Media mentions of Effect of Electricity Cables and Crabs:

The Guardian 2021 based on Lyndon's work Mesmerised brown crabs 'attracted to' undersea cables | Marine life | The Guardian

BBC 2021 mentions the same Brown crabs find underwater power cables 'difficult to resist' - BBC News

Sky News 2021 mentions the same Brown crabs mesmerised by underwater power cables for renewable energy sources, study finds | Climate News | Sky News

The Irish News 2021 Underwater cables for renewables have magnetic pull on brown crabs - The Irish News

A search for "Electromagnetic", "crabs", "power cables", in Google Scholar gives 4,470results:

A search for "Electromagnetic", "crabs", "power cables", in Web of Science gives 7 results:

Ward, J., Schultz, I., Woodruff, D., Roesijadi, G and Copping, A. (2010) Assessing the effects of marine and hydrokinetic energy development on marine and estuarine resources, Oceans-IEEE Proceedings Paper

Abstract

The world's oceans and estuaries offer enormous potential to meet the nation's growing demand for energy. The use of marine and hydrokinetic (MHK) devices to harness the power of wave and tidal energy could contribute significantly toward meeting federal-and state-mandated renewable energy goals while supplying a substantial amount of clean energy to coastal communities. Locations along the eastern and western coasts of the United States between 40 and 70 north latitude are ideal for MHK deployment, and recent estimates of wave and current energy resource potential in the US suggest that up to 400 terawatt hours could be generated, representing about 10% of national energy demand. Because energy derived from wave and tidal devices is highly predictable, their inclusion in our energy portfolio could help balance available sources of energy production, including hydroelectric, coal, nuclear, wind, solar, geothermal, and others.

As an emerging industry, MHK energy developers face many challenges associated with the siting, permitting, construction, and operation of pilot and commercial-scale facilities. As the industry progresses, it will be necessary not only to secure financial support and develop robust technologies capable of efficient, continued operation in harsh environments, but also to implement effective monitoring programs to evaluate long-term effects of device operation and assure resource agencies and members of the public that potential environmental impacts are understood and can be addressed.

At this time, little is known about the environmental effects of MHK energy generation at pilot-or full-scale operational scenarios. Potential effects could include changes to aquatic species behavior from exposure to electromagnetic fields or operational noise; physical interaction of marine mammals, fish, and invertebrates with operating devices or mooring cables; or changes to beach characteristics and water quality from long-term deployment of devices in coastal locations. This lack of knowledge

creates a high degree of uncertainty that affects the actions of regulatory agencies, influences the opinions and concerns of stakeholder groups, affects the commitment of energy project developers and investors, and ultimately, the solvency of the industry.

To address the complexity of environmental issues associated with MHK energy, PNNL has received support from the Department of Energy Office of Energy Efficiency and Renewable Energy Waterpower Program to develop research and development that draws on the knowledge of the industry, regulators, and stakeholders. Initial research has focused on 1) the development of a knowledge management database and related environmental risk evaluation system, 2) the use of hydrodynamic models to assess the effects of energy removal on coastal systems, 3) the development of laboratory and mesocosm experiments to evaluate the effects of EMF and noise on representative marine and estuarine species, and 4) collaborative interaction with regulators and other stakeholders to facilitate ocean energy devices, including participation in coastal and marine spatial planning activities.

In this paper, we describe our approach for initial laboratory investigations to evaluate potential environmental effects of EMFs on aquatic resources. Testing will be conducted on species that are a) easily procured and cultured, b) ecologically, commercially, recreationally or culturally valuable, and c) reasonable surrogates for threatened or endangered species. Biological endpoints of interest are those that provide compelling evidence of magnetic field detection and have a nexus to individual, community, or population-level effects. Through laboratory, mesocosm, and limited field testing, we hope to reduce the uncertainly associated with the development of ocean energy resources, and gain regulatory and stakeholder acceptance. We believe this is the best approach for moving the science forward and provides the best opportunity for successfully applying this technology toward meeting our country's renewable energy needs.

During the project, the team will work closely with two other national laboratories (Sandia and Oak Ridge), the Northwest National Marine Renewable Energy Center at University of Washington and Oregon State University, and Pacific Energy Ventures.

