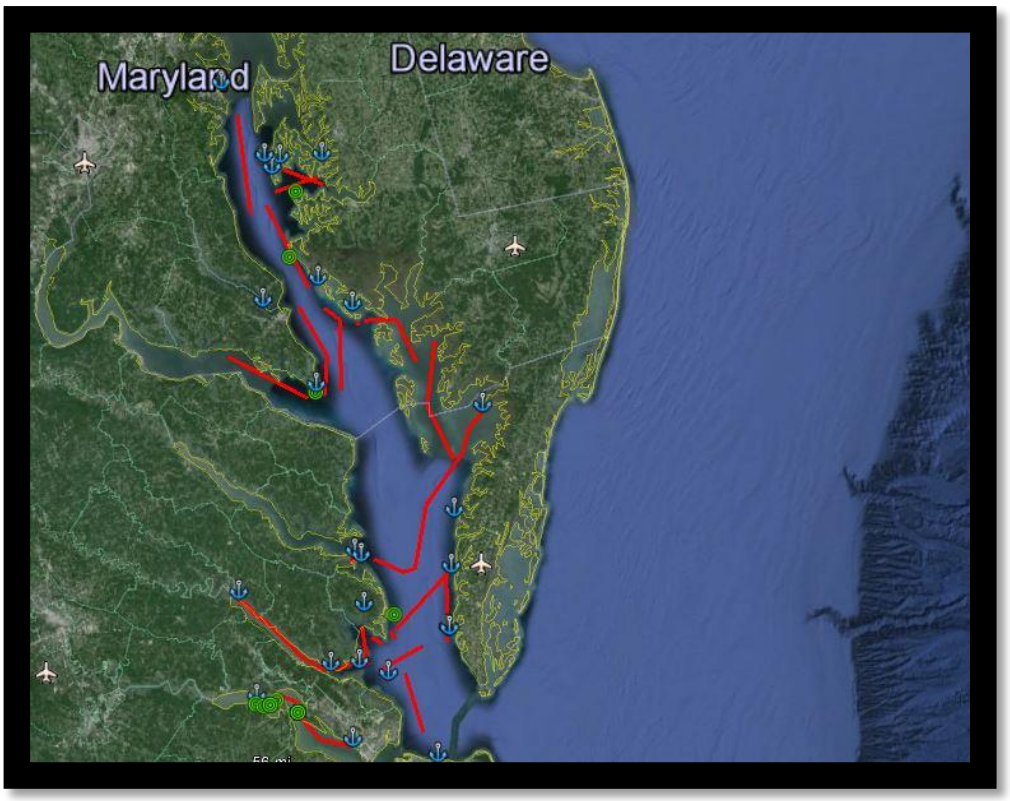
Ocean Research Project's Technical Report:

Chesapeake Bay Mobile Biotelemetry Survey



Final Report to Smithsonian Environmental Research Center

N. Trenholm September 30th 2014

OCEAN RESEARCH PROJECT

Contents:

SURVEY TITLE SHEET

State/Territory:	**Maryland & Virginia/ Mid-Atlantic Chesapeake Bay**		
Scale:	**N/A**	Dates of Survey:	**08/12/2014 to 09/17/2014**
		Project Number:	**N/A**
Vessel:	**R/V Ault**		
Chief of Party:	**Nicole Trenholm**		
Surveyed by:	**Nicole Trenholm** & **Matt Rutherford**		
Processed by:	**Nicole Trenholm**		
Verification by:	**Smithsonian Environmental Research Center**		

Remarks:

1) All Times are UTC

2) Data acquired and projected at UTM Zone 18 North.

N. Trenholm September 30th 2014

OCEAN RESEARCH PROJECT

A. Introduction:

The Ocean Research Project (ORP) is a mission based organization providing services in support of science, education and exploration based out of Annapolis, Maryland within the Chesapeake Bay. Monitoring the livelihood of the bay's biodiversity is key to conserving a healthy marine ecosystem, a must for sustaining mankind's continued use of the bay resource. The ORP characterizes the bay's vital habitat and in this instance serves as a vessel of opportunity employing biotelemetry technology to investigate the cownose ray population and other tagged species in collaboration with Dr. Matt Ogburn of of The Smithsonian Environmental Research Center SERC's Fish and Invertebrate Ecology Lab. There are significant gaps in our understanding of the basic biology and ecology of cownose rays resultinh with our nation's inability to make fishery management decisions based on sound science. The Chesapeake Bay is a vital nursing ground for the cownose ray species. Ray's annual migration revolves around first appearing in the bay around late April and exiting for southern warmer waters no later than October.

