Project Overview

SAND2018-4788PE

Marine and Hydrokinetic (MHK) Environmental Compliance Cost Reduction Strategies Workshop

May 2, 2018

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PROJECT TEAM

Sandia National Laboratories

integral consulting inc.

KEARNS WEST

H.T. HARVEY & ASSOCIATES
Ecological Consultants

AGENDA

- **Welcome & Project Overview**
- **Updated Quantitative and Qualitative Findings**
- **Qualitative Findings from Other Industries**
- **Next Steps, Adjourn**

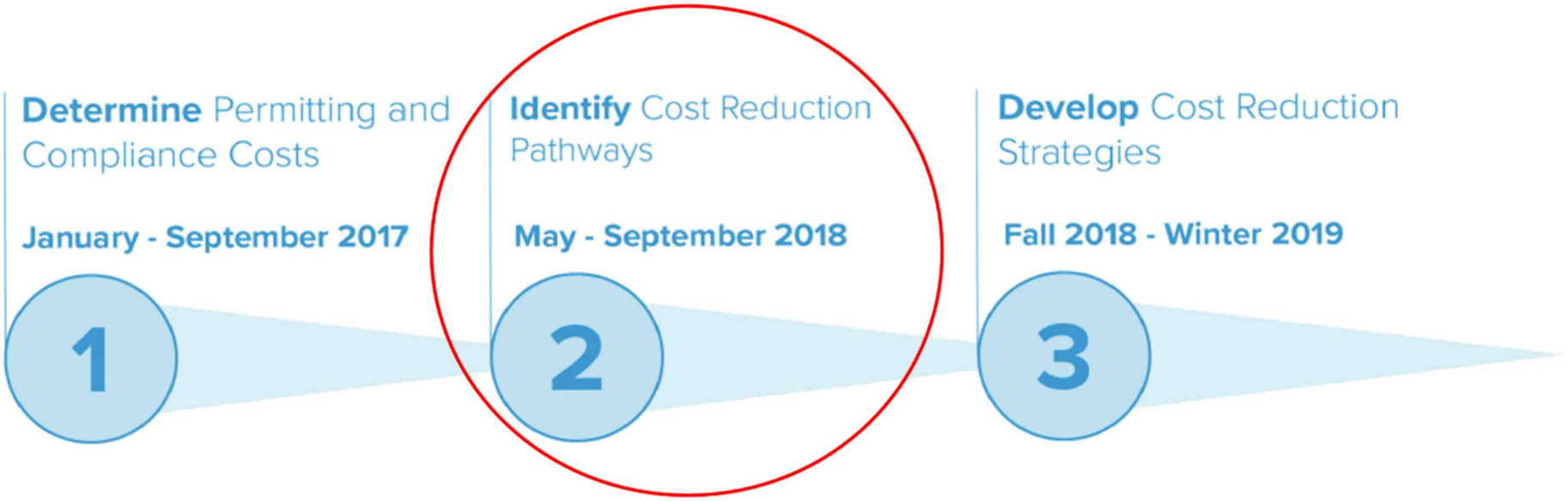
PROJECT OVERVIEW

Issue:
- High environmental permitting costs
- Costs not well understood

Goal:
- Create an economically competitive U.S. MHK industry
  - Create efficiencies in MHK environmental compliance process
    - Reduce time and costs to achieve environmental compliance, while meeting federal, state and local regulatory requirements.
  - Encourage investment in MHK projects
    - Reduce project deployment risk from environmental compliance

Project Objectives:
- Develop detailed and accurate estimates of the environmental compliance costs associated with licensing and permitting MHK developments.
  - Gathered from industry and federal / state regulatory agencies
- Determine how these respective costs contribute to LCOE and investment risk.
- Identify opportunities for cost reduction pathways.

