Status of Environmental Monitoring of Marine Energy Projects Around the World

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As marine energy interest grows, potential environmental effects must also be assessed and monitored in order for the industry to develop in a responsible and sustainable manner.

Why monitor environmental effects of marine energy?

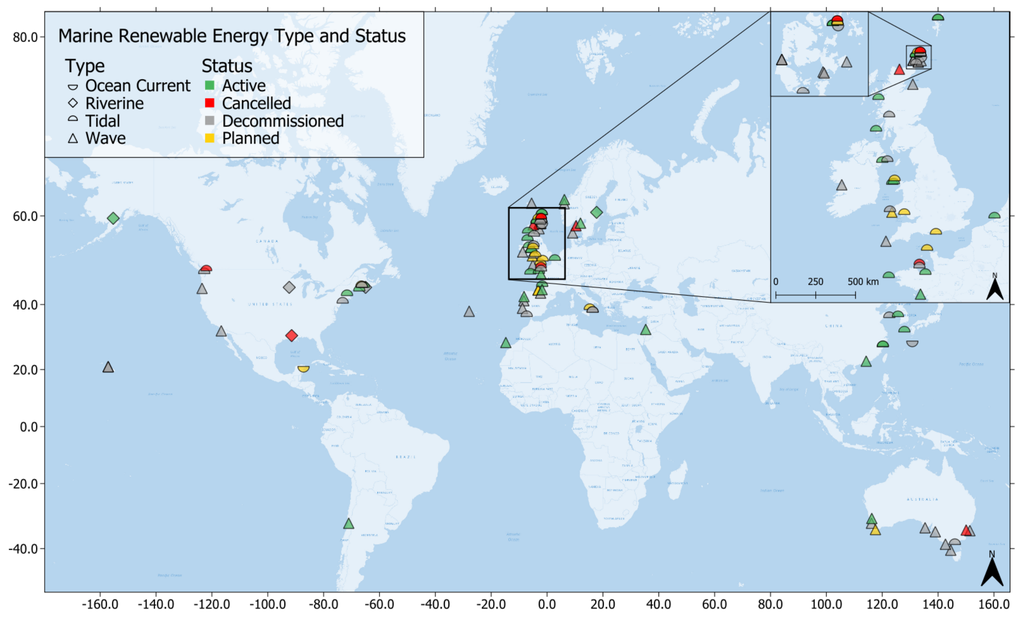
- Novel technologies bring unknown potential for harm
- Marine energy is a new use of ocean space and may interact with other uses already occupying that space
- Concerns about marine animals at or near marine energy project sites, especially populations already under stress
- Effects will be dependent on marine energy technology, supporting infrastructure, placement of device, presence of animals, number and size of devices, duration of deployment, and a variety of community factors
- Stressor = marine energy device or system that may cause harm
- Receptor = marine animal, habitat, ecosystem process

Environmental Effects of Marine Energy

Priority stressor-receptor interactions for marine energy:

- Collision risk
- Underwater noise
- Electromagnetic fields
- Habitat changes
- Entanglement
- Changes in oceanographic systems
- Displacement

RESULTS



80+ marine energy projects with environmental data

Nova Innovation

Case studies: marine energy projects with sufficient environmental monitoring data

Project	Technology	Location	Interaction focus
MeyGen	Tidal	Scotland, UK	Collision risk, underwater noise, EMF
Nova Innovation	Tidal	Scotland, UK	Collision risk
BiMEP	Wave	Spain	Underwater noise
Lysekil	Wave	Sweden	Underwater noise, habitat changes
Igiugig	Run of river	Alaska, U.S.	Collision risk

Case study: MeyGen	Criteria	Results
Level of Monitoring	Duration of monitoring	Long duration
	Baseline monitoring performed	Yes
	Post-installation monitoring performed	Yes
	Accepted methods used	Yes
Output of monitoring	Reports, papers, other products	5 reports, 10 papers, 1 thesis, 1 presentation
Outcome or use of information	Risk was retired	Risk retired for EMF
	Mitigation required	Yes
	Led to delays or cancellation	No
	Outcomes linked to monitoring outputs	No

Objective and Methods

Objective: assess the status of marine energy developments around the world for which environmental effects have been examined

Methods:

- Used metadata forms provided on the Tethys website[1] to gather information about past and present marine energy projects (145 forms)
- Data was gathered about country, stage of development, technology, and environmental assessment and monitoring
- A framework was developed to evaluate quality and outcome of environmental assessment by examining reports, papers, and outcomes of regulatory process
- This framework was applied to five projects as case studies

1 https://tethys.pnnl.gov/marine-energy-metadata

What have we learned?

- Tidal stream and riverine projects mostly focused on collision risk, while wave projects focused on underwater noise
- Few projects collected data on EMF and displacement
- More than one type of data may be needed to study collision risk (acoustics, underwater video, observations)
- Oceanographic changes and displacement will become more relevant as projects scale up to arrays
- Early deployments were mostly focused in the UK and Europe, followed by Canada and the U.S.
- Australia is joining in with wave projects, and other countries like Japan, Mexico, and Israel are starting testing and demonstrations

Conclusions and Recommendations

- Standardized monitoring approaches, instruments, and methods are needed
- Baseline assessments needed for all projects (biological and physical features)
- Determine most-likely risks from proposed project sites
- Identify relevant stressor-receptor interactions and create pre- and post-installation monitoring plans
- Ensure data are robust, quality controlled, and publicly available
- Collaboration is key among marine energy developers, regulators, researchers, and stakeholders

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