Dr. Santiago Hernández-León, Institute of Oceanography and Global Change,

Delivery of ultra-deep Acoustic Zooplankton and Fish Profiler (AZFP) to The Institute of Oceanography and Global Change, Canary Islands, Spain

ASL Environmental Sciences Inc. has successfully collaborated with the Institute of Oceanography and Global Change for the adaption of ASL's Acoustic Zooplankton and Fish Profiler (AZFP) for use as a tool to study the deep water (1000m+) zooplankton and micronekton in the subtropical waters of the Atlantic Ocean through measurement of quasi-instantaneous vertical profiles.

The new instrument is intended to provide absolute acoustic backscatter at four frequencies (38, 125, 200 and 455 kHz) as it is lowered down the water column to a maximum of 6000m of water depth.

As part of the project, ASL designed a prototype instrument and tested it to evaluate multiple frequency technology for use as a standard instrument in oceanography. The instrument will provide acoustic data from the bathypelagic zone of the oceans to complement other parameters for the study of deep water zooplankton, micronekton, and large particles.

The scientific collaboration includes the adaption of the existing Acoustic Zooplankton and Fish Profiler (AZFP) manufactured by ASL. ASL plans to leverage small, reliable and affordable MF-AWCP instruments with up to 4 frequencies for use as a profiling instrument below a rosette sampling system. Further, ASL modified the instrument package to increase its maximum operating depth from 1000m to 6000m of water depth. The instrument will be powered from an internal battery for a period of at least 20 hours of continuous pinging and will include enough removable memory to store three days' worth of raw data.

The goal of the collaboration between ASL and Dr. Santiago Hernández-León, Institute of Oceanography and Global Change, is to evaluate factors which contribute to errors in the measurement of the absolute backscatter strength (Sv) and target strength (Ts) of ensonified targets. Dr. Santiago Hernández-León will field test the prototype instrument with respect to acoustic calibration at depth. Upon successful completion, the parties shall collaborate in the publication of a technical paper.

Award Program for ASL's Acoustic Zooplankton Fish Profiler (AZFP)

Dr. Timothy Whitton

An ASL Acoustic Zooplankton Fish Profiler (AZFP) will soon be travelling to the UK to be deployed in the strong tidal waters off the coast of Wales (Figure1). While AZFP's are regularly deployed around the world, this usage is free of charge, the result of a successful application to ASL's AZFP Award Program for early-career scientists!

Although there were other deserving applicants for the Program, Dr. Timothy Whitton from the Centre for Applied Marine Sciences at Bangor University succeeded to draw our attention for his proposed study on the biological processes in areas of marine renewable energy development. Dr. Whitton will get the use of a 125, 200, 455 and 769 kHz instrument for 4 months free of charge starting in September 2016 to conduct his research. This will build on and progress research conducted by him during the SEACAMS project that collaborated with the Welsh marine renewable sector.

With the development of marine renewable energy (namely tidal and wave) gaining momentum in Welsh (UK) waters, understanding the physical and ecological characteristics and process in these high current and coastal areas will prove critical. Dr. Whitton aims to do just that, focusing particularly on the important micronekton group of organisms that can be conduits of energy transfer between the seabed and water column and between trophic levels.

Having the ability to acquire high-resolution observations over spring/neap tidal cycles will enhance Dr. Whitton's understanding on how diel periods, tidal velocity and turbidity may interact with vertical migratory behaviour of different groups of organisms. The wide range of frequencies on the AFZP will allow the observation of fish, zooplankton, and even sediments over the relevant time periods. The sea-bottom mounted AZFP will also enhance this research by removing the problem of ship-generated turbulence and bubble entrainment due to bow-mounted transducers, which can create noise (an issue common to areas of high tidal currents and sea swell). We would like to thank all participants for sending in their proposals to ASL for this equipment lending program, and await the results from Dr. Whitton's research.
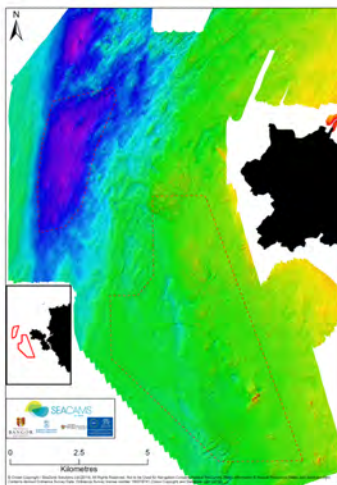

