Tracking the movements of large at-risk species at a turbine test site

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OERA Offshore Energy Research Association of Nova Scotia

Acadia Estuarine Centre for Research

FORCE Fundy Ocean Research Center for Energy

Acadia University

Open Seas Instrumentation Inc.

Ocean Tracking Network Headquartered at Dalhousie University

smru Limited

Ocean Sonics

Nova Scotia Power An Emera Company

vemco

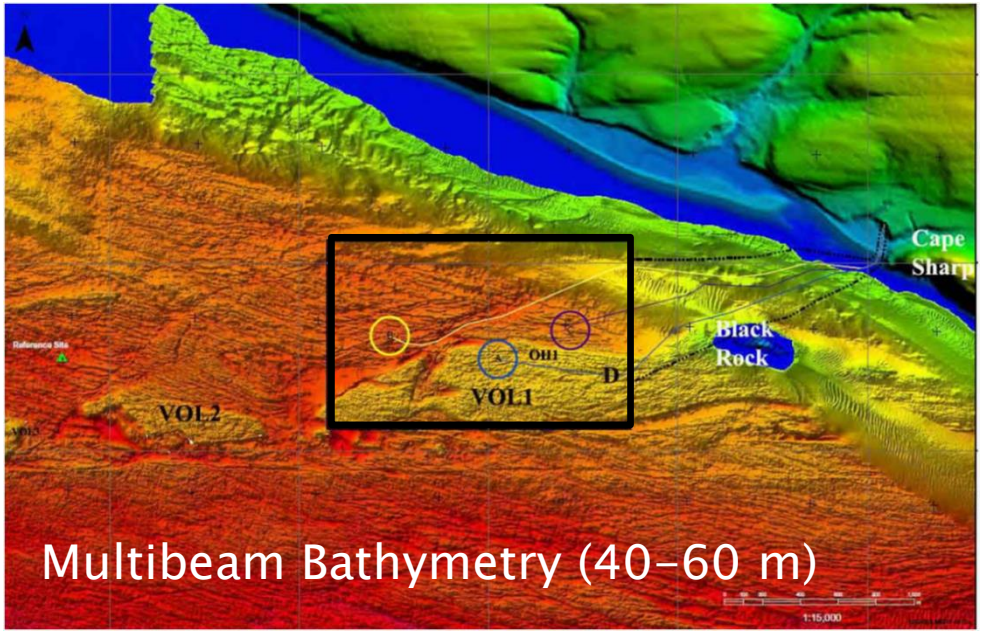
Mitacs

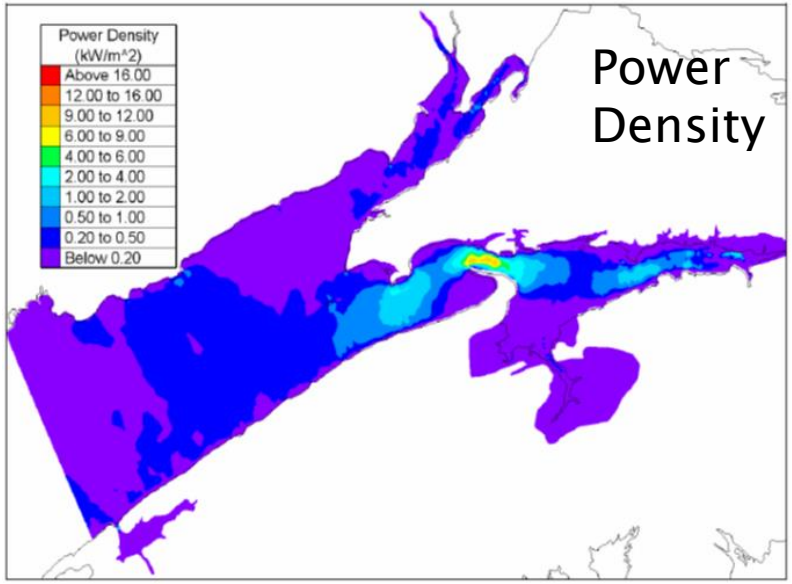
Natural Resources Canada

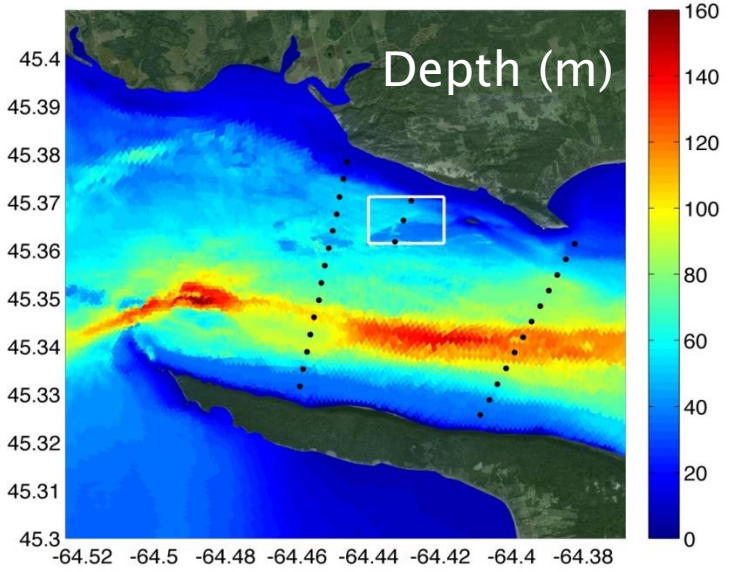
NSERC CRSNG

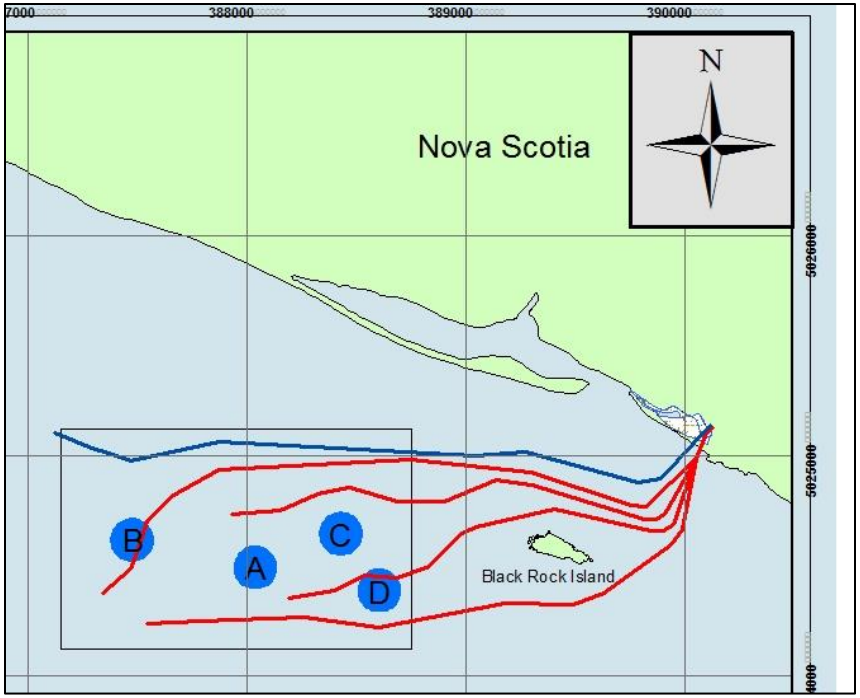
Fisheries and Oceans Canada

FORCE and Site Features







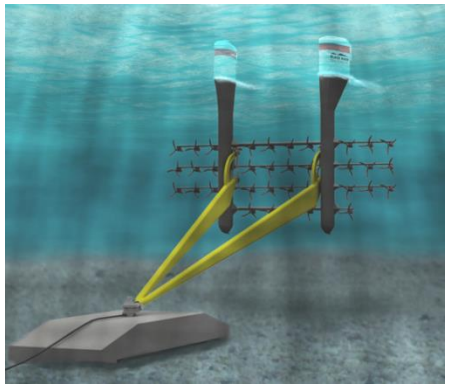


