

# Ocean Renewable Power Company: Adaptive Management

OES-Annex IV Webinar

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## About Ocean Renewable Power Company (ORPC)

- Founded in 2004
- Headquartered in Portland, Maine with affiliate offices in Alaska, Quebec and Ireland.
- Numerous technology and research partners, including U.S. national laboratories
- Five generations of technology designed and tested
- Delivered power to shore from both a tidal (Maine) and river (Alaska) hydrokinetic project
- Complex regulatory, environmental, fishermen and local community hurdles successfully addressed
- ORPC Solutions provides services to the broader industry

# ORPC Power Systems

TidGen® 2012



OCGen® Prototype 2014



RivGen® 2015



# Managing Environmental Risk and Uncertainty

## Challenge

*How can unquantified environmental effects with this nascent industry be addressed in a responsible, cost effective and holistic way?*

How do stakeholders manage risk?

- Developers?
- Investors?
- Regulators?
- Public?

Where are interests divergent, aligned?

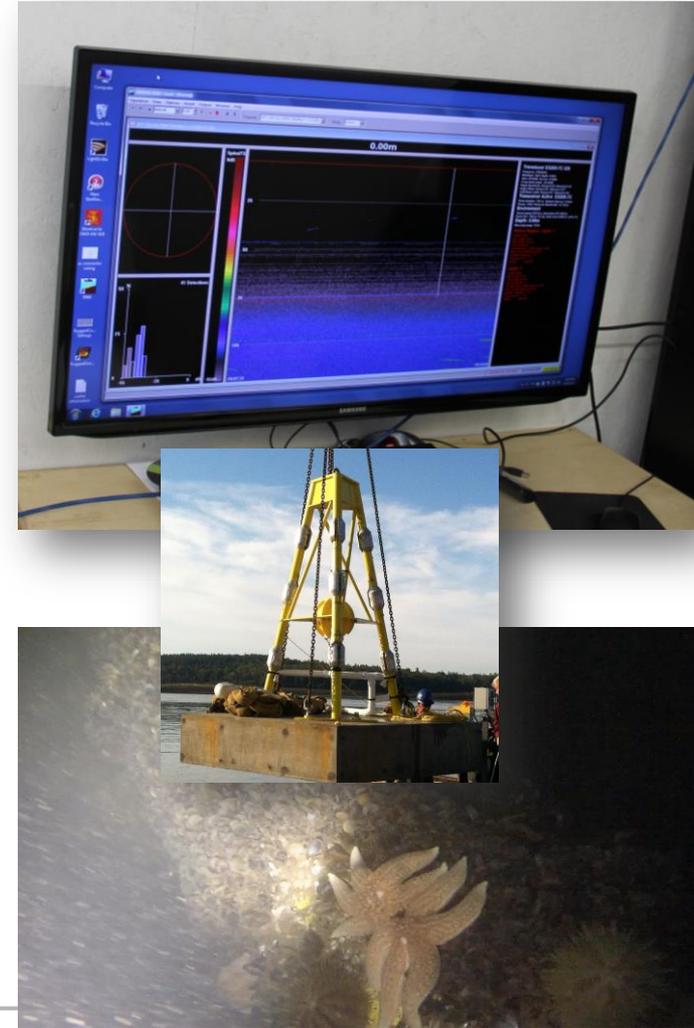


# ORPC's Approach to Adaptive Management

Adaptive management is fundamental for reducing environmental risk

Key components include:

- Early involvement of all stakeholders
- Building and maintaining regulatory trust
- Utilizing science-based data collection
- Engaging the harbor users and local community
- Initiating adaptive approach in the pre-application phase and continuing through project operation



# Formalization of ORPC's Adaptive Management Plan

- Required by the Federal Energy Regulatory Commission (FERC) within 3 months of license issuance.
- Plan was generated based on feedback from the Adaptive Management Team (ORPC, regulatory agencies, technical advisors) and includes:
- Workshop held in Eastport, Maine in July 2012 with team, FERC and DOE to further refine process.



