Current Ability to Assess Impacts of Electromagnetic Fields Associated with Marine and Hydrokinetic Tchnologies on Marine Fishes in Hawaii

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February 2017

Project Overview

Current ability to assess impacts of electromagnetic fields associated with marine and hydrokinetic technologies on marine fishes in Hawaii

The Challenge:

- Electric current flowing through subsea transmission cables associated with marine and hydrokinetic energy (MHK) and offshore wind devices will generate electromagnetic fields (EMF).
- Regulatory agencies have expressed concern that EMF may interact with, and potentially impact marine fishes, and, therefore, these agencies may require developers to demonstrate that MHK generated EMF will not adversely impact fish populations.
- Previous scientific literature reviews reach conclusions that the current state of research on this topic is still in its infancy and evaluations of potential impacts are associated with great uncertainty.
- A variety of MHK technologies are likely to be considered for deployment offshore of the Hawaiian Islands, and there is a need to be able to better predict and assess potential associated environmental impacts.

This study was funded, in part, by the US Department of the Interior, Bureau of Ocean Energy Management, Environmental Studies Program, Washington DC, through Interagency Agreement Number M14PG00012 with the US Department of Energy.

Program Strategic Priorities

Technology Maturity

- Test and demonstrate prototypes
- Develop cost effective approaches for installation, grid integration, operations and maintenance
- Conduct R&D for Innovative MHK components
- Develop tools to optimize device and array performance and reliability
- Develop and apply quantitative metrics to advance MHK technologies

Deployment Barriers

- Identify potential improvements to regulatory processes and requirements
- **Support research focused on retiring or mitigating environmental risks and reducing costs**
- Build awareness of MHK technologies
- Ensure MHK interests are considered in coastal and marine planning processes
- Evaluate deployment infrastructure needs and possible approaches to bridge gaps

Market Development

- Support project demonstrations to reduce risk and build investor confidence
- Assess and communicate potential MHK market opportunities, including off-grid and non-electric
- Inform incentives and policy measures
- Develop, maintain and communicate our national strategy
- Support development of standards
- Expand MHK technical and research community

Crosscutting Approaches

- Enable access to testing facilities that help accelerate the pace of technology development
- Improve resource characterization to optimize technologies, reduce deployment risks and identify promising markets
- Exchange of data information and expertise

Project Strategic Alignment

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Deployment Barriers

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The Impact

- Compiled and reviewed a set of resources so that researchers, managers and industry can better assess the sensitivities of fishes in the Hawaii region to electromagnetic fields, the role they play in navigation, migration and in other important behaviors during critical life stages
- Results will facilitate the evaluation of potential impacts on fishes, primarily in the Hawaii region, due to the deployment of new MHK and offshore wind energy generating technologies in U.S. waters

