Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

Welcome to the Annex IV Expert Forum on

Standardization of the Data We Collect

- The Forum will begin shortly
- Introductions
- This forum is expected to be very interactive, please provide your experience and thoughts
- Please IM if you are having technical difficulties with Skype

February 27, 2017

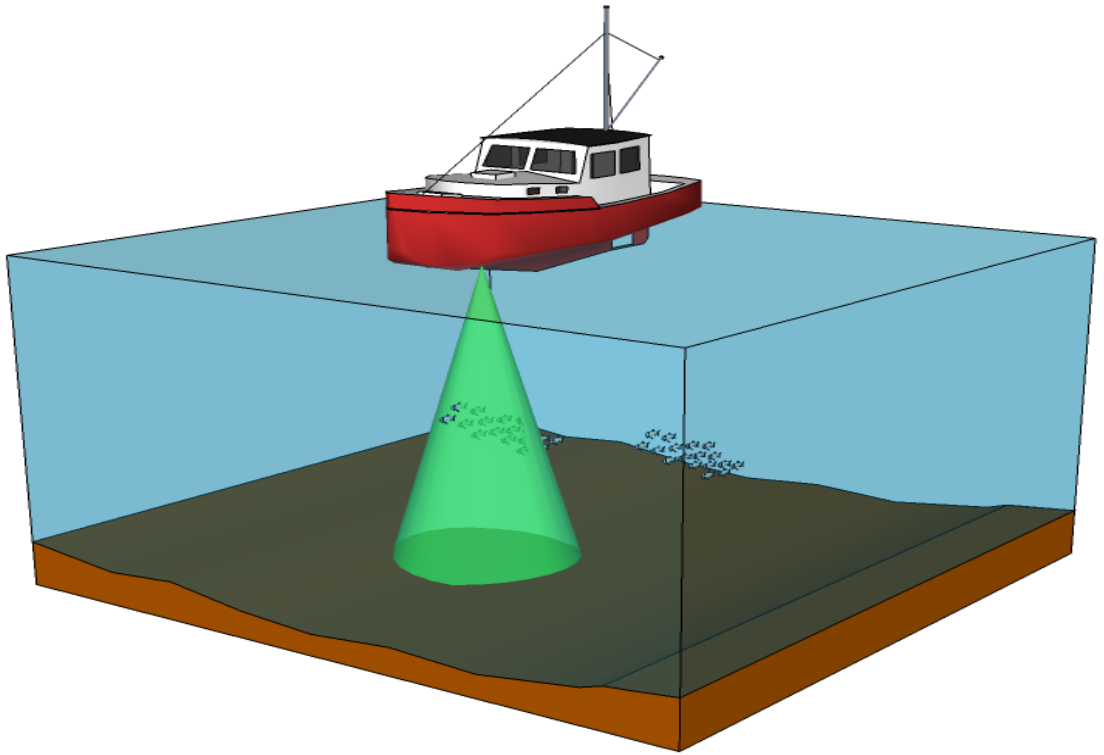
Pacific Northwest
NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

Presentations

- **Andrea Copping**, PNNL and Annex IV
  - Opening remarks, context
- **Aurélie Daroux,** University of Maine, **Melissa Oldreive**, Fundy Ocean Research Center for Energy (FORCE) and **Haley Viehman,** Acadia University
  - Fish interactions around turbine in Bay of Fundy
- **Haley Viehman**, Acadia University
  - Fast Platform in Bay of Fundy
- **Gayle Zydlewski**, University of Maine, **Garrett Stains**, Pacific Northwest National Laboratory and **Haley Viehman**, Acadia University
  - University of Maine, Cobscook Bay

Aurélie Daroux, University of Maine, **Melissa Oldreive**, Fundy Ocean Research Center for Energy (FORCE) and **Haley Viehman**, Acadia University

Methods



- Hydroacoustic mobile survey
- Broadband EK80 echosounder, but use mostly at **120 kHz**

