Monitoring at North Ocean Energy Test Site, Newport OR

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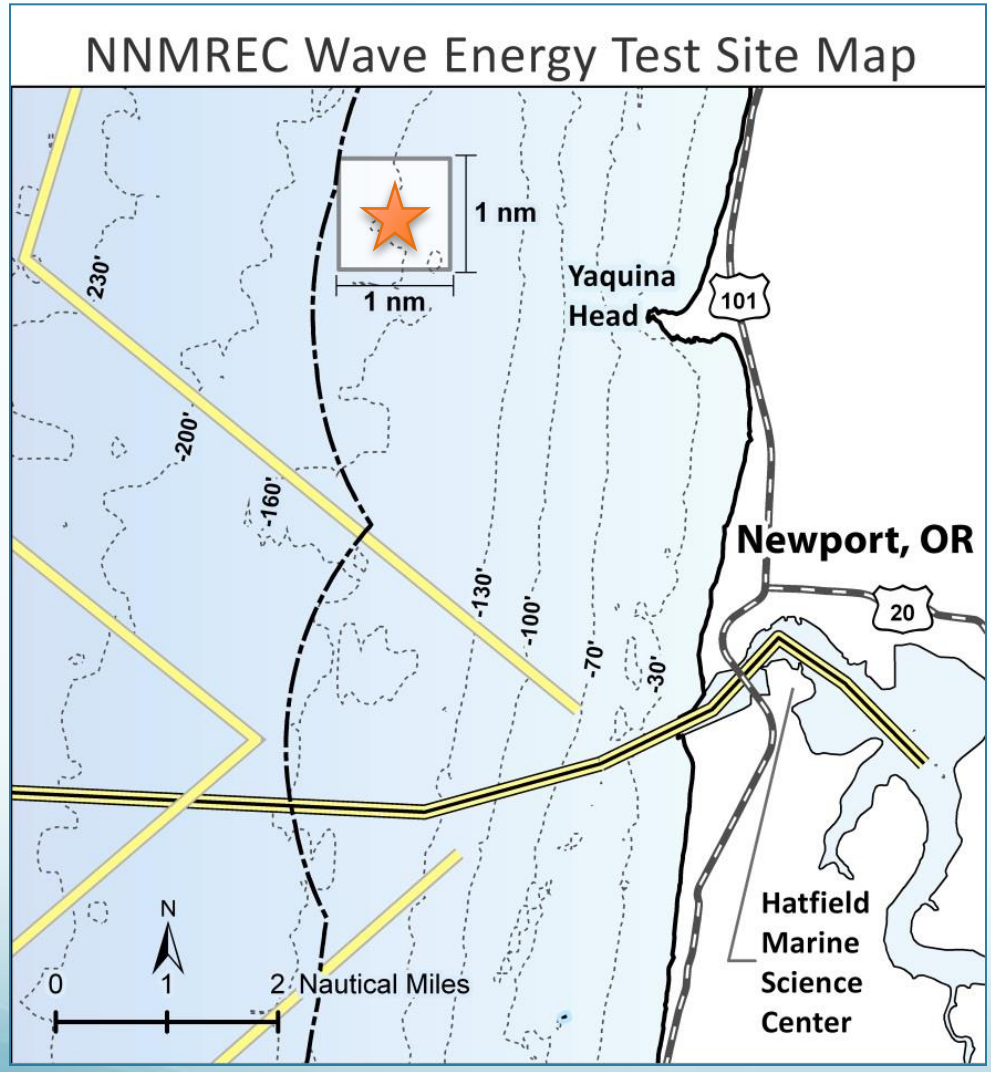
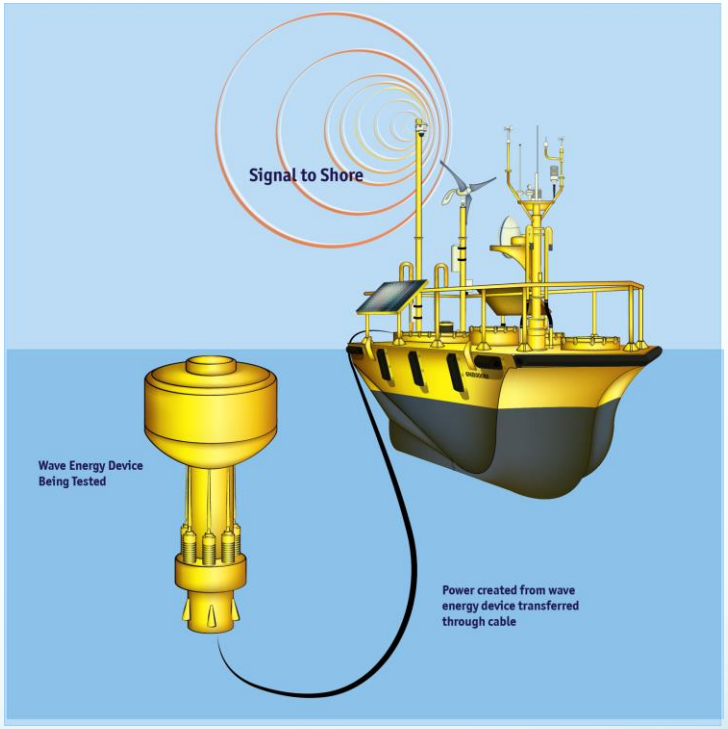
Newport North Ocean Energy Test Site