## ADAPTIVE MANAGEMENT TEAM

ORPC  
NOAA NMFS  
US F&W  
USCG  
USACE  
Maine DEP  
Maine DMR  
Technical Advisors

# Adaptive Management Case Study - Phase I Pile Driving

- ORPC was granted a FERC Pilot Project License on February 27, 2012
- License restricted pile driving activities to before April 9<sup>th</sup> due to potential impacts on Atlantic salmon smolt
- Mitigation measures required as part of Incidental Harassment Authorization (IHA) from NOAA



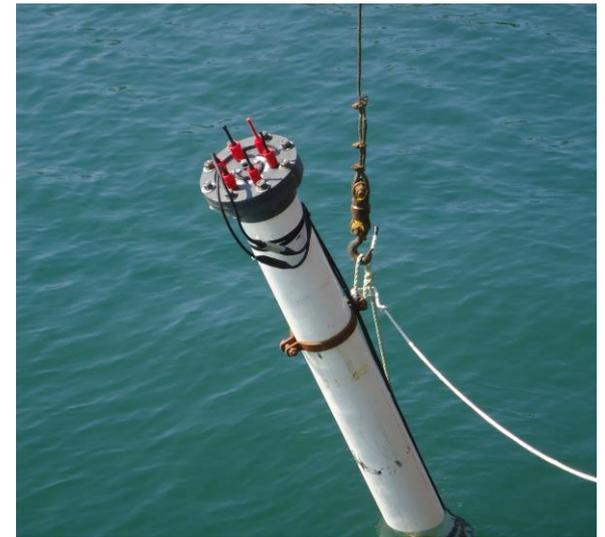
## Challenge

- Safely install 10 steel piles to secure bottom support frame prior to restrictive window in dynamic, demanding site conditions

# Adaptive Management Case Study - Phase I Pile Driving

## Execution

- Implemented comprehensive environmental monitoring to collect data during pile driving
  - Hydroacoustics
  - In-air acoustics
  - Marine mammal observations and mitigation procedures
  - Sea and shorebird survey
- Engaged FERC to discuss license modification
- Presented monitoring results to resource agencies
- Requested FERC License modification with support of resource agencies



# Adaptive Management Case Study - Phase I Pile Driving

## Results – Adaptive Management at Work

- FERC granted License modification to remove Phase I restrictive window for pile driving on April 4, 2012.
- Demonstrated that ORPC's approach was effective in efficient license modification through the use of adaptive management.
- Established Best Management Practices (BMP's) and recommendations for future installations



## Demonstrated Actions - FERC License Modifications

FERC Submittal/License Article(s)	Requested Modifications	FERC Order Date
<ul style="list-style-type: none"> <li>- Article 402. Restrictive Dates for Pile Driving</li> </ul>	Removal of April 10 through November 7 restrictions based on mitigation and measured acoustic levels	April 4, 2012
2012 Environmental Monitoring Report <ul style="list-style-type: none"> <li>- Article 405. Acoustic</li> <li>- Article 406. Benthic &amp; Biofouling</li> <li>- Article 407. Fisheries and Marine Life Interaction</li> <li>- Article 409. Hydraulic</li> <li>- Article 410. Marine Mammal</li> <li>- Article 412. Bird</li> </ul>	Modifications vary by license article but generally clarify monitoring plans or reduce frequency of monitoring surveys based on increased knowledge of species presence and environmental effects.	May 8, 2013
Temporary Variance Request <ul style="list-style-type: none"> <li>- Article 405. Acoustic</li> <li>- Article 406. Benthic &amp; Biofouling</li> <li>- Article 407. Fisheries and Marine Life Interaction</li> <li>- Article 409. Hydraulic</li> <li>- Article 410. Marine Mammal</li> <li>- Article 412. Bird</li> </ul>	Hiatus in environmental monitoring during technology optimization phase	October 29, 2013 (extended for 2014 and 2015)

## Building the Knowledge Base: Maine

On 2 of 3 occasions vertical fish distributions were different before and after turbine deployment