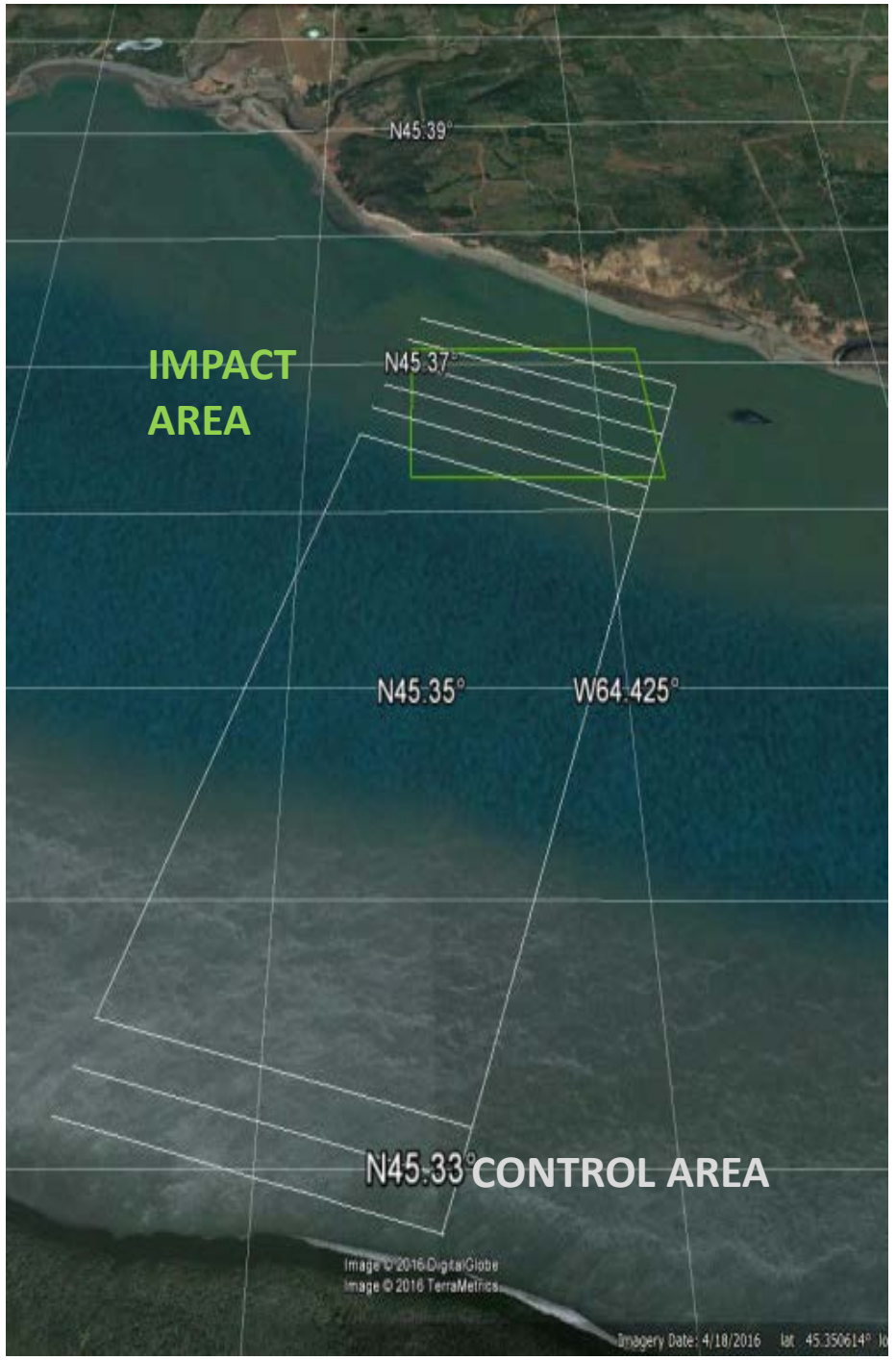
Sampling

- Parallel transect (against and with the tide):
  - 1.8 km long
  - 100m apart

- Good coverage of the impact area

- **Importance of the sampling of a control area**

- **Surveys:** 24 hours (2 ebb and 2 flood tides; day and night) on neap tides (every month)

