Global Water Futures 2021 Operations Team Meeting – Project Reporting Template

Instructions: All GWF projects are asked to provide a summary update on their activities and accomplishments in preparation for the upcoming Operations Team meeting. **Please submit these by email to chris.debeer@usask.ca by no later than December 2.** These will be used to help guide discussions and breakout synthesis activities and will be made generally accessible on our website in advance of the meeting.

Project Name:	Warming Estuaries, Closing Gates: Understanding Estuarine Thermal Sensitivity to Climate Change (small $70k project funded through the Ocean Frontiers Institute CFREF and a GWF Affiliate Project)

Our major accomplishments to date are:

- **Journal publication** (three others in prep for this project): KarisAllen J, Kurylyk BL. 2021. Drone-based characterization of intertidal spring cold-water plume dynamics, Hydrological Processes (HPEye), 35(6) e14258, DOI: 10.1002/hyp.14258
- **Invited talks at international conferences (*denotes HQP): (1)** Kurylyk BL,*Smith KA, *KarisAllen J. 2021. Thermal heterogeneity and climate change sensitivity of transitional, coastal waters. American Fisheries Society Meeting, virtual and Baltimore, Maryland (Nov. 2021) **and (2)** Kurylyk BL,*KarisAllen J, *Smith K, *Cantelon JA, *Zeighami A. 2020. (American Geophysical Union Fall Meeting, Virtual.
- **Other talks: (1)** *Smith KA, Kurylyk BL, O'Sullivan A, Kennedy G. 2020. Seasonal, interannual, and spatial patterns of groundwater temperature change in Nova Scotia, Canada. Geological Society of America Conference (GSA Connects), virtual. **(2)** *KarisAllen J, Jamieson RC, *Mohammed AM, Kurylyk BL. 2020. Groundwater-derived thermal buffering of coastal habitat in the context of climate change, Canadian Geophysical Union (online webinar series).
- **Multi-sector partners engaged** (most providing cash or in-kind support above committed levels): Abegweit First Nation Conservation Society, Fisheries and Oceans Canada, Parks Canada Agency, and community watershed groups (Souris Fish and Wildlife, St. Mary's Association, Cheticamp River Salmon Association, and Morell River Management Cooperative)
- **National and international awards to HQP in project team (selected shown): (1)** Jason Karisallen (MASc student, Canadian Geophysical Union Hoskin Scientific Best Poster Award, NSERC CGSM) **and (2)** Kathryn Smith (PhD student, Geological Society of America (GSA) Shlemon Scholarship, GSA Graduate Student Research Grant, Nova Scotia Salmon Association Scholarship)
- **Many coastal watersheds instrumented:** Basin Head Lagoon (Marine Protected Area), PEI; Morell River (traditional fishing lands of the Abegweit First Nation), PEI; St. Mary's River, NS; Cheticamp River, Cape Breton, NS; Margaree River, Cape Breton, NS

Our current activities are:

- Conducting drone flights (with thermal infrared sensing) in study watersheds to map thermal patterns in key coastal reaches - summer 2020 and 2021
- Map water temperature patterns in space and time with a fiber-optic distributed temperature sensing system - summer 2021 and 2022
- Compare drone-based (point in time) and fiber-optic based (continuous in time/space) water temperature datasets with data from conventional water temperature loggers (point in

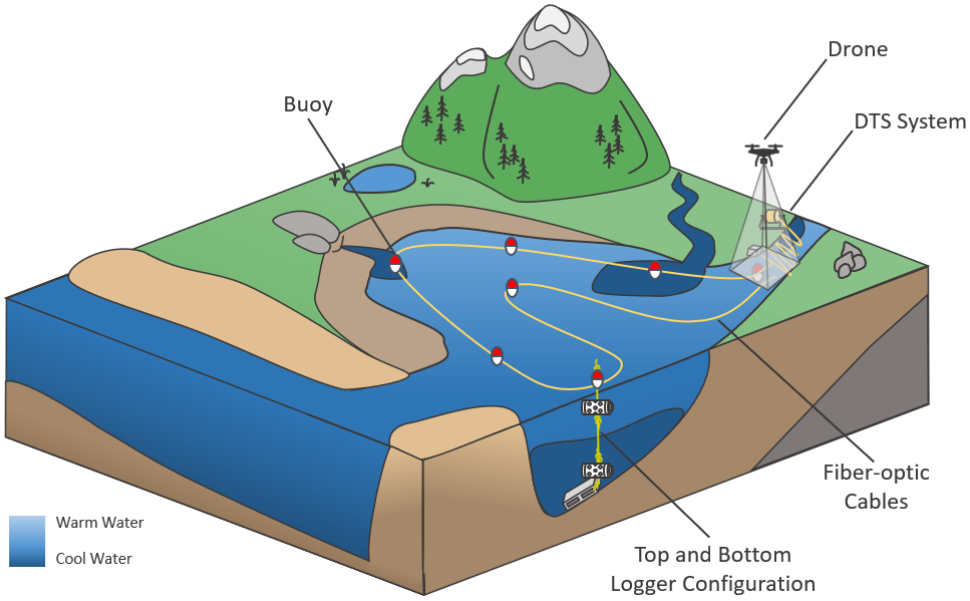
space) installed at multiple depths within the water column and in inter-tidal springs – fall/winter 2021-2022
- Processing thermal mosaics from drones and geo-referenced fiber optic surveys
- Develop numerical model (3D hydrodynamic with coupled heat transport) of coastal water temperature to assess the impacts of changing sea levels and atmospheric conditions on water temperature patterns (winter 2021 to spring 2022)
- Preparing journal manuscripts (detailed below) – fall 2021-summer 2022

The main accomplishments expected by the end of the project are:

- **Multi-sector engagement** – knowledge transfer to Indigenous, provincial, federal, and local watershed partners via annual reports and presentations in watershed management workshops
- **Five journal manuscripts/publications** – 1 on inter-tidal spring temperature dynamics (already published in *HP*), 1 on coastal groundwater warming and impacts to groundwater-dependent coastal ecosystems (in prep, led by MASc student J. KarisAllen – to be submitted to *HESS*), one on groundwater temperature patterns in coastal regions as measured in provincial observation well networks (in prep, led by PhD student K. Smith – to be submitted to *HESS*), 1 on estuary temperature modeling under climate change scenarios (in prep, led by PhD student A. Zeighami – to be submitted to *WRR*), 1 on drone vs. fiber-optic DTS vs. loggers ("what do we miss from the air", led by PhD student K. Smith – to be submitted to a hydrology like *HP* or environmental technology journal like *ES&T*). We are also considering a sixth paper on coastal storms and the impacts to thermally stratified lagoons.
- New datasets from five coastal watersheds – including water temperature at all sites and hydrology/weather data at selected sites (all under DMP).
- Conference presentations – approximately 5 more, including an invited webinar by PhD student Kathryn Smith to the Atlantic Salmon Conservation Foundation (Dec. 2021), likely presentations at Halifax 2022 (GAC, MAC, IAH-CNC), and in the 2022 Frontiers in Hydrology Meeting (AGU HS).

Here is a key visual from the project (figure, photo, table, graph, etc.)

Below we show a cartoon of our thermal monitoring approach in coastal watersheds.


Drone
Buoy
DTS System
Fiber-optic
Cables
Warm Water
Cool Water
Top and Bottom
Logger Configuration