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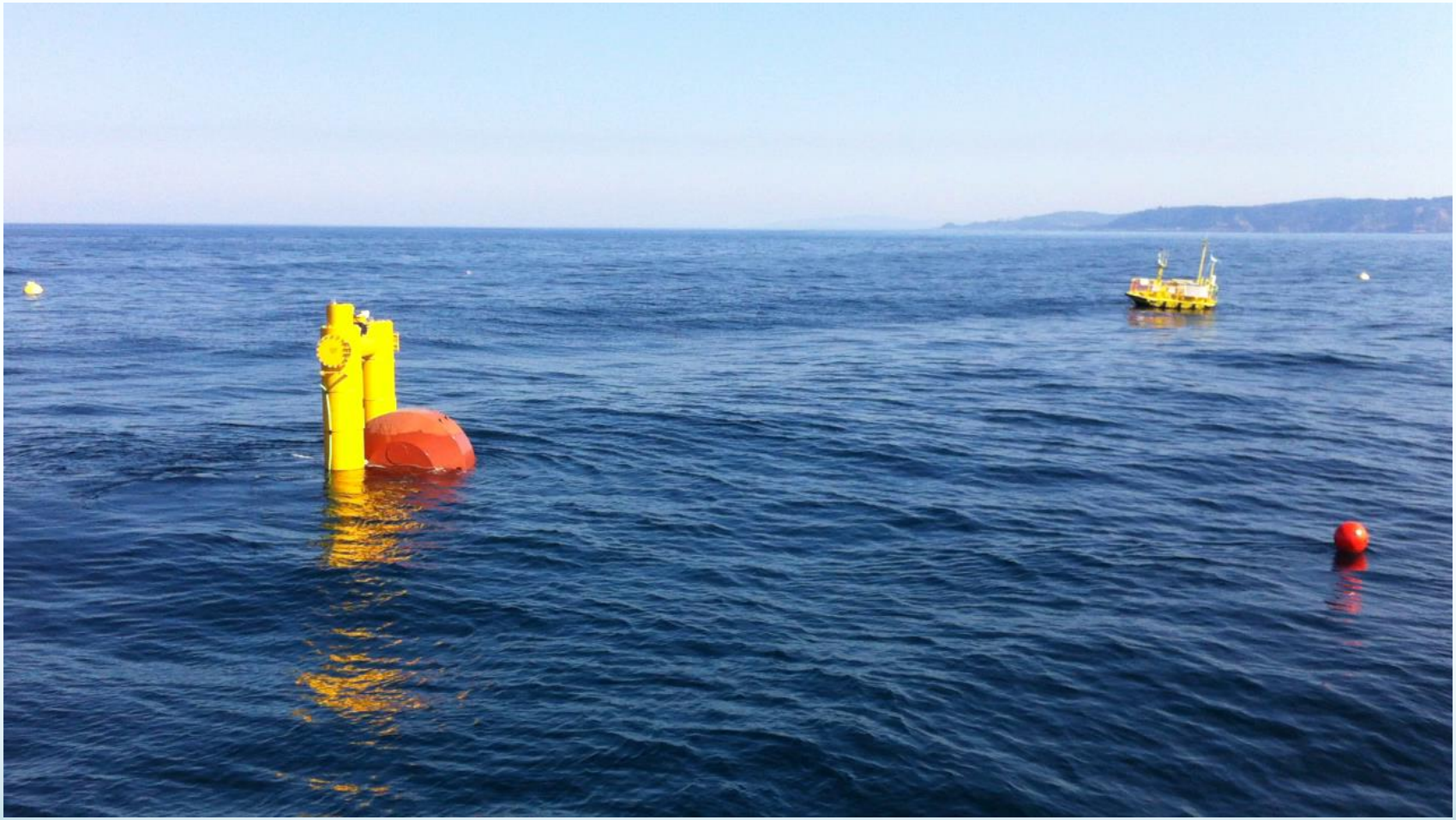
WET-NZ and Ocean Sentinel



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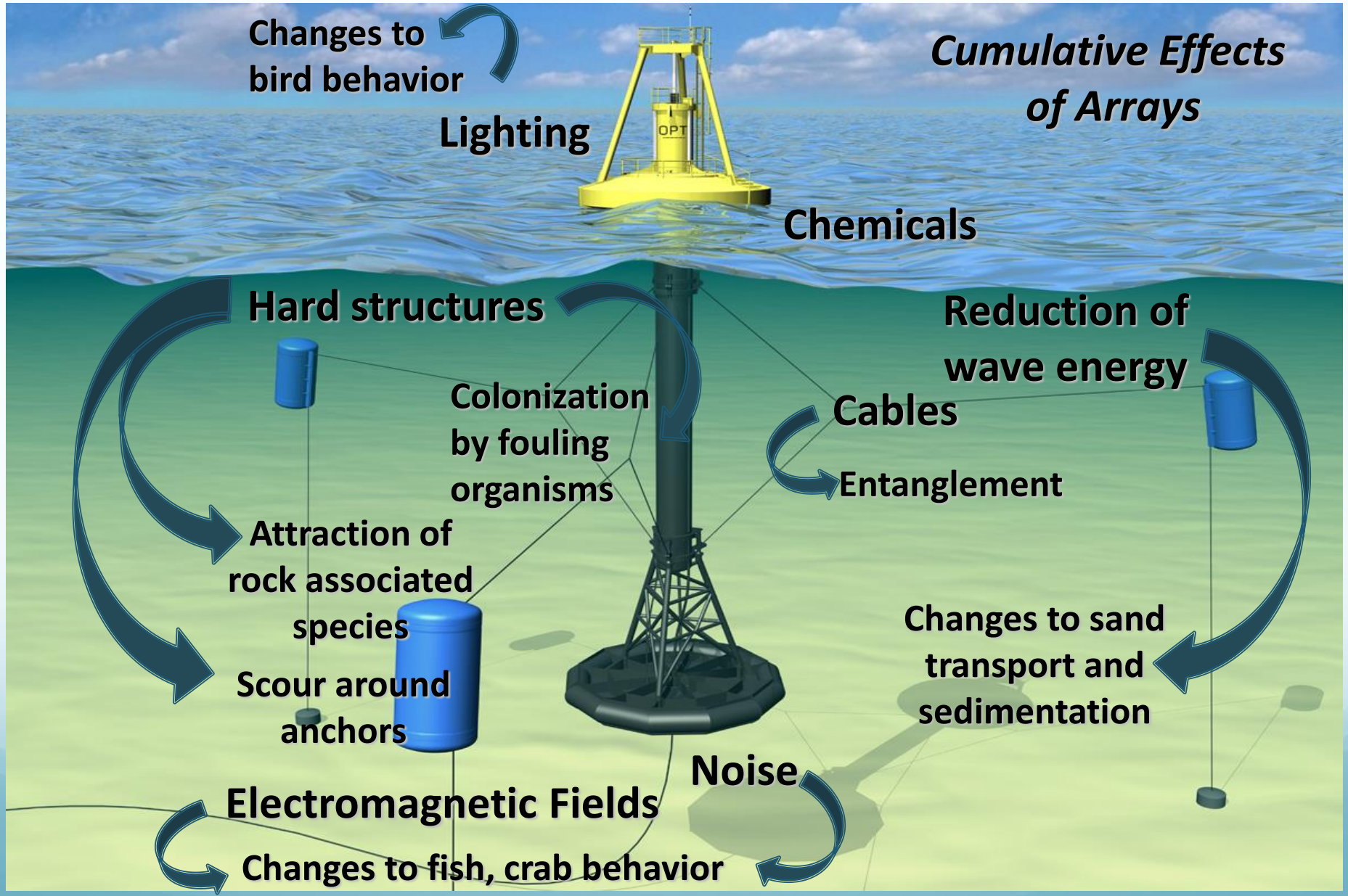
Potential Environmental Effects