In-Stream Tidal Turbines
FORCE: 2015-2018

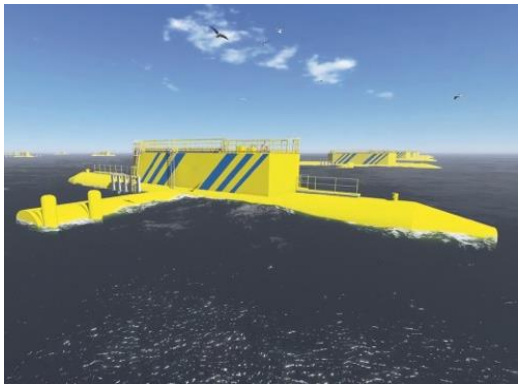
- 1.0 x 1.6 km test site
- 4 berths with cables
- Large commercial scale devices
  - Rated 1 MW+ per installation
  - Power for 300-600 homes / unit

OpenHydro

Black Rock Tidal



Minas Energy, Siemens & Bluewater

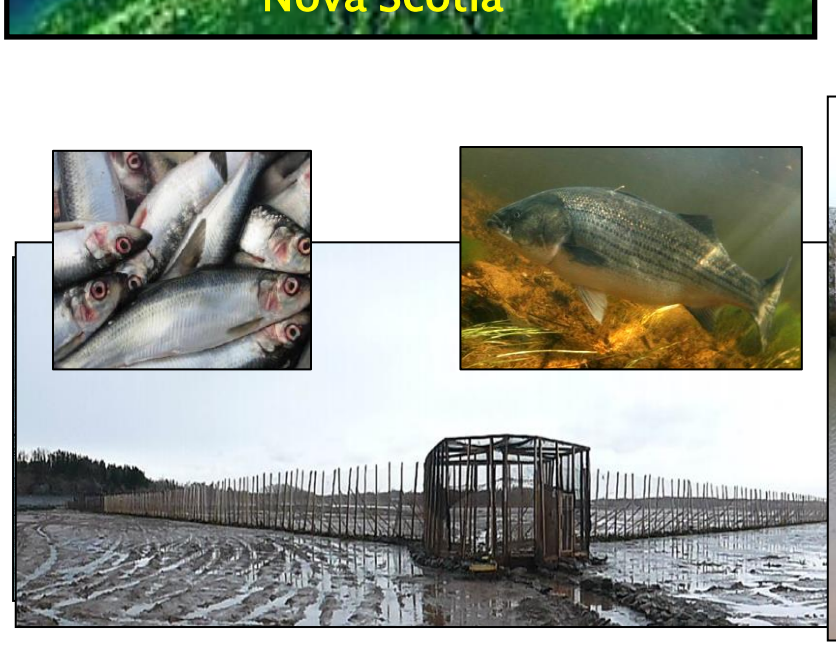


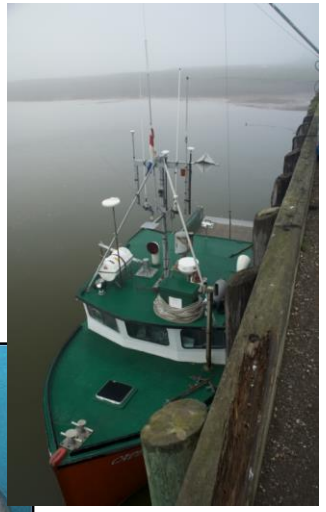
Atlantis Resources & Lockheed Martin

FORCE
Fundy Ocean Research Center for Energy

Tidal Energy Dev't: Environmental Implications

- Environmental Monitoring Advisory Committee (EMAC)
- Near to mid-field effects?
- Impacts on marine mammals?
- Impacts on fish and lobsters?
  - Migration corridor
  - Transboundary fishes
  - Threatened / endangered





