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Do fish talk? An innovative experiment to study fish using sound and imaging

Submitted by Katie Shoemaker Wed, 2017-04-26 14:19

Understanding whether fish communicate using sound is of growing interest and importance. Although many fish species are soniferous?they naturally produce sounds?we know very little about how and why this happens. Among the approximately 400 known marine fish species swimming in British Columbia waters, only 22 have been reported to be soniferous, although many more species are suspected to produce sound.

Ocean Networks Canada (ONC) is partnering with University of Victoria and the Institute of Marine Sciences in Barcelona, Spain, to deploy an innovative experiment to study fish behaviour through sound and imaging. Combining video and passive acoustics (i.e., hydrophones) with acoustic imaging, the experiment aims to better understand fish behaviours through fish-emitting sounds, and to explore how human-made sounds?such as shipping noise?affects those behaviours. This ground-breaking research project will be led by University of Victoria biology professor Francis Juanes, who specializes in fish behavior applied to fisheries management. Xavier Mouy is a PhD student in Dr. Juane?s laboratory who also works for JASCO Applied Sciences; Mouy plans to use the data from this experiment for his thesis.

Figure 1. The fish behaviour monitoring experient will be deployed in the Strait of Georgia near the delta dynamics laboratory at a depth of 150 metres.

Innovative use of combined technologies

In order to evolve this research idea into a practical experiment, ONC hosted multi-team discussions for a year prior to the deployment during *Expedition 2017: Wiring the Abyss* aboard the CCGS *John P. Tully*. The delta dynamics laboratory site in the Strait of Georgia (*Figure 1*) was selected as an optimal location for this experiment due to the documented presence of a diverse fish community in that area.

Figure 2. Instrument platform with mounted video camera, LED lights, ARIS dual frequency sonar (acoustic camera), subsea instrument interface module (SIIM) and underwater power supply cable.

The instrument platform for this experiment (*Figure 2*) contains a video camera with a pair of LED lights and a dual frequency imaging sonar (ARIS 3000), an ?acoustic camera? that produces a clear image of underwater objects by reflecting sound pulses generated by the sonar transducer. This hardware is controlled by a subsea instrument interface module (SIIM) that provides power to all the instruments and Ethernet data connectivity with the Strait of Georgia observatory shore station. Data generated by the hardware will flow through ONC?s data management system, Oceans 2.0, providing global access in real time.

Additionally, a hydrophone will be positioned within the field of view of both the video and acoustic cameras (*Figure 3*) so that sounds generated by fishes will be easily associated with camera images. The acoustic camera will be particularly useful at this location where waters often get ?murky? with the suspended sediments from the dynamic Fraser River delta.

