Deep Dive: Whale Entanglement

Presented by:

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California Offshore Renewables Environmental Regulatory Workshop

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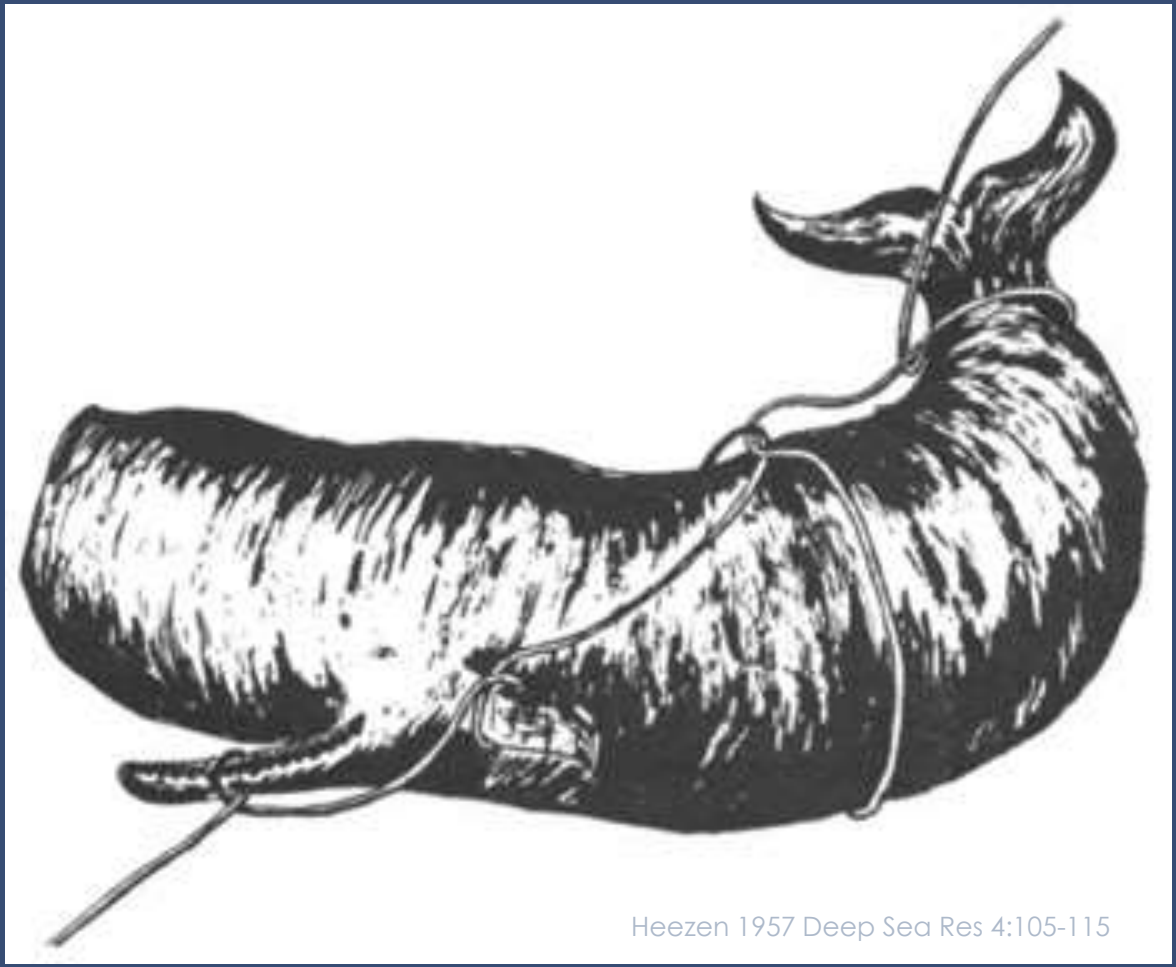
H. T. HARVEY & ASSOCIATES

Ecological Consultants

Will whales become entangled in offshore wind energy infrastructure?