Acoustic Detection of Fish & Lobsters

- Temporal and spatial patterns in the use of Minas Passage / FORCE
- Acoustic tags (Vemco)
  - Fish (286 tags implanted)
  - Lobster (85 tags, carapace)
    - Battery / tag size limits

Species	Status	#Tags
Atlantic sturgeon	Threatened	114
American eel	Threatened	45
Striped bass	**Endangered (BoF)**	**165**
Atlantic salmon	Endangered (iBoF)	62

Minas Passage / FORCE Receiver Lines

2011

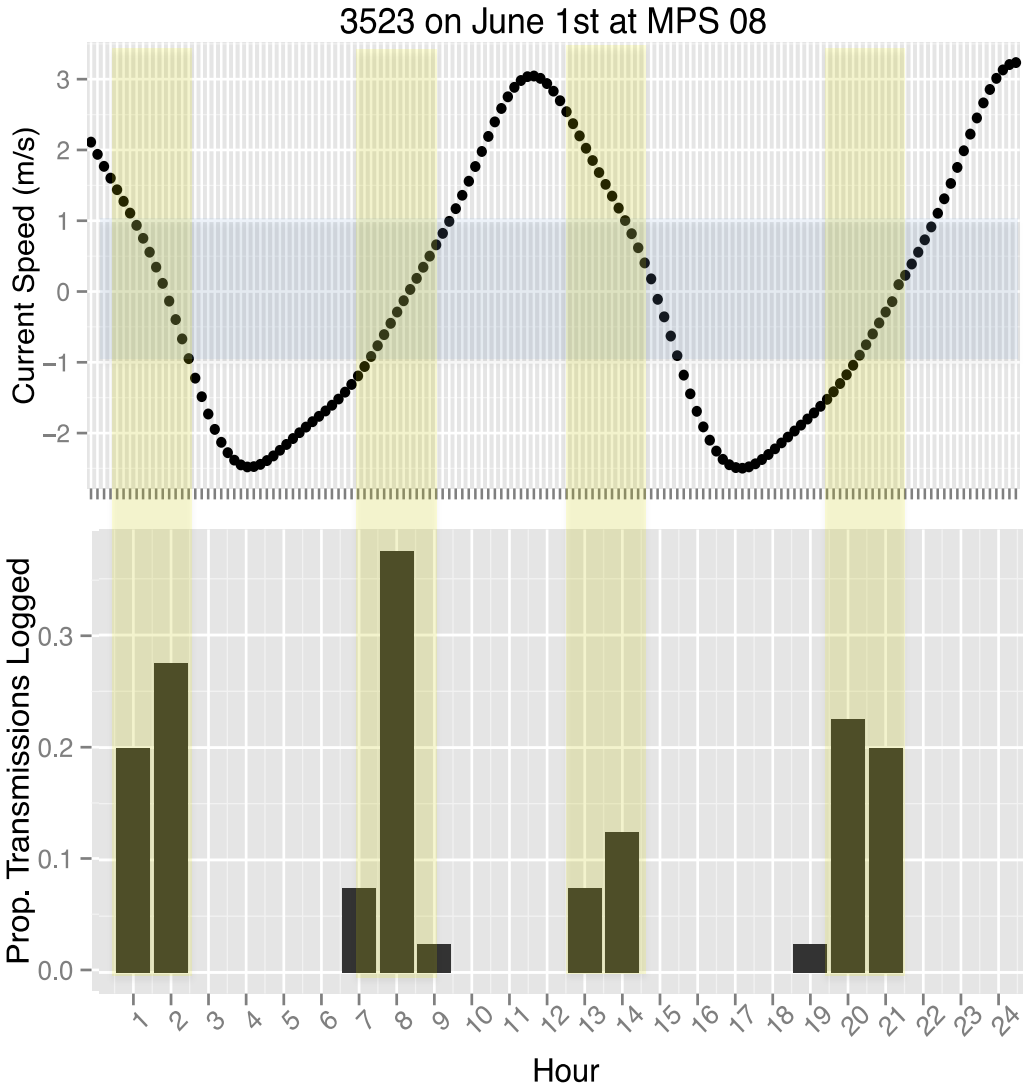
2012 / 2013

Listening gates

OCEAN TRACKING NETWORK
Headquartered at Dalhousie University

300-400 m between units

Depth-Averaged Current Speed & Range Test Acoustic Tag Detection

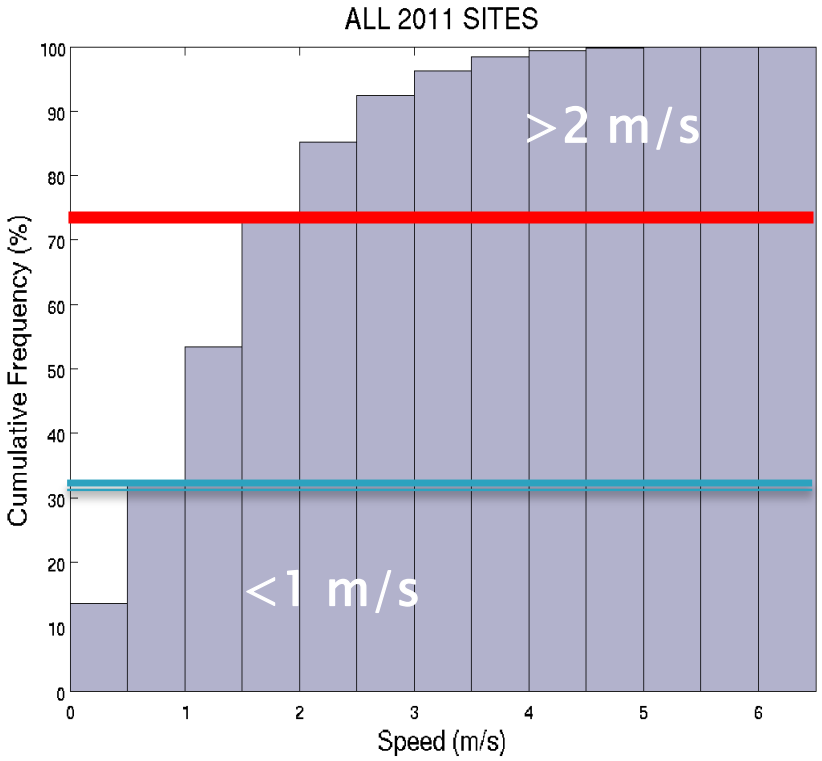


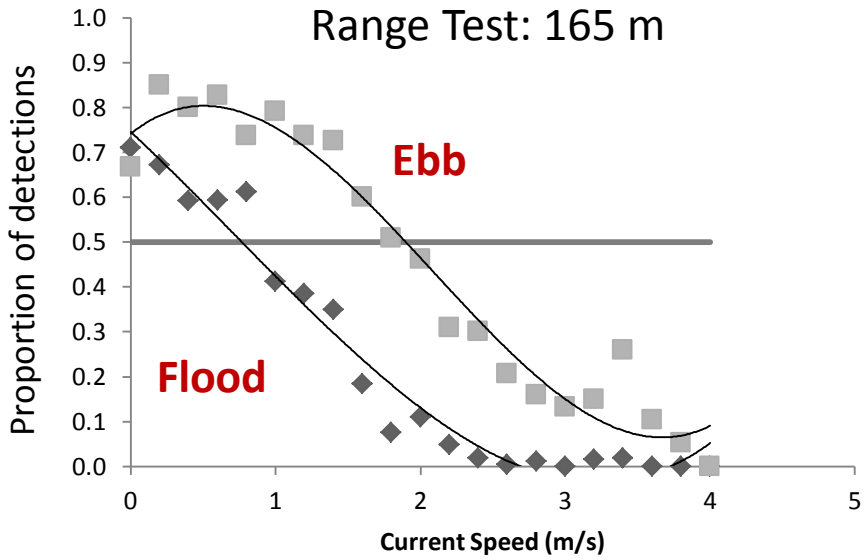
Flood

0-1 m/s

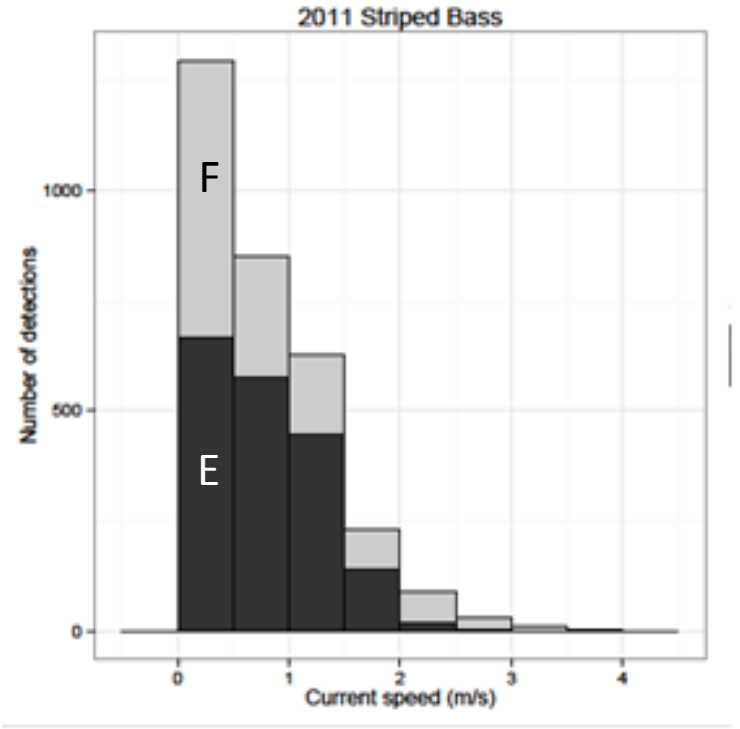
Ebb

Tags detected ~40% of the time and not during peaks flows



