

PRAWLER

A Wave-Driven Vertical Profiler

Technology Transfer and First Article Deployment

Tim Shanahan

Director of Engineering

McLane Research Labs, Inc.



Joe Grenier, MRL

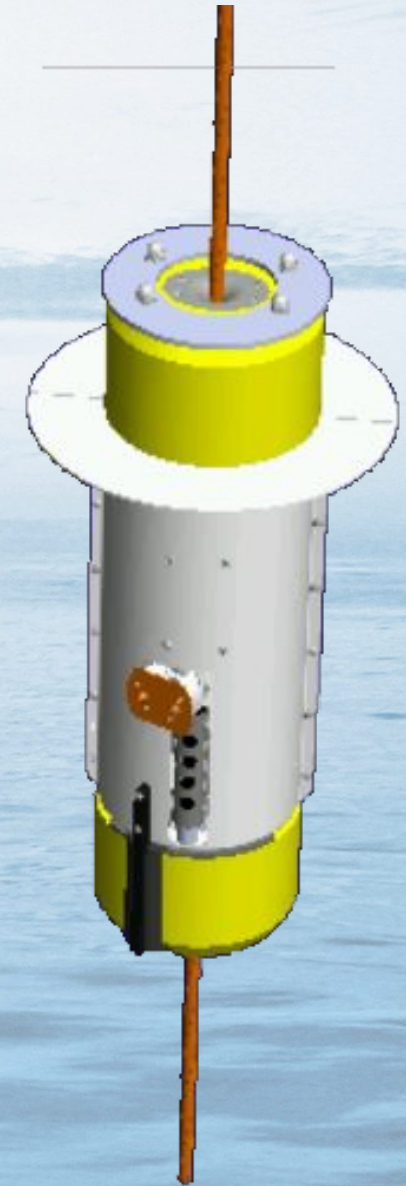
Scott Stalin, NOAA PMEL

Nick Delich, NOAA PMEL

Christian Meinig, NOAA PMEL (formerly)

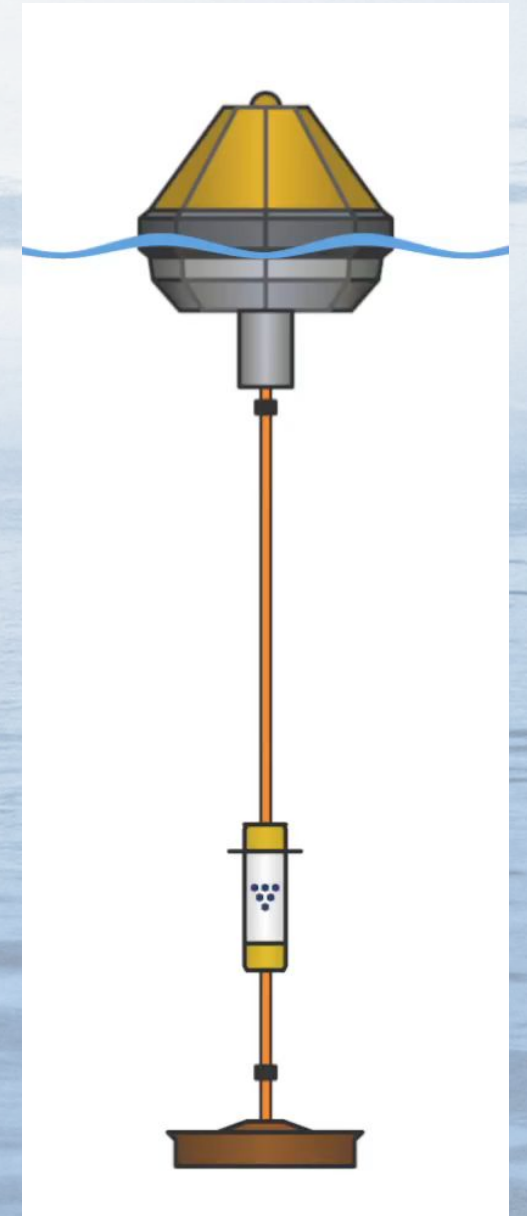
What is the PRAWLER?

- The PRAWLER (**PR**ofiling **crAWLER**) is a wave-driven vertical moored profiler for characterizing the upper 500 m of the water column.
- In development and field testing at NOAA Pacific Marine Environmental Laboratory (PMEL) for 10+ years.
- Technology Transfer with McLane to bring the PRAWLER to commercial production.



What is the PRAWLER?

- Uses wave action to ratchet up the mooring wire with spring loaded cam cleats following the wave action of the surface buoy.
- At a programmed top pressure, the PRAWLER enables the onboard sensors, opens the cam cleats, and free falls down to the bottom pressure stop.
- Data is stored locally as well as transmitted via inductive modem to a surface controller in the surface mooring. Then sent via Iridium / RUDICS to shore.