Heezen 1957 Deep Sea Res 4:105-115

Recap: Definition of Entanglement

The unintended restraint or capture of marine animals entwined by strong, flexible materials of anthropogenic origin

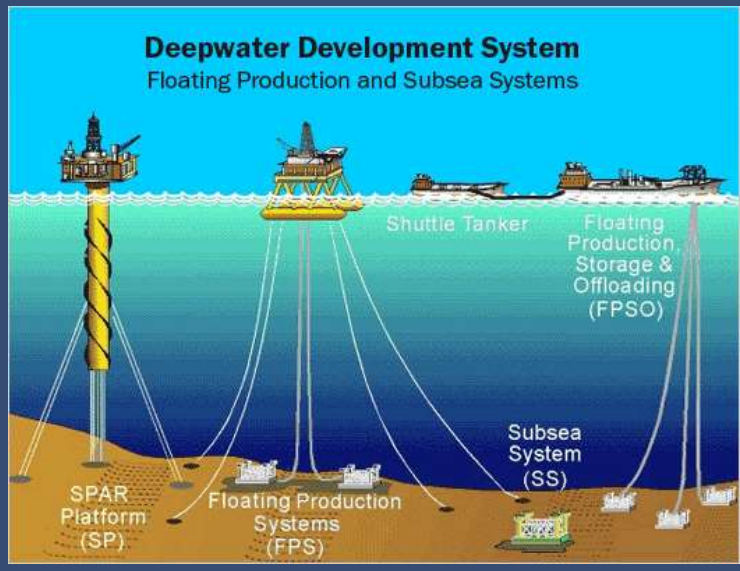
- All scenarios are hypothetical for OSW and MHK
- For floating platforms, entanglement could be *direct, secondary,* or *tertiary*
- Key animal groups (mostly ESA-listed species and marine mammals):
  - Large cetaceans—whales
  - Small cetaceans, pinnipeds, sea turtles, seabirds, fishes

Existing Data

- **Entanglements at surrogate structures**
- **Generally rare, anecdotal**
- **Known entanglement issues**
  - Fishing gear
  - Bycatch reduction efforts
- **Observations/monitoring currently difficult**
  - Difficult: rare events, deep water, detections challenging, carcasses may be lost
  - Emerging technology for monitoring

Offshore Wind Analogs

- Floating gas and oil platforms
- Navigation, oceanographic, and research buoys
- Fishing gear (pots and traps, nets, long-line gear)
- Submarine cables (communications, power)
- Wide range of configurations, sizes, cables and ropes



http://www.api.org/oil-and-natural-gas/wells-to-consumer/exploration-and-production/offshore/offshore-production-facilities

Sperm Whales Entangled in Submarine Cables

- Early transoceanic cables were not buried
- 14 whale entanglements documented before 1957* despite rarity of animals and gear (<500K miles of cable)
- Early proof of whale diving capabilities (6 at 500 fathoms, 1 at 620 fathoms)
- Animal behavior
- Not "chance" encounters

*Heezen 1957 Deep Sea Res 4:105-115

Whale Caught in Cable Drowns at Sea Bottom;
Hoisted 3,000 Feet by Repair Ship's Crane