Priority Issues for Investigation

1. **Static/moving devices & cetaceans -** Cetaceans could collide with devices or become entangled in mooring lines. Behavioral changes associated with avoiding devices may result in different energetic requirements or feeding opportunities.
2. **Noise/vibration & fishes, elasmobranchs, sea turtles, and cetaceans –** May interfere with navigation, communication, foraging, recruitment.
3. **EMF & elasmobranchs and other organisms -** Attraction, for example, can distract them away from hunting for prey.
4. **Static devices & benthic habitats and organisms -** Potential changes to sediment and water circulation, resulting in changes to the species that utilize that habitat.

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Issue 1: Devices and Cetaceans

Gray Whale Movement Patterns

PIs: Bruce Mate, Joel Ortega-Ortiz, Barbara Lagerquist

OSU Oregon State University
Marine Mammal Institute

Dec 2007 – May 2008
Observations of gray whales migrating along Yaquina Head

Estimations of
- speed
- distance to shore
- bottom depth

were obtained for each tracked individual

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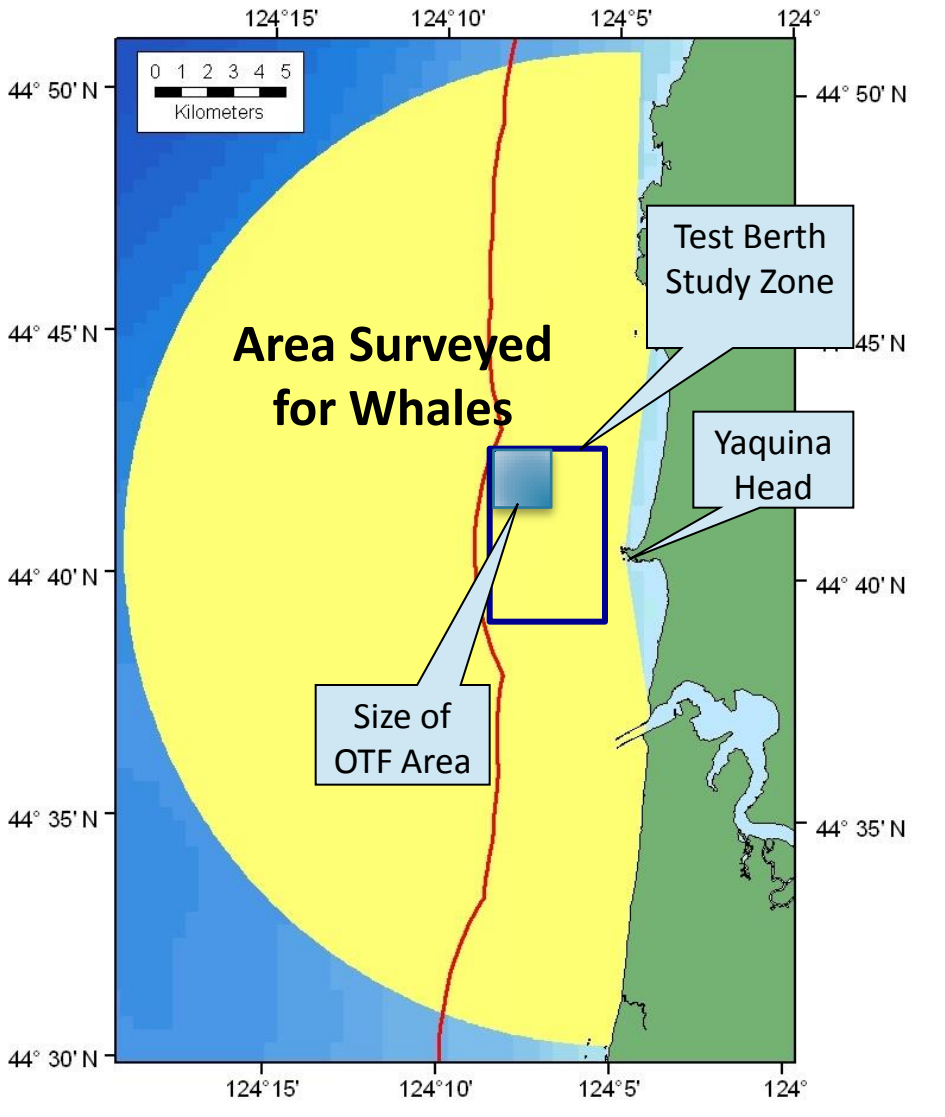
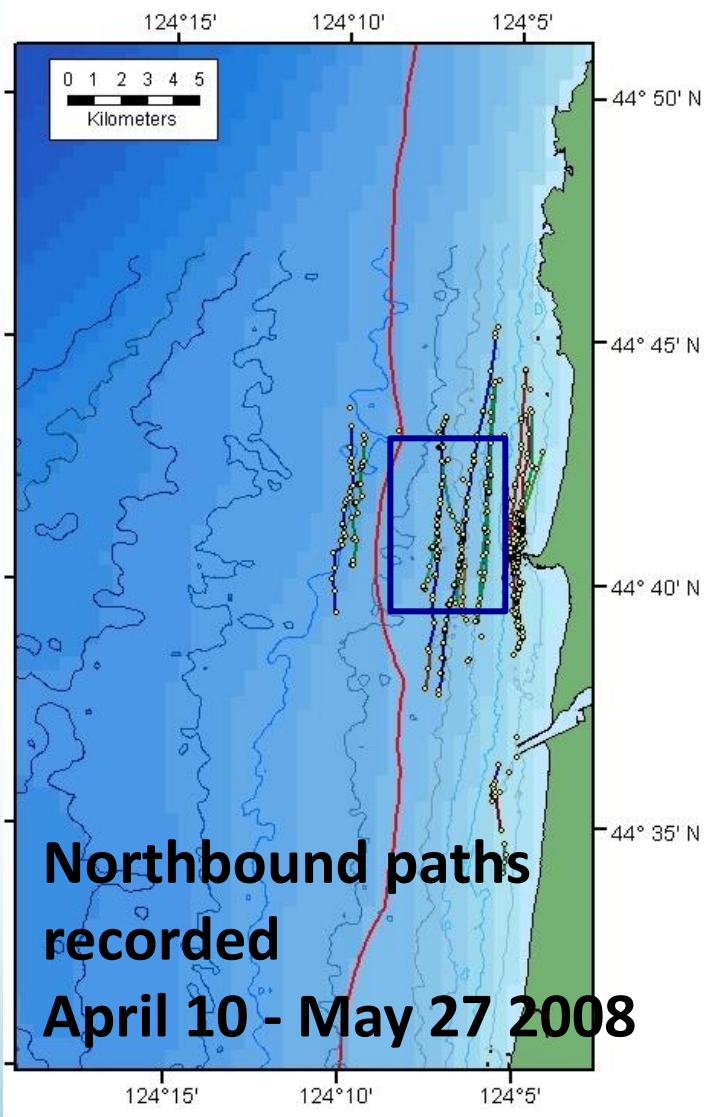
Gray Whale Observations





