPs, largely determines the ADCP configurations and deployment*

depths." This statement is correct; however, three WH300s or a single 150 kHz would have been more appropriate to cover (almost) the entire water column for this site (> 300 m).

Page 3. The observation regarding reduced ADCP ranges at the Wallace Cove site is not unexpected (see Record and de Young 2006). A discussion of the implications of this on both measurements (i.e. range loss and statistic representativeness) and modeling (i.e. providing statistically robust time-series of currents to model finfish farm waste settling on the sea-bottom at the site) would be beneficial.

Page 4, Figure 3. While Figure 3 is illustrative, a figure (i.e. plot) of the reduced range over time is recommended. The report should also be updated to provide clarification on whether the measurements at any given depth were or were not representative. This is key for substantiation of the modeling work. For example, sampling the surface layer only at night (i.e. when zooplankton were present) cannot justify that the hydrodynamics are properly sampled.

Page 7. In reference to *"Records were flagged that exceeded the following limits",* the units should be provided.

Page 7. *"Since the missing data is daylight related, and not tidal related, the data collected is unbiased and represents the current speed distribution over the 30 days."* This is not correct. Tides have diurnal signals (24 hour) that would be aliased by a diurnal sampling and a broad range of other signals (from hours to days) that may be present at this location and could be aliased as well, as indicated in the figures of the time-series provided. The result of a tidal analysis and/or spectrum analysis should be provided to support statements regarding the role of tides in the circulation at the proposed site.

Time-series of the range and percentage of time coverage at each sampled depth should be provided to assess whether or not the measurement is representative. In Newfoundland, DFO uses 80% coverage as a quality threshold based on the analysis of more than nine years of data collected in the general area; using coverage less than 80% would not be appropriate.

Page 7. Mid-water current. The figures show estuarine circulation. A figure illustrating current direction for the entire water column is suggested. When using DEPOMOD, it is recommended to first find the depth at which the currents are lowest (i.e. change of direction of the mean current), and then use that depth to evaluate the other depths from which current data will be used for DEPOMOD.

Page 8. Clarification is required on how the maximum and mean currents were calculated (i.e. maximum value and average value of the speed for/at a given direction).

Conclusions

The objective of the Science Response Process was to determine whether the (DEPOMOD) model output is supported by current relevant scientific knowledge of local oceanographic conditions and nature of substances that may be released at the site. **Overall, the company has fulfilled the AAR requirements and the report is relatively clear in terms of ocean current data collection. The DEPOMOD simulation results appear to be reasonable based on the input information used to run the model.** However, the report would benefit from additional explanation of the selection of these model inputs and assumptions.

General comments on the use of DEPOMOD simulations in the NL Region and reporting for future baseline assessments have been provided in this Science Response Report. In particular, as a recommendation for future baseline assessments, the selection of depths of the

currents used to run the deposition model should take into account the vertical structure of the water column. This structure can be evaluated using temperature and salinity data (for stratification) or/and cross-correlation of the currents at different depths. As the structure is specific to each site, its consideration will verify the appropriateness of the data to the site.

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Sources of information

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