New York Times, April 19, 1931

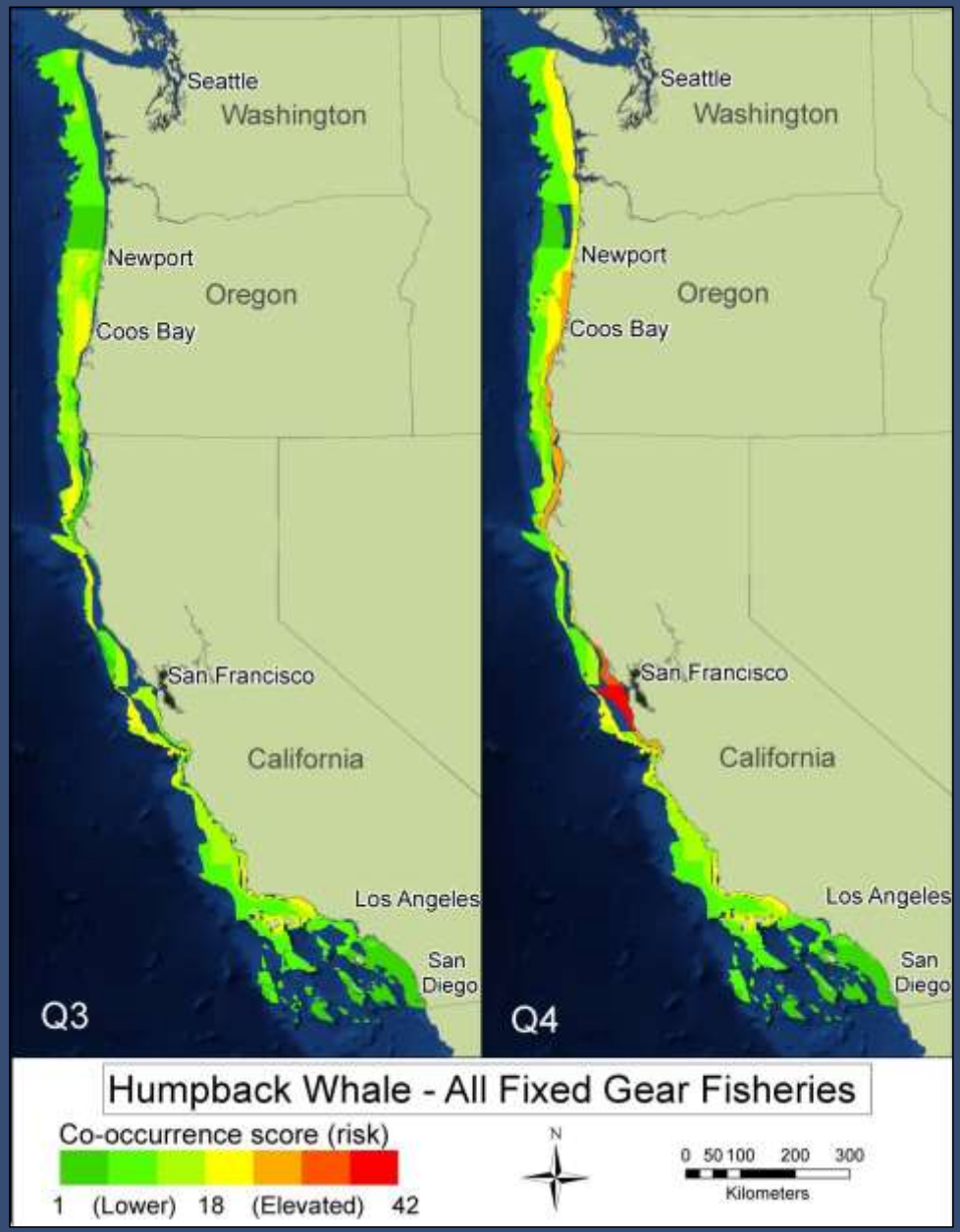
Scale of Entanglement Problem

- **Nature of the technology**
  - Mooring layout
  - Line material properties
  - Scope (line length-to-depth ratio)
  - Hydrodynamics of structure
  - Environment
- **Physical modeling**
- **Animal behavior**
- **Sensory biology**

Peter Nelson 2017

Context: Whale Entanglements on Pacific Coast

Scale of Entanglement Problem



Coincidence of likely OSW project locations with:

- Large whales
- Smaller marine mammals
- Commercial fishing

http://www.westcoast.fisheries.noaa.gov/publications/protected_species/marine_mammals/noaa-tm-nmfs-swr-044_final.pdf

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Scale of Entanglement Problem

- Spatial modeling for risk
- Animal behavior
- Modeling interactions with mooring technology