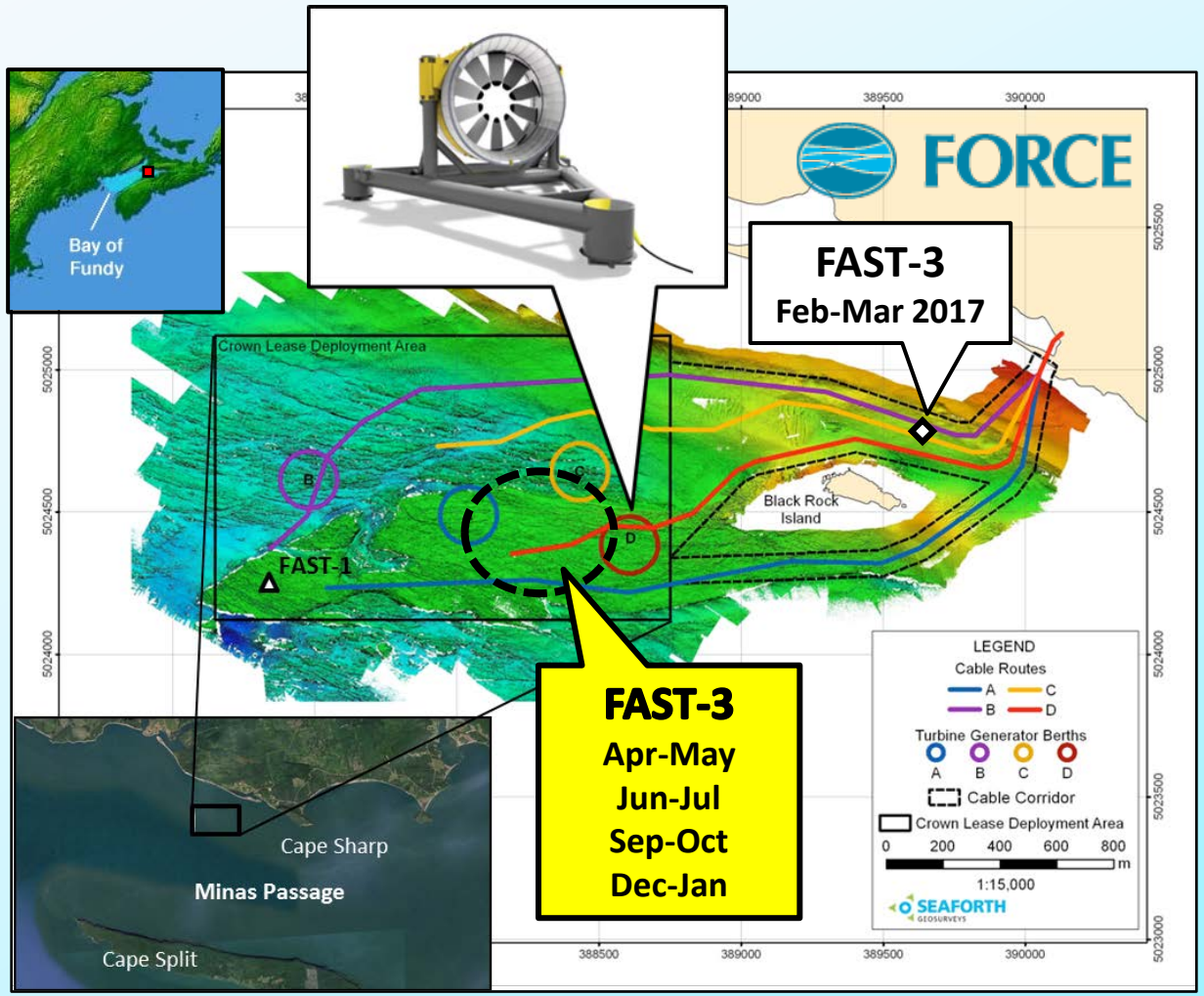


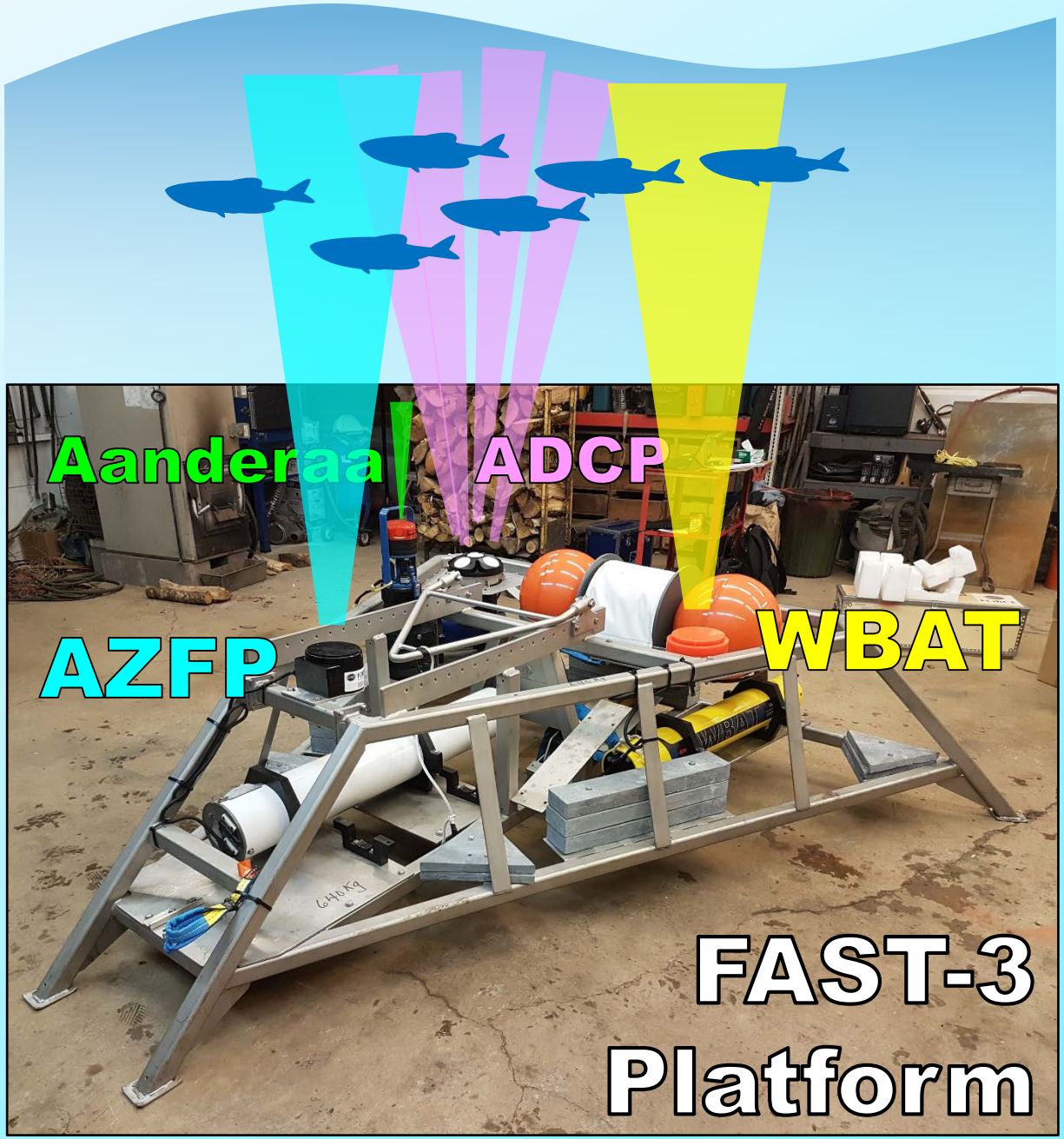
Data processing and analysis

- Data processing using EchoView, and export of the relative fish density (apply a TS threshold of -60dB)
- Applying a before-after-control-impact to examine indirect effects of TISEC devices on **water column relative fish density**.
- Examine indirect effects of TISEC devices on **fish vertical distribution**
- Determining the probability of **fish being at the same depth** of the deployed turbine

