Running Tide Iceland Research Program Progress Report

2024-Q1

This report outlines the progress and status of Running Tide's research program in Iceland, submitted to the Marine and Freshwater Research Institute and the Environment Agency of Iceland, and is part of the consultation and progress update requirements set out in the research permit issued by the government of Iceland on July 8, 2022.

Our current focus is processing the data from last year's deployments (Phase 1 of our research program) and planning the next phases.

This progress report includes updates on the following research programs and reports focused on furthering knowledge on the efficacy and potential environmental impacts of ocean based carbon removal:

1. Macroalgae at Alda - 2023 Annual Report
2. Coastal Benthic Experiment
3. Model- and literature-based assessment of biogeochemical changes to the benthic environment, following the deployment of biomass (NIVA)
4. Forest Floor to Ocean Floor: Poster at 2024 Icelandic Forestry Conference

Appendixes to Research Program Progress Report	
Appendix I	Macroalgae at Alda - 2023 Annual Report
Appendix II	Model- and literature-based assessment of biogeochemical changes to the benthic environment, following the deployment of biomass (NIVA)
Appendix III	Poster at 2024 Icelandic Forestry Conference: Forest Floor to Ocean Floor

For any additional questions, please contact

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1. Macroalgae at Alda - 2023 Annual Report

In parallel with Phase 1 of our research program in Iceland (repeat experiments of deployment of coated wood chips), we've been developing the seeding capabilities needed for next phases, i.e. the deployment of macroalgae seeded substrate.

The Macroalgae at Alda report discusses the process and capabilities of the facility as we ramp up the cultivation of macroalgae seedstock, develop novel protocols and processes, and optimize seeding and attachment. The facility is now capable of supplying seedstock for our off-shore experiments.

Read more in the attached report.

2. Iceland Benthic Study Update

Fifteen sampling trips have now been completed since the baseline samples were collected for the coastal benthic experiment in Hvalfjörður. Sediment and seawater have been sampled regularly and data collected from loggers that were placed with the material, in both a control and an experimental plot.

45 weeks after the start of the experiment, no significant effects of the deposited biomass have been observed on pH, total alkalinity, calcium and dissolved organic carbon in seawater and total nitrogen and total organic carbon in sediment.

This experiment is one of multiple benthic research projects Running Tide is engaging in related to the fate and impact of carbon removal material deposited in the benthic environment, but is the first one conducted within Icelandic waters. The experiment is due to end in june this year and a final report will then follow.

3. Model- and literature-based assessment of biogeochemical changes to the benthic environment, following the deployment of biomass (NIVA)

Running Tide engaged NIVA (The Norwegian Research Institute for Water and the Environment) to assess the biogeochemical impact of our deployment system on water quality. The institute wrote a model- and literature-based assessment for Running Tide, which was then presented at the **European Geosciences Union General Assembly in 2024**.

The goal of this work was to assess the environmental impact of woodchip and calcium carbonate deployments in the Norwegian Sea as a marine carbon dioxide removal (mCDR) approach. For this the 2-Dimensional Benthic Pelagic Model (2DBP) was used, coupled with biogeochemical Bottom RedOx Model (BROM). In this study the maximum weight of wood chips that can be accumulated on the seafloor without dramatic changes was evaluated,

focusing on the oxygen regime, acidification and biogeochemistry that can negatively affect the local ecosystem.

The report consists of three efforts:

1. A review of the available literature as it relates to specific risks (Sections 1.2, 1.3 and summarized in Table 7.2)
2. The development and application of a biogeochemical model (Sections 0 and 3)
3. Discussion of the model results.

The model was used to evaluate the maximum amount of wood chips that could be added to the benthic (or seafloor) environment before leading to adverse impacts to oxygen and acidification in benthic water.

The model was conservative, as it did not account for drifting in the surface water before sinking (Running Tide wood chips float and disperse on the surface for hours to weeks before sinking). **The model shows that deploying 2000 metric tonnes of wood chips in 24 hours in 1 km^2 surface area with no dispersion is the recommended threshold for the studied area.**

The results show a benthic density of 3600 gC/m^2 and 5 mm deep is still within good water quality. For reference, the density of wood chips on the seafloor during the 2023 deployments from Iceland was modeled to be, at a maximum, 30 gC/m^2 and ~0.06 mm deep.

The report is attached.

4. Poster at 2024 Icelandic Forestry Conference: Forest Floor to Ocean Floor

Running Tide presented a poster at the 2024 Icelandic Forestry Conference about our biomass research.

Running Tide's goal is to improve ocean health by reducing the amount of carbon currently in the fast carbon cycle (atmosphere, upper layers of the ocean, biosphere). To that end, Running Tide is developing a system where small, passively floating drifters, made from terrestrial biomass, alkaline materials, and seeded with algae seeds, are deployed in the open ocean. The alkaline materials enhance ocean alkalinity, the algae grows and binds CO2 via photosynthesis, and the entire drifter sinks after a predetermined duration to the deep sea, where the carbon is durably sequestered in the slow carbon cycle. For this purpose, Running Tide seeks to source biomass that isn't being used for infrastructure and would in most cases release carbon back to the atmosphere in near future through decaying or burning.

The poster is attached.