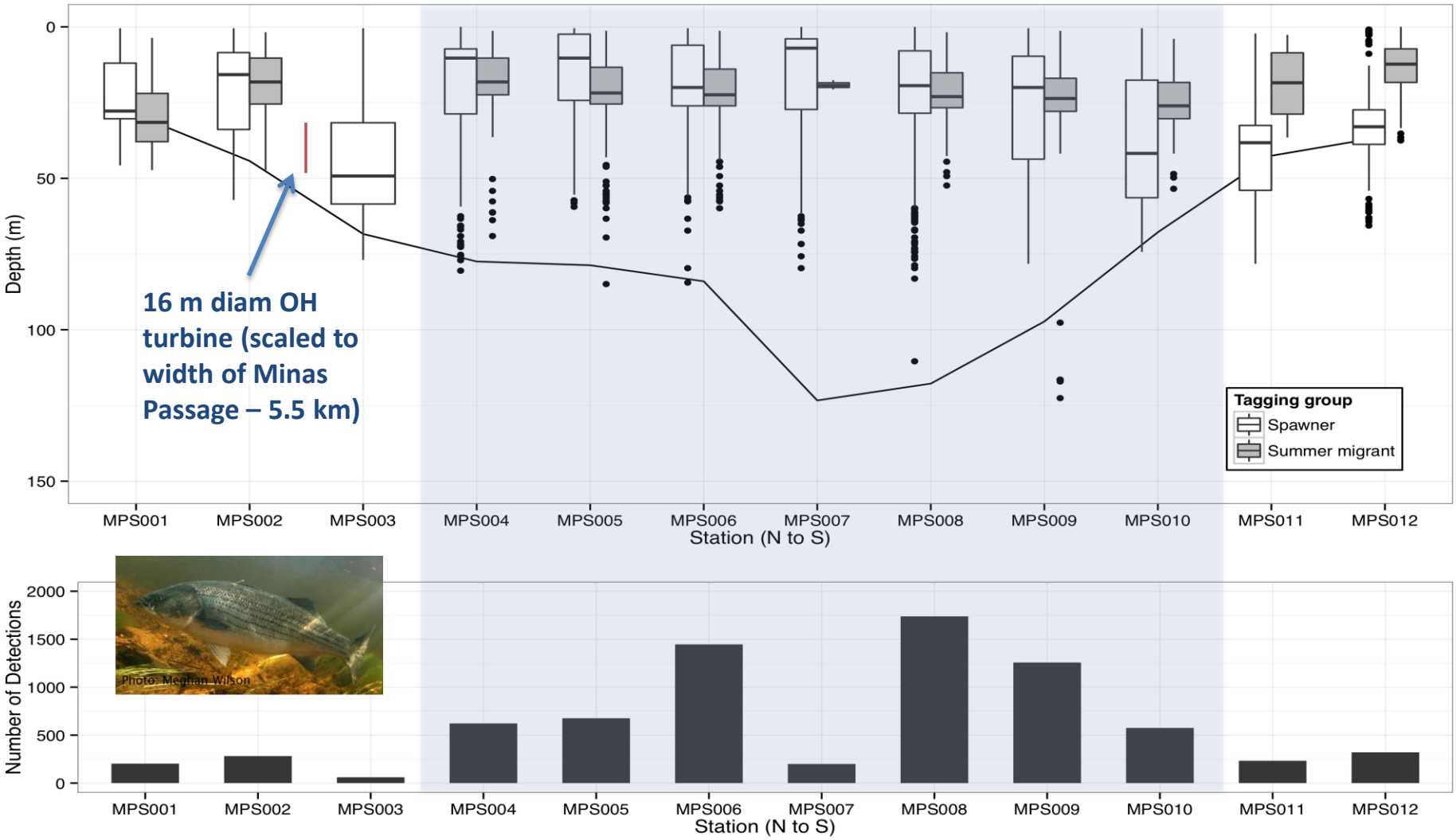


- Top left: Depth-ave speeds are often >2 m/s
- Bottom left: Receiver detection efficiency ↓ as current speed ↑
  - Ebb >> flood
- Bottom right: Low detections at high flows reflects detection efficiency, not absence of fish



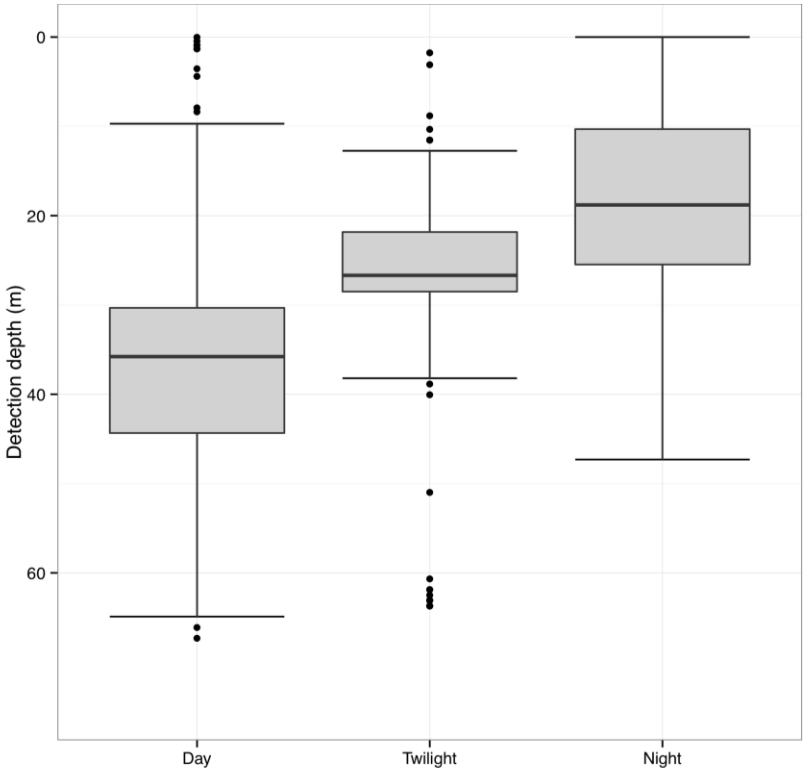
Credit: Jeremy Broome

Striped bass tag detections & depths
(2011 – 2013)

