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Evaluating Connections: BOEM's Environmental Studies and Assessments

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Prepared for:

BOEM Environmental Sciences Division
45600 Woodland Road, VAM-OEP
Sterling, VA 20166-9216

Prepared by:

Industrial Economics, Incorporated
2067 Massachusetts Avenue
Cambridge, MA 02140
617/354-0074

DISCLAIMER

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LIST OF ABBREVIATIONS AND ACRONYMS

A&I	abstract and indexing
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
COR	Contracting Officer's Representative
CZMA	Coastal Zone Management Act
DOE	Department of Energy
DOI	Department of the Interior
EA	environmental assessment [for National Environmental Policy Act]
EIS	environmental impact statement
EMF	electromagnetic field
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESP	Environmental Studies Program
ESPIS	Environmental Studies Program Information System
ESP-PAT	Environmental Studies Program-Performance Assessment Tool
FCR	Field Citation Ratio
GOM	Gulf of Mexico
ICR	Information Collection Request
IDIQ	Indefinite Delivery, Indefinite Quantity
IEc	Industrial Economics, Inc.
MMP	Marine Minerals Program
MMPA	Marine Mammal Protection Act
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NCEI	National Centers for Environmental Information
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NSL	National Studies List
OCS	Outer Continental Shelf
OCSLA	OCS Lands Act
OEP	Office of Environmental Programs
OREP	Office of Renewable Energy Programs
RCR	Relative Citation Ratio
RFP	request for proposal
SDP	Studies Development Plan
SNA	social network analysis
SWSS	Sperm Whale Seismic Study
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

EXECUTIVE SUMMARY

The Bureau of Ocean Energy Management's (BOEM's) Environmental Studies Program (ESP) develops studies that establish information needed for the assessment and management of environmental impacts of oil and gas, renewable energy,[1] and minerals development on the human, marine, and coastal environments.[2] BOEM describes this process as a "feedback loop" in which studies inform assessments, and assessments inform studies. This project's overarching objective is to evaluate the effectiveness of BOEM's feedback loop and understand how ESP-funded science is used within and outside of BOEM.

The first two years of this three-year project focused internally (within BOEM). This third year—the external evaluation—addressed one overarching evaluation question: **What is the impact of BOEM's scientific research on the external environmental community (e.g., other federal agencies, state agencies, academia)?** The detailed questions underlying this overarching question are shown in the callout box. This report describes the external evaluation effort characterizing how well BOEM is communicating science to external users, how BOEM collaborates with other federal and state agencies, whether and how BOEM is contributing to the greater body of scientific research, and whether and how federal and state agencies are using BOEM's science to inform their own environmental policy and planning documents and decisions. It also explores BOEM's impact on the careers of young and emerging scientists, including how BOEM has supported graduate education.

Evaluation Questions

1. How does BOEM science impact external stakeholders and decision-makers?
2. How is information on BOEM science communicated to and among external stakeholders?
3. Are BOEM's environmental products used externally and how?
    a. Which BOEM environmental documents are cited in external products, such as assessments produced by other federal or state agencies?
    b. Which peer-reviewed publications resulted from ESP-funded projects?
    c. What is the system for tracking BOEM's impact on the external environmental community and how can it be improved?
4. How do external stakeholders contribute to BOEM's environmental products?
5. What are BOEM's impacts on the career of young and emerging scientists, including how BOEM has supported graduate education?

[1] Since the evaluation research was conducted for this report, BOEM has added carbon sequestration as an additional area of study under the ESP in response to Executive Order 14008, which calls for an all-government initiative to reduce the impacts of climate change, and the Infrastructure Investment and Jobs Act (2021), which gives the Secretary of the Interior the authority to grant a lease, easement, or right-of-way on the Outer Continental Shelf (OCS) for "long-term sequestration of carbon dioxide that would otherwise go into the atmosphere and contribute to further climate change." **Source:** BOEM. 2023. Carbon Sequestration. *BOEM.gov.* Accessed online July 2023: https://www.boem.gov/about-boem/regulations-guidance/carbon-sequestration

[2] This evaluation includes environmental studies funded by BOEM's ESP between 1999 and 2019. Studies provide scientific information (including the biological, physical, and social sciences as broadly defined). For the purposes of this Year 3 external evaluation, external "environmental assessments" refers to a variety of federal and state agency planning, management, and policy documents frequently prepared pursuant to relevant statutes and regulations (as listed in Section 4.1). External assessments are prepared by a lead agency other than BOEM.

The following sections describe the data sources and methods used in the external evaluation, followed by overarching thematic findings, evaluation question-level findings, and recommendations.