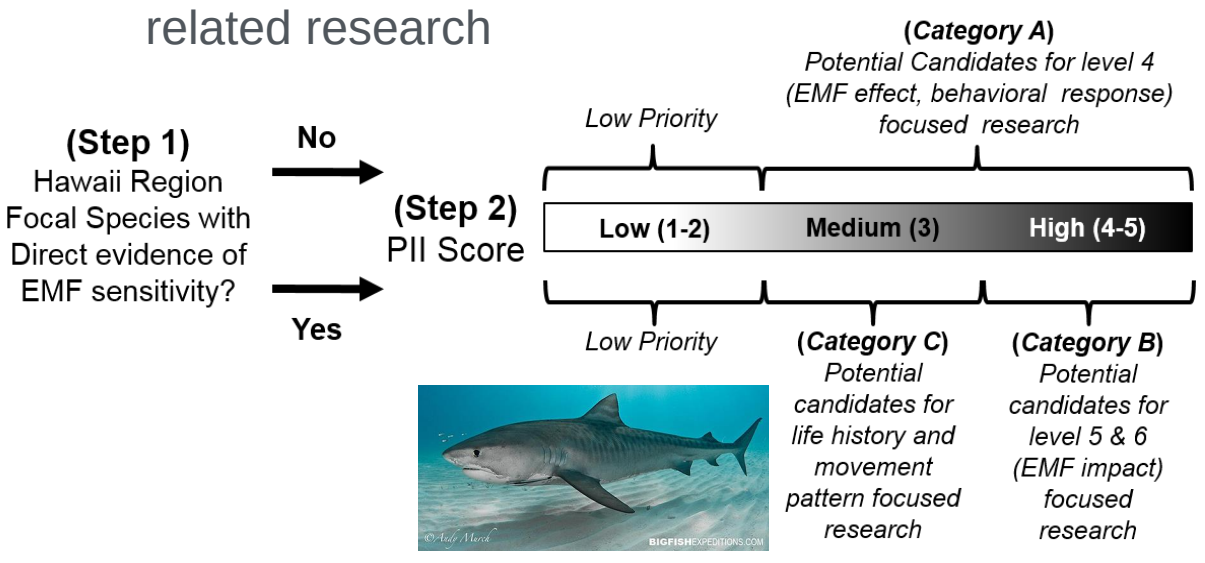
Technical Approach

- Literature Search and Information Gathering
  - Conduct a literature search to compile recently published information on EMF sensitivity of marine fishes and potential impacts of MHK and offshore wind technologies in the marine environment
  - Narrowed over 1,000 marine fish species that occur in the Hawaii Region to a Hawaii Region Focal Species List that includes species more likely to be sensitive to EMF. Conducted literature search for these species on their sensitivity to EMF, and life history, movement and habitat use information.

- Literature Review and Assessment
  - Compiled a matrix of EMF sensitivity metrics, and life history, movement and habitat use information for the Hawaii Region Focal Species
  - Developed a *Potential Interaction Index (PII)* as a way to rank the Hawaii Region Focal Species (relative to each other) based on their potential for interacting with EMF generated undersea transmission cables associated with MHK and offshore wind devices

Technical Approach

- Recommendations for Future Research
  - Develop recommendations for research needs to close important knowledge gaps regarding the potential interaction of fishes and MHK technologies in the Hawaii Region
  - Included developing and applying an approach to prioritize the Hawaii Region Focal Species as candidates for, and within, multiple paths of related research



Dasyatis lata
Brown Stingray

Galeocerdo cuvier
Tiger Shark

Sphyrna lewini
Scalloped Hammerhead

PII score: relative species potential for interacting with EMF generated undersea transmission cables

Accomplishments and Progress

- The literature search results from this project were incorporated into the U.S. Department of Energy's Tethys knowledge management system.

- Information reviewed and compiled in a final technical report:
  - Narrowed the over 1,000 marine fish species that occur in the Hawaii Region to a Hawaii Region Focal Species List that includes 99 species more likely to be sensitive to EMF
  - EMF sensitivity only documented in 11 of the marine fish species in this region, also relatively little detailed information published on fish movement and habitat use patterns
  - Discussed the types of research needed which involves studies relating to:
    - Defining species-specific EMF sensitivity thresholds under various environmental conditions
    - Life history, movement and habitat use patterns to improve our understanding of the likelihood and frequency fishes may be in the vicinity of EMF generated by subsea transmission cables
    - Potential for related population, community or ecosystem impacts
  - Many of these studies can and should occur opportunistically as pilot and commercial scale MHK devices are deployed in Hawaii
  - Project results will assist regulatory agencies and developers to prioritize species that may have a higher likelihood of being impacted by EMF to better focus additional research needed and mitigation strategies to minimize potential impacts if they are identified

Project Plan & Schedule

Project duration (Start and End Date):

1 April 2014 to 30 September 2015

Project Budget

Budget History					
FY2014		FY2015		FY2016	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
$48.600k	N/A	$21.335k	N/A	N/A	N/A

- There were no deviations from planned budget or scope of work
- Project ended 30 Sept 2015 – all funds were expended
- No additional funding sources

Research Integration & Collaboration

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Partners, Subcontractors, and Collaborators:

This study was funded, in part, by the U.S. Department of the Interior, Bureau of Ocean Energy Management, Environmental Studies Program, Washington DC, through Interagency Agreement Number M14PG00012 with the U.S. Department of Energy.

Communications and Technology Transfer:

Final technical report:

Claisse, J.T., D.J. Pondella, C.M. Williams, L.A. Zahn, and J.P. Williams. 2015. Current ability to assess impacts of electromagnetic fields associated with marine and hydrokinetic technologies on marine fishes in Hawaii. Final Technical Report, OCS Study BOEM 2015-042. U.S. Department of Energy, Energy Efficiency and Renewable Energy, Golden, Colorado.

This report may be downloaded from:

http://www.boem.gov/Pacific-Completed-Studies/

http://www.oxy.edu/vantuna-research-group/publications

The literature search results from this project were incorporated into the U.S. Department of Energy's Tethys knowledge management system.

Next Steps and Future Research

FY17/Current research:

Project was completed in Fall 2015

Proposed future research:

In our report we discuss the types of research needed to help fill gaps in the scientific knowledge base for this region. These involve studies to better define species-specific EMF sensitivity thresholds under various environmental conditions, studies of life history, movement and habitat use patterns to improve our understanding of the likelihood and frequency fishes may be in the vicinity of EMF generated by subsea transmission cables, and studies of the potential for related population, community or ecosystem impacts. Many of these studies can and should occur opportunistically as pilot- and commercial-scale MHK devices are deployed in Hawaii.