FAST-3 Platform, FORCE

Anna Redden, Haley Viehman
Acadia University; FORCE team





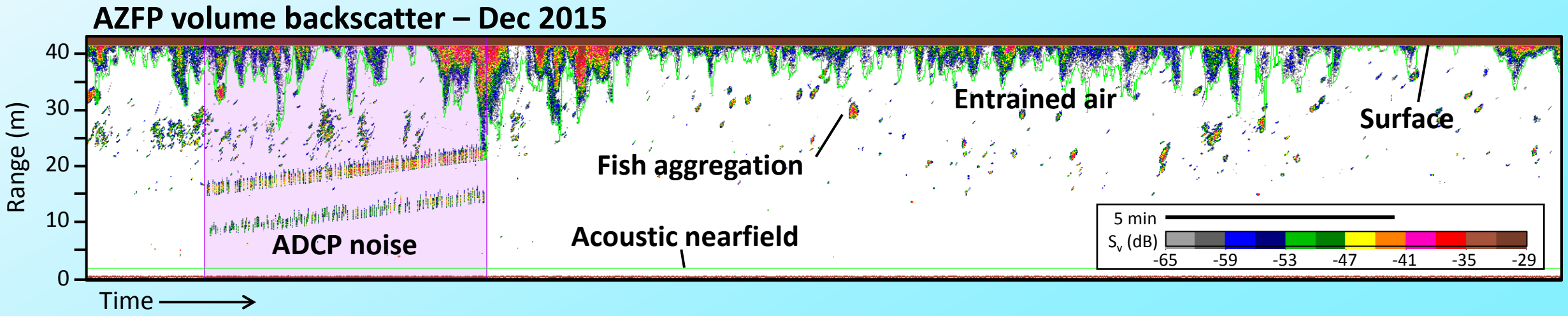
Data to be Collected

Measured quantities

- Volume backscatter (fish “density”)
- Target strength (fish “size”)
- Current velocity
- Temperature
- Pressure
- Conductivity
- O_2
- Tilt/Roll

Timing

- Sampling rates of 1 to 4 times per second
- Sampling a few minutes per __ amount of time
- All data saved
- Planned deployments ≥ 1 month