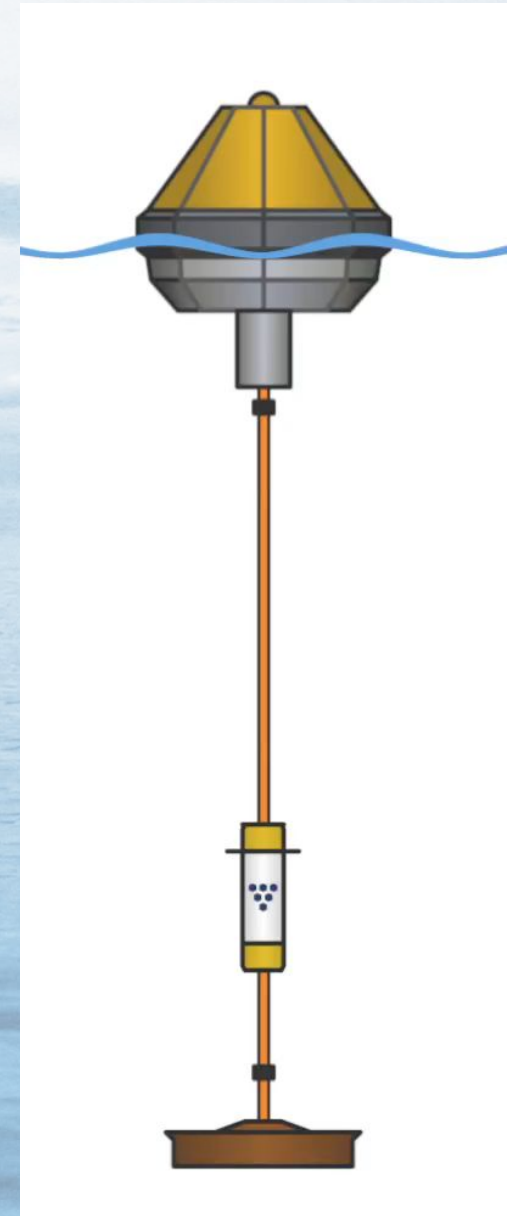
PRAWLER Sensors

- Conductivity, Temperature, and Depth: SeaBird PRAWLER Pumped CTD, based on the SBE 37 MicroCAT.
- Dissolved Oxygen: Aanderaa Optode 4330F, Fast Response foil.
- Optical Backscatter: SeaBird/WetLabs ECO (FLBB, FLNTU).



PRAWLER SENSORS

- Low cost, low power pressure sensor for detecting upper and lower depth limits.
- Since the travel of the PRAWLER is driven purely by wave action, the vast majority of the battery power (95%) is used to power the sensors, allowing long term ocean observing.



Technology Transfer

- In 2018, NOAA and McLane entered into a Cooperative Research and Development Agreement (**CRADA**) to bring the PRAWLER into commercial development.
- This allows both NOAA and McLane to jointly continue research and development of the technology transfer.

Technology Transfer

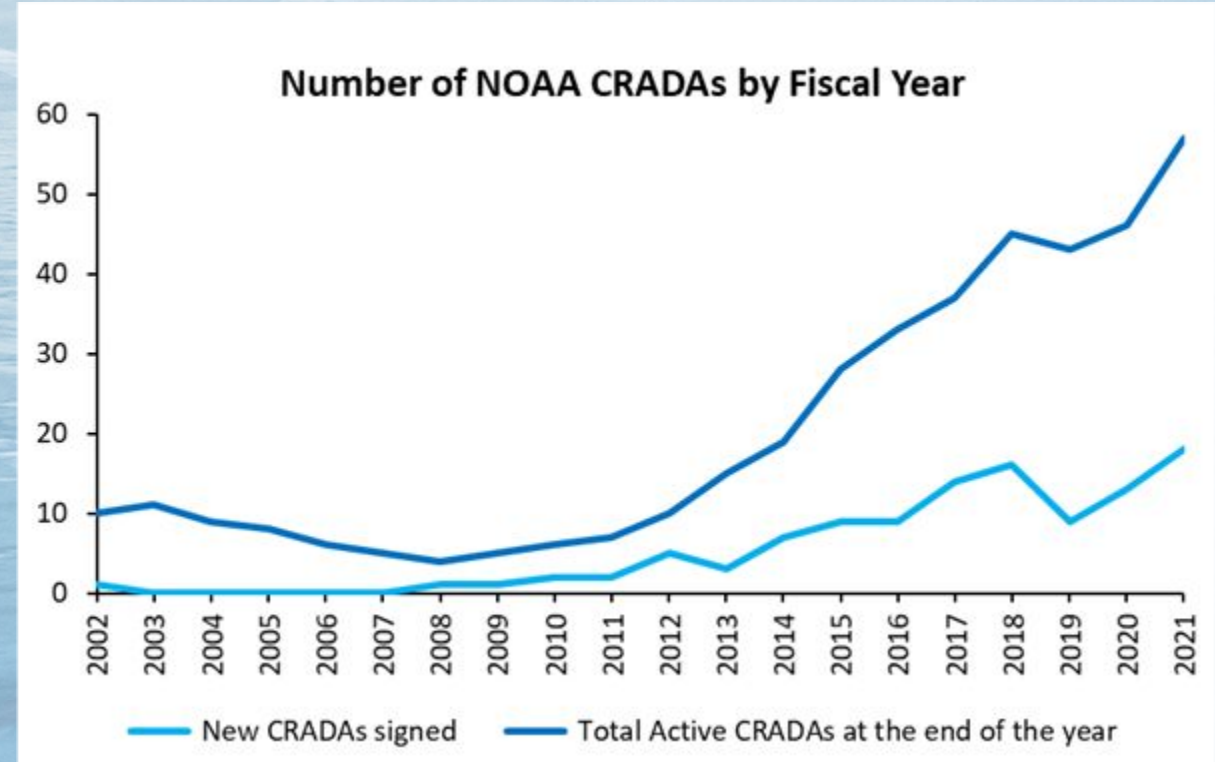
- PMEL designed the PRAWLER based on requests from scientific staff. Developed, tested, and modified the design to solve problems and increase robustness.
- McLane offers the experience of commercial manufacturing, customer support, unique testing capabilities, and existing relationships with potential customers.
- PMEL offers the ability to conduct low cost local deployments in Puget Sound to field test modifications and improvements.