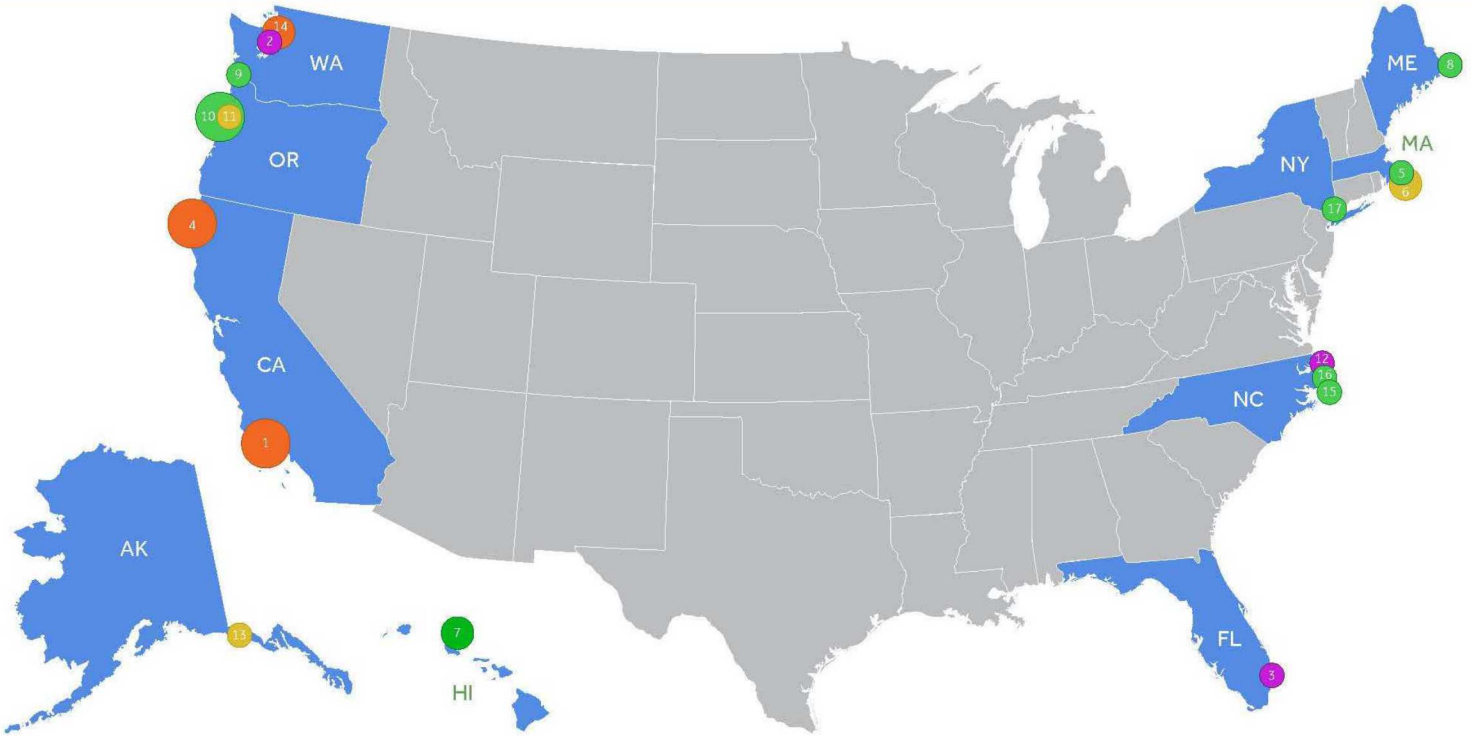
PROJECT PROCESS



PROJECT PROCESS: COSTS AND QUALITATIVE FEEDBACK GATHERED

- **Total Project Cost**
- **Permitting/Licensing Costs**
  - Stakeholder Outreach,
  - State and Federal Permitting,
  - Studies (baseline characterization and pre-deployment)
- **Monitoring & Compliance Costs**
  - Studies (post deployment)
  - Adaptive Management
  - Decommissioning

PROJECTS INCLUDED (so far)



#	Project Name	Location	Type	Sub-Type	Capacity (KW)
1	CalWave	Central Coast, CA	Wave	Test Site	30,000
2	Columbia Power - StingRay Wave Power System	Pudget Sound, WA	Wave	Test Deployment	500
3	Florida Atlantic University – Brower Test Site	Boca Raton, FL	Ocean Current	Test Site	N/A
4	Humboldt WaveConnect Pilot Project	Central Coast, CA	Wave	Test Site	25,000
5	MRECo - Bourne Tidal Test Site	MA	Tidal	Test Site	50
6	MRECo - Muskeget Channel	Muskeget Channel, MA	Tidal	Test Deployment	5,000
7	Navy Wave Energy Test Site	HI	Wave	Test Site	1,000
8	ORPC - Cobscook Bay Tidal Energy Project	Eastport, ME	Tidal	Commercial Deployment	300
9	PMEC - North Energy Test Site	Newport, OR	Wave	Test Site	100
10	PMEC - South Energy Test Site	Newport, OR	Wave	Test Site	20,000
11	Resolute Energy Camp Rilea Trials	National Guard Base Camp Rilea - Warrenton, OR	Wave	Test Deployment	60
12	Resolute Marine Energy - Duck Field Research Facility - USACE	NC	Wave	Test Deployment	25
13	Resolute Marine Energy Yakatut Project	Yakutat, AK	Wave	Test Deployment	500
14	Snohomish PUD - Admiralty Inlet	Snohomish, WA	Tidal	Commercial Deployment	1,000
15	UNC - Gulf Stream	Cape Hatteras, NC	Ocean Current	Test Deployment	N/A
16	UNC - Jeanette's Pier	Nags Head, NC	Wave	Test Site	N/A
17	Verdant Power - Roosevelt Inlet Tidal Energy	NY	Tidal	Commercial Deployment	175

U.S. Marine and Hydrokinetic Projects

September 2017

Project Size

- >5 MW
- 1 - 5 MW
- <1 MW

Project Status

- Completed
- Active
- On Hold
- Cancelled

INDUSTRY OUTREACH CONDUCTED
(so far)

- **Initial Discussions**
  - **Qualitative and Quantitative Project Details**
- **Economic Discussion Follow-up**
  - **Data Gaps and Comparability**
  - **Project and Study Timelines**
- **Partner Outreach**
  - **Additional Study Costs**

FEDERAL AND STATE AGENCY DISCUSSIONS

Federal Agencies

- **Bureau of Ocean Energy Management (BOEM)**
- **Federal Energy Regulatory Commission (FERC)**
- **Department of Defense (DOD)**
- **National Marine Fisheries Service (NMFS)**
- **United States Fish and Wildlife Service (USFWS)**
- **U.S. Navy**

State Agencies

- **California –** California Department of Fish and Wildlife, CA Coastal Commission, CA State Lands Commission
- **Maine –** Maine Department of Environmental Protection, Maine Department of Marine Resources
- **New York –** NY Department of Environmental Conservation - Division of Fish & Wildlife
- **Washington** – Washington State Department of Ecology
- **Oregon** – Oregon Department of Fish and Wildlife, Oregon State Lands Commission