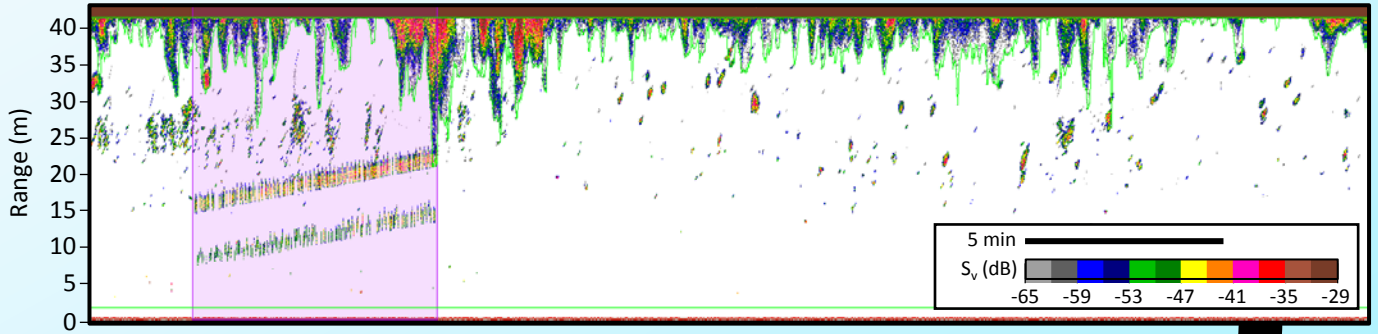
Data analysis

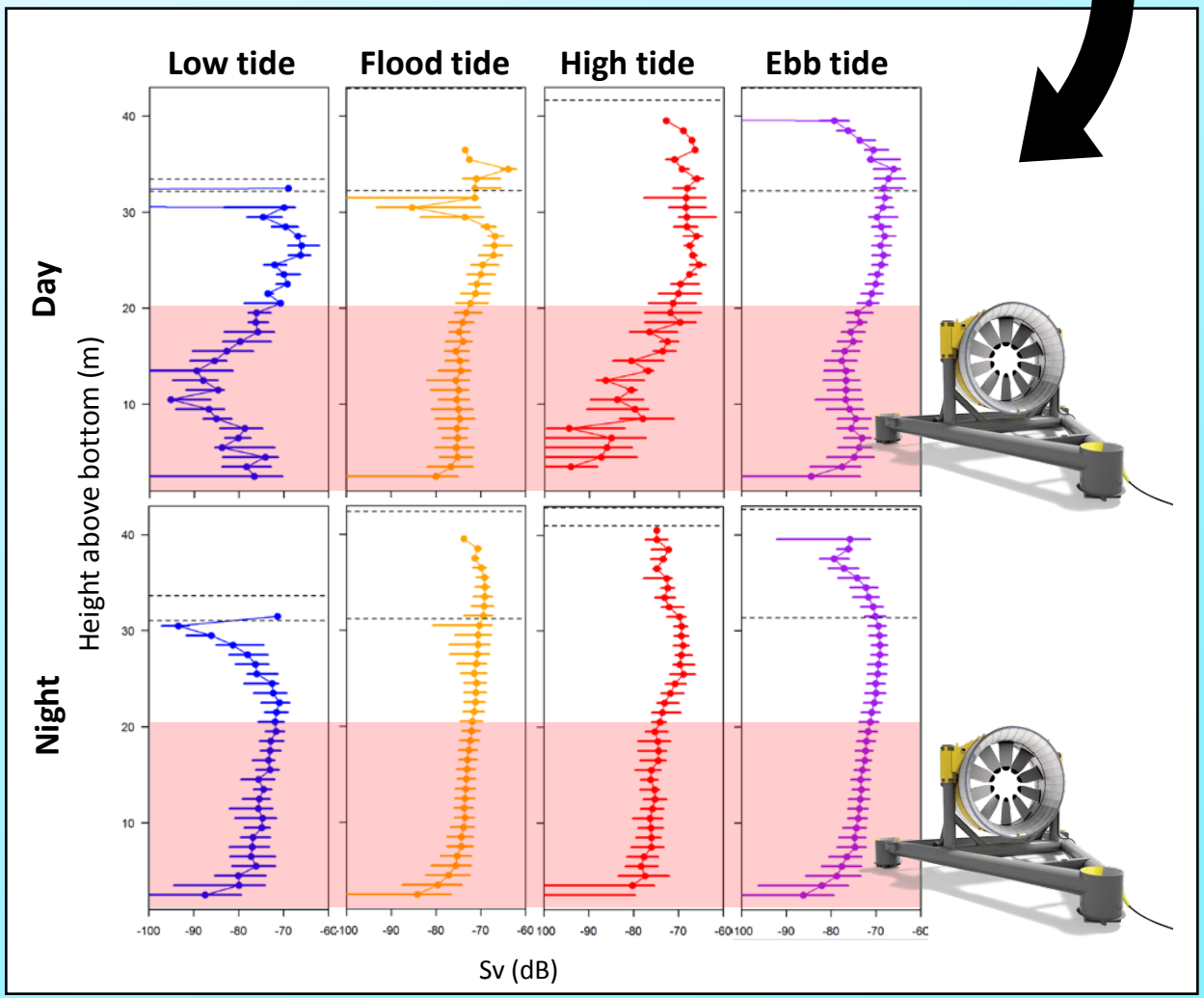
Analysis

- Relative density
- Vertical distribution
- Temporal variation

Objectives

- Long-term time series, before/after
- Probability of turbine encounter
- *Population level effects*