Study Complete and Available on OWET Website

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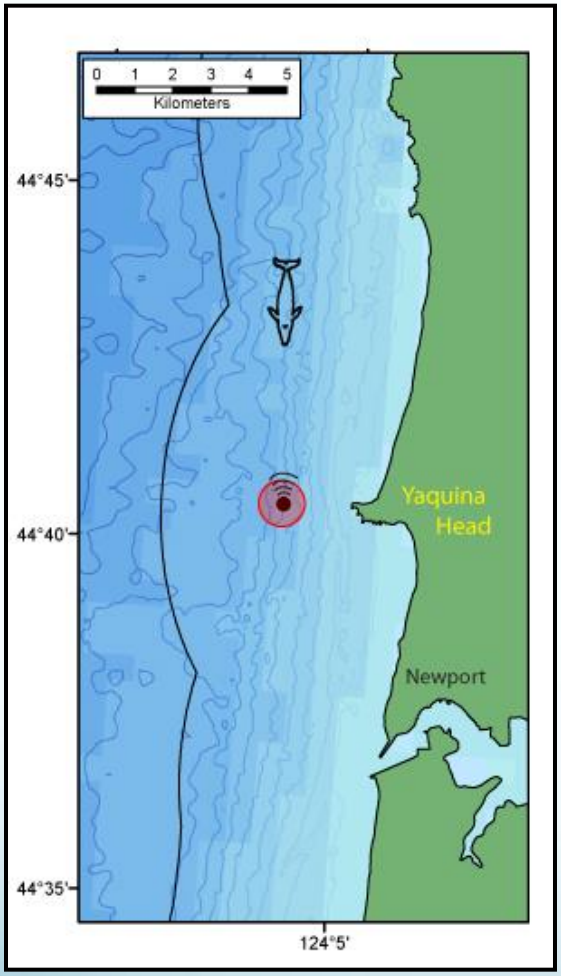
Testing a Gray Whale Acoustic Deterrent

PIs: Bruce Mate and Barbara Lagerquist, OSU MMI



Objective: Deflect movement of gray whales by 500 m using a low-power sound source.

- Moor acoustic device in gray whale migratory path. Circle shows predicted zone of influence
- Transmit sound (1-s signal, 3/min) for 6-hr each day during daylight
- Conduct concurrent shore-based observations of gray whales using theodolite to accurately track position, trajectory, and speed
- Compare results between experimental and control (no sound) periods, as well as 2008 data.

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Issue 2: Noise/vibration & fishes, elasmobranchs, sea turtles, and cetaceans