PROJECT CATEGORIES

- **Project Type**
  - Commercial Deployment (3)
  - Test Deployment (6)
  - Test Site (8)
- **Phase**
  - Active (8)
  - On-hold (3)
  - Cancelled (3)
  - Completed (3)
- **Type of Energy**
  - Tidal (5)
  - Wave (10)
  - Ocean Current (2)
- **Geography**
  - East Coast (8)
  - West Coast (9)
- **Grid Connected or not** (9 connected, 8 not)
- **Early vs More Recent Projects**
- **Nearshore State Waters vs Federal Waters**
- **Permitting Type**
  - FERC (7)
  - USACE (7)
  - FERC/BOEM (2)
  - State (1)
- **Stage**
  - Permitting/Licensing (10)
  - Monitoring and Compliance (7)

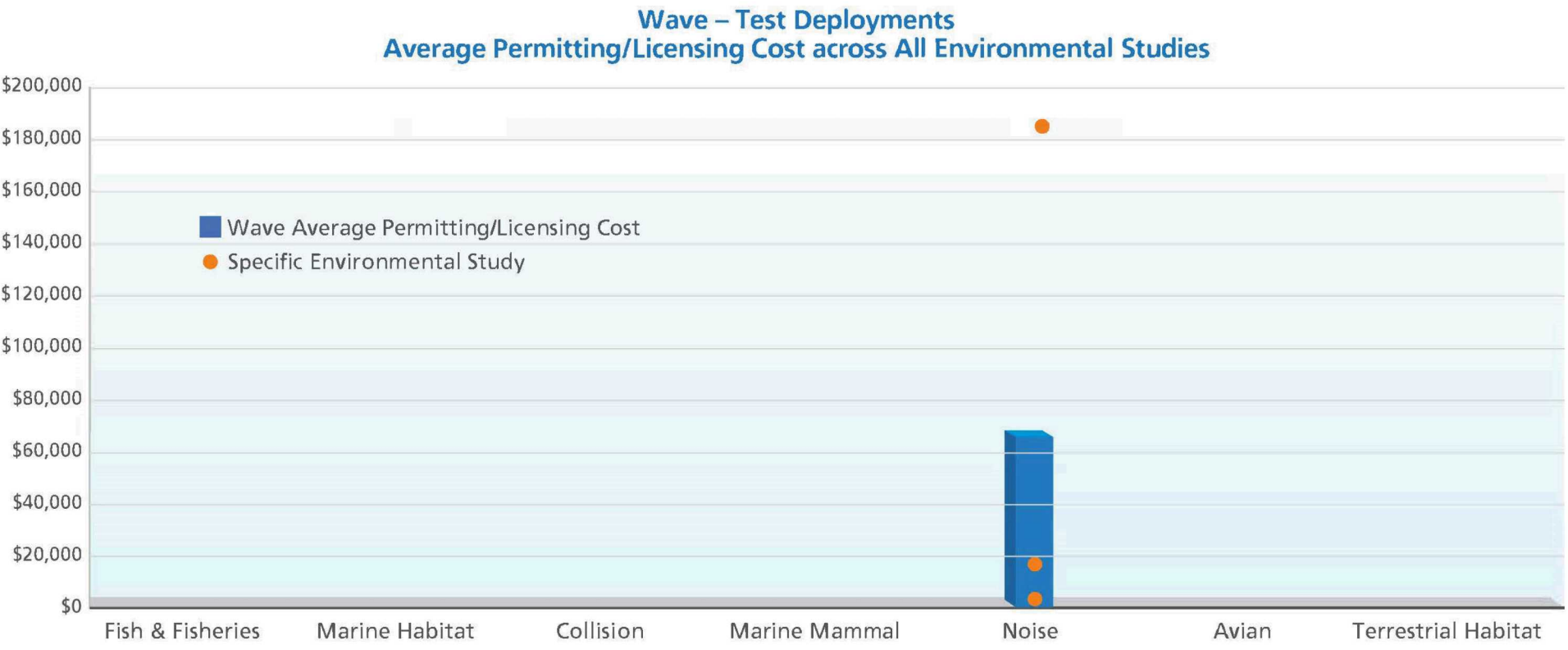
DATA ANALYSIS CATEGORIES
(so far)

Comparison of:

- Wave Test Deployments
- Wave Test Sites and Commercial Tidal Deployments
  - Permitting/licensing study costs
  - Monitoring & compliance costs
- Project Timeline