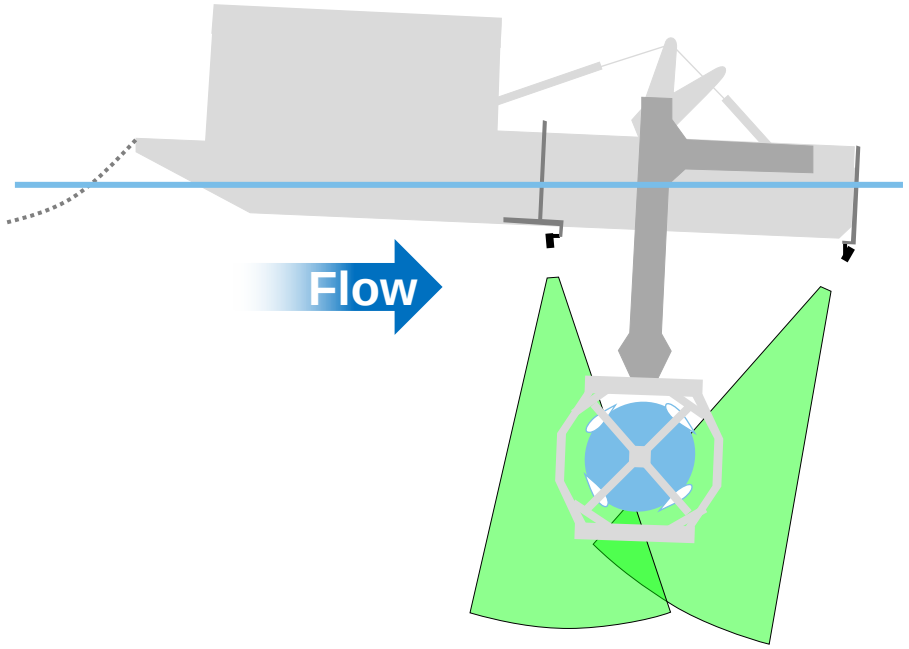
Cobscook Bay, Maine

Gayle Zydlewski, Garrett Staines, Haley Viehman, Haixue Shen, James McCleave, Jeff Vieser, Aurélie Daroux (University of Maine)

Methods

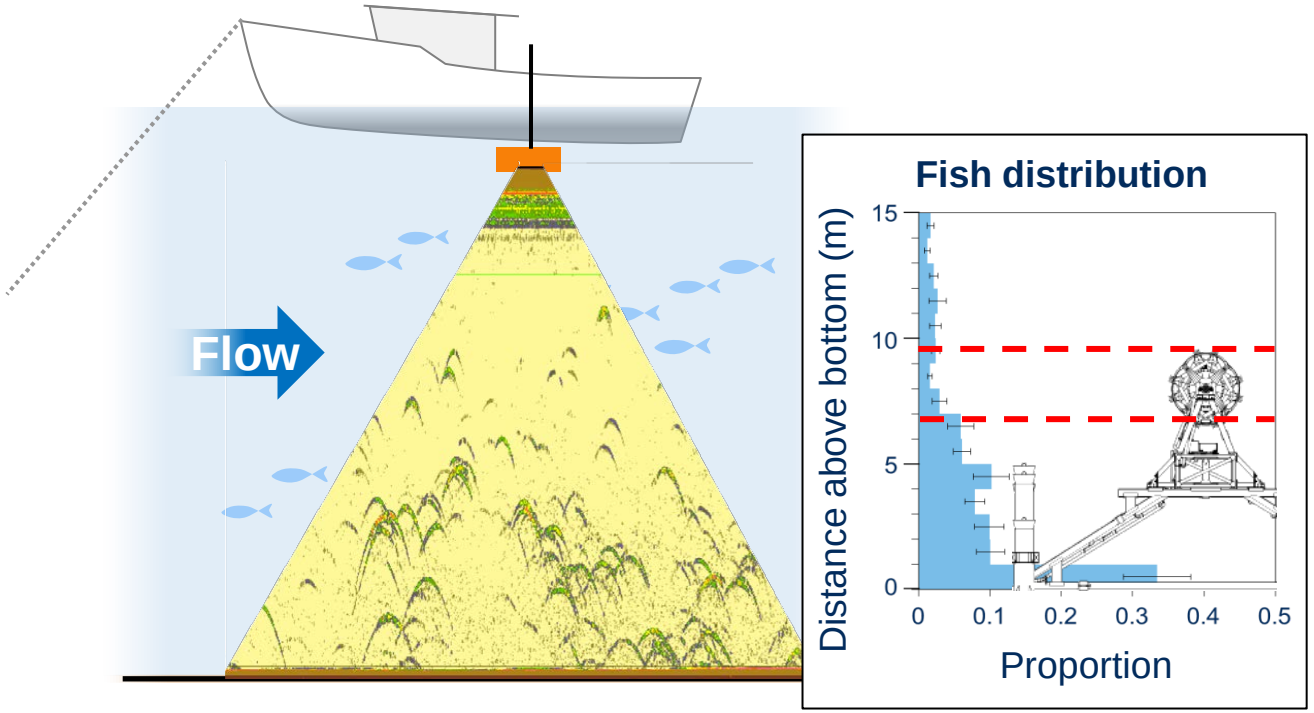
Dual DIDSON acoustic cameras (24 hrs, 2010)

- Fish behavior within 3 m of test turbine, up- and down-stream



Stationary down-looking hydroacoustics (24-hr surveys, 2010-2015)