Technology Transfer Experience

Both McLane and PMEL have vast experience with Technology Transfers

PMEL

- PRAWLER
- SAILDRONE
- PICO BUOY
- DART Tsunami Buoy
- ASVC02



NOAA Technology Partnerships Office

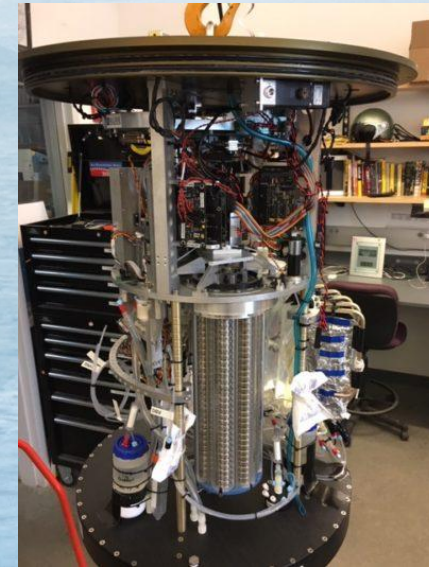
<https://techpartnerships.noaa.gov/2022/01/11/public-private-research-partnerships-are-fueling-noaa-innovation/>

Technology Transfer Experience

Both McLane and PMEL have vast experience with Technology Transfers

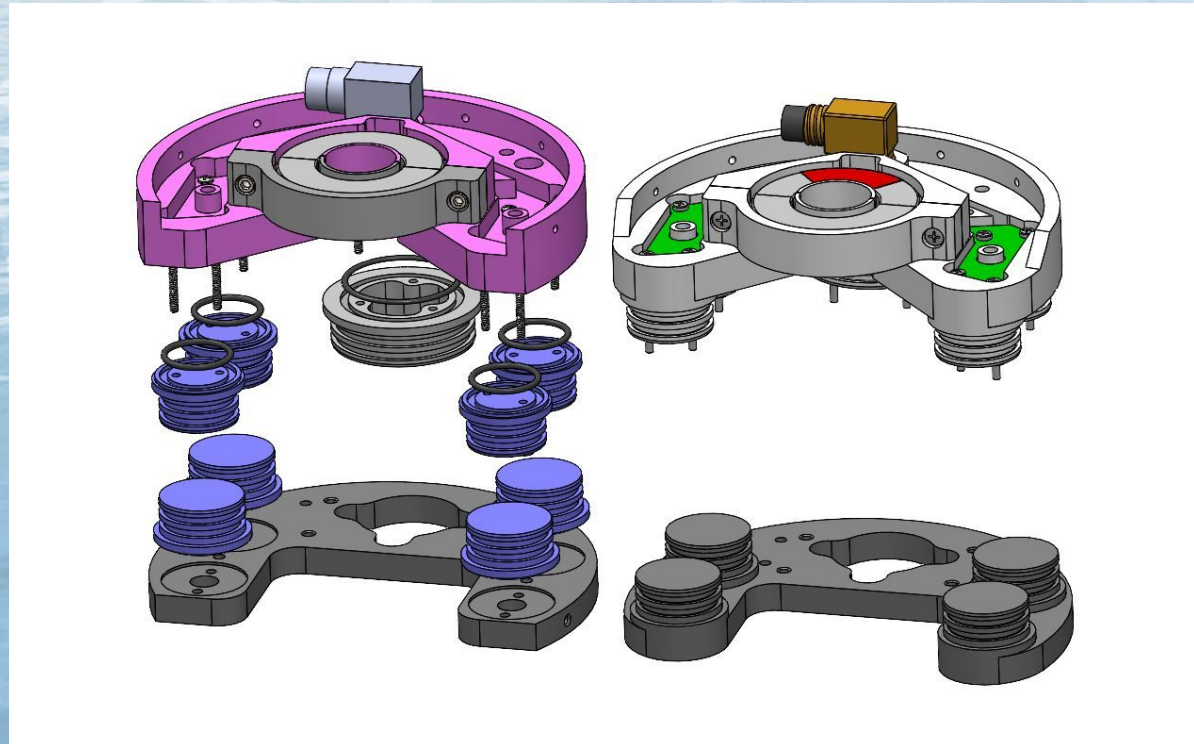
McLane

- Sediment Trap
- Moored Profilers (MMP and ITP)
- Environmental Sample Processor
- Imaging FlowCytobot
- PRAWLER



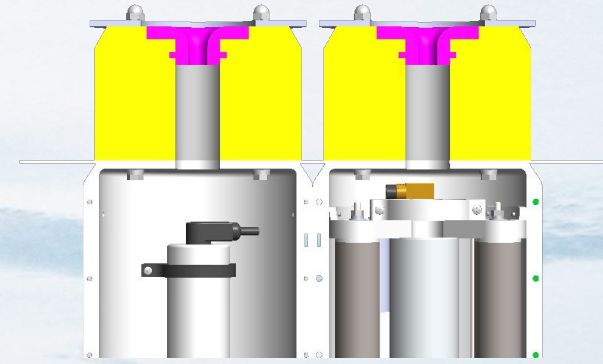
Manufacturing Improvements

- Top and Bottom Cap
 - Converted an assembly that consisted of 7 parts down to just 2 using a silicone molded urethane casting.
 - Eliminated 5 o-ring interfaces, eliminating these potential leak risks.