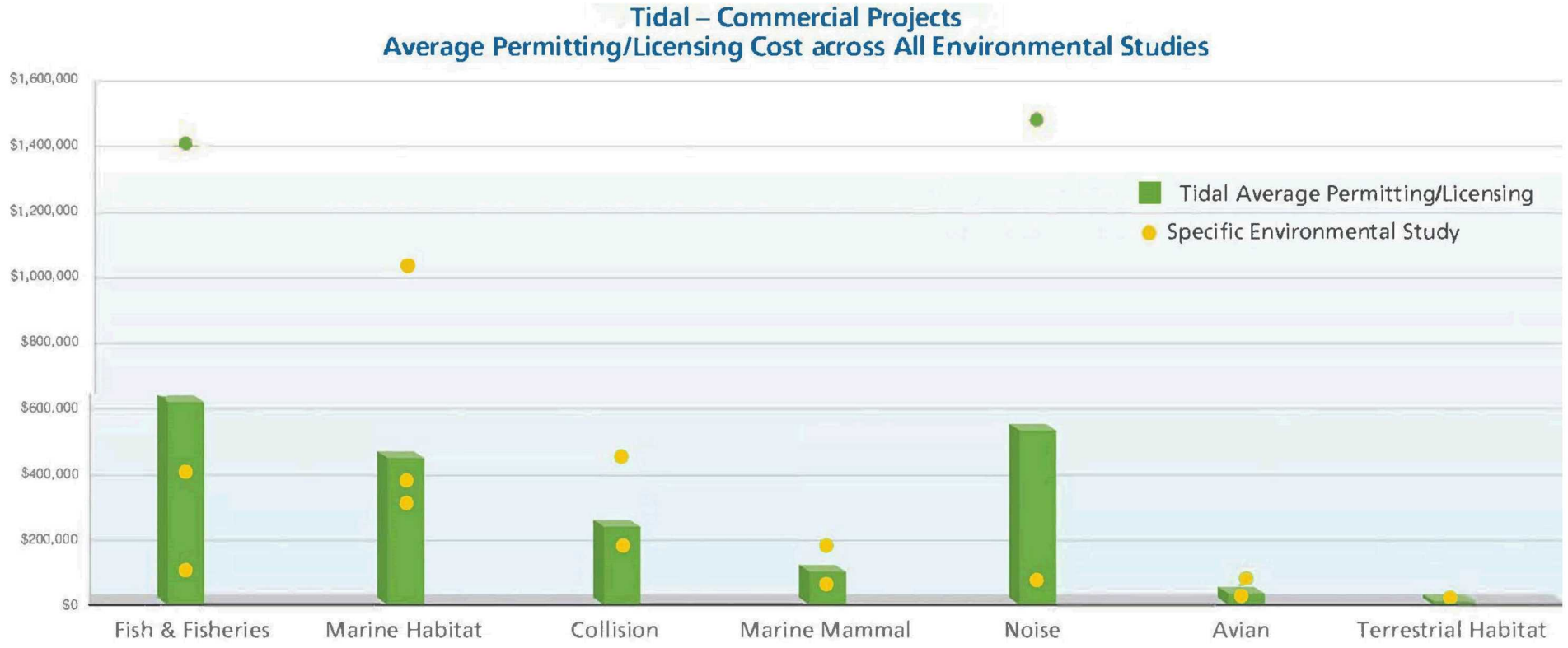
- Planned:
  - Outreach Costs
  - Permitting Activity Length

PERMITTING / LICENSING STUDY COSTS
3 Wave Test Deployments



- Only noise studies were conducted at Wave test deployments
- Most deployments were short term, therefore the costs were relatively low.