Acoustic Baseline and Characterization at NNMREC's North Test Site

PIs: J.H. Haxel, H. Matsumoto, and R.P. Dziak

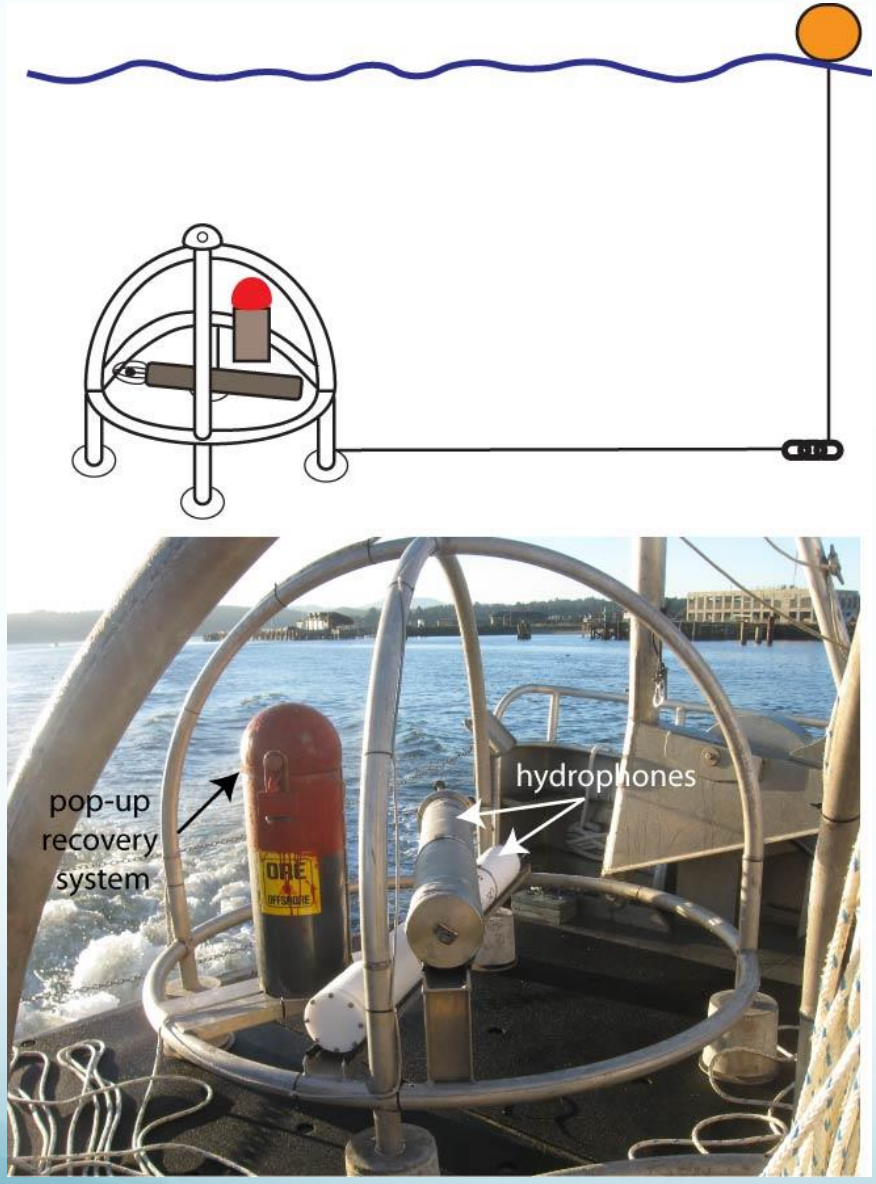
Oregon State University

Cooperative Institute for Marine Resources Studies

NOAA

Pacific Marine Environmental Laboratory

Passive Acoustic Lander Mooring



Methods:

- Lowered to the seafloor (50 m)
- Hydrophones record continuously or on duty cycle (1 Hz – 20 kHz)

Objectives:

- Collect continuous passive acoustic data (~1yr)
- Characterize amplitude and frequency distribution through time of ambient noise field
- ID sound sources

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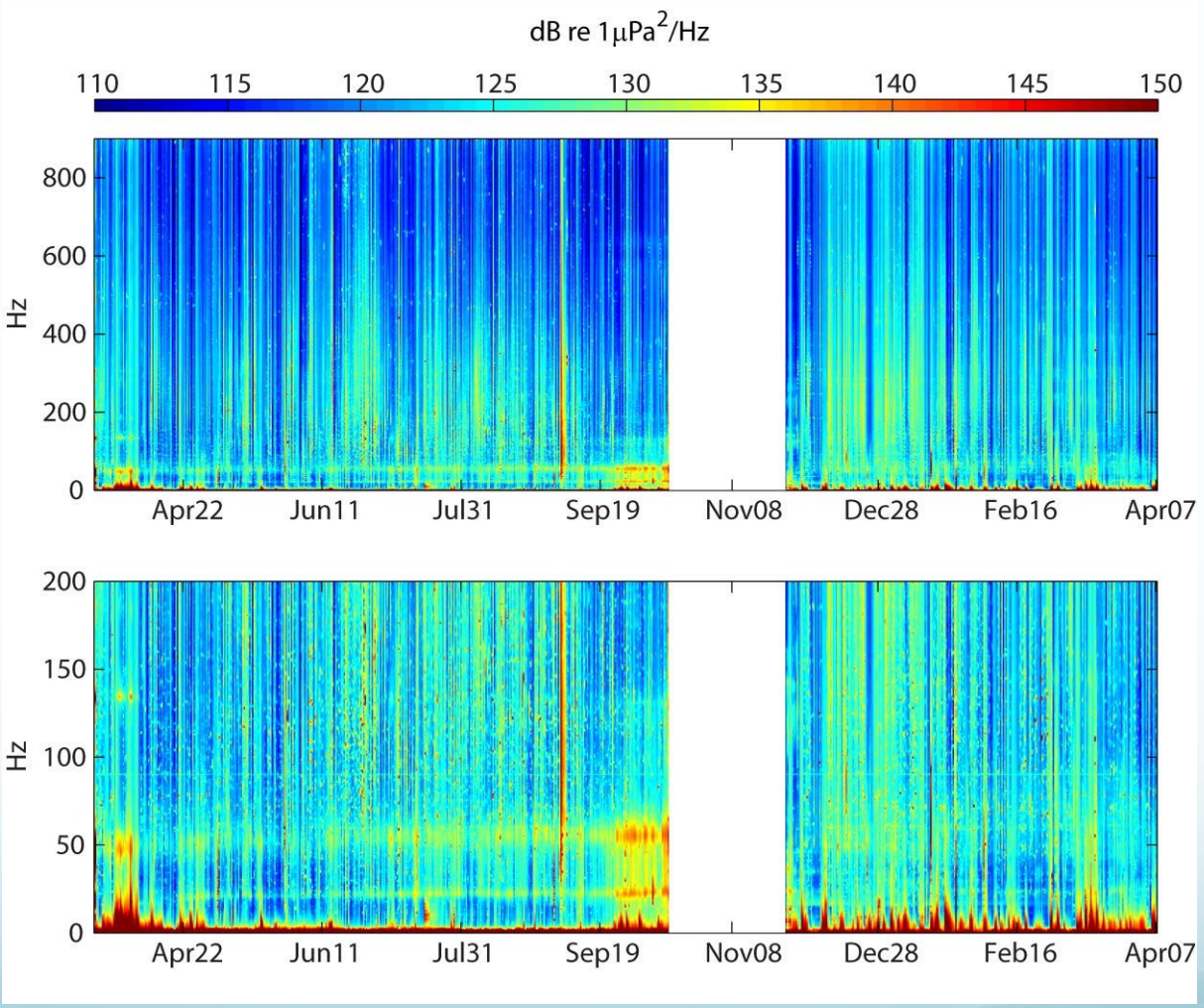
2010 – 2011 Seasonal Variation in Ambient Sound Levels