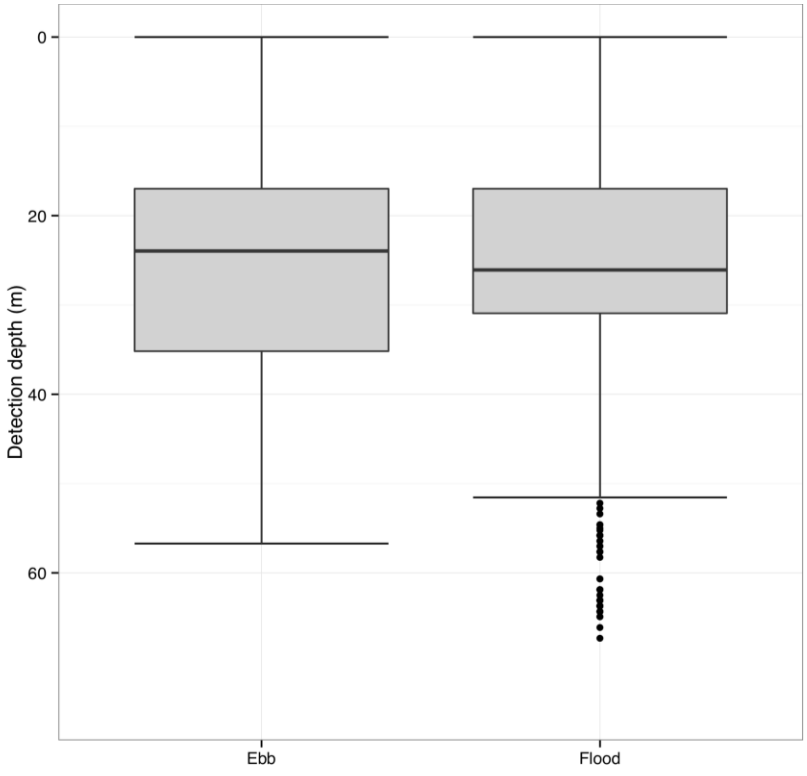


Striped bass - detection depths at FORCE

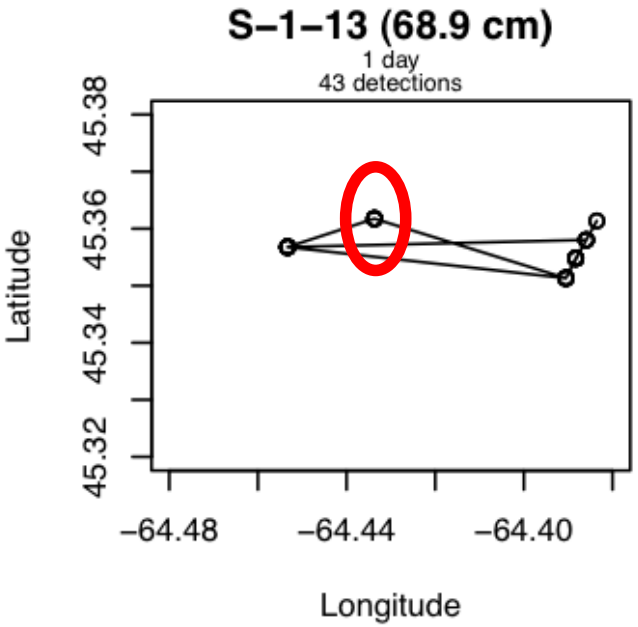
Day Night

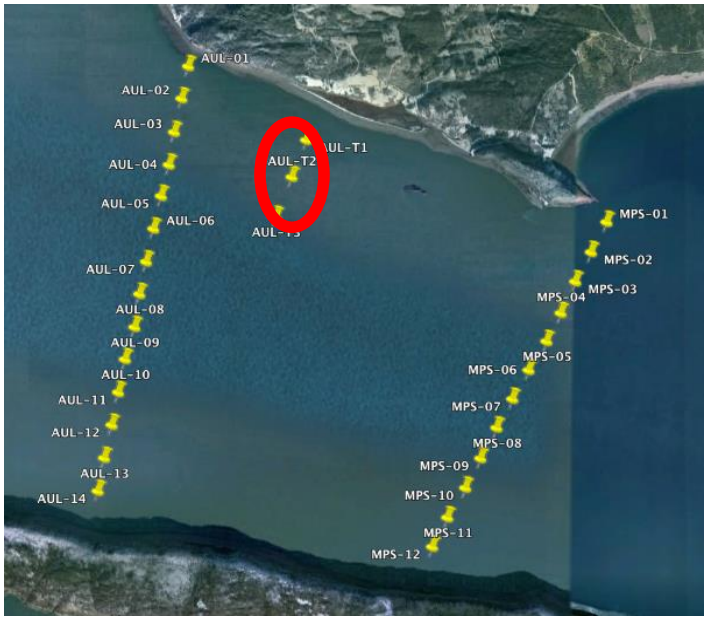


Ebb Flood

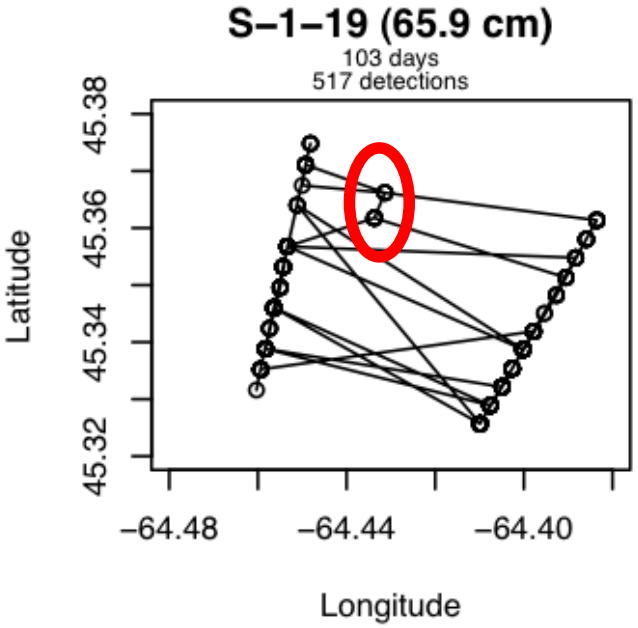


1 day





103 days



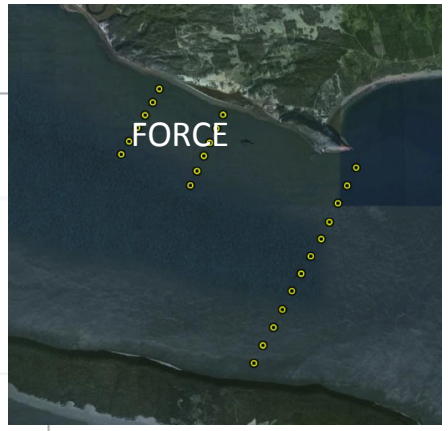
Striped bass utilize the entire Passage but are more commonly detected in the middle of the Minas Passage