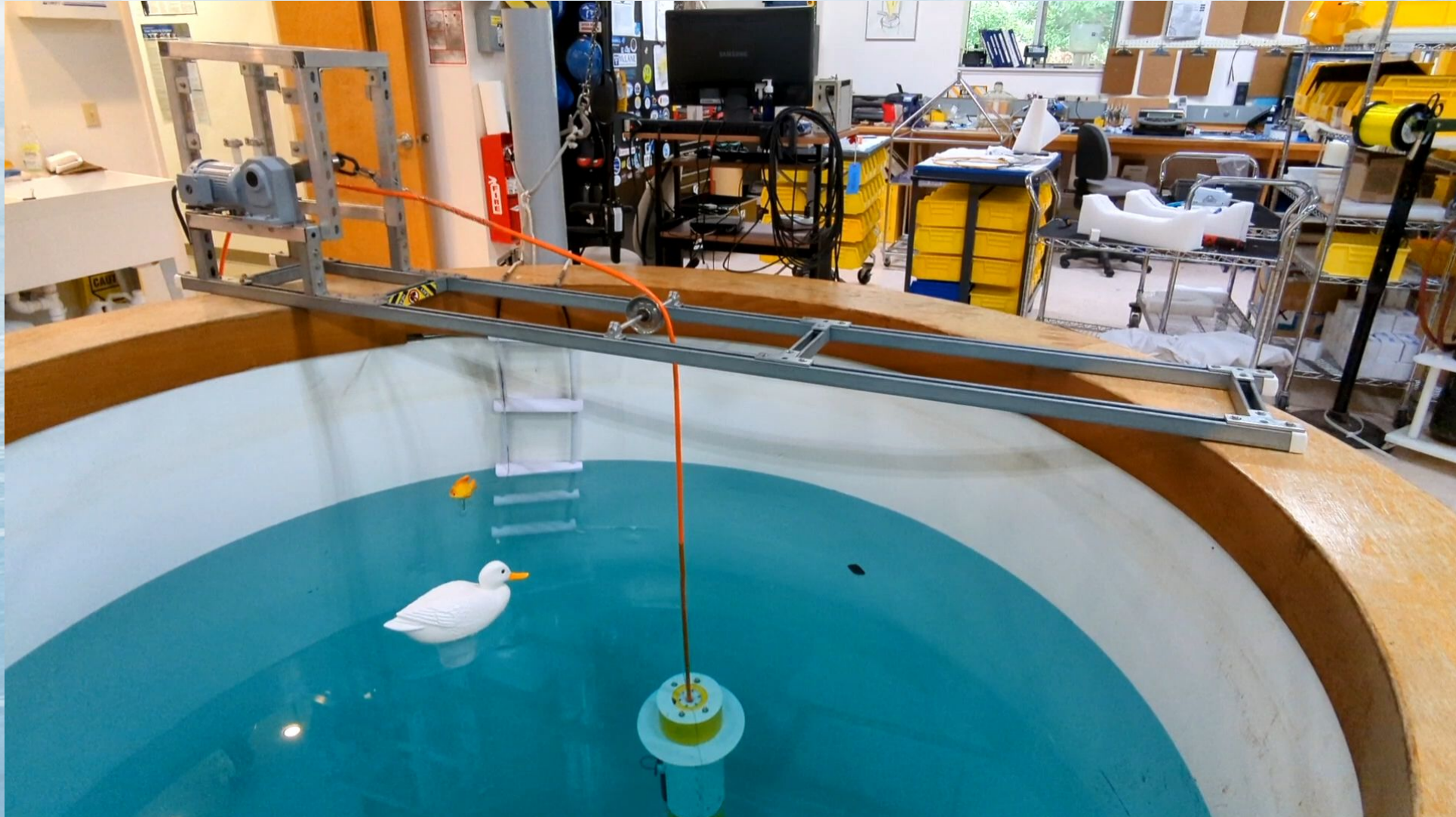


Manufacturing Improvements

- Eliminated need for bottom flotation removal when changing batteries
- Flotation and wire rope bushing redesigned to reduce separation
- Certified PRAWLER Li Primary Batteries for Domestic and International Shipping.
- Converted several pieces from machined parts to silicone cast molded, reducing costs.
- Attempted replacing custom fiberglass outer housing with molded shell – still a work in progress



McLane Testing Capabilities



First Article Deployment

- First Article Deployment not the FIRST deployment – by far!
 - First McLane manufactured PRAWLER deployment.
 - PMEL has had many successful deployments during the initial R&D phase of the project:
 - Chukchi Sea
 - Tao Array Central Pacific
 - SPURS

First Article Deployment



NOAA PMEL
R/V S.P. Hayes



Deployment



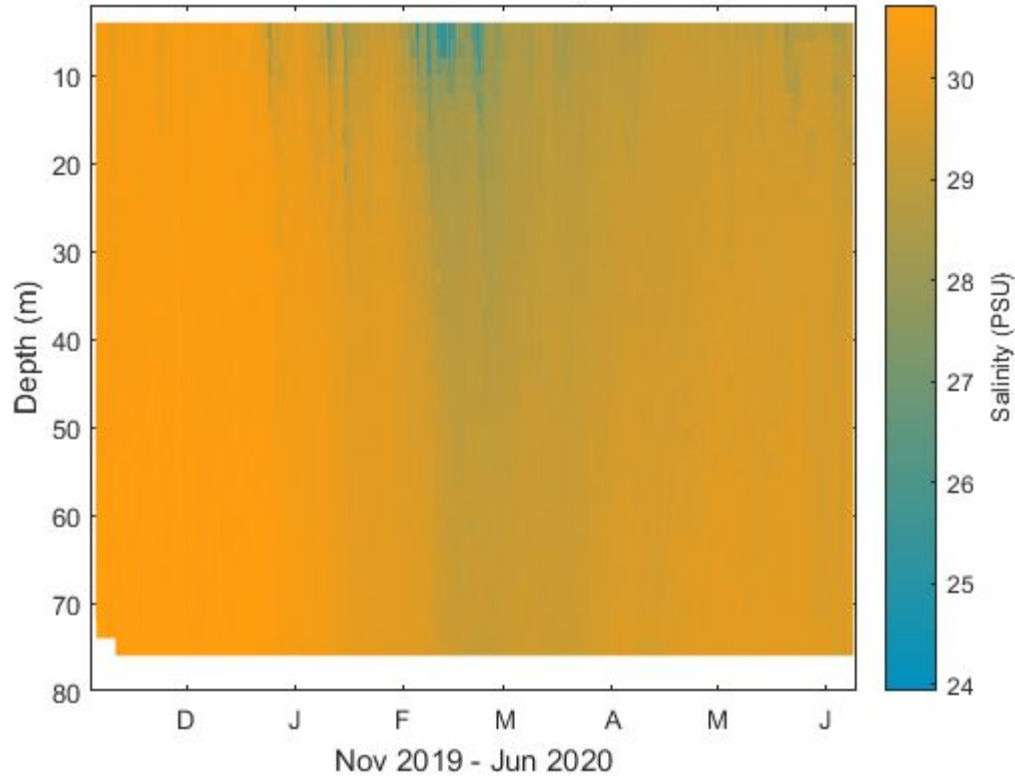
Shilshole Bay Data

- Profiling range: 2 – 80 m.
- Originally planned to be deployed for 6 – 8 weeks.

