TITLE Exploring the Canadian continental slope and inactive vents on the Mid Atlantic Ridge

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WORKSHOP Unable to attend because of prior commitments. Willing to attend if dates change.

TARGET NAMES (1) Canadian Continental Slope (Eastern Canyons and Laurentian Fan cold seeps); (2) Mid Atlantic Ridge (inactive hydrothermal vents) (all, at depths >> 200 m)

GEOGRAPHIC AREA OF INTEREST Northwest, North Central

RELEVANT SUBJECT AREAS Biology, Geology

DESCRIPTION OF THE REGION RECOMMENDED FOR EXPLORATION

One region of interest is the continental slope off Nova Scotia Canada, in the northwest Atlantic (Fig. 1). In the last 6 years, we have had a long-standing successful US-Canada collaboration during which we have been collecting data on the ecological assemblages of the Gulf of Maine and submarine canyons and fans along the US and Canadian continental slopes. We propose to continue extending this coverage to the northeast (Fig. 1 in green shading), in an effort to generate a mechanistic understanding of faunal distributions, and particularly the role of connectivity in generating these distributions. This area contains highly complex ridge formations and is expected to contain cold seeps. The shallow (<1000 m) depths of the canyons and slope have been surveyed, including in 2018. However, the deeper sections of the canyons and the adjacent waters to the EEZ remain largely unexplored by ecologists. The "Laurentian Fan Cold Seeps" Ecologically and Biologically Significant Area (EBSA) (Fig. 1, shaded in orange) includes several cold seep communities at ~ 4000 m depth that were discovered by geologists and only surveyed photographically and cursorily once (Mayer et al. 1988. Deep-Sea Res, Part A 35: 1235-1246). The extent and composition of the chemosynthetic communities remains unknown, but it has been proposed that this location may serve as a critical node of connectivity of cold seeps between the two sides of the north Atlantic Ocean.

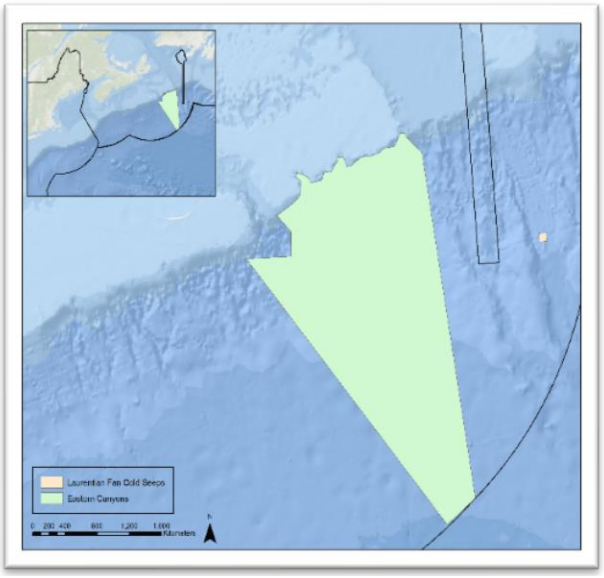

Figure 1: Proposed locations on the Canadian continental slope.

In March 2018, Fisheries and Oceans Canada announced plans to advance a new fishery closure (Marine Refuge) for a large deep-water area encompassing the two large canyons and extended out to the Exclusive Economic Zone. In addition to the known aggregations of corals along the slope, the area was selected because it encompasses representative examples of canyon, slope, continental rise, and abyssal plain habitats and associated biological communities. Knowledge of the dominant biological assemblages, as well as evidence of connectivity among deep sea systems from the "shallow" (shelf edge) to the deepest extent of the planning region, will inform management measures being designed for that area. The Laurentian Fan cold seeps EBSA is included in the draft Marine Protected Area Network Design for the Scotian Shelf Bioregion to be released in 2018, as it is currently the only confirmed seep community in the region. Again, baseline data on the biological communities are needed to better inform its inclusion in the overall design.

