

REPORT DOCUMENTATION PAGE

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FY '21 Report: UUV NUSC KEYPORT
Contract N00024-21-D-6400, Task Order #N0002421F8702

During fiscal year 2021, APL/UW received funding via NUWCKPT to support the use of Autonomous Underwater Gliders (AUG) to perform fisheries surveys for PACFLEET's environmental impact assessment (EIA) as advised by NOAA. During FY21, an AUG survey was completed with support from NUWCKPT personnel, fisheries sensor systems were integrated with an underwater glider system.

Systems Integrations:

For the FY20 field program TWR Slocum Glider Husker provided near real time measurements of in situ water density. It was deployed with an internally logging VR2W 69 kHz fish tag reader that needed to be recovered to obtain fish tag readings. For the FY21 program, TWR Slocum Glider Saul (200m rated) was outfitted with an Anderaa Oxygen Optode and a VR2C 69kHz cabled tag reader. Both of these systems were integrated with Saul such that water structure, dissolved oxygen concentration/saturation and fish tag ID's could be uploaded during every vehicle surfacing. The vehicle was also equipped with two test tags. These test tags would have to validate the integration of the Vemco received by producing for telemetry at regular intervals in addition to acting as tag sources to stimulate Vemco receivers attached to NOAA moorings in the operating area. Having these test tags on a mobile platform would enable NOAA to study the effective range of the moored systems in situ. All systems integrations were validated through in lab simulation and local testing in the Puget Sound with APL/UW small boat support and seen to function nominally.

Field Program:

The FY21 field program can be broken into three stages: two deployment days and a recovery.

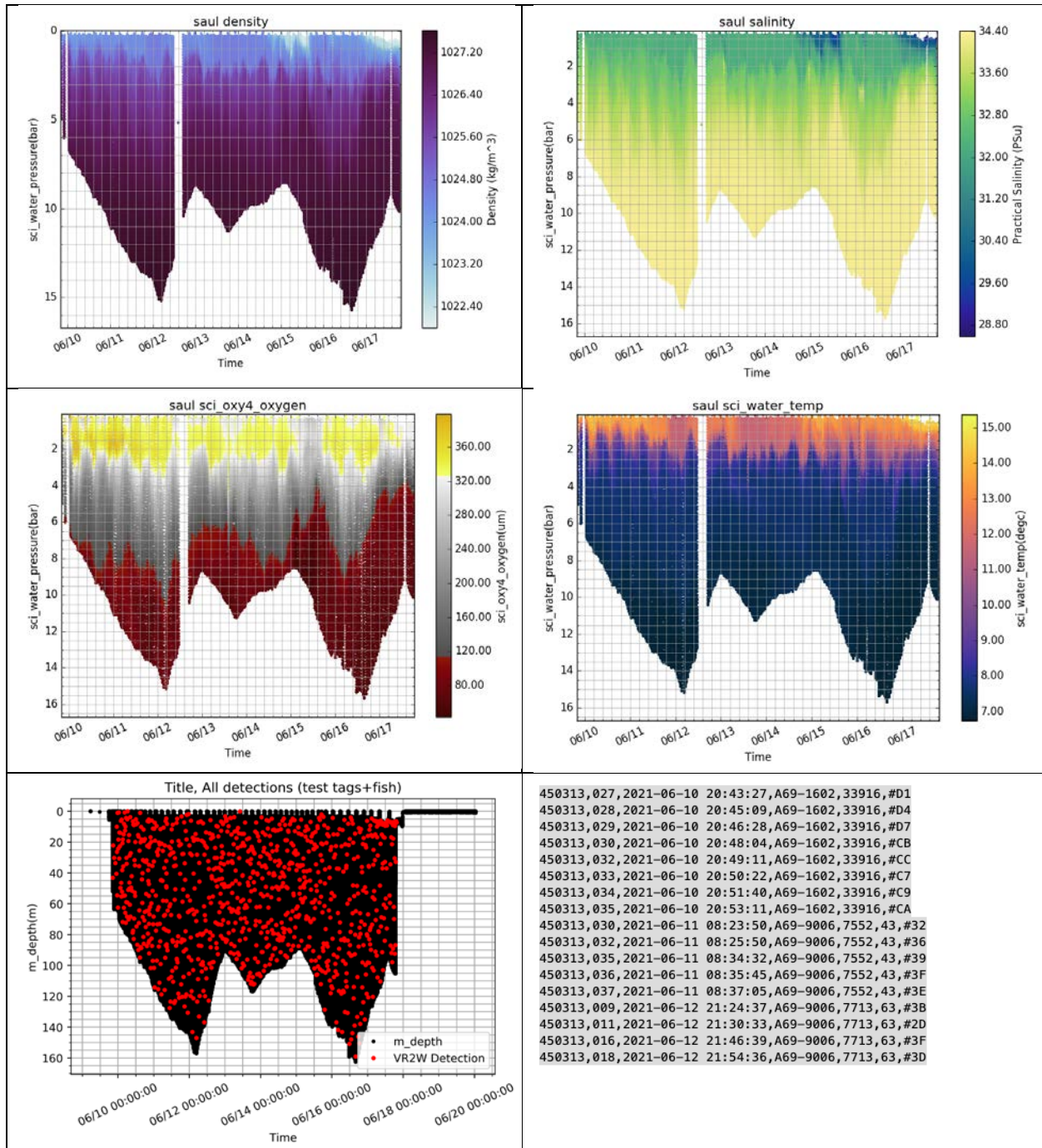
Deployment day 1:

On 14 May 2021 River Iannaccone (NUWC KPT) attempted deployment of the Slocum Glider out of Hammond, Oregon just north of the Columbia River Plume. Unfortunately, there was an issue with the glider ballasting (ballast element left out of vehicle during final closure) and the vehicle was too light to operate, necessitating a return trip to APL/UW.