Scott Terrill

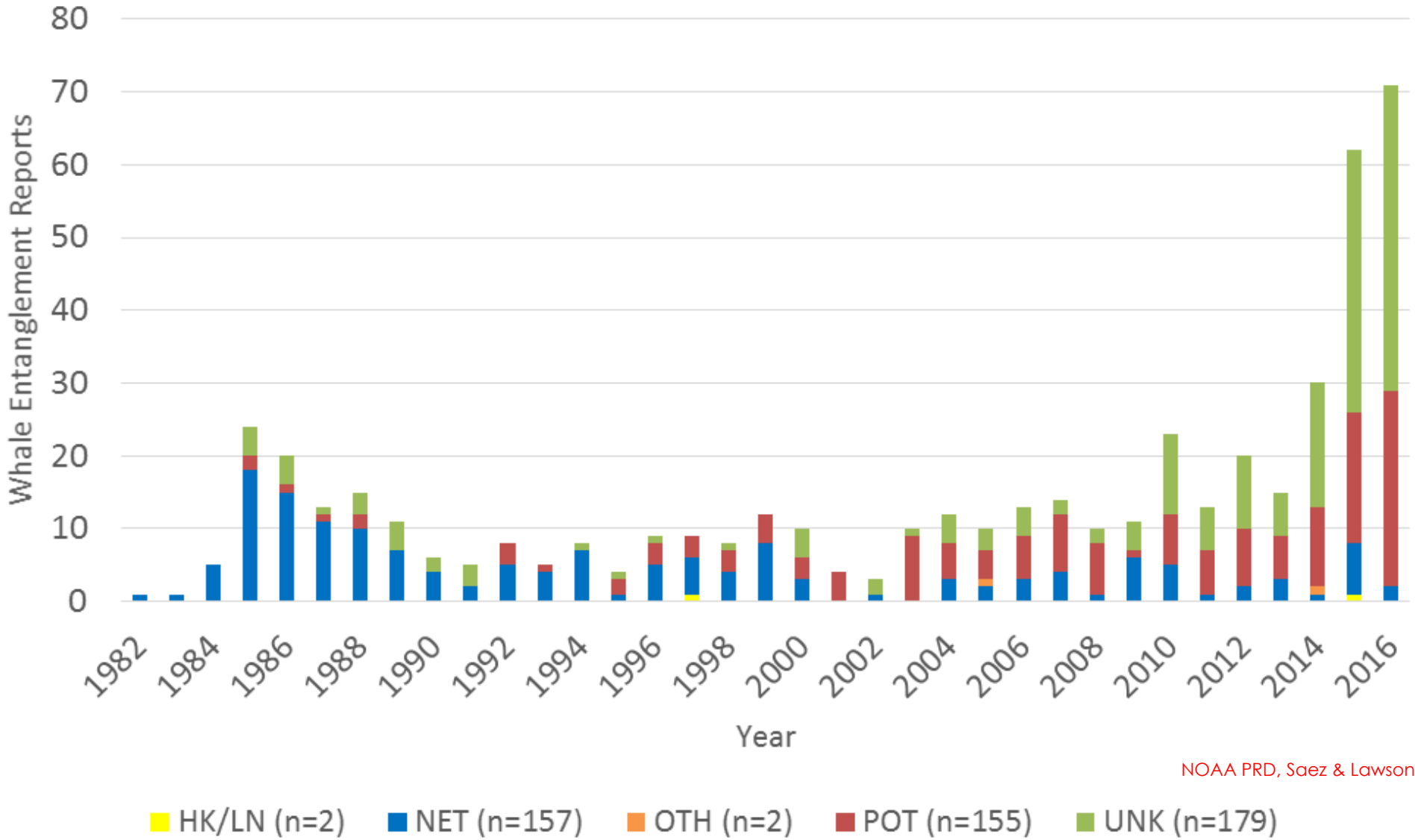
Entanglement Risk: Examples from Pacific Region

- Dramatic, recent increase
- Population increases
- Gear and fishing effort
- Reporting
- Ecological factors

West Coast Whale Entanglements

- **From 2000 to 2012, annual large whale entanglement reports averaged ~10**
  - 62 in 2015
  - 71 in 2016
  - 41 in 2017
  - 2017 is still third highest
- **Ecological factors**
- **Entanglement reduction efforts**