DATA SOURCES AND METHODS

The main data sources for this evaluation include an inventory of external environmental assessments (i.e., assessments led by agencies other than BOEM) that Industrial Economics, Inc. (IEc) compiled from multiple sources in cooperation with BOEM; journal publications resulting from BOEM-funded studies that have the potential to be cited in the external scholarly literature; a web-based survey of 58 external stakeholders that BOEM staff identified during the internal (Year 2) survey;[3] and 86 interviews with external stakeholders identified by BOEM.[4] Based on these data sources, IEc used several analytical approaches to answer the evaluation questions, including an assessment citation analysis, external publication citation impact analysis, interview coding and qualitative analysis, survey analysis, and social network analysis (SNA) (Table ES-1). Section 4 provides further details about the methodology.

TABLE ES-1. OVERVIEW OF DATA SOURCES USED IN THE EVALUATION

Data Source	Analytical Method
External Environmental Assessments (240)	• Searched for citations of ESP-funded study documents and associated publications referenced in the inventory of external assessments as a direct measure of how BOEM environmental documents are cited in external assessment products.
Journal Publications from BOEM Studies (2,100)	• Captured basic citation counts in Google Scholar for all journal publications resulting from in-scope, BOEM-funded studies using SerpAPI (an automated service to web scrape Google Scholar) and R code developed by IEc using R statistical software. Compiled additional citation metrics (e.g., relative citation ratio) for a subset of publications through a manual search of multiple citation databases.
Web Survey Responses from External BOEM Contacts and Collaborators (58)	• Sent the survey to 164 external stakeholders who BOEM staff identified during the Year 2 survey and received 58 responses (35.4% response rate). Respondents included representatives from federal agencies, state agencies, academia, and consultants. • Summarized responses overall and broken out by type of respondent. Conducted a thematic analysis of responses to open-ended survey questions. • Conducted SNA using the web survey data to understand interactions between external stakeholders and BOEM, and to determine whether external stakeholders share BOEM study and assessment results with others.
External Stakeholder Interviews (86)	• Completed 86 interviews with external stakeholders from federal agencies, state agencies, academia, and consultants. • Qualitatively coded interview notes and summarized findings to characterize the broader impact of BOEM science.

[3] The internal evaluation (Years 1 and 2 of this project) examined how well BOEM communicates information needs and study results across the Bureau, the extent to which results from ESP-funded studies are incorporated into BOEM assessments and inform BOEM's policy decisions, and the extent to which information needs identified through the assessment process inform future studies. In Year 2, IEc conducted a survey of all BOEM technical staff that work on environmental studies or environmental assessments, or manage staff who do. BOEM survey respondents identified external (non-BOEM) study and assessment stakeholders, who IEc surveyed in Year 3.

[4] BOEM obtained approval to conduct the external survey and interviews from the Office of Management and Budget (OMB). Evaluating Connections: Environmental Studies and Assessments - OMB 1010-0194.

CROSSCUTTING THEMATIC FINDINGS

Crosscutting thematic findings are not limited to any one evaluation question; instead, they are relevant to the overarching evaluation question (what is the impact of BOEM's scientific research on the external environmental community?) and cut across the individual evaluation questions. This section presents a synthesis of information to provide BOEM with the main takeaways from the report; Section 6.1 provides further details about each crosscutting finding. Key crosscutting findings include the following:

1. **BOEM staff regularly engage with trusted stakeholders/collaborators in the external science community,[5] which helps extend the reach of BOEM science beyond the Bureau but can also make it difficult to expand BOEM's network.** Survey and interview findings both indicate the importance of the direct interactions between BOEM staff and members of the broader scientific community.[6] In fact, survey respondents reported that they primarily receive information on BOEM studies and assessments directly from BOEM staff. This finding is reinforced by the SNA, which suggests that BOEM's network has the potential to have a broad reach, but that interactions generally occur among a limited group of organizations and individuals. The stakeholders and collaborators most closely involved with BOEM science are generally aware of relevant new research and important results. Conversely, reliance on closely held relationships with a group of recurrent collaborators may limit expansion of BOEM's network and therefore the reach and influence of BOEM science. Additionally, the fact that most of BOEM's close contacts receive information directly from BOEM staff may indicate that BOEM's network is not readily accessible for other members of the external science community.
2. **BOEM study reports and data target technical audiences in the science community but may not be readily understood by less technical stakeholders, including decision-makers.** BOEM science is communicated to multiple types of stakeholder audiences with different levels of technical expertise. Interviews suggest that BOEM is already successfully communicating scientific findings to more experienced technical or scientific experts, including state environmental resource agencies and environmental organizations. However, BOEM could improve the use of its science with additional attention to communicating scientific findings in an accessible way to more general audiences. For example, effective science communication enables a broad range of stakeholders to engage more with BOEM science and advance their understanding of environmental implications of projects and policy directions, enabling more informed discourse. Effective science communication additionally facilitates bringing science to policy for decision-makers.
3. **BOEM studies fill critical knowledge gaps and meaningfully advance ocean scientific research.** The external environmental community's use of BOEM's scientific research includes informing and furthering their own research to teach others, for use in models, and for

[5] The terms "stakeholders" and "collaborators" are used interchangeably throughout this report unless otherwise specified.