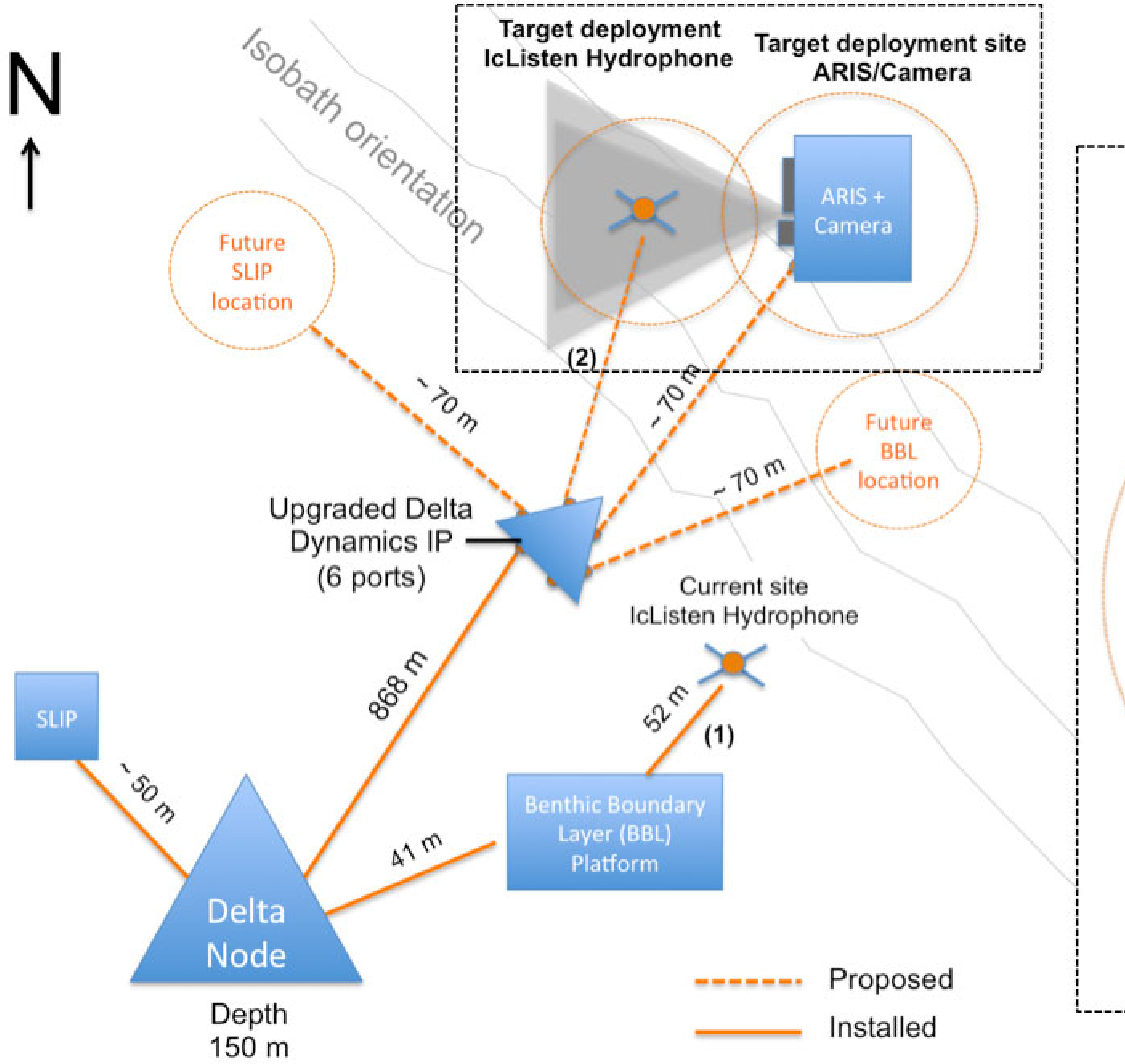

Figure 3. Conceptual diagram of the Strait of Georgia seafloor monitoring infrastructure that will be deployed for the fish behavior monitoring experiment in May 2017 (*left*). In detail (*right*) the instrument platform (*blue*) will house a SubC Imaging Dragonfish video camera with LED lights, the ARIS dual frequency sonar, and an ICListen hydrophone. The hydrophone will be placed in the overlapping field of view of both imaging devices (*shaded grey triangular areas*).

Orange lines represent the Strait of Georgia observatory network of underwater fiber-optic cables. SLIP= seismic liquefaction in situ penetrometer. NOTE: this diagram is not to scale.

In the weeks leading up to deployment in early May 2017, ONC?s marine engineers, scientists, software developers, and data specialists collaborated on an intense routine of tests at ONC?s Marine Technology Centre in Sidney. During this final testing stage, the instruments were submerged in a large seawater test tank to confirm they were working properly and that data was flowing and archiving to Oceans 2.0 (*Figure 4*).