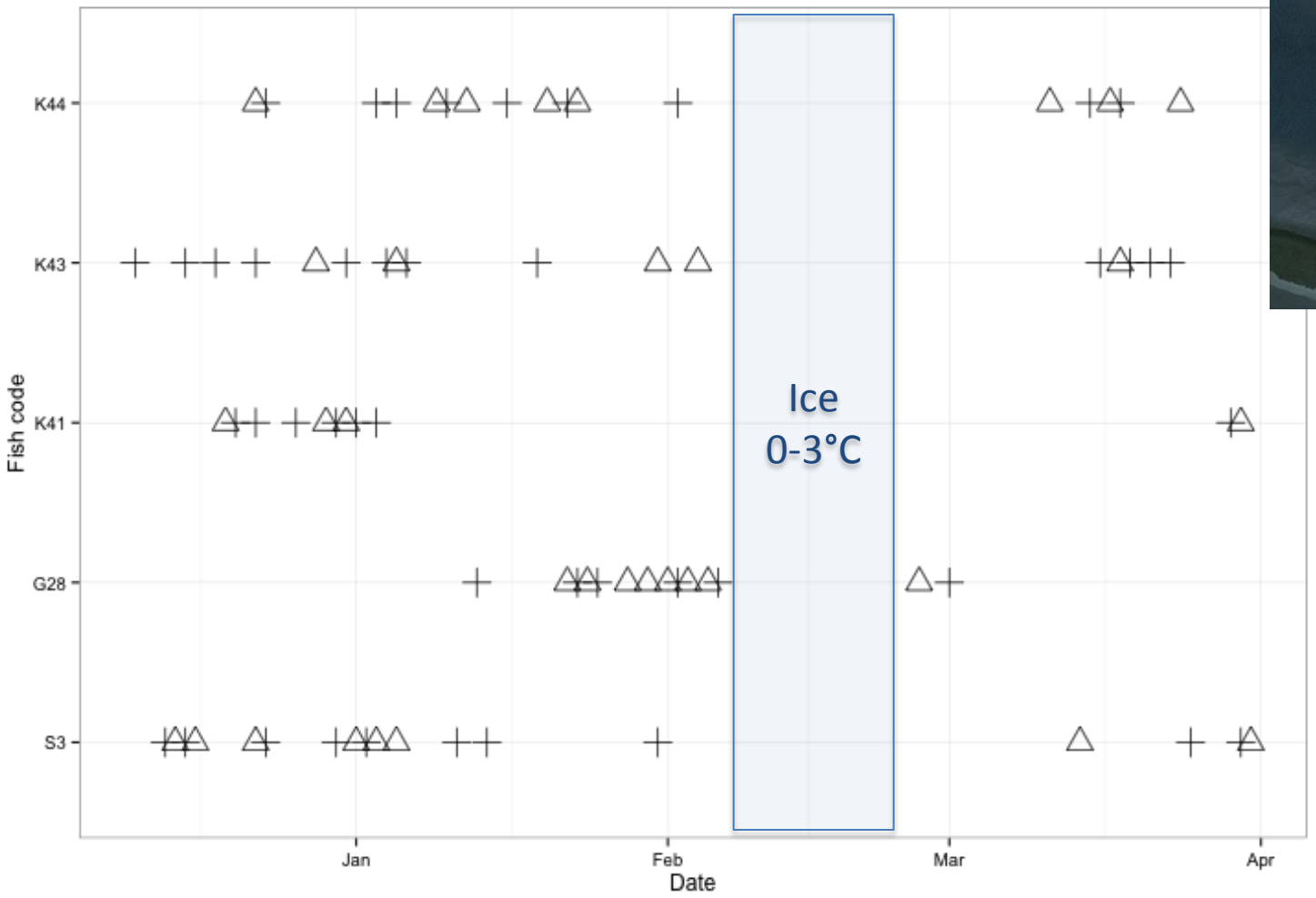
Credit: Freya Keyser

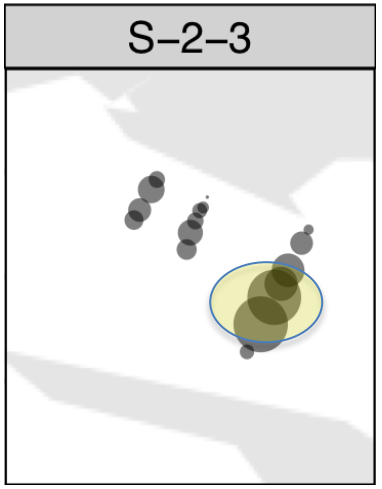
FORCE - Winter 2012-2013 receiver detections