Deployment day 2:

On 10 June 2021, River I. attempted a second deployment of the Slocum Glider out of Hammond Oregon on NOAA m/v Sailfin. This deployment went as expected and continued for just under 9 days without issue (see data in Table 1).

Table 1: Glider observations/data collected during glider deployment. The following information was updated during every glider surfacing and made available to program personnel via password protected website. Engineering data is not retrieved via Iridium unless diagnostics are necessary to minimize power and time budge for satellite communications.



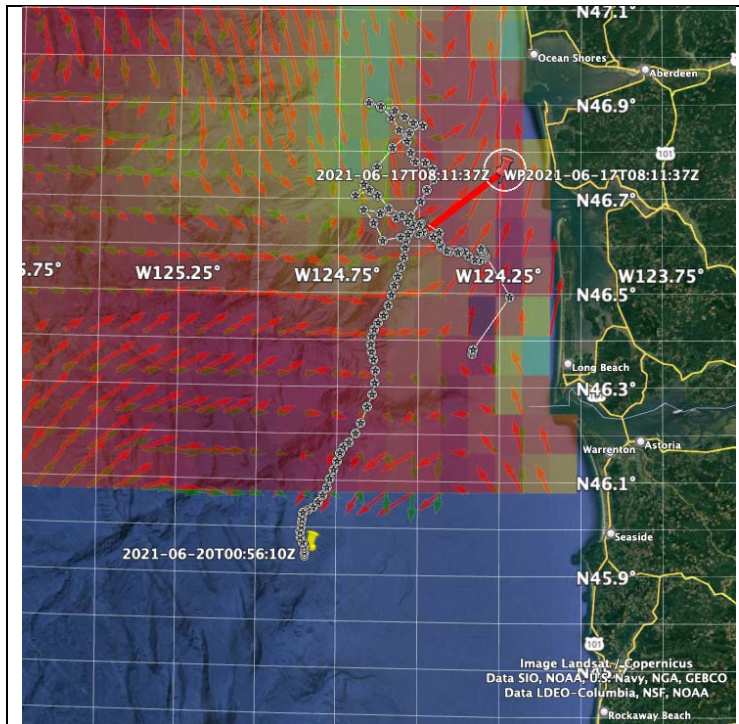


Figure 1: Glider op area and trajectory during FY21 deployment

Recovery

During the glider deployment, the Pacific Northwest experienced a strong heat wave that enhanced the strength of the Columbia river plume driving a lens of fresh water over much of the coastal shelf. As the glider user here is a legacy system, with a small buoyancy pump and no thruster capability, it is unable to cope with extreme stratification. The glider began struggling to make surface comms late on 17 June and ejected its recovery weight on the afternoon of 18 June, leaving it stranded at the surface. An emergency recovery effort was mustered as the glider began drifting at approximately 2 kts Southward in the coastal current. Fortunately OSU's R/V Pacific Storm was steaming into Westport, WA after completing an OOI cabled array service cruise the night before. The vessel was able to meet in the Westport marina to accept recovery gear on the morning of 19 June and proceed with recovery that day. Around 1700 local on the 19th, the vessel and managed a glider recovery by 1800. It was noted that glider pressure vessel vacuum and battery voltage dropped significantly during recovery, indicating a breach of the pressure vessel and significant seawater intrusion. On 2 July, River I was able to drive down to Newport, OR to retrieve the recovered glider and discovered that one of the bulkhead connectors had been sheared off. After bringing the glider back to APL/UW 3 July, it was seen that the glider had taken on significant water. Fortunately, the glider data storage cards were completely recoverable, and all engineering and science data was available without significant effort.

Data Distribution:

Science data was distributed as processed PNGs and CSV format in near real time (Table 1). Vehicle trajectory information was updated in near real time and available via a Google Earth updating network link which involved ocean model currents, SST and SSH overlays (Figure 1). The engineering and science data were merged to produce the final data set within 24 hours of

request from NOAA collaborators on 14 March 2022 and distributed via password protected website.

Planned follow on work:

During the FY21 field season, it was identified that there would be no glider-based activities in FY22. Discussions during FY21 indicated that NOAA desired combining fish tag reading, passive acoustic monitoring, physical water structure and oxygen saturation measurement capabilities in a single glider platform. This would provide the fisheries researchers with information on both predators and prey in the water column, in addition to water structure context.