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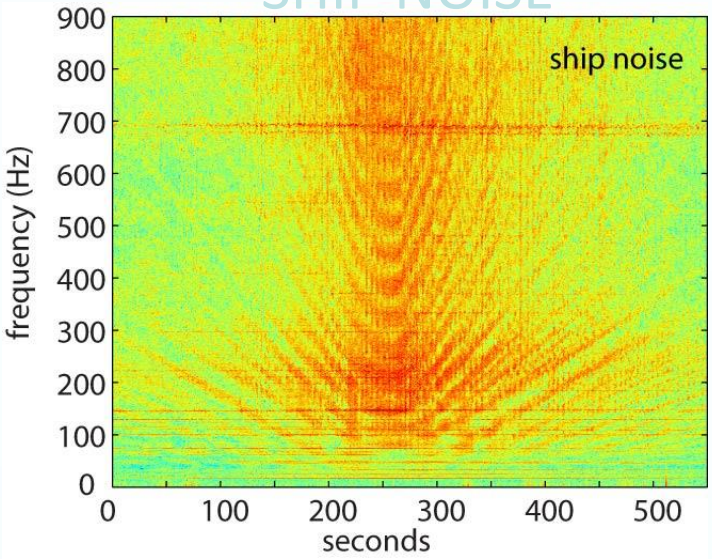
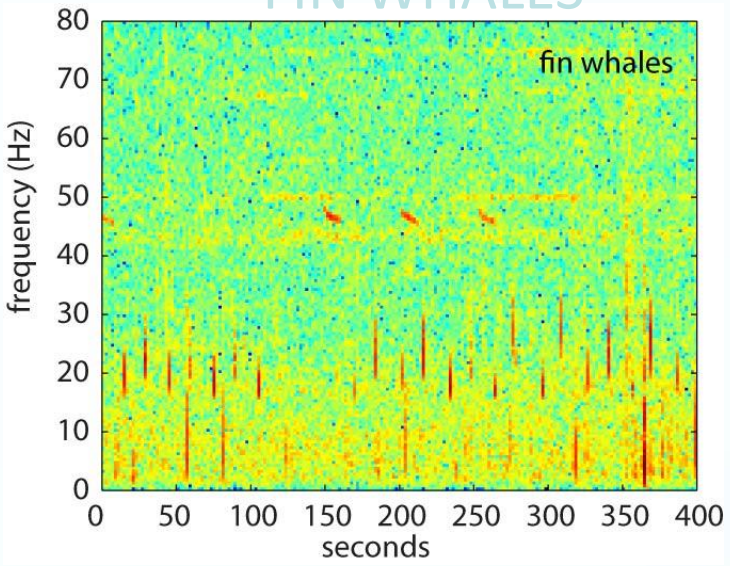
Other Important Sound Sources

SHIP NOISE



FIN WHALES




Barry Fisher's RV *Excalibur*

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Acoustic Baseline Results

- Mean broadband sound pressure levels (SPL_{rms}) = 113 dB re 1 μPa (1Hz – 1kHz)

  min SPL_{rms} = 95 dB re 1 μPa max SPL_{rms} = 136 – 142 dB re 1 μPa

  - **10% of observations > 120 dB re 1 μPa (MM harassment)**

- SPL_{rms} well correlated with significant wave height

  - seasonal variations in ambient noise structure

- Vessel traffic, marine mammals significant sources of transient sound; however, low frequency acoustic field dominated by breaking surf noise

Further Research

- Investigate relationships between wave height, wind speed, tidal flow, vessel traffic and 1/3 octave bands SPL
- Establish time series of marine mammal vocalizations by species

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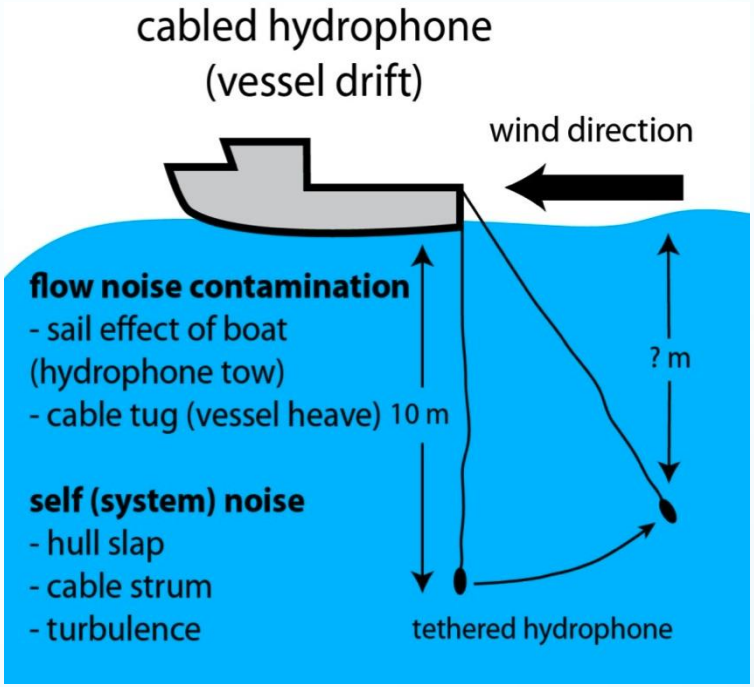
Acoustic Monitoring during WET-NZ Test

Methods:

- Technique similar to Bassett et al. (*2011*) for evaluation of WEC in Puget Sound
- Calibrated hydrophone from a drifting vessel
- Continuous 50 kHz sample rate
- 4 drifts per recording mission (~ 4 h of data)
- Record baseline data in May 2012



Results:

- One-second SPL values associated with WET-NZ harmonic signals during peak signal to noise ratio intervals (times with the least amount of low frequency contamination) average around 115 dB at 10 m and 112 dB at 85 m.

