

A Python tool for Acoustic Telemetry Analysis

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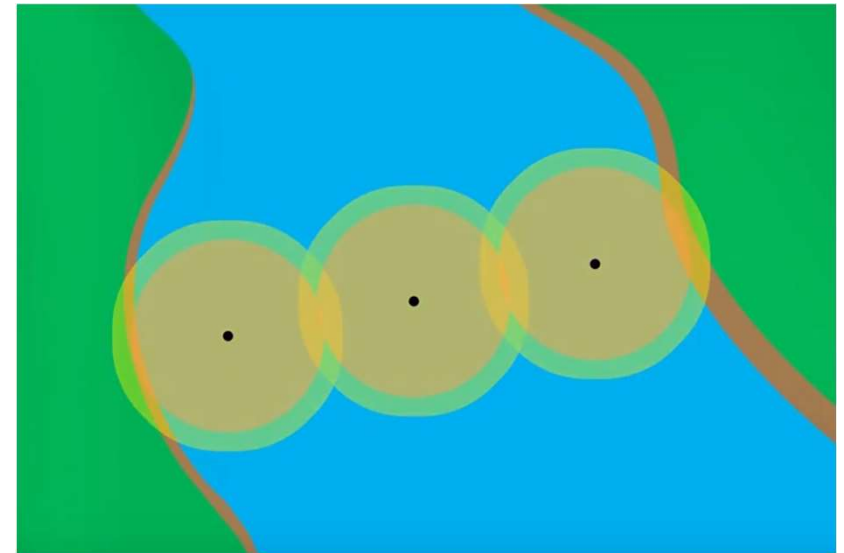
Meridian - OTN Project at SFU's Big Data Hub



Acoustic Telemetry – Detection Range

Factors driving Signal to Noise Ratio (SNR)

- Water quality at research site
 - Salinity, turbidity, temperature
- Weather
- Biological noise
- Anthropogenic noise
- Moorings
- Bottom type / Geomorphology / Vegetation



