

Environmental Studies – Electromagnetic Fields (EMF)

Applied Science for Informed Decisions on Ocean Energy

BOEM is responsible for overseeing renewable energy development on the outer continental shelf (OCS) in an environmentally sound manner. One issue of concern to the public, and particularly the fishing community, is the effects of electromagnetic fields (EMF) on marine species. Electromagnet fields are generated by cables when an electric current is flowing through them. Some fish, sharks, rays, and eels can sense the EMF and may be attracted or repulsed by the field. The primary concern is that the cable emitting the field will act as a barrier for migration. BOEM is funding several studies on both the West and East coasts to address this issue.



EFFECTS OF EMF FROM TRANSMISSION LINES ON ELASMOBRANCHS AND OTHER MARINE SPECIES

BOEM funded a literature synthesis to understand sensitive marine species and the potential effects of exposure to EMFs from offshore power cables. The study includes a review of existing information and a model to describe and quantify predicted EMF from power cables connected to offshore renewable energy projects. Existing information on sensitive marine species that have the potential to respond to EMF was compiled. Anticipated EMFs from power cables can be modeled easily if specific information is available: cable design, burial depth and layout, magnetic permeability of sheathing, and loading. Behavioral responses from EMFs are known for a few species, this information cannot easily be extended to other species and population impacts are speculative. **Status:** Final report (2011-09) is available at: http://www.data.boem.gov/PI/PDFImages/ESPIS/4/5115.pdf

EMF (ELECTROMAGNETIC FIELD) IMPACTS ON ELASMOBRANCH (SHARKS, RAYS AND SKATES) AND AMERICAN LOBSTER MOVEMENT AND MIGRATION

BOEM is funding direct measurement of both electric and magnetic field from two HVDC cables, 330 MV (Cross Sound) and 660 MV (Neptune) using state of the art sensors placed on a remotely operated vehicle. Field experiments will be conducted on lobster and skates using a mesh enclosure. The study will use the most up to date acoustic telemetry technology to detect the real-time movements in 3-D of individually identifiable fish within the enclosure in relation to an energized section of sub-sea electric cable. **Status:** Conducting field work in 2016, final report in 2017.



POTENTIAL IMPACTS OF SUBMARINE POWER CABLES ON CRAB HARVEST

Relying on local professional fishermen and using existing cables, BOEM-funded researchers are testing crabs to see if they will cross through EMF to reach baited traps. The method uses scuba diving and gives crabs a choice to decide if they will cross an energized power cable to get to bait inside a commercial trap. Within a large, confined cage system, crabs can choose to enter either of two baited traps. To get into one trap, they walk across an unobstructed seafloor. To get into the other trap, crabs have to walk over a cable that is emitting EMF. Researchers have tested over 400 rock crabs in the Santa Barbara Channel. Results suggest rock crabs will cross an unburied 35 kV AC power cable to enter baited commercial traps. **Status**: Scientists are now headed to Puget Sound, where they will conduct similar testing of dungeness crab in fall 2015. A final report will be available fall 2017. Results from the Santa Barbara Barbara Channel were presented at Ocean Sciences 2016 and reported by *Science News* here: https://www.sciencenews.org/article/magnetism-underwater-power-cables-doesnt-deter-sea-life

RENEWABLE ENERGY IN SITU POWER CABLE OBSERVATION

Submarine transmission cables that power offshore oil platforms in the Pacific Region provide a unique opportunity to assess potential behavior and reaction of electromagnetic sensitive species to industry activities. This study is measuring the strength, spatial extent, and variability of EMFs along both energized and unenergized cables. Observations using scuba divers and a deep-water submersible were used to determine attraction/repulsion of fish and large invertebrates such as crabs and sea stars to the EMF from the power cables. No response, attraction or repulsion to EMF from a 35 kV AC in situ power transmission cable has been observed thus far. The apparent lack of response would indicate burial is not always essential for biological reasons. Actual EMF measured on the cables and away from cable output closely fits the model results from a previous BOEM study (2011-09). Knowledge gained from this study will be directly applicable to renewable energy projects in any OCS planning area. **Status:** A final report is available here: http://www.boem.gov/2016-008/

For more information about BOEM's Environmental Research:

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Renewable Energy Research Webpage: www.boem.gov/Renewable-Energy-Environmental-Studies/