Figure 1. *Study area off the North West Coast of Anglesey with tidal demonstration zones (red dashed polygons). Multibeam North West coast of Anglesey in Wales, derived bathymetry shows depths of 40 m (green) reaching down UK (53.2798, -4.7398 WGS 1984), this area to 98 m (pink) in the Holyhead Deep*

Good news, we now have 4 AZFP instruments in our lease pool including:
Two 125, 200, 455 and 769 kHz AZFPs,
One 38, 125, 200 and 455 kHz AZFP,
One 38, 70, 125 and 200 kHz AZFP.

Each instrument comes with a pressure case that can accept a battery for deployments up to one year and is available with a bottom mooring frame, a taut-line mooring cage, or an inline taut-line mooring cage. Some leasing arrangements are already in place.

Update on the Uncabled Bio-acoustic Sonar Instruments of Ocean Observatories Initiative

ASL Environmental Sciences Inc. (ASL) is expected to supply the last of the Un-Cabled Bio-acoustic Sonar Instruments for the National Science Foundation-funded Ocean Observatories Initiative (OOI) Coastal and Global Scale Nodes by the middle of 2016. Under the terms of the contract, ASL will have supplied 16 Acoustic Zooplankton and Fish Profiler (AZFP) instruments for the Coastal Arrays and 20 individual instruments for the Global Arrays. The two Coastal Arrays use a single bottom mounted instrument while the four Global Arrays use one upward looking and one downward looking instrument mounted on the mid-water platform of the Apex Profiler Mooring.

The photo below shows part of the OOI Woods Hole Oceanographic Institution (WHOI) team in front of Multi-Function Node (MFN) bottom frame destined for the Coastal Pioneer Array, about 80 miles off Martha's Vineyard, Mass., at the edge of the continent shelf. The MFN holds a variety of chemical, biological and physical oceanographic sensors including an Acoustic Doppler Current Profiler, CTD sensor, Oxygen sensor and CO_2 sensor. The acoustic transducers for the internally-powered, internally-recording AZFP echosounder with 38, 125, 200 and 455 kHz channels are shown in the lower right of the picture.

Sheri White (team leader), Aidan Alai and Jennifer Batryn (from r. to l.) of Woods Hole
Oceanographic Institution in front of a Coastal Multi-Function Node bottom frame
with the AZFP transducers shown on the lower right

In the fall of 2015, 7 AZFPs instruments which had been deployed on the Coastal Arrays were returned to the factory for calibration verification by WHOI and Oregon State University (OSU). All 7 instruments had a 100% data recovery rate and a minor adjustment was made on the acoustic calibration of one channel of one of the instruments.

In 2016, the first AZFP instruments with 38, 70, 125, and 200 kHz channels will be deployed on the Global Arrays. These include the Argentine Basin, Station Papa, Irminger Sea, and Southern Ocean Arrays.

ASL's 4-frequency AZFP lease instrument was used to conduct zooplankton research in Pangnirtung Fiord

Sarah Fortune, PhD candidate at the University of British Columbia and guest student at Woods Hole Oceanographic Institution in collaboration with Dr. Steve Ferguson from Fisheries and Oceans Canada and University of Manitoba as well as LGL Limited and VDOS Global LLC, conducted several days of zooplankton backscatter observations in Pangnirtung Fiord with co-located Optical Plankton Counter data.

The four-frequency (125, 200, 455 and 769 kHz) AZFP with cage and floatation from ASL's lease pool was shipped to rendezvous with the Arctic equipment. The instrument was deployed in Pangnirtung Fiord in the Canadian territory of Nunavut and floated at the surface off a small locally contracted vessel (Peter's Expediting & Outfitting). Unfortunately, extreme and unusual ice conditions (the presence of thick, multi-year ice) prevented deployment in Cumberland Sound where she conducts most of her PhD research near bowhead whales.

Fortune was encouraged by the collected data because it demonstrates the potential to record rapid and fine-scale zooplankton data in a way that she couldn't before. She expects that it will be particularly interesting to compare the OPC and AZFP data. Fortune anticipates conducting field research during the summer of 2016 in Cumberland Sound and she hopes to redeploy the AZFP close to bowhead whales to study their feeding behavior.