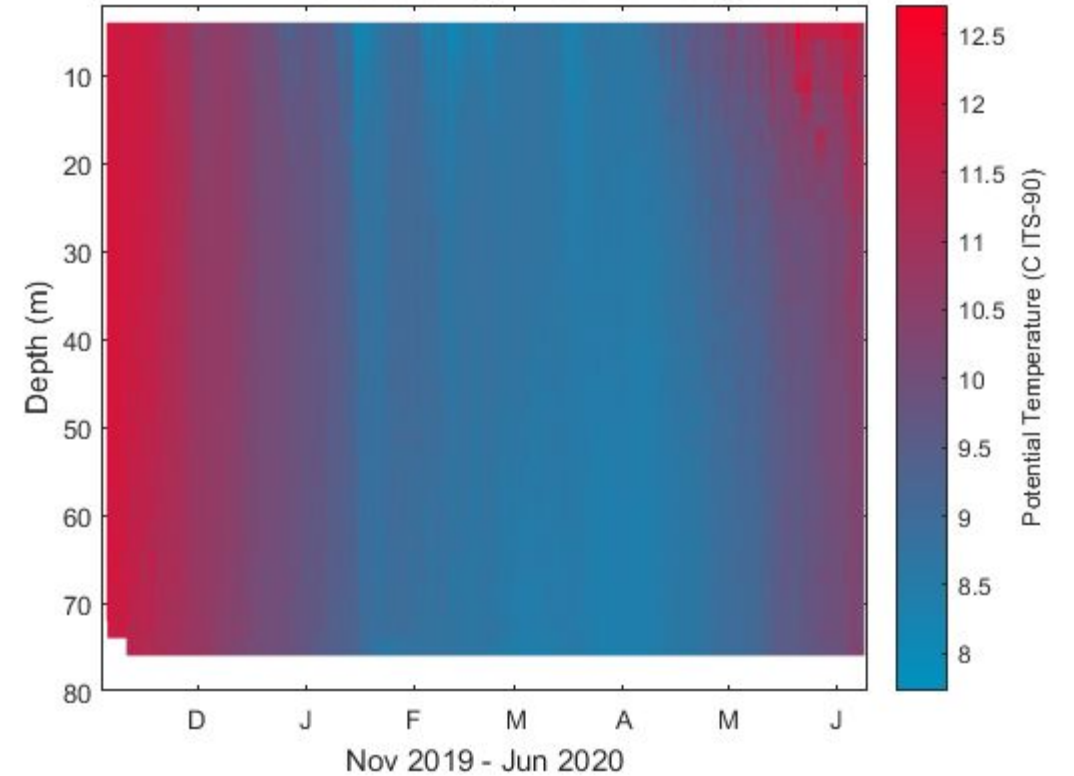
Deployment Length:	33 Weeks
Number of Science Profiles:	1478
Scheduled Profiles per Day:	8
Average Points per Profile:	46.8 (~1.6m resolution)
Total Distance of Science Profiles:	101,000 meters of travel