PERMITTING / LICENSING STUDY COSTS
3 Tidal Commercial Deployments

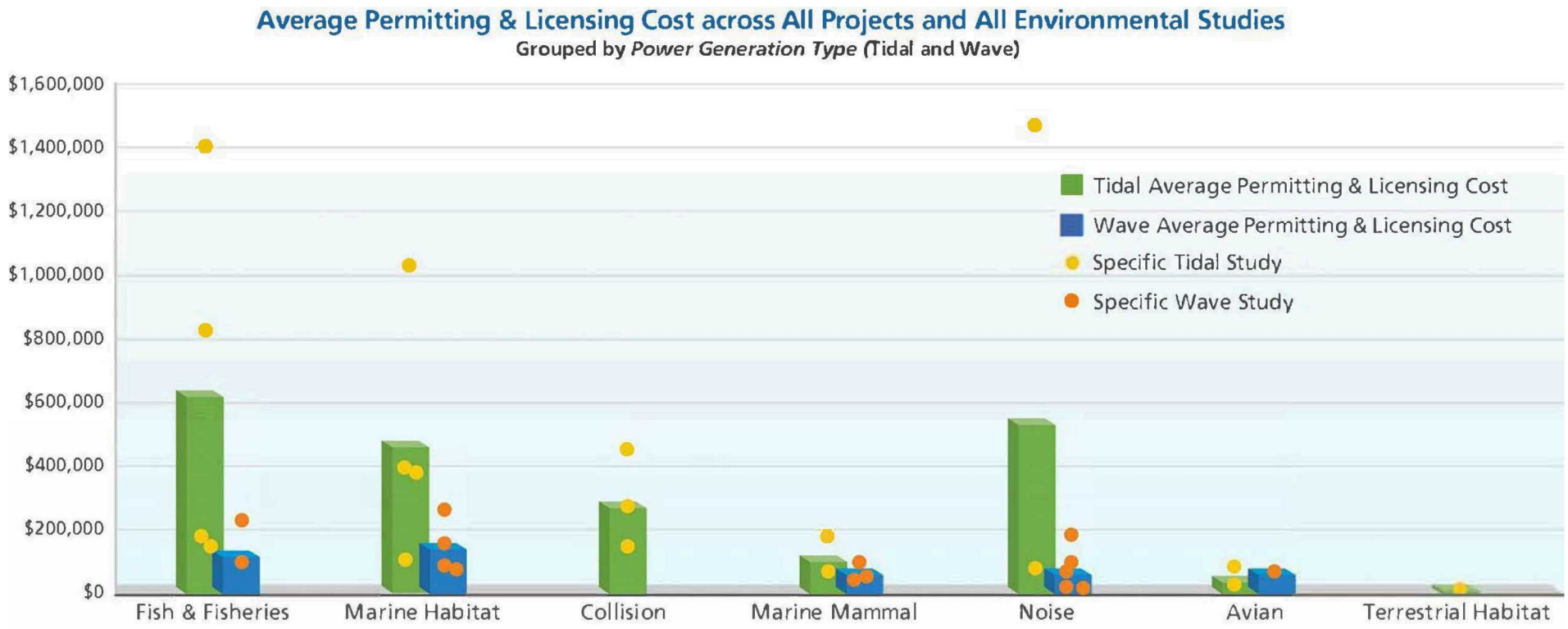


- Fish/fisheries and Noise have highest pre-deployment study costs for this project type
- Tidal projects study types performed depended on:
  - Project Technology
  - Species/location
- High study costs often associated with need to pioneer methods/technologies (1st of a kind)

PERMITTING / LICENSING STUDY COSTS
4 Wave Test Sites

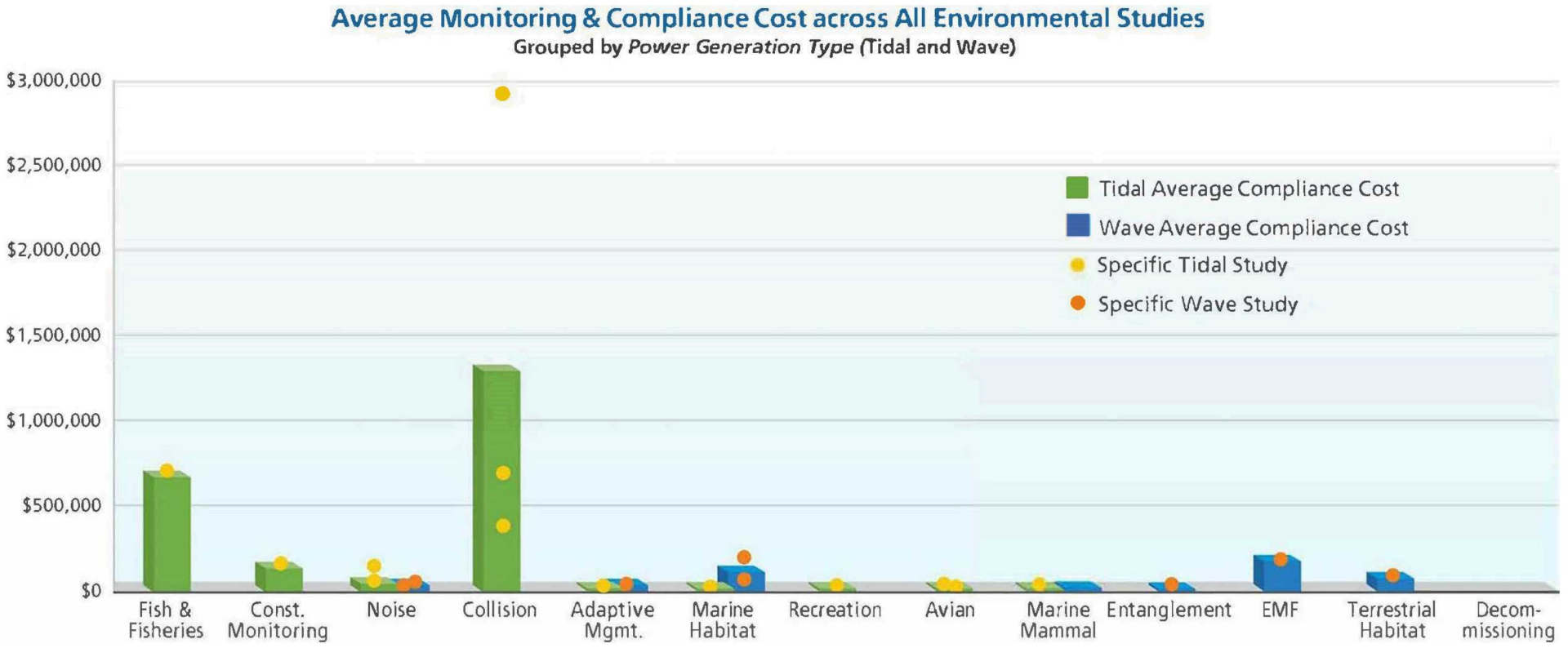
- Highest test site study costs are fish/fisheries and marine habitat characterization
  - May be associated with size of project footprint