Gear Type by All Entanglements Reported by Year

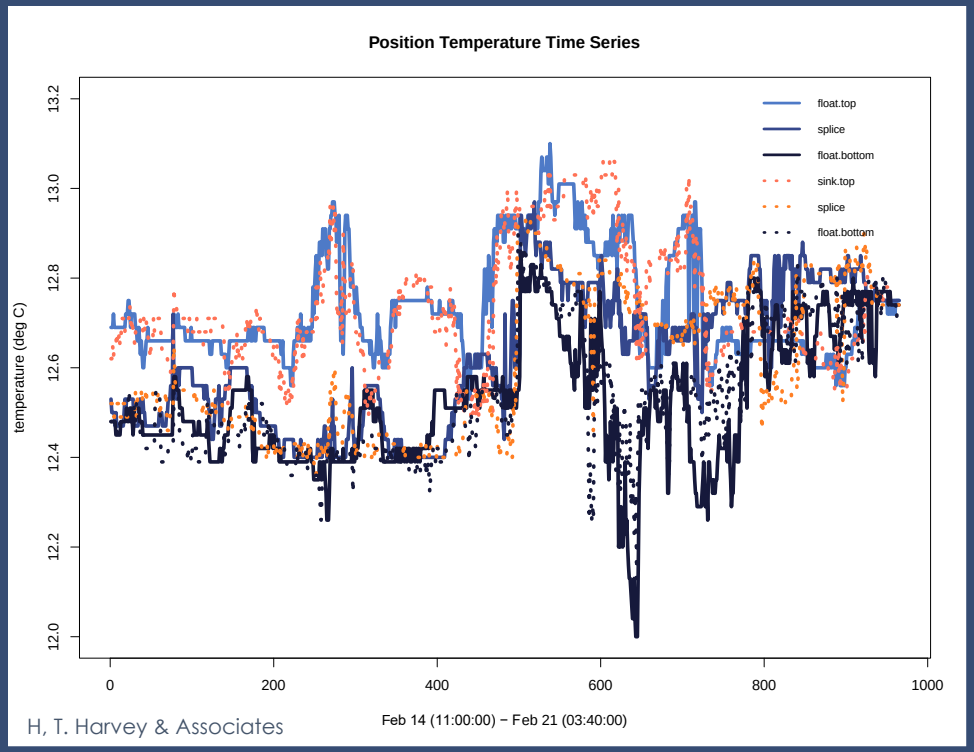


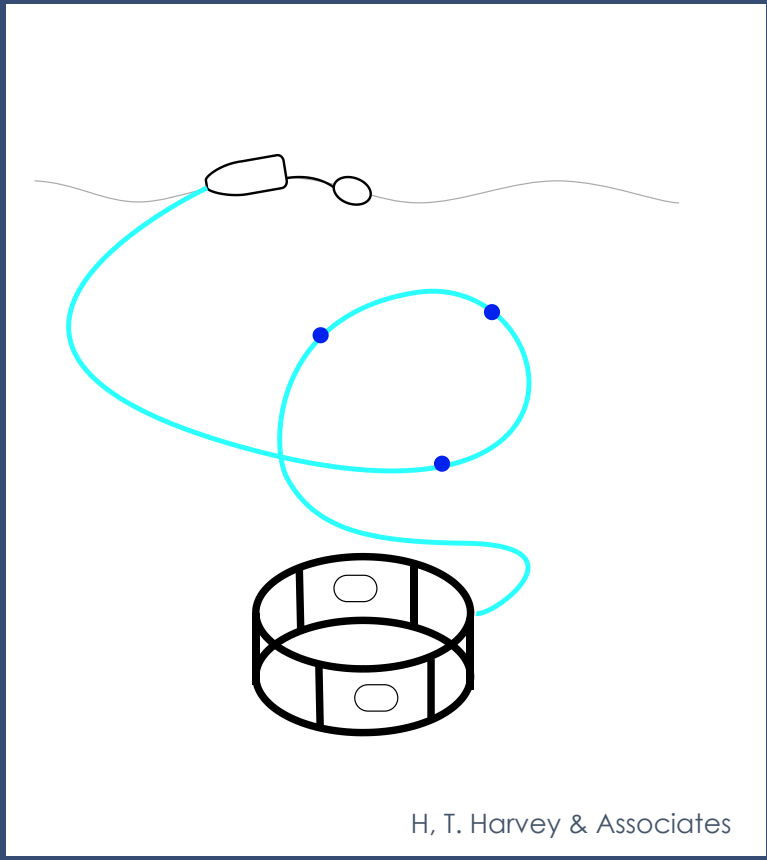
Pathway for Retiring This Risk

- Direct entanglement appears highly unlikely
- Secondary or tertiary entanglement more plausible, but probabilities are lower
- Behavioral studies needed to understand probability and consequences of entanglement
- Consider entanglement early in design process