Shilshole Bay Data

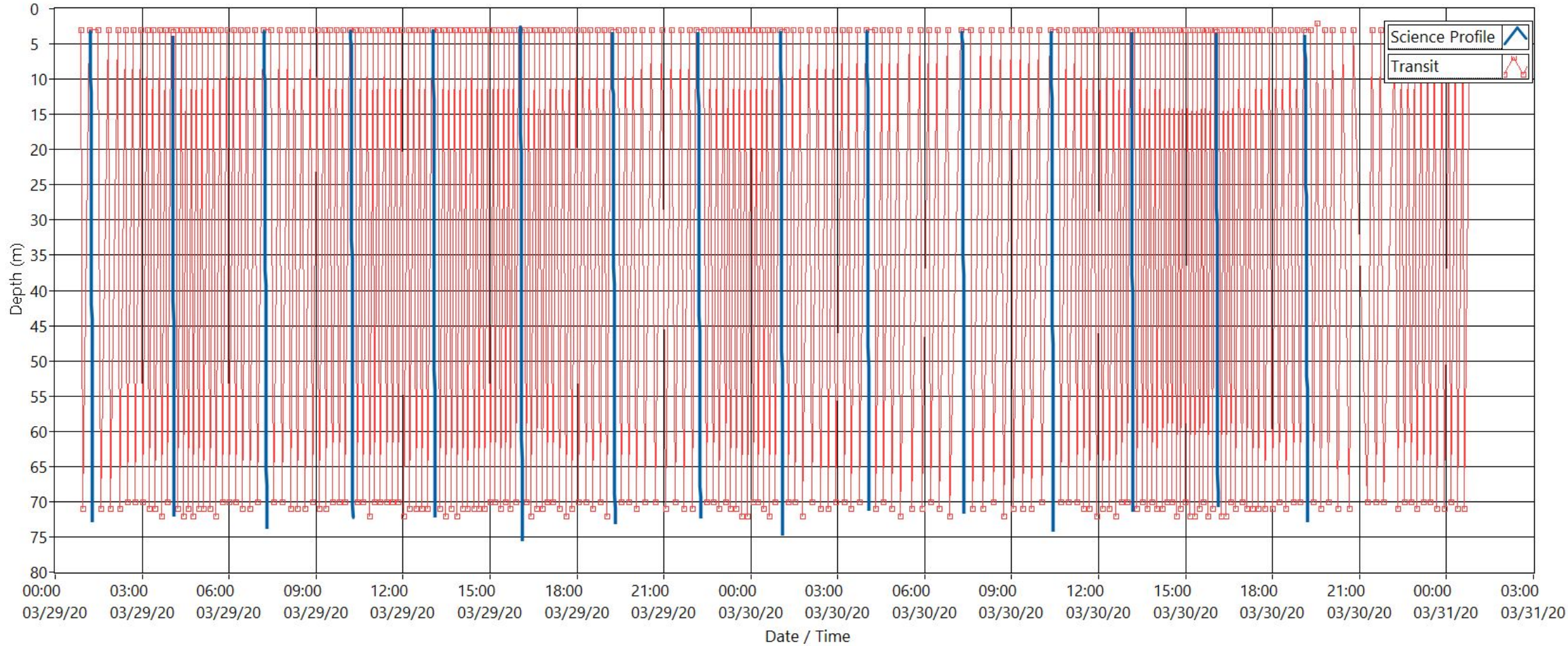
PRAWLER - Shilshole Bay - Salinity



