Hackathon Case Study 3: AI Acoustic Monitoring for Marine Mammals

Offshore Wind Construction. Student Version.

The Scenario

Building an offshore wind farm means driving enormous steel monopiles into the seabed, and pile driving is loud. The noise can travel for kilometres underwater and is intense enough to injure or disturb marine mammals such as harbour porpoises, dolphins and seals, which rely on sound to navigate, feed and communicate. Regulators require developers to monitor for marine mammals during construction and to pause or reduce pile-driving activity if animals are detected nearby, a legal requirement known as mitigation.

For years, this monitoring relied on trained human observers on boats, plus underwater microphones, or hydrophones, that someone had to listen to and interpret in real time, which is exhausting, imprecise, and hard to scale across a large construction site. AI-based acoustic monitoring systems are changing that. Tetra Tech's "Neptune" software processes hydrophone data automatically to detect and classify marine mammal sounds, and on one project it cut the volume of data that needed transmitting by 40%, reducing monitoring costs by around 70%. Sinay's platform does something similar, aggregating data from multiple hydrophones and applying detection algorithms in real time so developers can act on the results as construction happens.

The Moray West offshore wind farm off the Scottish coast gave researchers a chance to check how well this works in practice. Noise measurements and harbour porpoise behavioural data collected during the installation of 13 monopiles were compared against the predictions made in the project's original regulatory assessment, giving a rare real-world test of whether the models regulators rely on to grant permits actually hold up.

This is a case where AI is being used explicitly in service of environmental protection, in a legally regulated context, which raises a different set of RRI questions than a purely commercial deployment.

Further Reading

- Tetra Tech, *Leveraging High-End AI Software to Detect and Protect Marine Mammals for Offshore Energy Projects*: tetratech.com
- Sinay, *Protecting Marine Mammals During Offshore Wind Construction: Real-Time Acoustic Monitoring in Action*: sinay.ai
- Springer Nature, *Measurements of Noise Levels and Porpoise Disturbance During Pile-Driving at Moray West Wind Farm*: link.springer.com

RRI Discussion Questions

Work through these following six questions as a team.

1. Anticipate

Before this technology existed, monitoring depended on trained people who could exercise judgement about ambiguous or unusual sounds. What kinds of situations do you think an AI classifier trained mostly on known, common calls might be less reliable for, and what would happen during construction if the system missed something a human observer might have caught?

2. Reflect

A regulatory assessment predicts, in advance, how a construction project will affect marine mammals, and it's what a permit is granted on. The Moray West study checked those predictions against real measurements after 13 monopiles had already been installed. What does it tell you that this kind of check usually happens after construction rather than before, and who benefits from that timing?

3. Engage

Regulators, the wind developer, the AI vendor, conservation and fisheries groups, and the marine mammals themselves, who obviously can't speak for their own interests, are all affected by how this technology performs. Who do you think has the power to demand better evidence before a permit is granted, and who is currently left arguing after the fact, once construction is already under way?

4. Act

Cutting monitoring costs by 70% makes offshore wind construction cheaper and faster, which supports the broader push toward renewable energy. But cheaper, faster monitoring could also make it easier to treat environmental mitigation as a cost to minimise rather than a genuine constraint on how and when construction happens. How would you tell the difference between those two outcomes on a real project?

5. Scoring It

Using ORBIT's own tools, score this case study: what Technology Readiness Level (TRL) would you assign it, which Sustainable Development Goals does it affect, and what RRI Intensity Level (RIL) does that combination suggest? Be ready to explain your reasoning, since two teams might reasonably score this differently.

6. Your Proposal

You've been asked to advise a UK offshore wind developer on how to present its AI-based acoustic monitoring plan as part of a marine licence application. As a team, draft a short (3-5 point) proposal covering:

- What independent validation of the AI system's accuracy you'd want included in the application
- What should happen, procedurally, if the system flags a possible detection that a human reviewer disagrees with
- How you'd report monitoring results to the regulator in a way that a specialist could scrutinise later

Presentation Task

In your team, prepare a 15-minute presentation covering your answers to all six questions above, with at least one slide per question. You should all participate in both the development and delivery of your presentation.