Another area of interest focusses on inactive vents on the Mid Atlantic Ridge (MAR). The precise location is not critical because it is the feature that is of interest and may be combined with any other research effort that focusses on active hydrothermal vents or the general geographic region of the ridge. [InterRidge Vents Database ver. 3.4 (http://vents-data.interridge.org/) includes all known locations of hydrothermal vent fields, all at depths > 800 m; the most logistically convenient can be selected, e.g. near Iceland or the Azores.]

Most ecological research done on hydrothermal vent ecosystems globally has focused on active vents because of the unique and spectacular fauna that inhabits them. Active vents eventually become inactive and the flow of hydrothermal fluids permitting chemosynthesis to occur ceases. The hard substratum at most hydrothermal vents may become partially covered with sediment, altering the types (and diversity) of habitats available for colonization. These physical and chemical changes will lead to inevitable changes in the biological assemblages from those based on chemosynthesis to ones that rely on an allochthonous food supply. Suspension feeders that require hard substratum, such as deep-water corals and sponges, are likely members of the new assemblages, although their ability to colonize will depend on proximity to adult populations. Over time and with increasing sedimentation, fauna that typically occupy soft sediments may also begin to colonize. To date, the patterns and rates of the ecological succession that occurs when active hydrothermal vents transition to inactive ones remain unknown. Here, I propose to survey a series of inactive hydrothermal vents at increasing distances (starting at 100 m) from the active vent field to begin to describe their biological assemblages and shed some initial light on the rates of colonization and succession.

This research is not only novel scientifically, but it is also very timely in light of the accelerated development of deep-sea mining. In a publication earlier this year, we proposed that active hydrothermal vents should not be mined at all (Van Dover et al. 2018. Marine Policy 90: 20-28). This proposal appears to be gaining at least partial support from the International Seabed Authority and the mining industry. Although inactive vents will most likely be the target of mining activities, we made no explicit recommendations with respect to mining those because of the lack of data on their ecological assemblages. Thus, a pressing need exists to, at least, describe the assemblages that occupy inactive vents in order to make recommendations on the best approaches for managing the mining activities.

RELEVANT PARTNERSHIPS

The research on the Canadian continental slope will benefit from a number of existing partnerships. I am a member of the leadership of the ***Canadian Healthy Oceans Network (CHONe)*** and lead research on the role of population connectivity in the design of Marine Protected Areas. The proposed work closely aligns with CHONe's interests and the priorities of the Science and Ocean Management branches of the ***Department of Fisheries and Oceans Canada*** and extends the work we have been doing with Dr. Martha Nizinski at ***NOAA*** (and that she is proposing as part of this same program). Additionally, it closely links with the research that Snelgrove is proposing for 2018 ASPIRE because of the hydrodynamic connection between the Labrador Sea and Nova Scotia current. CHONe also has a partnership with ***ATLAS*** and our research on deep-water corals and sponges will directly inform the overall objectives of ATLAS to improve our understanding of complex deep-sea ecosystems, and in particular the role of connectivity. Our research will also be relevant to ***SponGES***, which aims to develop an integrated ecosystem-based approach to preserve and sustainably use deep-sea sponge ecosystems of the North Atlantic**.** In fact, Dr. Kenchington (one of the co-coordinators of SponGES) is a member of DFO-Science mentioned above and one of the proposed focus areas for 2018 ASPIRE by her and Whoriskey of the ***Ocean Tracking Network*** is the Scotian Shelf.

The research on inactive vents has been developed from the many coordinated efforts of the ***Deep Ocean Stewardship Initiative*** (DOSI) to propose management solutions for deep-sea mining. We will collaborate closely with the 2018 ASPIRE proposal by ***ATLAS*** in the northeast Atlantic (e.g. south of Iceland or by researchers Carreiro Silva and Morato focused on describing the diversity of deep-sea ecosystems in the Azores region).