UNDERWATER OBSERVATIONS – MONITORING THE ENVIRONMENT AROUND MARINE ENERGY DEVICES

Presented by: Alicia Amerson and Joe Haxel
Pacific Northwest National Laboratory
June 24, 2021
Triton Initiative is sponsored by the DOE Water Power Technologies Office
Welcome!

WPTO R&D Deep Dive Webinar Series
A bi-monthly look into the ongoing work of WPTO sponsored projects and program areas

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WPTO R&D Deep Dive Webinar Series
Welcome!

• This webinar will be recorded and made available to registrants.
• Attendees’ microphones are muted and attendees are not visible on video.
• Questions will be answered during the Q&A after the presentation has ended.
• To ask questions:
  • Submit question into Chat Box and select “Everyone”
  • If you have technical issues, try calling into the webinar via phone.

Thank you for participating!
Hi, it’s nice to meet you

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www.pnnl.gov/projects/triton
Where we are located
Utility Scale Marine Energy

Technical Power Potential of U.S. Marine Energy Resources
(In TWh/year)

Kilcher et al., 2021
The Triton Initiative supports industry partners, innovates technology, and performs tests to explore the best methods and technology for environmental monitoring around marine energy (ME) devices.
Marine Energy Devices

Tidal and Current Energy Production

Current Energy Converter (CEC)

- Turbine

Photo courtesy of Nicholas Konefal, UAF
Wave Energy Converter (WEC)

- Floating
- Buoy
Triton Field Trials (TFiT)

Four environmental stressors the Triton team research in the field to create recommendations about different types of technology and scientific methods to help further the deployment of marine energy devices.

Illustration by Rose Perry, OES Environmental
Monitoring underwater noise

- Marine mammals, fish, turtles and invertebrates use or are sensitive to sound for critical life functions – foraging, communication, navigation

- Uncertainty -> concern for disturbance from ME projects

- How do we best measure and evaluate changes in acoustic conditions from ME?
  - Cost effective
  - Regulatory compliance
Field trials for monitoring underwater noise

• Acoustic characterization of marine energy converters
  IEC TS 62600-40 (2019)

Tidal/Riverine

• University of New Hampshire
  – Living Bridge (UNH-LB)

Wave/Oceanic

• Scripps Institution of Oceanography, CalWave WEC

Technology

Commercial off the shelf technology: Ocean Sonics drifting buoy and hydrophone
Monitoring electromagnetic fields (EMFs)

- Transmission lines are necessary to bring electricity from marine energy devices back to shore.
- As electricity is transmitted along the cable, it generates an electromagnetic field.
- Many animals are known to be sensitive to marine life, perhaps using electromagnetic fields to sense prey or migrate.
- There are still many unknowns around electromagnetic fields, including understanding the intensity and variability in a marine energy site.
Field trials for measuring electromagnetic fields

- 2020 Field trials in Sequim Bay tested EMFs from cables and a point source generator calibrated to be comparable to a marine energy device
- 2021 Field trials in Sequim Bay test background EMF, initial data analysis highlights the importance of collecting background characterization to detect cable’s magnetic field
Collision Risk

- Typical turbine applications are in fast tidal and river currents
- Risk concerns are with marine animals
- No observed blade strikes
- Difficulty of observations in such energetic environments
- Additional uncertainty about consequences of blade strike

www.audubon.org

www.smruconsulting.com

www.inhabitat.com
Field trials for collision risk

Field trials conducted at:
- University of New Hampshire
  Living Bridge
- University of Alaska, Fairbanks
  Tanana River Test Site

Technology tested:
- Acoustic camera
- Multibeam echosounder
- GoPro
Monitoring changes in habitat

What is Changes in Habitat?

- Modification of species communities
- Alteration of habitat of these species
- Benthic and pelagic habitats
- Small and large spatiotemporal scales

How does it translate?

- Footprint / Scour
- Community composition
- Colonization / biofouling
- Artificial reef / FAD
- Marine reserve
- Food web
Field trials for changes in habitat

How do we measure?

- Seabed characterization: sonars, cores, imagery
- Benthos (infauna & epifauna): cores, imagery, trawls
- Pelagios: sonars, trawls, imagery
- Biofouling: scrape samples, imagery

What is Triton’s role?

- Discuss with subject matter experts
- In-depth literature review of methods
- Identify methods best suited for ME context
- Test (new) methods at ME sites
- Propose guidelines and best practices
Survey Results
Survey Results

Who took the survey:

- **100%** of respondents were familiar with ME
- **87%** said their primary role was in ME
- **69%** are familiar with, but do not work in ME environmental monitoring
- Only **8%** work in ME permitting
Survey Results: Key Questions

What type of environmental data are needed to fulfill permit requirements?

“Longer term deployments of environment device interactions, such as noise, material ablation, mooring and anchor scouring, etc.”

“Site characterization data, often with surveys for seabirds, marine mammals, fisheries, benthos”

“Data that informs compliance with NEPA, ESA and MMPA”

“Baseline data, which will need to be collected if it does not exist already. Then monitoring data after device installation.”
Survey Results:
Key Questions

What instrumentation or technology is needed to collect the environmental data to fulfill requirements?

| “seafloor samples via dive surveys, seafloor visual inspection via dive surveys” | “So far, we haven't lacked needed instrumentation or technology. It's the cost of such instrumentation and technology that needs to come down significantly.” | “Passive acoustic and audiovisual equipment to detect species/devices interaction” | “fish tagging, pinniped and cetacean telemetry tags to collect behavioral data” |
Thank you!

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Q&A

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Thank you for attending!
Underwater noise monitoring technology at PacWave

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