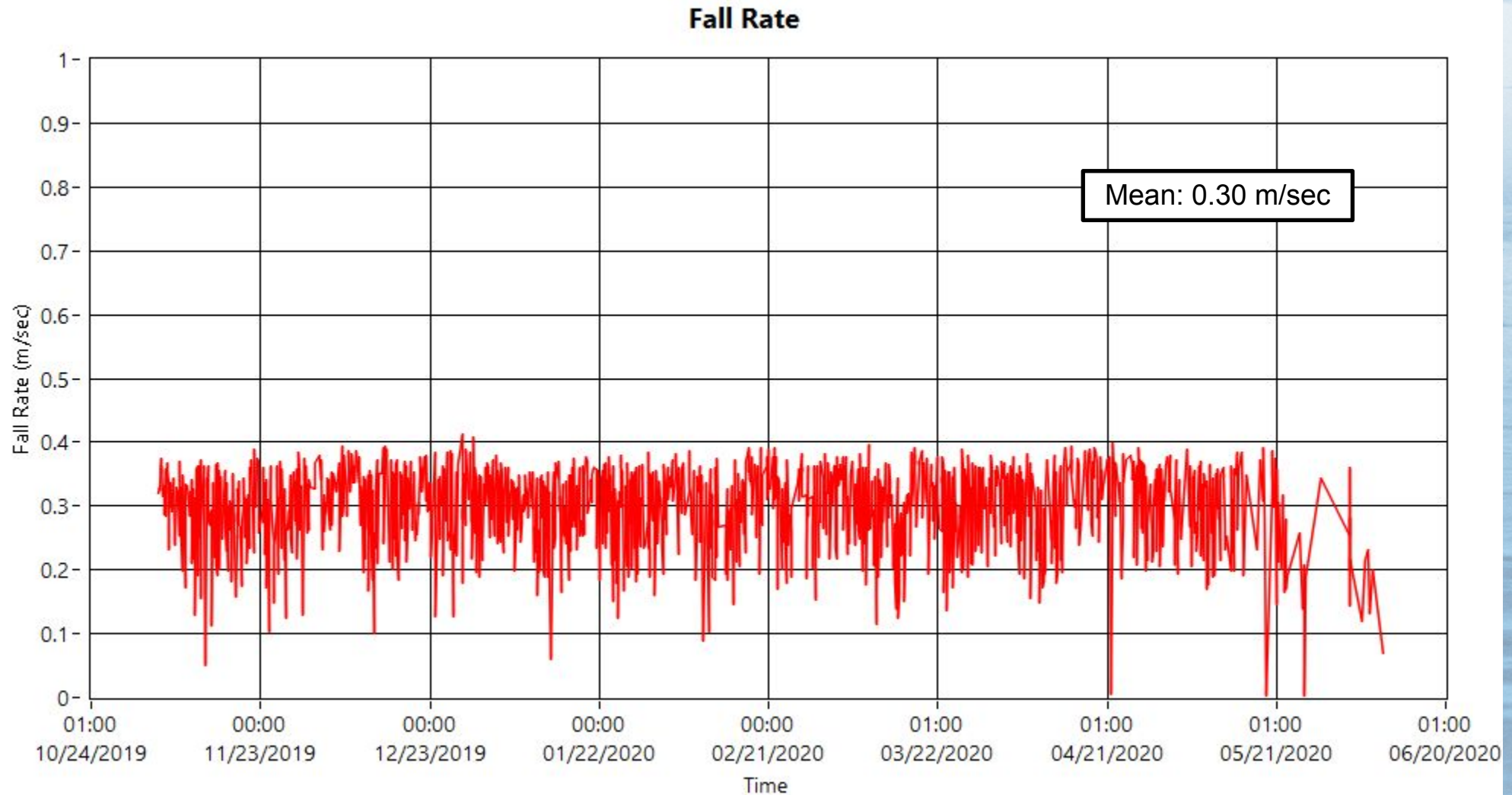
PRAWLER - Shilshole Bay - Potential Temperature