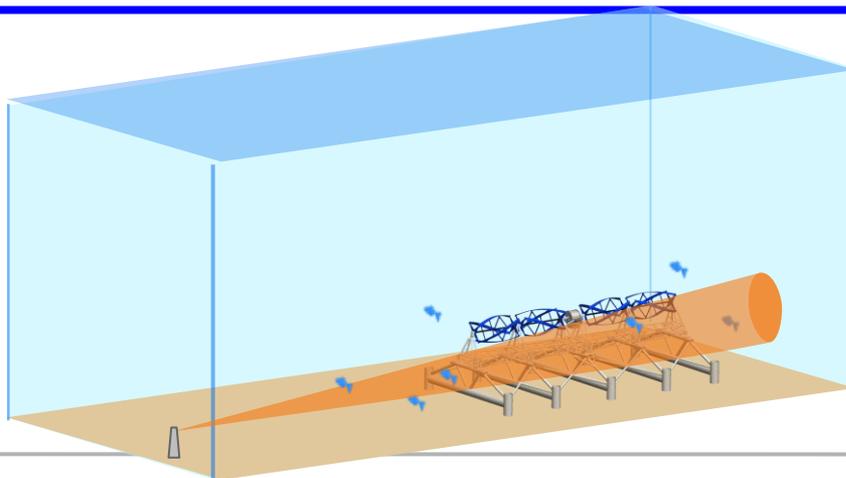
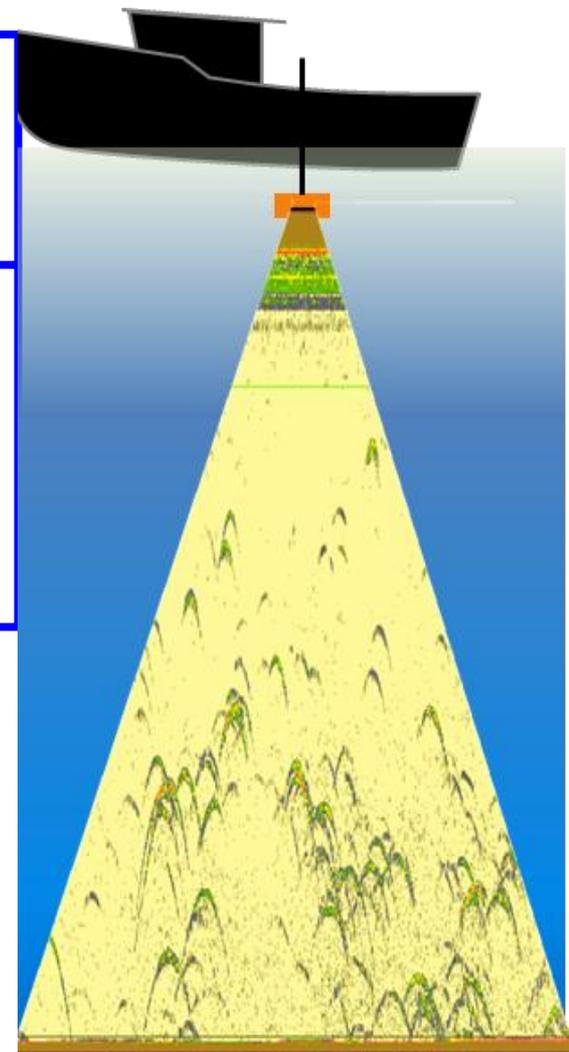
*Staines, G. J., G. B. Zydlewski, H. A. Viehman, H. Shen, J. D. McCleave. 2015. Changes in Vertical Fish Distributions Near a Hydrokinetic Device in Cobscook Bay, Maine, USA. Proceedings of the 11<sup>th</sup> European Wave and Tidal Energy Conference, 6-11 Sep, Nantes, France.*

- The turbine did not affect lateral fish movement in the ranges sampled

*Viehman, H. A. and G. B. Zydlewski. Analyses in progress.*

- Long-term data showed distinct diel and tidal cycles of fish density

*Viehman, H. A. and G. B. Zydlewski. 2015. Using temporal analysis techniques to optimize hydroacoustic surveys of fish at MHK devices. Proceedings of the 11<sup>th</sup> European Wave and Tidal Energy Conference 6-11 Sep, Nantes, France.*



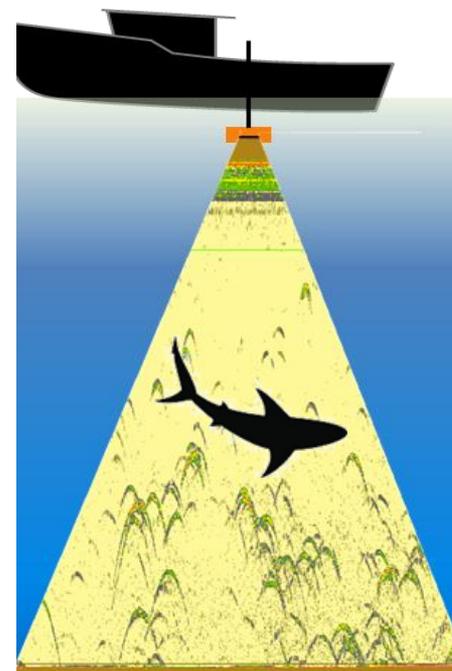
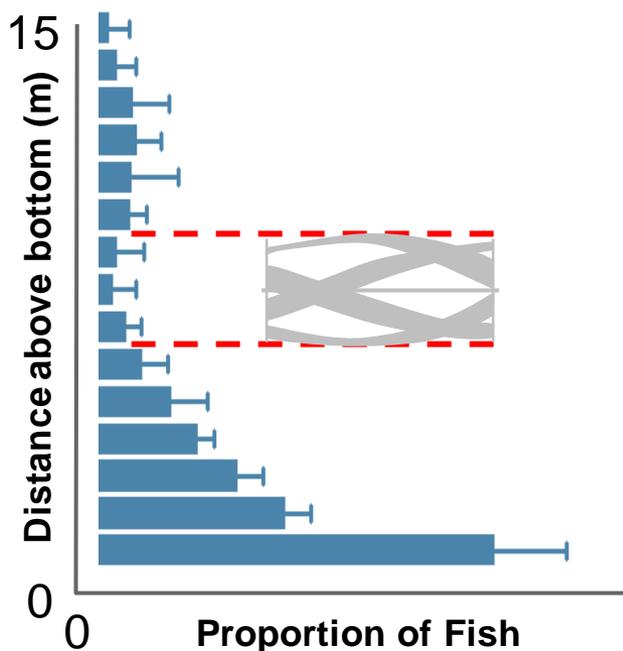
## Building the Knowledge Base: Maine