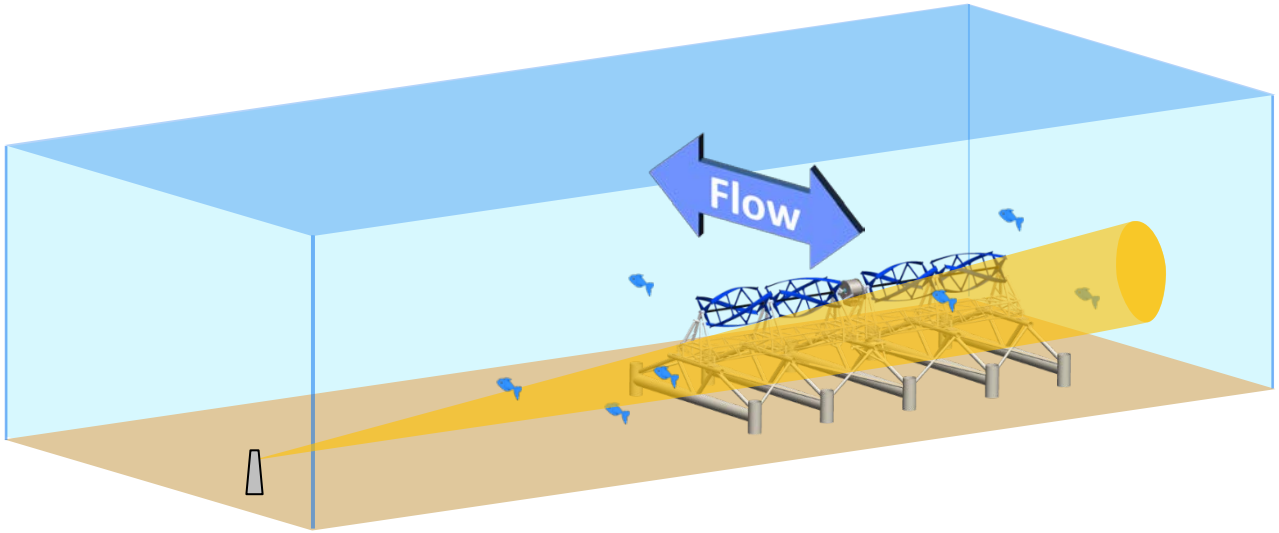
- Vertical distribution
- Relative density (seasonal trends)
- Before-After-Control-Impact



Methods

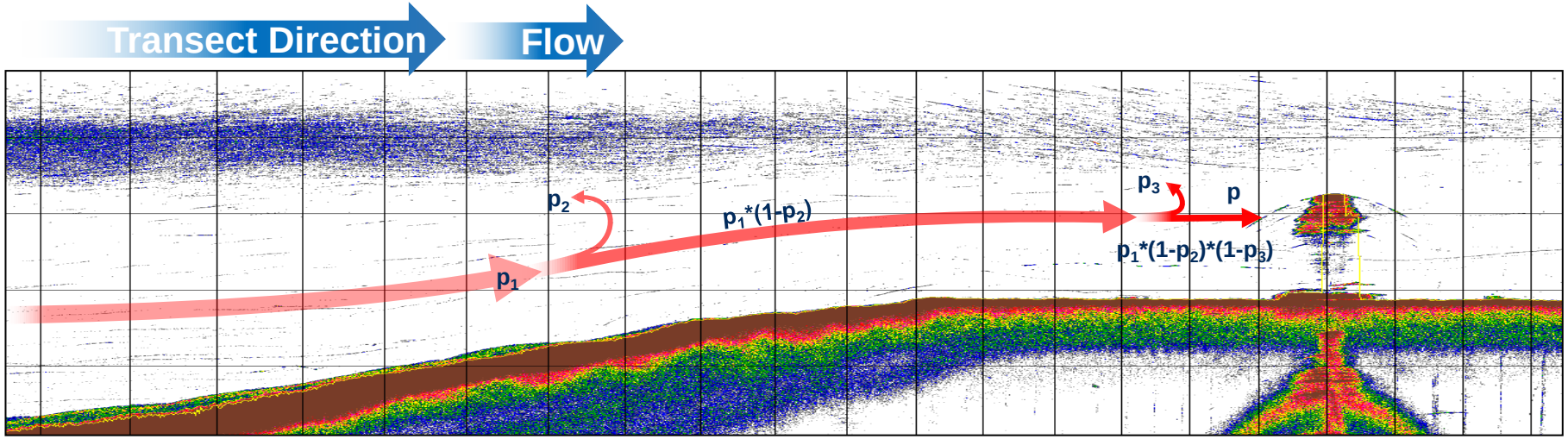
Stationary side-looking hydroacoustics (2012-2015)

- Temporal variation in fish presence at turbine depth
- Fish behavior near static turbine