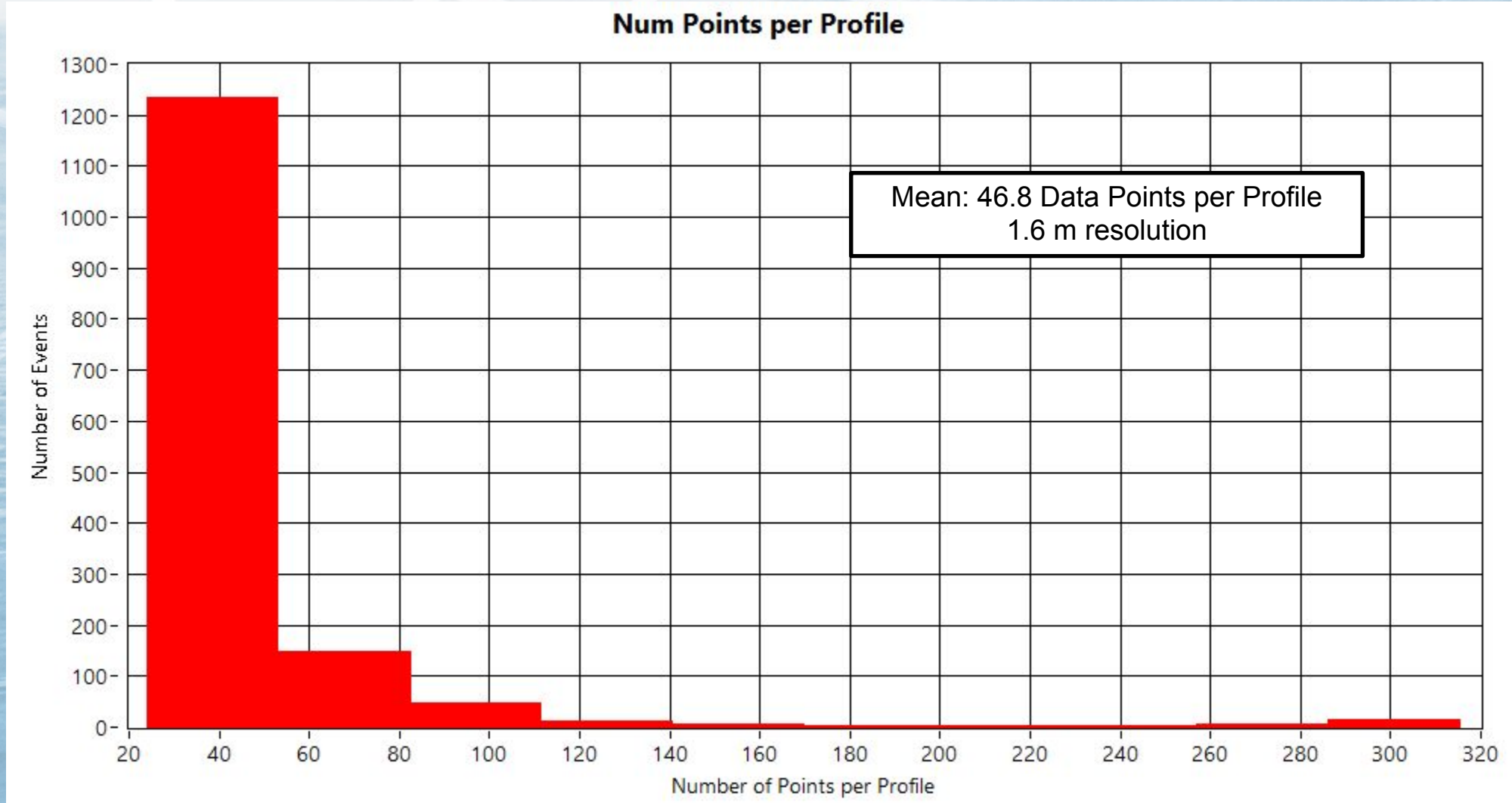
Shilshole Bay Data



Shilshole Bay Data



Shilshole Bay Data



Improvements Jointly Planned

- Motor redesign (in progress to address robustness ease of assembly and enhance PRAWLER motor capabilities).
- Tech Transfer of Surface Controller.
- Possibility of new sensor integration.

Next Steps

- SWOT Project?
- Other upcoming deployments?