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Issue 3: EMF & Elasmobranchs and other Organisms

EMF Monitoring

PI: Adam Schultz

College of Earth, Ocean & Atmospheric Sciences
Oregon State University

National Geoelectromagnetic Facility

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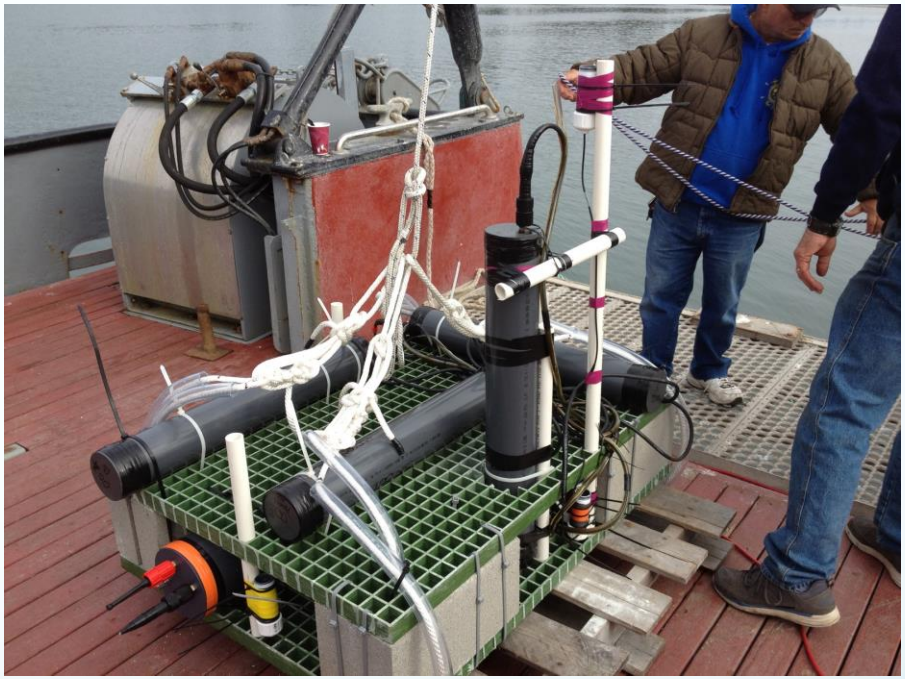
High Definition Wide-Band Receiver

- 1st generation Oregon Wave Energy Trust (OWET) prototype receiver built by SAIC/OSU
- Designed as low-cost test bed/demonstrator capable of detecting ocean wave/swell frequencies as well as powerline frequencies and harmonics
- 3 electric field and 3 magnetic field channels, 32-bit resolution, 1 kHz sampling
- Separate compass, tilt sensors



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Baseline Survey at North Test Site

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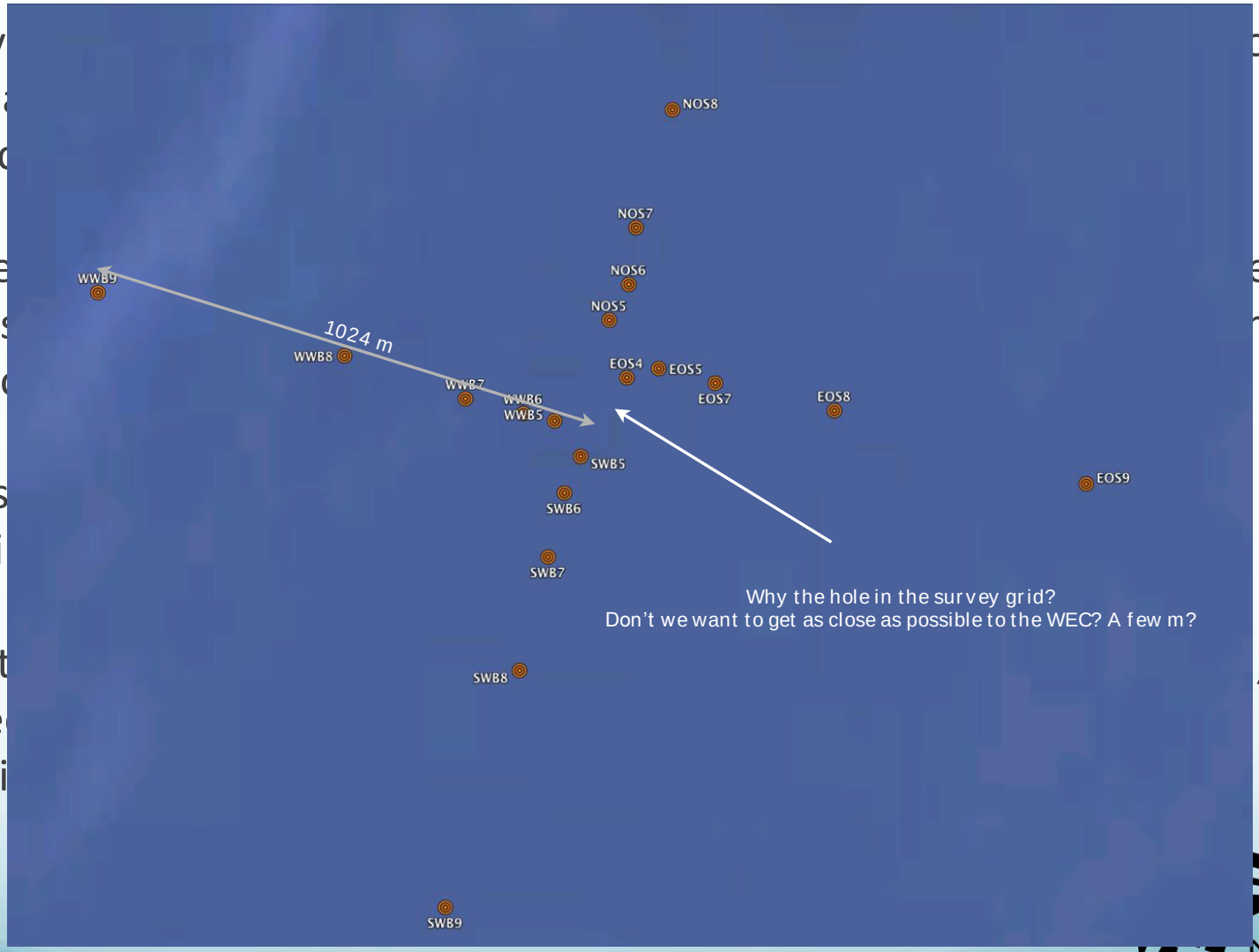