Cownose ray movement is tracked by an array of stationary hydrophones. A few dozen cownose rays equipped with passive acoustic telemetry transmitters were released near the mouth of the York River and Tilghman Island in opposite regions of the bay over the summer. Large gaps between stationary receiver stations were filled by the mobile biotelemetry unit (R/V Ault) between August and late September. The R/V Ault survey ranged from Jamestown, VA to Annapolis, MD. The total trip was approximately 300 nautical miles. The mobile survey was conducted using ORP's VEMCO VR100 acoustic receiver and VEMCO VR2w 69khz receiver towed at the average speed of 2 knots while the VR2w receiver was always deployed when the R/V Ault was not underway to occupy each anchorage location. Average survey speed was not increased considering multiple attempts to conduct a range and speed test were abandoned or delayed due to a variety of unfavorable conditions.

The data and acquisition logs were populated after each significant survey day. Detection data notifications and survey plan updates were provided often for Dr. Matt Ogburn's input and shared with the Anne Arundel county School District Intern to include in an acoustic telemetry database. Detections of fish tagged by other researchers were transmitted via the Atlantic Cooperative Telemetry Network.

Objectives:

1. Conduct a range and speed test to determine the optimum speed at which VR100 and VR2W hydrophones can be used in mobile telemetry applications.
2. Conduct a mobile telemetry survey via sailboat at the optimum speed from near Jamestown, VA to Annapolis, MD.
3. Download telemetry data at daily intervals and email to Dr. Matt Ogburn for inclusion in a survey database.

B. Area Surveyed:

Survey was conducted beginning in August 2014 from 8/12-9/17/2014. The survey consisted of the acquisition of VEMCO tag detection data from VEMCO VR100 & VR2W 69 khz receivers. The survey began in the lower Bay up to Annapolis. MD off of Thomas Point. The James, York, Potomac, Jackson Creek, and Choptank tributaries were included in the bay survey. When conditions were not

permitting quality survey data collection or after a full day of surveying the R/V Ault would anchor and occupy the area with the VR2w receiver deployed and monitoring for detections.

Survey Metrics:

Total	**#**
Survey Lines Mileage	298.15 nm
Occupations	25
Tags Identified	15
Average Speed	2.0 knots

C. Methods: Data Acquisition and Processing

1. Survey Vessel

The R/V Ault was used throughout the entirety of this survey. It is a steel schooner with a Perkins 4108 50hp single screw engine and autopilot making for a functional biotelemetry survey platform in the Chesapeake Bay and surrounding tributaries. Ault's sail plan allows her to sail at the optimal biotelemetry survey speed averaging at 2.0 knots. Ault's 4.5ft draft permits surveying in the dominating shallow regions of the bay while the receiver hydrophones can be lowered below the vessel keel, hull and rudder to eliminate receiver interference from the vessel's substructure. Amidships, the low freeboard and adjacent pilothouse access allows for the VR100 cable to run direct and freely, from outside to inside allowing for easy monitoring of the VR100 topside unit from within the pilot house and where the system could easily be recharged by an inverter unit. Lead weights and a mushroom anchor were used to help the receiver hydrophones stay submerged when underway surveying.

2. Survey Equipment

- VR2W 69 khz
- VR100 has internal GPS positioning unit

- **Horizontal Positioning**: Garmin 546

  The horizontal datum used for this survey is the North American Datum of 1983 (NAD 83). The projection is Universal Transverse Mercator (UTM-Zone 18N).

- **Software**: Hydrographic & Navigation Software
  - VR100 Host Software 3.2.1: by AMIRIX Systems used for VEMCO's VR100 data upload and export software
  - VUE 2.1.3 (007): by AMIRIX Systems used for VEMCO's VR2W data upload, offload and configuration.
  - Google Earth Pro: Aided in survey planning, path, occupation and detection plotting, data analysis, and report graphic development.

3. **Quality Control**

- Pre-project equipment briefing on the use of the VR100 was conducted in early August 2014 at SERC facility in MD as well as discussions on survey and test procedures with Dr. Ogburn. A pre-survey Speed & Range Test attempt occurred in early August which allowed for VR2w & VR100 operation trials with the use of transmitters. ORP has operated a VR2W unit in multiple international oceanic surveys & is competent in its management.

4. **Corrections to Biotelemetry Receiver:**

VR100's time was configured incorrectly at first and was then corrected at -5 hours behind UTC time after 8/14. Spreadsheet detection times before 8/14 were adjusted adding three hours from the recorded time.