No Results, This was a plan for a research project

Love M.S., Nishimoto, N.M., Clark, S., McCrea, M and Bull, A.S. (2017) Assessing potential impacts of energized submarine power cables on crab harvests, Continental Shelf Research

Abstract

Offshore renewable energy facilities transmit electricity to shore through submarine power cables. Electromagnetic field emissions (EMFs) are generated from the transmission of electricity through these cables, such as the AC inter-array (between unit) and AC export (to shore) cables often used in offshore energy production. The EMF has both an electric component and a magnetic component. While sheathing can block the direct electric field, the magnetic field is not blocked. A concern raised by fishermen on the Pacific Coast of North America is that commercially important Dungeness crab (Metacarcinus magister Dana, 1852)) might not cross over an energized submarine power cable to enter a baited crab trap, thus potentially reducing their catch. The presence of operating energized cables off southern California and in Puget Sound (cables that are comparable to those within the arrays of existing offshore wind energy devices) allowed us to conduct experiments on how energized power cables might affect the harvesting of both M. magister and another commercially important crab species, Cancer productus Randall, 1839. In this study we tested the questions: 1) Is the catchability of crabs reduced if these animals must traverse an energized power cable to enter a

trap and 2) if crabs preferentially do not cross an energized cable, is it the cable structure or the EMF emitted from that cable that deters crabs from crossing? In field experiments off southern California and in Puget Sound, crabs were given a choice of walking over an energized power cable to a baited trap or walking directly away from that cable to a second baited trap. Based on our research we found no evidence that the EMF emitted by energized submarine power cables influenced the catchability of these two species of commercially important crabs. In addition, there was no difference in the crabs' responses to lightly buried versus unburied cables. We did observe that, regardless of the position of the cable, Cancer productus in southern California tended to move to the west and Metacarcinus magister tended to move to the east.

No Evidence Either Way

Using existing cables on the sea floor or slightly buried there was no difference.

Scott, K., Harsanyi, P. and Lyndon, A.R. (2018) Understanding the effects of electromagnetic field emissionsfrom marine renewable energy devices on the commercially important edible crab Cancer Pagurus (L.), Marine Pollution Bulletin

Abstract

The effects of simulated electromagnetic fields (EMF), emitted from sub-sea power cables, on the commercially important decapod, edible crab (Cancer pagurus), were assessed. Stress related parameters were measured (L-Lactate, D-Glucose, Haemocyanin and respiration rate) along with behavioural and response parameters (antennular flicking, activity level, attraction/avoidance, shelter preference and time spent resting/roaming) during 24-h periods. Exposure to EMF had no effect on Haemocyanin concentrations, respiration rate, activity level or antennular flicking rate. EMF exposure significantly disrupted haemolymph L-Lactate and D-Glucose natural circadian rhythms. Crabs showed a clear attraction to EMF exposed shelter (69%) compared to control shelter (9%) and significantly reduced their time spent roaming by 21%. Consequently, EMF emitted from Marine Renewable Energy Devices (MREDs) will likely affect edible crabs both behaviourally and physiologically, suggesting that the impact of EMF on crustaceans must be considered when planning MREDs.

They Rest More

Simulated magnetic fields attract them when looking for shelter, and they reduced their roaming behaviour.

Taomina, B., Di Poi, C., Agnault, A.L., Carlier, A., Desroy, N., Escobar-Lux, R.H., D'eu, J.F., Freytet, F. and Durif, C.M.F. (2020) Impact of magnetic fields generated by AC/DC submarine power cables on the behavior of juvenile European lobster (Homarus garnmarus), Aquatic Toxicology

Abstract

The number of submarine power cables using either direct or alternating current is expected to increase drastically in coming decades. Data concerning the impact of magnetic fields generated by these cables on marine invertebrates are scarce. In this context, the aim of this study was to explore the potential impact of anthropogenic static and time-varying magnetic fields on the behavior of recently settled juvenile European lobsters (Homarus gammarus) using two different behavioral assays. Day-light conditions were used to stimulate the sheltering behavior and facilitate the video tracking. We showed that juvenile lobsters did not exhibit any change of behavior when submitted to an artificial magnetic field gradient (maximum intensity of 200 mu T) compared to non-exposed lobsters in the ambient magnetic field. Additionally, no influence was noted on either the lobsters' ability to find shelter or modified their exploratory behavior after one week of exposure to anthropogenic magnetic fields (225 +/- 5 mu T) which remained similar to those observed in control individuals. It appears that static and time-varying anthropogenic magnetic fields, at these intensities, do not significantly impact the behavior of juvenile European lobsters in daylight conditions. Nevertheless, to form a complete picture for this biological model, further studies are needed on the other life stages as they may respond differently.