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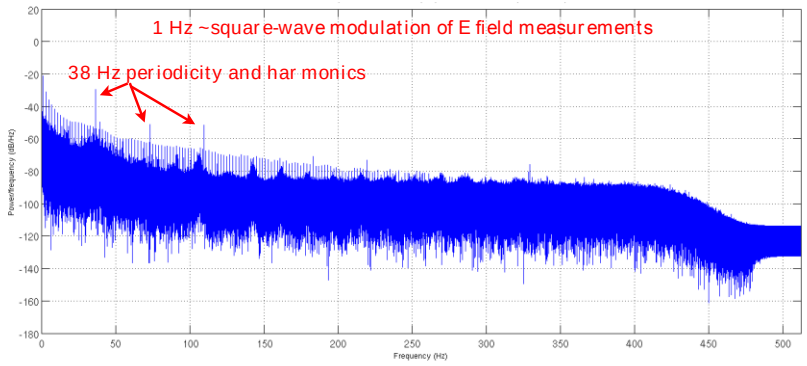
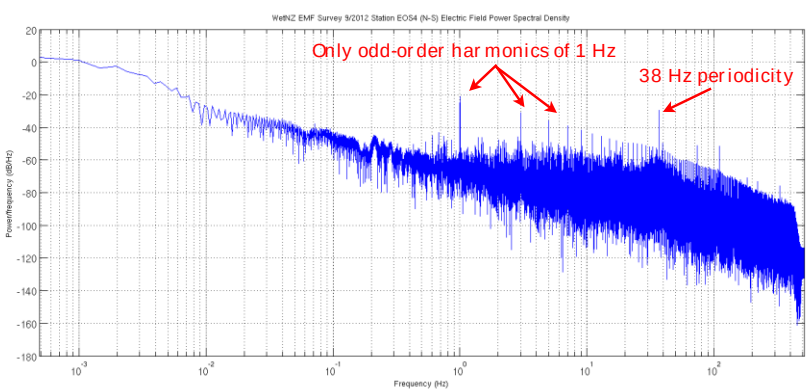
Baseline Survey at North Test Site

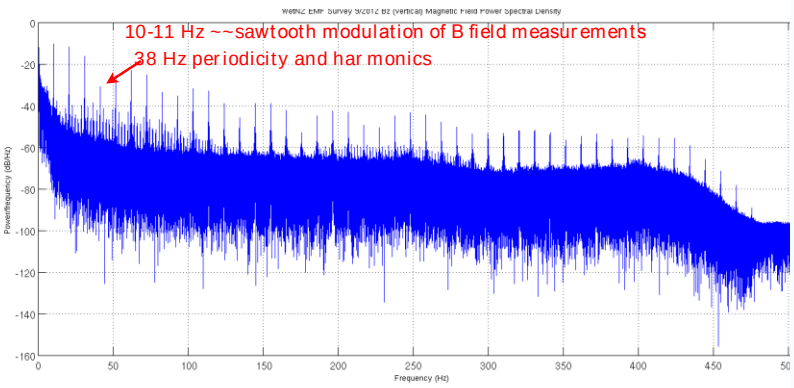
Electric Field Data





Magnetic Field Data

B_z



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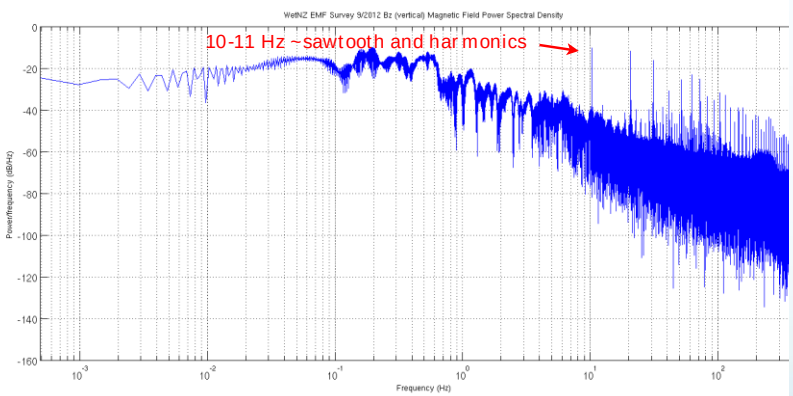

1 Hz (E) and 38 Hz (E & B) peaks ubiquitous in coastal Oregon offshore surveys

1 Hz peak may be induced by LEDs flashing at 1 Hz

Apparent variations in 10-11 Hz spectral peak intensity with offset from WEC/Sentinel

Monitoring Summary at North Test Site

- Gray whales have been surveyed before installation and use the area heavily in their migrations
- Testing of an acoustic deterrent device is underway
- An acoustic baseline of the sound field at the OTF has been established – recordings during deployment are similar to baseline
- Before and after monitoring of the EMF fields surrounding the devices will result in a model of EMF propagation – more testing is needed in greater sea state
- Benthic studies to be reported by Sarah Henkel

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Thank you

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