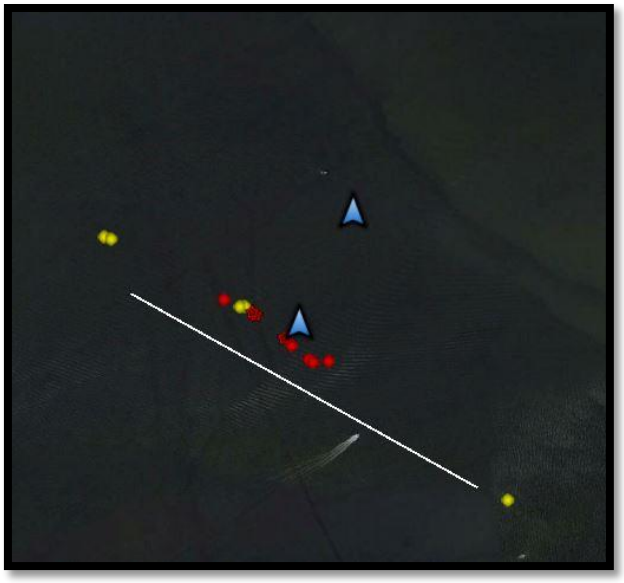
D. Results:

4 speed and range tests were attempted while multiple conditions challenged their completion. The conditions included: to little or inconsistent wind, heavy boat traffic, strong currents, lack of large enough flat surface for 1km transect, and imminent thunderstorms events.

The first speed and range test on 8/1/2014 revealed that both receivers can detect transmission up to 400 meters while surveying under sail up to 2.0 knots.

The second and third test attempts to determine the maximum survey speed were abandoned and delayed due to unfavorable conditions.

On 09/28 the fourth test was conducted at the mouth of the Severn River. Sailing a light weight high performance boat in very light winds allowed us to navigate the tracklines at different speeds. The increase in boat freeboard and draft and the ability to sail at test speeds greater than + 2.0 knots made it more challenging to drop receivers below sailboat substructure. Excessive boat traffic and need for engine at low RPM to keep test transect course as wind died decreased potential for maximum detection recordings.



Graphic: Blue triangles are tags on station, yellow marks are detections of furthest tag and red marks are detections of the closest tag to the white track line. Furthest tag detected at 750 from receiver at 3.0 knots.

A 5th post contract speed and range test will be conducted using the down planer apparatus and additional weight to ensure that the receivers locations are below sailboat subsurface structure. Test speeds will range from 1.5, 2.0, 2.5, 3.0, and 3.5 with one tag positioned at the center of 1 km transect and the other 250m from the first tag and perpendicular to the transect. A brief test report will be available detailing the test and its outcome post-contract.

28.5% of the VR2W's detections were made on anchor during occupation. 85.7% of VR100 detections were also recorded by the VR2W.

Product deliverables include:
Google Earth GIS Files: Survey Detections, Paths (survey tracks), and Occupations (Anchorage points), and Test geographic information
Detection Data: VRL, CSV, ZLOG files from VR2W and VR100

E. Conclusion

The pilot study was completed to determine the use of a sailboat for large-scale mobile acoustic telemetry surveys. A comparison to the regional stationary acoustic receiver array with the mobile receiver detection data during the survey duration could provide insight to whether or not mobile biotelemetry is a useful data collection method. Dominating little to no wind during the survey period made it challenging to sail and survey consecutive days or during the majority of daylight hours. Lack of wind to optimize maximum mileage potential during survey duration may have contributed to

little detection yield. Detections were recorded primarily nearshore and in regions where known species were released. Species detections were recorded both in the day and evening, during anchored occupation periods and while surveying under sail. 15 species detections were made, 1 false detection, 1 cownose ray, 2 sea turtles, 1 unknown, and 10 sturgeon. I recommend using a longer cable than the 5 m omnidirectional cable for VR100 data collection possibly with a down planer device or appropriate weight relative to speed to ensure greatest detection potential. After the final test I may recommend a down planer device to be used potentially to best control depth of VR2w while submerged undertow again to ensure greatest detection potential. I recommend the use of a sailboat for mobile bio-telemetry studies at a speed not to increase the tests optimal speed. A follow-up study could be planned in the future but a statistical probability of species detection should be considered when planning survey route and occupation location.

F. Approval

As Chief of Party, I have ensured that standard field surveying and processing procedures were conducted in close accordance with Dr. Matt Ogburn's instruction and in compliance with the Statement of Work Issued to The Ocean Research Project. I acknowledge that all of the information contained in this report is complete and accurate to the best of my knowledge.

Nicole Trenholm, Program Director