Figure 1. Sarah Fortune with 4-frequency AZFP—image taken by Dr. Bill Koski (LGL Limited).

Figure 2. Vessel in Pangnirtung Fiord –image taken by UAV operated by Thomas Seitz from VDOS Global LLC (project collaborator).

Upcoming Conferences

Salish Sea Ecosystem Conference Vancouver, BC	**April 13-15**
Working Group on Fisheries Acoustics Science and Technology (WGFAST) Vigo, Spain	**April 19-22**
Offshore Technology Conference (OTC 2016) Houston, Texas	**May 2-5**

For more information on the AZFP instrument click: http://www.aslenv.com/azfp.html
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Canada Basin Experiment (CBEX)

Figure 1. *Frank Bahr, Andrey Proshutinsky, and Richard Krishfield with the 6 ASL ULSs.*

ASL instruments will soon be put to the test as part of a study aimed at collecting data on sea ice thickness in the Arctic Ocean. This summer, 6 of ASL's Model IPS-5 Upward Looking Sonar (ULS) instruments will be deployed for use in the Canada Basin Experiment (CBEX) to observe (or measure) sea ice thickness variability, which is funded by the US Office of Naval Research. The addition of ASL's ULSs will contribute to the Canada Basin Acoustic Propagation Experiment (CANAPE), taking place between 2016-2017 which is conducted by Scripps Institution of Oceanography and Woods Hole Oceanographic Institution.

This project will provide further insight to the larger Beaufort Gyre Observing System (BGOS) field program that has been in operation since 2003. With the help of ASL's ULS instruments, CANAPE will be able to provide an unprecedented coverage of the Canadian Basin for quantifying spatial variability of sea ice thickness in all seasons.

ASL's Model IPS-5 ULS instruments will be deployed beneath the Arctic ice pack on 6 CANAPE bottom-tethered moorings in the Canada Basin (location indicated in Figure 1) to obtain ice draft measurements. These instruments will provide over 15 million observations per mooring per year, and after the seawater corrections are applied, the accuracy of each acoustic range measurement is better than ±10 cm (Melling and Riedel, 1995).
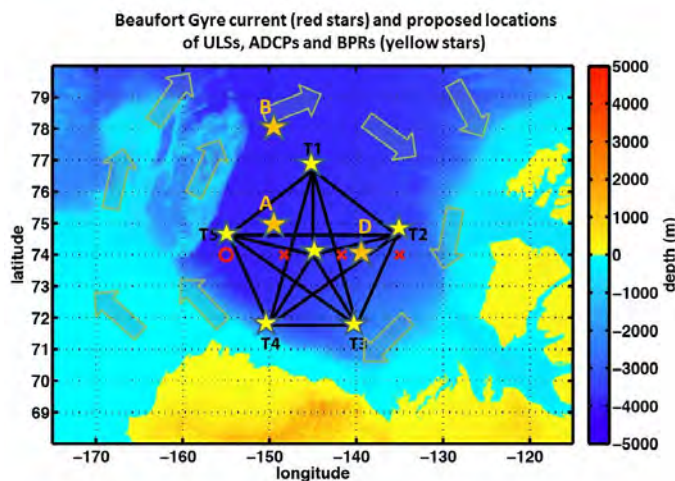

Figure 2. *Stars show location of ASL's ULS instruments. A,B,C – depict locations of ULS at BGEP moorings where observations have been conducted since 2003 while small yellow stars indicate locations of CBEX program instruments.*

The major products of scientific and practical importance of this study will be the processed observational data from instruments used as well as a synopsis of how and why sea-ice conditions and water stratification in the Canada Basin have evolved since 2003 to 2017, with a focus on conditions observed during the 2016-2017 CBEX observations. The project will provide sound estimates of the consequences to sea ice from changes in any of the forcing mechanisms, and causal mechanisms of sea-ice variability at different time scales, which will be essential for more reliable sea ice predictions.

To find out more information on the Model IPS-5 Upward Looking Sonar (ULS) instrument check out http://aslenv.com/ips.html, and to learn more about the study, see http://www.whoi.edu/beaufortgyre/expeditions.