PERMITTING / LICENSING STUDY COSTS
7 Wave and 4 Tidal Projects

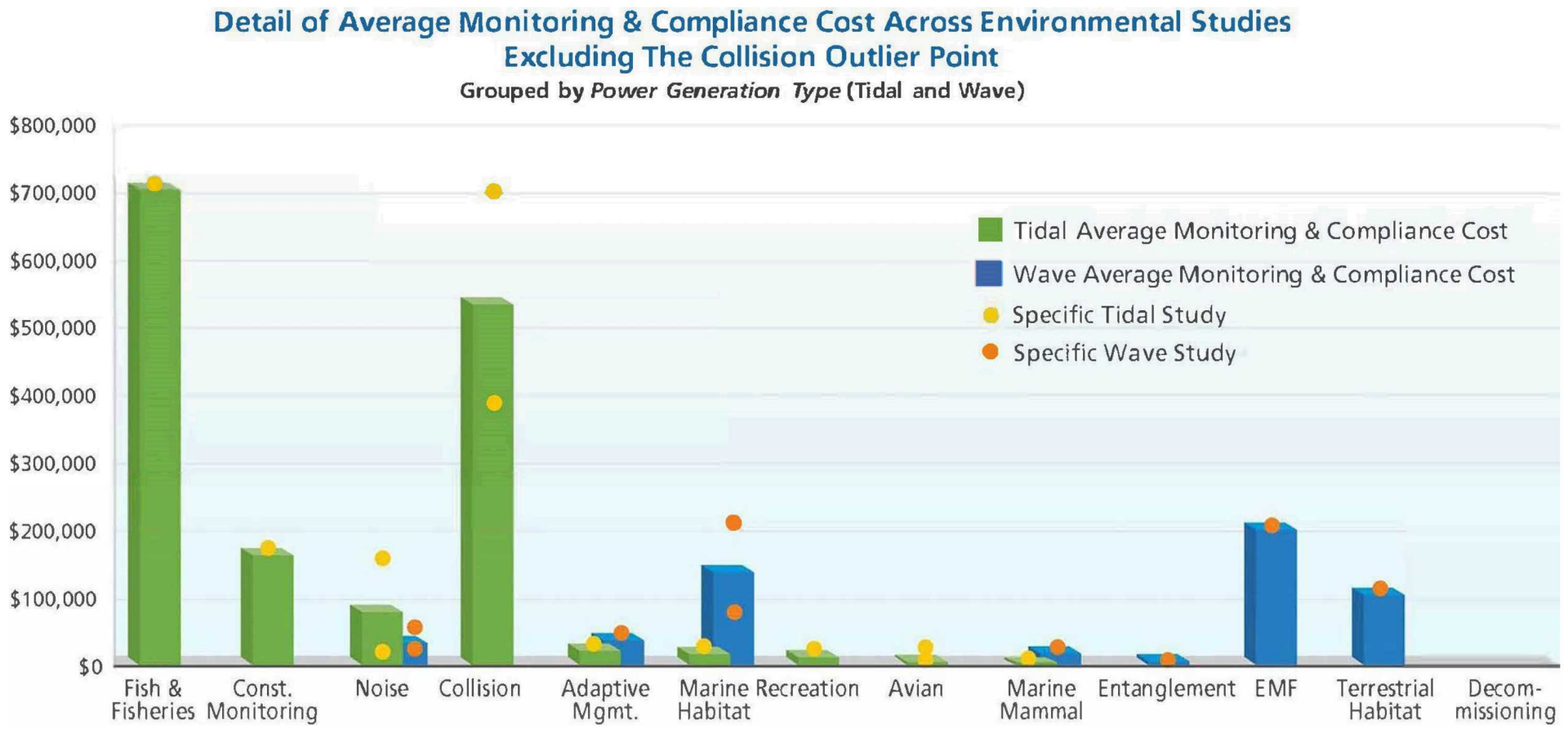


- Study costs for tidal projects are generally more expensive than for wave.
- Environmental risks and uncertainties appear to be less of a concern for wave projects, based on differences in study costs.