35% of active tags detected in winter

Cold temperature effects on turbine avoidance are unknown







S-2-3

3/14/2013

3/25/2013

3/26/2013

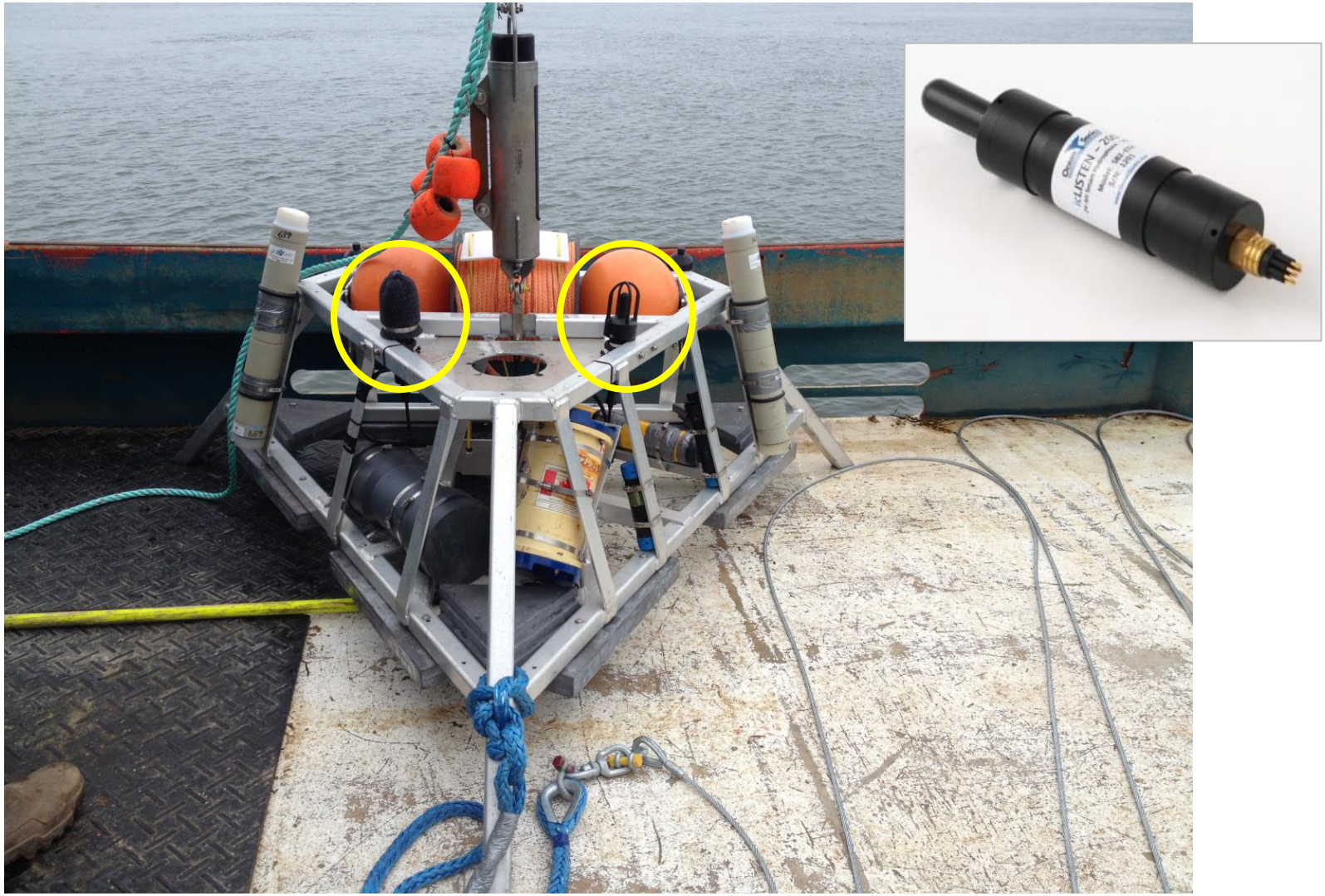
3/30/2013

3/31/2013

Baseline Studies: Harbour Porpoise Detection / Presence

- Hydrophone detection of harbour porpoise click trains
- Seasonal peaks related to prey (herring) abundance
- Detection limitations due to
  1. Ambient noise
     - Flood >> Ebb
     - Spring >> Neap Tides
     - Site effects
  2. Pseudonoise (flow noise)

Hydrophone Performance Testing: June 2014



Ocean Sonics

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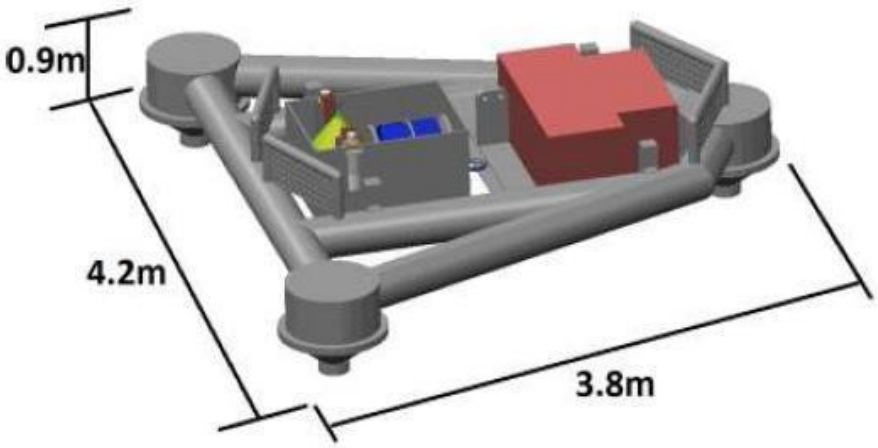
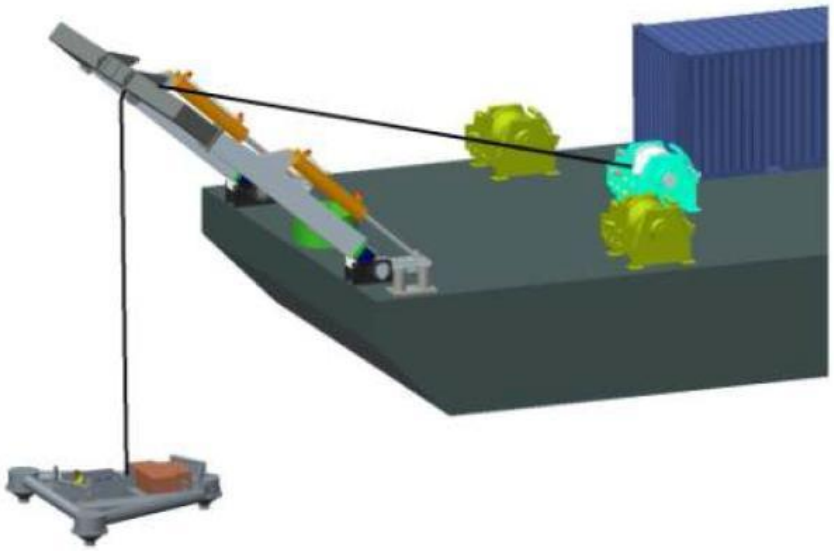
FORCE Sensor Platforms

- Sensors on cabled and non-cabled platforms
  - Acoustic (passive & active)
  - Optical
- Testing of sensor compatibility
- Within berth testing
- Environmental research

- Collaboration potential!!





Approach to Addressing Environmental Research and Monitoring Needs