Research Needs

- How do whales (and other marine animals) behave around MHK and OSW devices?
- How do mooring technologies behave under varying environmental conditions?





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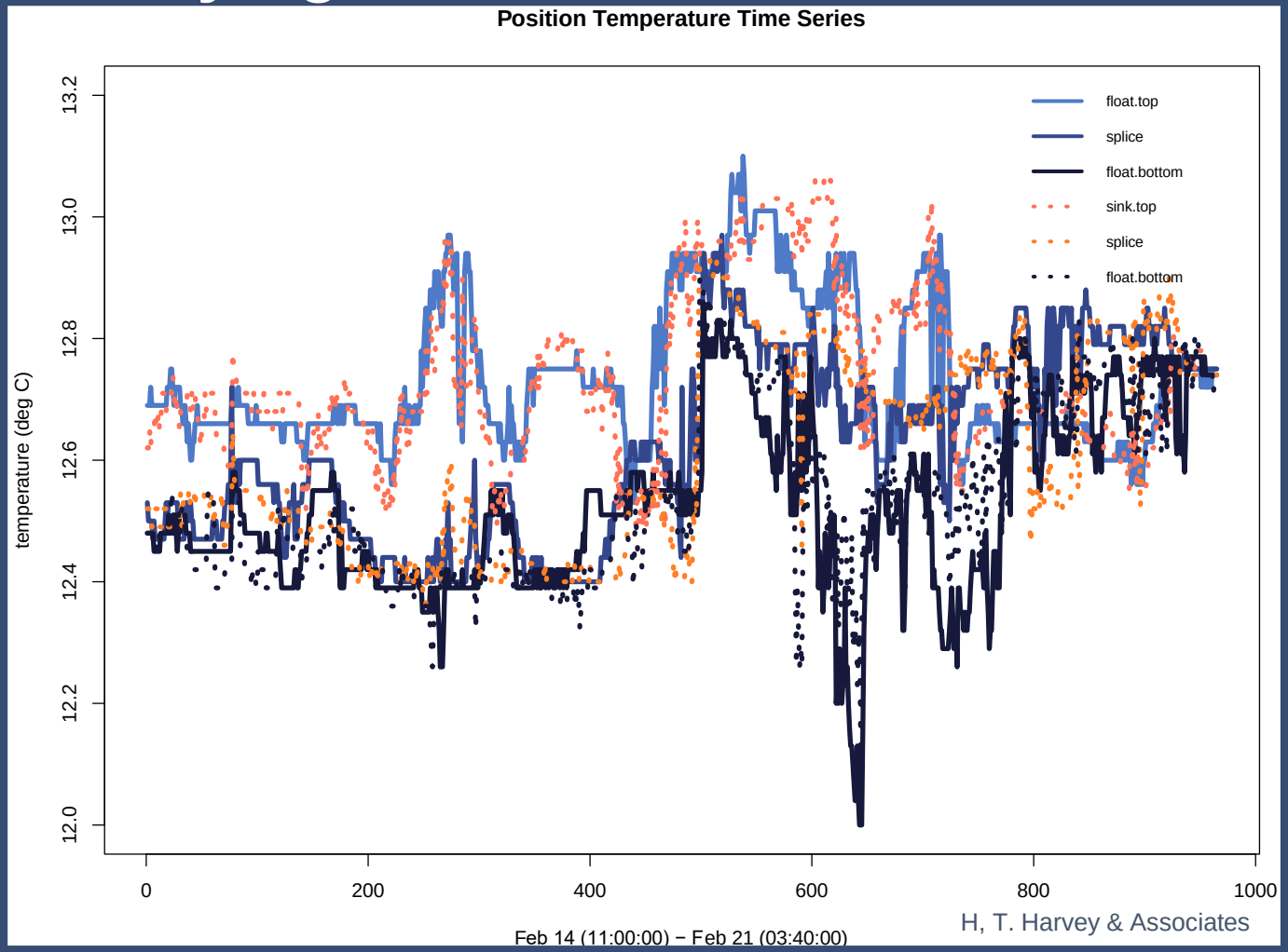
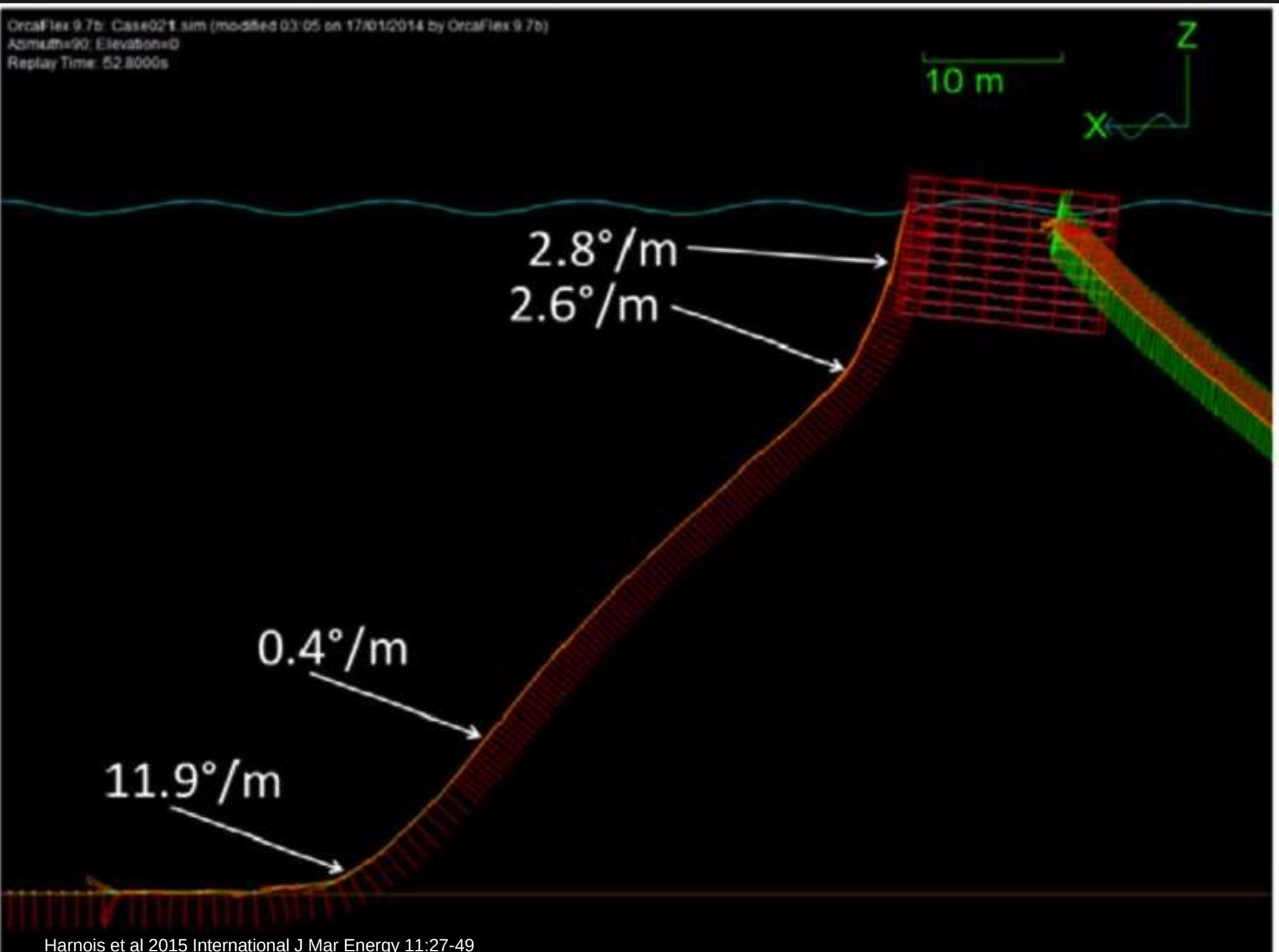
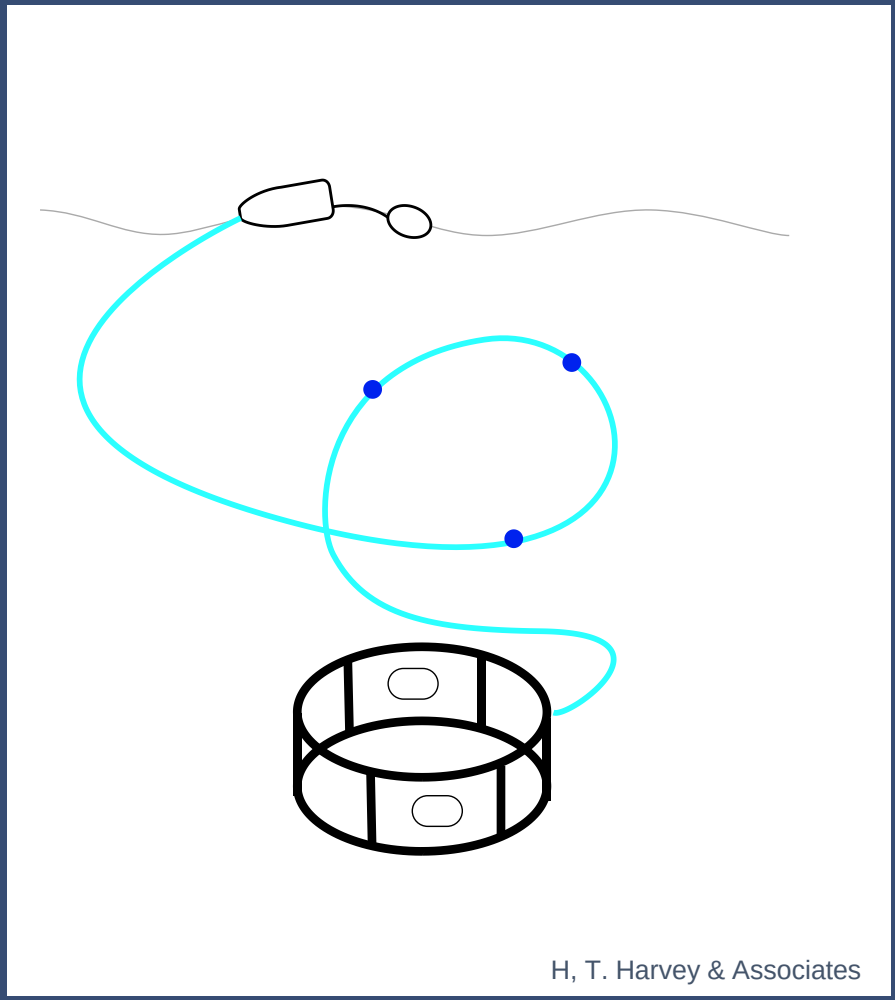




Harnois et al 2015 International J Mar Energy 11:27-49

Successful Collaboration

- Engaging with fishermen
- Working with marine scientists
- Involving resource agencies



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Conclusions

- **Direct entanglement is unlikely**
- **Secondary and tertiary entanglement also unlikely, but greater uncertainty**
- **Addressing uncertainty requires research (ecology, behavior, technology, modeling)**
- **Collaboration and communication**

Acknowledgements

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For additional information about the California Offshore Renewables Environmental Regulatory Workshop organized by the Pacific Ocean Energy Trust in Sacramento on March 14, 2018 and to access additional presentations go to:
http://pacificoceanenergy.org/california-offshore-renewables-environmental-regulatory-workshop/