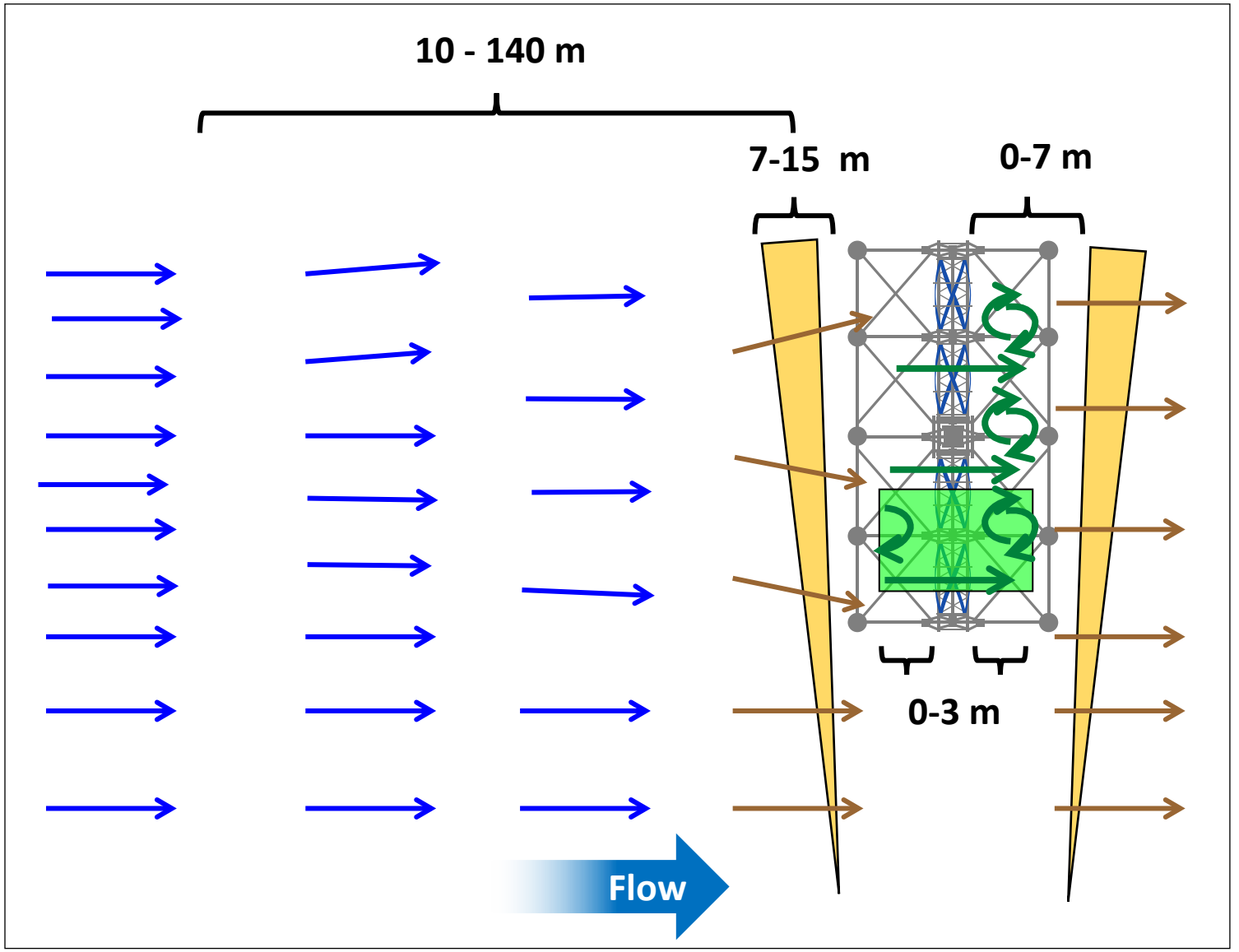
Mobile down-looking hydroacoustics

- Probability of fish encountering turbine



Discussion

- Methods provide fish tracks or fish backscatter
- Data collected with no thresholds (all saved)
- Data analyzed in a variety of ways
  - Vertical distributions (downlooking hydroacoustics)
  - Before-After-Control-Impact (downlooking hydroacoustics)
  - Behavior near device (sidelooking hydroacoustics)
  - Temporal changes in fish presence (sidelooking hydroacoustics)
  - Probability of encounter (mobile hydroacoustics)
- Interpretation of data
  - Detect changes in:
    - Behavior near device (0 – 15 m)
    - Fish abundance over time near device (0 – 15 m)
    - Vertical distributions or abundance near device (50 – 150 m)
    - Abundance approaching device (5 – 140 m)



Shen et al. 2016 (Mobile down-looking, stationary down-looking)

Viehman 2016 (stationary side-looking, static turbine)

Viehman and Zydlewski 2015 (DIDSON)

Standardization Issues:

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- What level of standardization is important, and feasible, for monitoring around devices? For example, should everyone use the same instruments and methods to make the data completely comparable, or is measuring the same parameters using a variety of well calibrated instruments and methods sufficient?

- If we want to standardize data collection, how could we help make this happen? For instance, should we work with the regulatory agencies to have them require standardization, or are there other effective mechanisms?

Thank you!

Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

- Recordings of the presentation and discussion will be posted on Tethys at:
  https://tethys.pnnl.gov/expert-forums-marine-renewable-energy

- For more information or ideas for future forums, please contact:

Andrea Copping (Andrea.Copping@pnnl.gov)
Amy Woodbury (amy.woodbury@pnnl.gov)
Jonathan Whiting (Jonathan.Whiting@pnnl.gov)
Mikaela Freeman (Mikaela.Freeman@pnnl.gov)
Nikki Sather (Nichole.Sather@pnnl.gov)

U.S. DEPARTMENT OF ENERGY

OES OCEAN ENERGY SYSTEMS

ANNEX IV