There is a ~6% chance of fish being at the depth of the turbine blades

*Shen, H., G. B. Zydlewski, H. A. Viehman, G. J. Staines. 2015. Estimating the Probability of Fish Encountering a Marine Hydrokinetic Device. Proceedings of the 3<sup>rd</sup> Marine Energy Technology Symposium, 27-29 Apr, Washington D.C.*

In Western Passage 29 large targets detected from May-Sep in 2010-11; 9 confirmed (8 porpoises & 1 shark)

*Staines, G. S. and G. B. Zydlewski. Analyses in Progress*



# Building the Knowledge Base

## Igiugig 2015

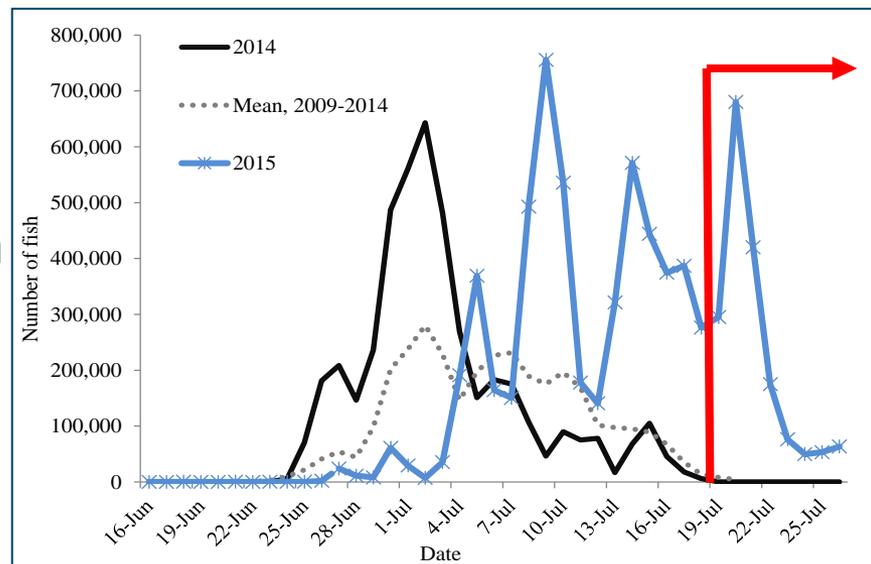
- Located on the Kvichak River, one of North America's most significant salmon migratory runs.
- State and federal permits required
- ORPC's RivGen® Power System installed from July through September in partnership with the Igiugig Village Council.



# Building the Knowledge Base

## Igiugig 2015 - Results

- Presence, timing, and characterization of movement of fish (and wildlife) were documented. Nearly 2 million adult sockeye were counted on the river during the first week of operation.
- No evidence of passage delay was observed
- No evidence of animal attraction. Some avoidance behavior was recorded
- No indication of injury or mortality. Some potential disorientation by salmon smolt