MONITORING & COMPLIANCE STUDIES COSTS
3 Wave and 3 Tidal Projects

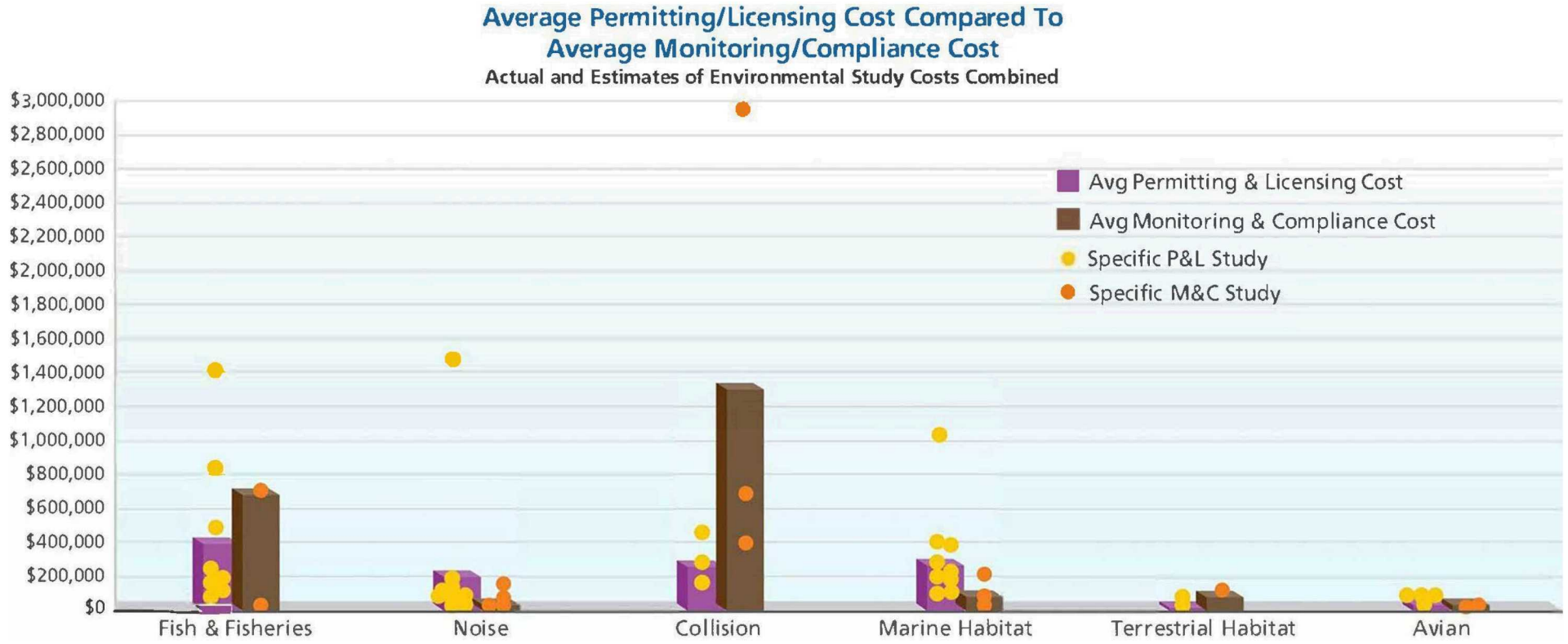


MONITORING & COMPLIANCE STUDIES COSTS
3 Wave and 2 Tidal Projects *(minus outlier)*

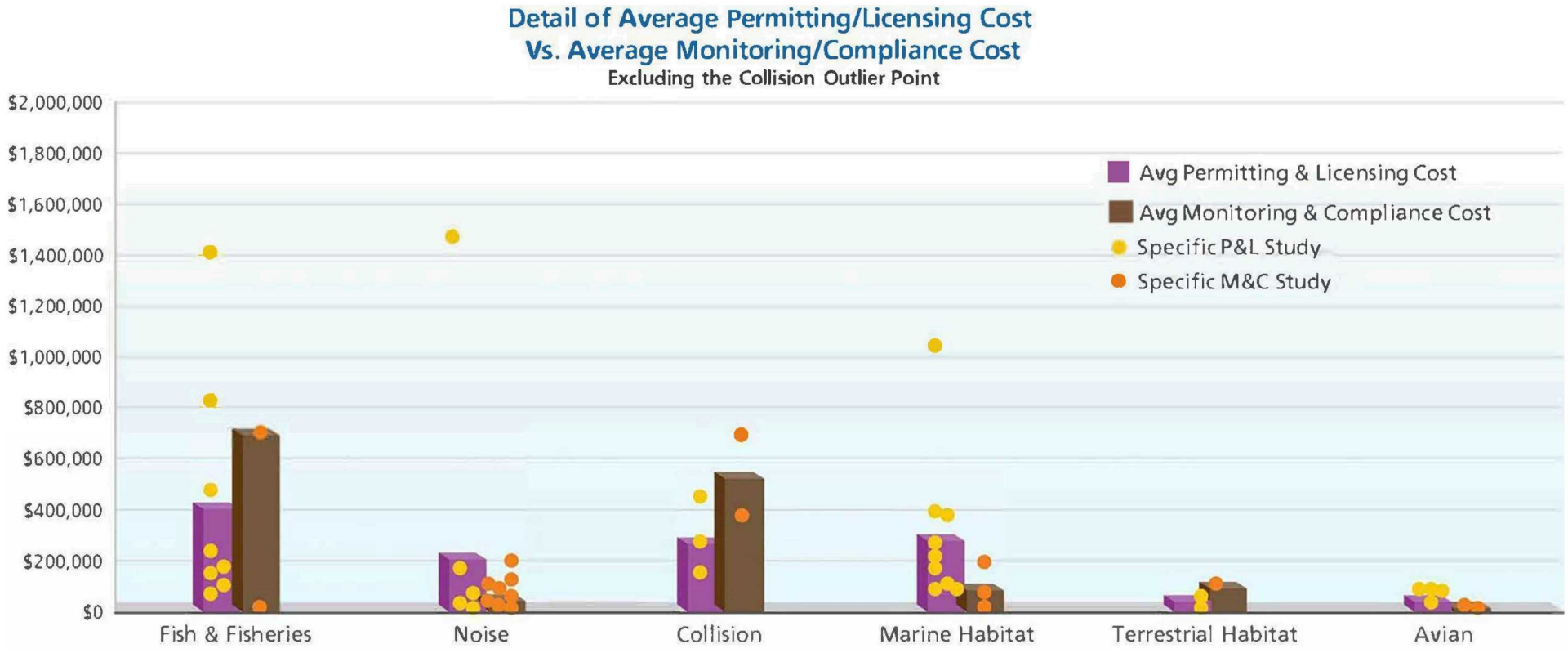


- Wave projects: highest three costs are EMF, terrestrial, and marine habitat
- Tidal projects: highest three costs are fish/fisheries, collision, and noise