No Effect on Juvenile Lobsters

Static or varying magnetic fields up to 200 mu T don't seem to bother juvenile lobsters

Scott, K ., Harsanyi, P.,, Easton B.A.A., Piper, A.J.R. Rochas, C.M.V. and Lyndon, A.R. (2021) [Exposure to electromagnetic fields from submarine power cables can trigger strength-dependent behavioural and physiological responses in Edible Crab, Cancer pagurus (L.)], Journal of Marine Science and Engineering

Abstract

The current study investigated the effects of different strength Electromagnetic Field (EMF) exposure (250 mu T, 500 mu T, 1000 mu T) on the commercially important decapod, edible crab (Cancer pagurus, Linnaeus, 1758). Stress related parameters were measured (L-Lactate, D-Glucose, Total Haemocyte Count (THC)) in addition to behavioural and response parameters (shelter preference and time spent resting/roaming) over 24 h periods. EMF strengths of 250 mu T were found to have limited physiological and behavioural impacts. Exposure to 500 mu T and 1000 mu T were found to disrupt the L-Lactate and D-Glucose circadian rhythm and alter THC. Crabs showed a clear attraction to EMF exposed (500 mu T and 1000 mu T) shelters with a significant reduction in time spent roaming. Consequently, EMF emitted from MREDs will likely affect crabs in a strength-dependent manner thus highlighting the need for reliable in-situ measurements. This information is essential for policy making, environmental assessments, and in understanding the impacts of increased anthropogenic EMF on marine organisms.

Crabs Like Stronger Magnetic Fields

Stronger than 250 mu T fields are attractive for crabs.

Harsanyi, P., Scott, K., Easton B.A.A., Ortiz, G.D., Chapman, E.C.N., Piper, A.J.R., Rochas, C.M.V. and Lyndon, A.R. (2022) The effects of anthropogenic electromagnetic fields on the early developent of two commercially important crustaceans, European Lobster, Homorus gammarus (L) and Edible Crab, Cancer apagurus (L), Journal of Marine Science and Engineering

Abstract

Proposed offshore windfarm sites could overlap with the brooding and spawning habitats of commercially important crustacea, including European lobster, Homarus gammarus and Edible crab, Cancer pagurus. Concerns have been raised on the biological effects of Electromagnetic Fields (EMFs) emitted from subsea power cables on the early life history of these species. In this study, ovigerous female H. gammarus and C. pagurus were exposed to static (Direct Current, DC) EMFs (2.8 mT) throughout embryonic development. Embryonic and larval parameters, deformities, and vertical swimming speed of freshly hatched stage I lobster and zoea I crab larvae were assessed. EMF did not alter embryonic development time, larval release time, or vertical swimming speed for either species. Chronic exposure to 2.8 mT EMF throughout embryonic development resulted in significant differences in stage-specific egg volume and resulted in stage I lobster and zoea I crab larvae exhibiting decreased carapace height, total length, and maximum eye diameter. An increased occurrence of larval deformities was observed in addition to reduced swimming test success rate amongst lobster larvae. These traits may ultimately affect larval mortality, recruitment and dispersal. This study increases our understanding on the effects of anthropogenic, static EMFs on crustacean developmental biology and suggests that EMF emissions from subsea power cables could have a measurable impact on the early life history and consequently the population dynamics of H. gammarus and C. pagurus.

Very Strong Magnetic Fields are not Good for Larval Crabs or Lobsters

These magnetic fields are 2800 mu T, compared with the previous one. The ambient strength is 25 to 65 mu T. The field on the surface of a typical wire is about 3,200 mu T (Harsanyi et al 2022). Paid for by the Scottish Fisherman's Federation.

Albert, L., Maire, O., Olivier, F., Lambert, C., Romero-Ramirez, A., Jolivet, A., Chauvaud, L. and Chavaud, S. (2022) Can artificial magnetic fields alter the functional role of the blue mussel, Mytilus edulis? Marine Biology

Abstract

Along European coasts, the rapid expansion of marine renewable energy devices and their buried power cables, raises major societal concerns regarding the potential effects of their magnetic field emissions (MFs) on marine species and ecosystem functioning. MFs occur at a local spatial scale, which makes sessile species the primary target of chronic and high-intensity exposures. Some of them, as ecosystem engineers, have critical functions in coastal habitats whose behavioral alteration may drive profound consequences at the ecosystem level. In this context, the present experimental study explored the effects of short exposure to direct current MFs, on the feeding behavior of a widespread ecosystem engineer, the blue mussel (Mytilus edulis). A repeated measure design was carried out with adult mussels successively exposed to control treatment (ambient magnetic field of 47 mu T) and artificial MF treatment (direct current of 300 mu T produced by Helmholtz coils), as measured around power cables. The filtration activity was assessed through valve gap monitoring using an automated

image analysis system. The clearance rate was estimated simultaneously by measuring the decrease in algal concentration using flow cytometry. Our findings revealed that mussels placed in MF treatment did not exhibit observable differences in valve activity and filtration rate, thus suggesting that, at such an intensity, artificial MFs do not significantly impair their feeding behavior. However, additional research is required to investigate the sensitivity of other life stages, the effects of mid to long-term exposure to alternative and direct current fields and to test various MF intensities.

Typical Intensity round cables

Mussels don’t mind a jump from 47 mu T to 300 mu T in direct current induced magnetic fields.