# Building the Knowledge Base

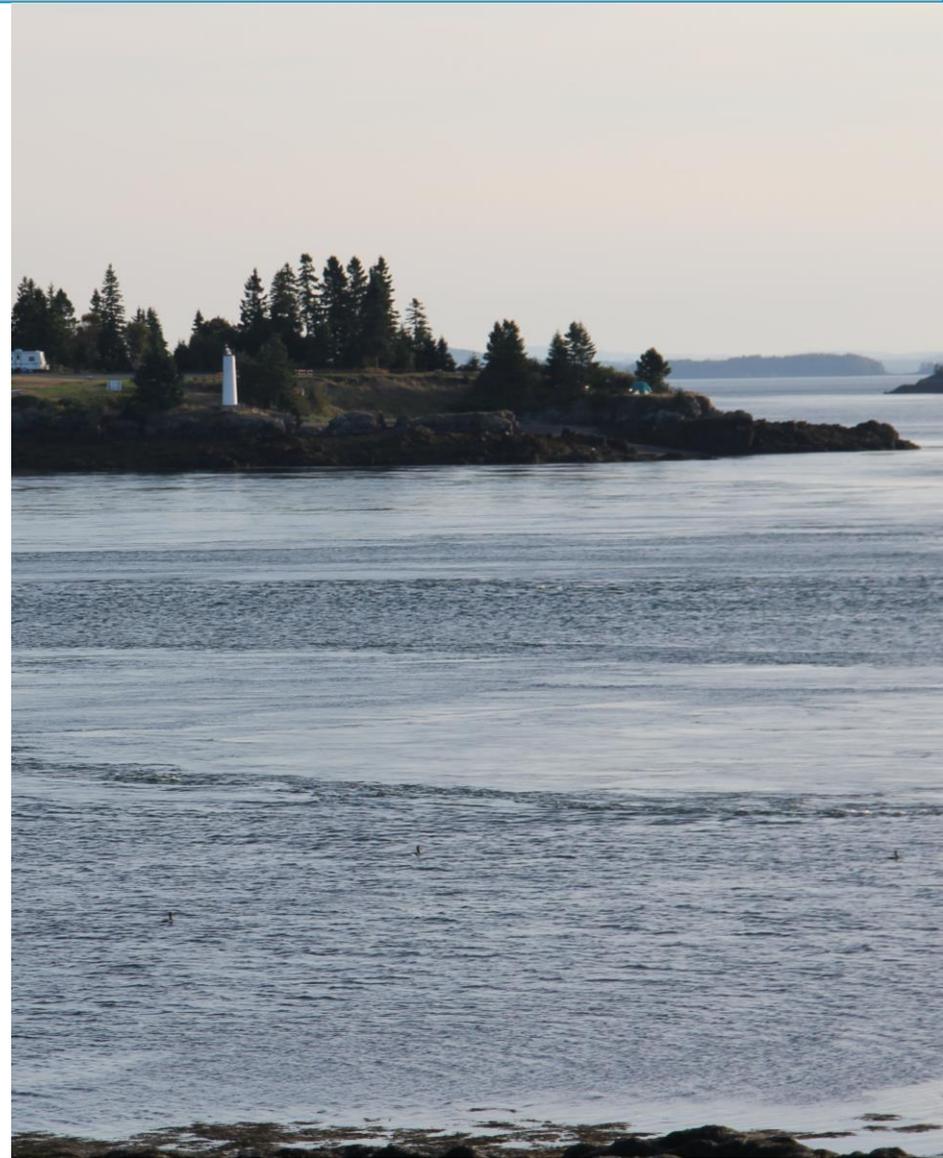
## Igiugig 2015 – Next Steps

- Project details and results presented to the Cobscook Bay Tidal Energy Project AMT on November 19, 2015
- Additional research by PNNL has been funded to conduct further analysis and to develop automation tools.
- Igiugig Village Council was selected by DOE in recent funding opportunity to evaluate increases to system durability and availability.



## Establishing a path to commercialization

- Determining acceptable levels of monitoring that are proportional to the risk is key.
- Increased knowledge base has contributed to reductions in permitting cost and effort
- Retiring risk for single devices facilitates further in water deployments
- ORPC has incorporated our core adaptive management approaches into the development process for marine and hydrokinetic projects in Maine, Alaska and elsewhere.



# Conclusions

***Adaptive management allows stakeholders to collaborate and develop a responsible approach to environmental monitoring. This process seeks to balance the need for accurate data collection with cost constraints faced by an emerging industry.***

**ORPC has demonstrated a proven methodology and results that:**

- Establishes a realistic process based on tangible results
- Maintains realistic levels of effort that are proportional to the project risk
- Contributes to more efficient permitting and licensing
- Creates a path to transition projects from pilot to commercial stage based on a growing knowledge base of device interactions with the environment

A decorative graphic of water splashing across the top of the slide, rendered in various shades of blue.

**Thank you**

**For more information:**

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