P&L STUDIES COSTS VS. M&C STUDIES COSTS
9 Wave and 4 Tidal Projects



P&L STUDIES COSTS VS. M&C STUDIES COSTS
9 Wave and 3 Tidal Projects

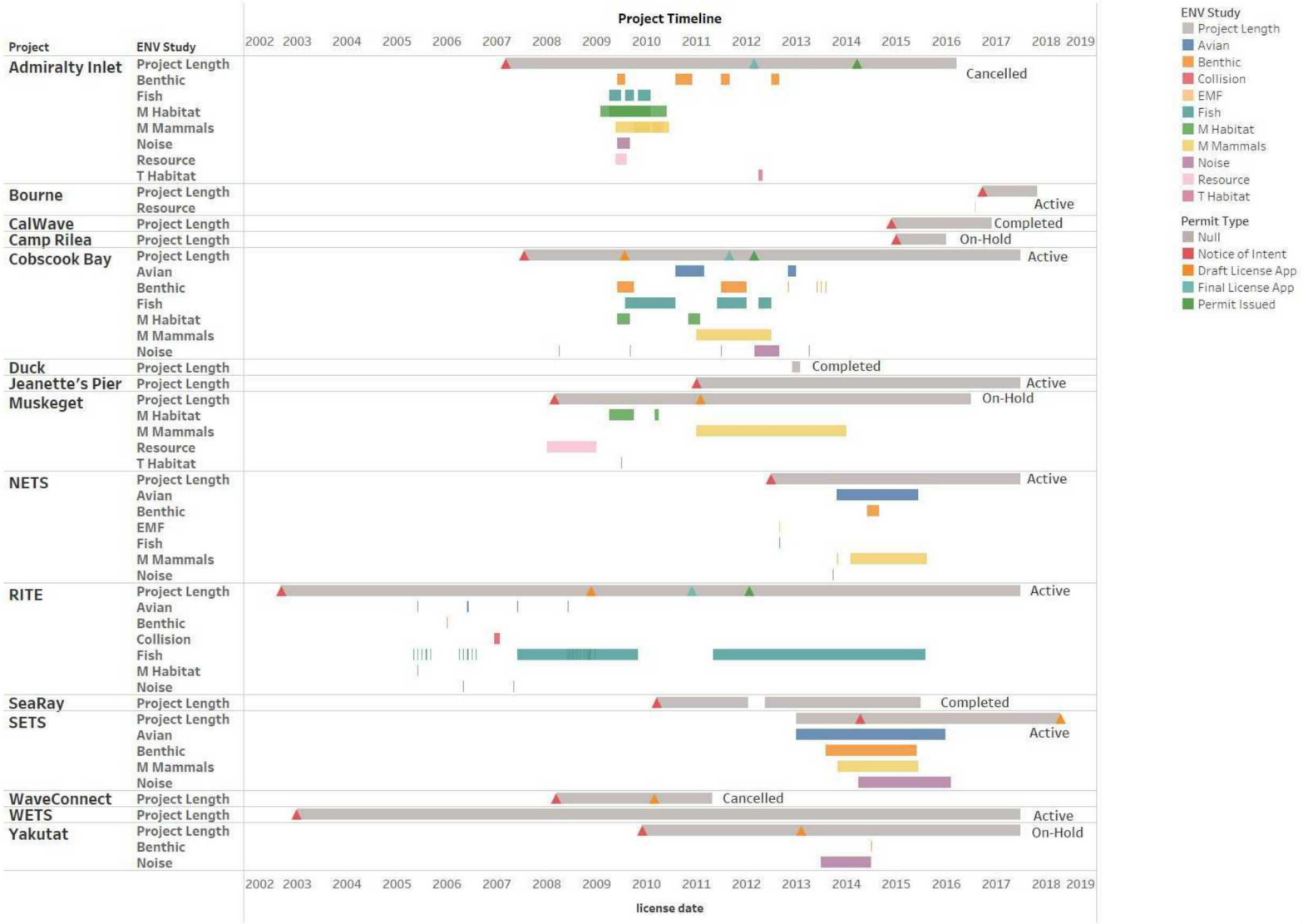


- Opportunity: Explore ways to reduce high costs of studies for both permitting/licensing and monitoring/compliance.

Project Timelines

Timeline of Marine Hydrokinetic Projects

Includes Enviromental Study Duration and Permitting



INITIAL CONCLUSIONS

- Project type and design determine what impacts are a concern and what environmental studies are needed for permitting/licensing and monitoring & compliance driving cost variability.
  - There are a limited number of projects at the monitoring and compliance stage.
- Need to find ways to reduce the high costs of studies.
- Pioneering technologies increase individual project costs, but may reduce costs for later projects.
- Most projects involve developer and federal/state funding (13 out of 17 projects).
- Geographic location (East vs West) is hard to compare because of differing project phases and deployment types.

OVERVIEW
OTHER INDUSTRIES ANALYSIS

- Other Energy and Marine Industries Reviewed
  - Offshore Oil & Gas
  - Offshore and Onshore Wind
  - Onshore Solar
  - Subsea Power and Data Cables
- Examined
  - Changes in Levelized Cost of Electricity (LCOE) Over Time
  - Permitting Pathway
  - Potential Environmental Effects and Types of Monitoring
  - Factors Contributing to Easing Environmental Permitting
- Discussions with Regulatory Agencies Underway

LESSONS FROM OTHER INDUSTRIES

- Use existing baseline studies and effects analyses for analogous projects
- Apply permitting and regulatory solutions
- Form partnerships among industry, agencies, and scientists, and conduct collaborative research to address important concerns
- Develop and implement guidance, protocols, and siting tools
- Continue to hone technology and installation

NEXT STEPS

- Improve the quantitative analysis:
  - state and federal permitting
  - outreach costs
  - updating with better information on state and federal funding contributions
  - separate costs for commercial deployments, test deployments
  - Test sites, and considering regional effects on costs (e.g. west coast vs. east coast and changes from north to south of each coast)
  - Update and refine project timeline data and analysis

- Develop an updated discussion guide to support subsequent rounds of outreach during FY 18.

- Continue to assess environmental compliance progression within other industries
  - Regulatory agency discussions
  - Refine lessons learned that can apply to the MHK industry

Project Overview

Questions?