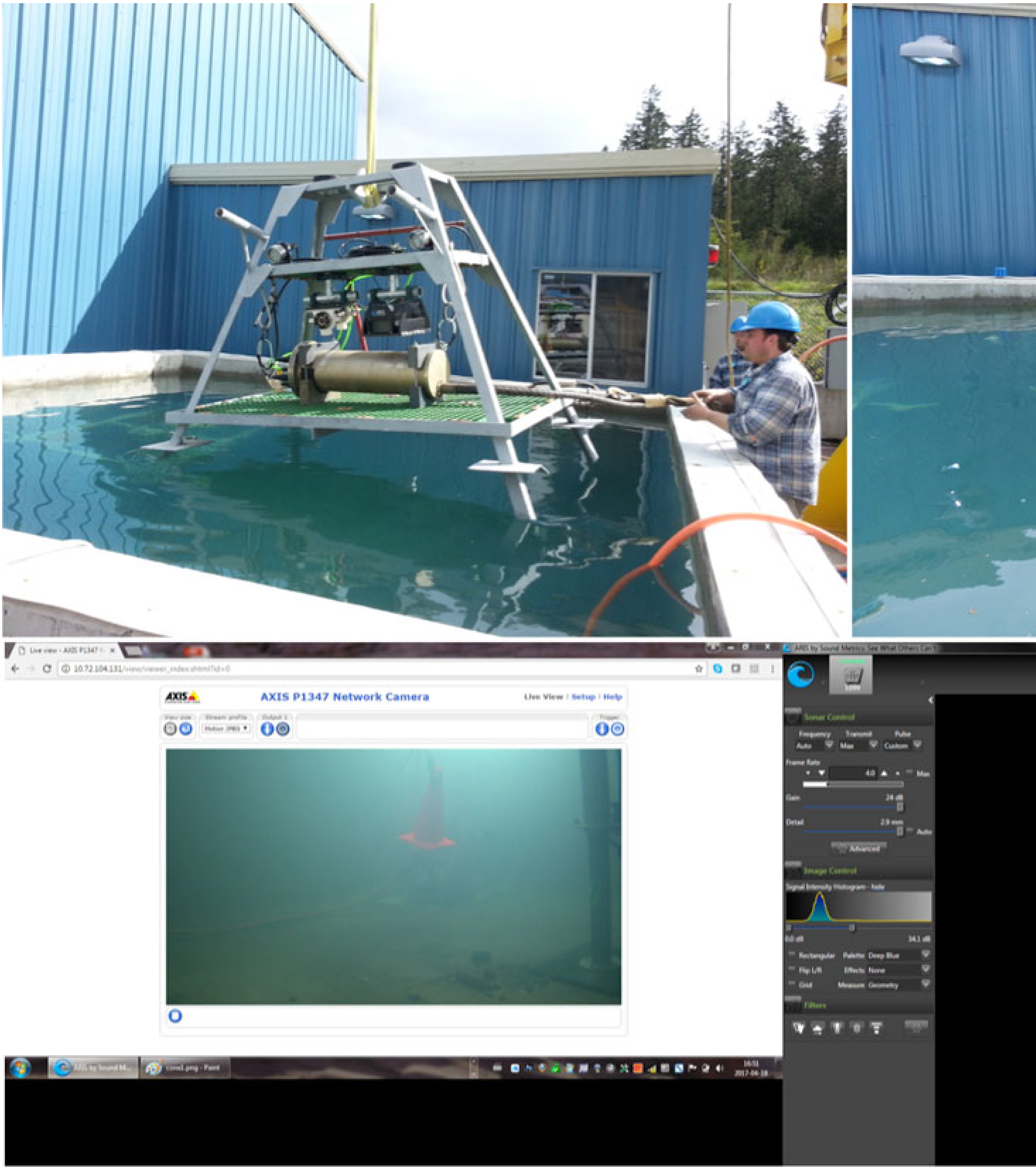

Figure 4. (Top) The experiment instrument platform is lowered into the seawater test tank at ONC?s Marine Technology Centre. (Below) The video and acoustic camera computer interfaces during tests. In order to set instrument configuration settings, a plastic cone was lowered into the test tank and in the field of view of both cameras. For the ARIS imaging sonar, adjusting settings?such as recording frame rates and the number of acoustic beams per sample?provide optimal data outputs and high quality images. These settings can be fine-

tuned once the instrument is deployed in the field.

Study objectives

The objectives of the proposed study are to:

1. identify and characterize the types of sounds produced by Strait of Georgia fish species;
2. assess obvious changes of fish behavior (such as movement, vocalizations, and predator-prey interactions) due to changes in underwater noise levels;
3. determine whether the number of fish sounds in recordings can be used to infer fish abundance; and
4. define if artificial lighting from underwater video observatories affect the density of fish population near the monitoring location (by light attraction or avoidance).

This experiment will be a great addition to ONC?s long-term ocean monitoring program in the Salish Sea. It will also benefit from all the co-located instruments that are constantly monitoring other oceanographic variables such as sea temperature, salinity, turbidity, currents, and dissolved oxygen. This will allow fish ecologists to correlate if fish abundance patterns and behaviors are also being affected by changing ocean conditions. Finally, University of Victoria scientists are hoping this experiment will generate practical information that can support regulation agencies in defining noise disturbance criteria for British Columbia waters. Results from this experiment may also support research programs such as the Pacific Salmon Foundation and the Vancouver Fraser Port Authority?s ECHO (Enhancing Cetacean Habitat and Observation) program.

For further information about this new experiment, please contact ONC Staff Scientist Fabio De Leo.

Tags:

- soniferous
- fish behavior
- Acoustics
- SIIM
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- ARIS Imaging sonar

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