Receivers forming a gate

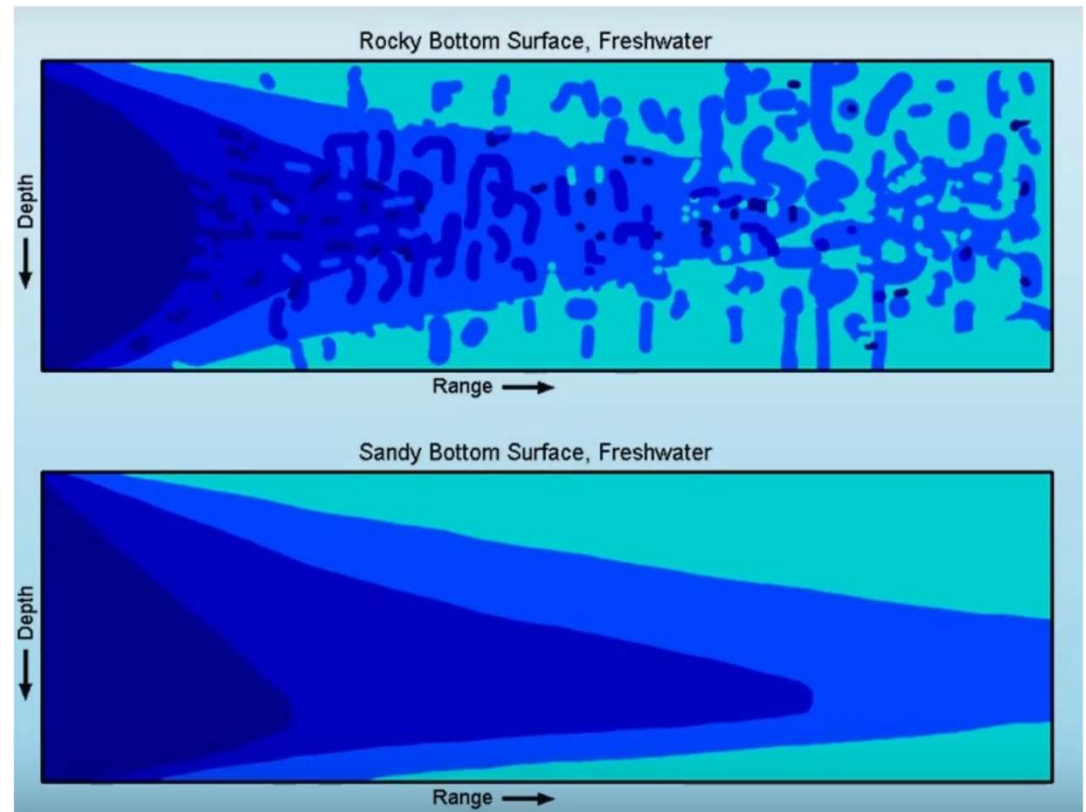
Source: Vemco/INNOVASEA

<https://support.vemco.com/s/article/How-much-detection-range-can-I-expect-from-my-tags-and-receivers>

Understanding Detection Range

- Factors are specific to research site
- Can change over time
- **No single model works well under all conditions**

Example: Bottom type effect on SNR



Source: Vemco

Proposed Workflow

1. Perform **range test**
2. Collect Environmental Variables for Test location and time
3. Combine data
 - Detection event based
 - Time grid for detection rate – all variables are sampled and aggregated on one grid of time bins
4. Visual Analysis of pair-wise relationships
5. Statistical Modeling DR
6. Use predictive model of DR for **field study** analysis

1. Range Test

- Eliminates movement of tags
- Fixed moorings for Receivers and Transmitters
- Test for multiple days or months



Source: Vemco - <https://support.vemco.com/s/article/How-much-detection-range-can-I-expect-from-my-tags-and-receivers>

2. Data Sources

- Environmental variables
 - Sourcing via Kadlu.fetch
- Custom variables via NetCDF import
- Tidal time tables interpolation

Kadlu.fetch data sources

Source	Variable(s)	Notes
ERA5 – Copernicus Climate Datastore	<ul style="list-style-type: none">• Wind speed and direction• Wave height, direction, period• Precipitation type and flux• Energy fluxes and stress	0.5° resolution Global coverage GRIB data format
HYCOM	<ul style="list-style-type: none">• Salinity• Temperature• Ocean currents	0.08° resolution Global coverage NetCDF data format
WWIII – NOAA/NCEP WaveWatch Gen 3	<ul style="list-style-type: none">• Wind speed and direction• Wave height, direction, period	0.5° x 0.5° global resolution Global coverage GRIB data format
GEBCO	<ul style="list-style-type: none">• Bathymetry	15 arc-second resolution Global coverage NetCDF data format

Tool Ecosystem



- Data Science Community
 - R – Rstudio, CRAN
 - **Python** – Anaconda, Pip package management
- Env. Variables: Kadlu – Meridian
<https://docs.meridian.cs.dal.ca/kadlu/>
- Metadata: Resonate – OTN
<https://resonate.readthedocs.io/en/latest/index.html>

4. Demo

- **Jupyter notebooks**
 - Brief version with YAML configuration
 - Details of data sourcing
- **Visual Analysis**
- **Desktop App (streamlit)**

The screenshot shows a web browser window displaying the 'Acoustic Tracking Streamlit' application. The interface is divided into a left sidebar menu and a main content area. The sidebar menu includes a 'Load Data' dropdown and a section titled 'Please Choose your data source' with checkboxes for CHS, ERA5, GEBCO, HYCOM, and WWIII. The main content area contains input fields for a date range (2016/03/09 to 2016/03/11), a longitude value (44.55), and a latitude value (-64.17). Below these are four offset input fields: North Offset (0.20), South Offset (1.00), East Offset (1.00), and West Offset (1.00). There is also a checkbox for 'Enable Debug Mode'. A 'Map' section follows, with a text description and a 'Render Map' checkbox that is checked. At the bottom, a map visualization shows a geographical area with a red boundary and a blue line.

References

- Meridian Tools
<https://meridian.cs.dal.ca/tools-services/>
- Acoustic Tracking Tool
- Documentation
Temporary location: <http://rcg-garage.dcr.sfu.ca/>
Project Page will be update with source code location:
<https://meridian.cs.dal.ca/acoustic-tracking-toolkit/>

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