[6] It is important to note the longevity of the relationships between the interviewees and BOEM. Because interview candidate names were provided by BOEM staff, the interview sample predominantly included interviewees who have more established, long-term relationships with BOEM. The sample of survey respondents was focused on respondents who have worked with BOEM recently, but many of these were also long-term connections.

environmental analyses.[7] The publication citation analysis identified that BOEM is a leader in key research topics, including oil spills, marine minerals extraction, oil and gas surveys and extraction, and climate change. Interviews revealed that BOEM's science is often essential to advancing the state of knowledge, filling ocean science knowledge gaps, and answering fundamental research questions about basic science for a range of non-academic stakeholders, from the Department of Energy (DOE) to the International Seabed Authority. BOEM is also uniquely positioned to lead the advancement of the state of knowledge around offshore wind development.

4. **BOEM science directly influences decision-making outside of the Bureau, particularly in the context of coastal and marine resource management for federal and state agencies.** Beyond informing BOEM planning and policy, BOEM studies and assessments influence external stakeholder decisions. BOEM science is used to inform industry, regulators, and policymakers about key topics. These stakeholders use BOEM science to inform mitigation options, to develop environmental analyses, and to inform other policy and management directions, as evidenced by citations in other agencies' assessments and the interview findings. However, determining the level of influence of BOEM studies on external decision-making is challenging, given that the specific role of any BOEM study in the ultimate decision is not always known or indicated publicly.

5. **BOEM's impact on the broader scientific community is challenging to track and evaluate, but obtaining access to a citation service would help.** BOEM's studies are designed to inform BOEM's assessments and decision-making, not the needs of other federal or state agencies. BOEM recognizes that ESP studies benefit the broader scientific community, so the Bureau seeks to collaborate and leverage co-funding wherever possible; however, studies must align with BOEM's research priorities to move forward. Other agencies' assessments use BOEM's studies to inform decision-making, but the role of any BOEM study on the policy is not always known or publicly indicated. Where tracking impact to the broader scientific community is possible, BOEM does not have a systematic approach to tracking impact of its studies or assessments on the wider scientific community. The Bureau encourages publication and tracks publications as BOEM study products, but BOEM currently does not track citations of those study products. IEc used a web-scraping method to analyze citation metrics using SerpAPI and Google Scholar, but access to a citation analysis software would be a more sustainable systematic and repeatable approach to track BOEM's citation impact.[8]

[7] A survey question asked specifically about the use of BOEM science in environmental damage assessments. The general finding applies more broadly to environmental analyses.

[8] Web scraping refers to the use of an automated process to extract data from a single or multiple webpages.

RECOMMENDATIONS

The recommendations developed from the above findings are grouped under five main topic areas: BOEM's impact on the wider environmental science community, network expansion, user-friendly information dissemination for general audiences, outreach and engagement with other government entities, and research funding. These topics are described below, with a specific set of potential action items for BOEM under each topic. Section 6.2 provides further details for each recommendation.

1. **Improve the ways in which BOEM tracks impacts on the wider environmental science community.** *(Corresponds to Findings 3, 4, and 5)*
   - 1.1. In addition to tracking study idea co-developers, consider adding a request for the anticipated or potential uses of the information to assess instrumental use of BOEM science (e.g., in policymaking).
   - 1.2. Invest in a citation analysis service and bibliometrics to assess the incremental use of BOEM science by the scientific community.
   - 1.3. Use Google Analytics to track web traffic on BOEM ESP Hub.[9]
   - 1.4. Where possible, track BOEM-sourced data downloads from data portals to which BOEM contributes.
   - 1.5. Develop an annual report summarizing and interpreting tracked metrics, including citation metrics.

2. **Expand BOEM's network.** *(Corresponds to Finding 1)*
   - 2.1. Plan for institutional knowledge loss or staff turnover by building relationships and funding studies led by emerging or early career scientists new to BOEM's network.
   - 2.2. Cross-post BOEM's call for study ideas to multiple listservs, including to listservs at universities beyond where BOEM-funded scientists are currently employed.
   - 2.3. Publish a "Who We Are" staff page with mini biographies, photographs, curriculum vitae, and contact information for all BOEM staff. At minimum, publish a staff directory with name, office, and contact information. If scientists can find BOEM staff contact information with a quick internet search, it may help them make connections at BOEM to gain entry into BOEM's network.
   - 2.4. Actively target and track engagement with scientists at Minority-Serving Institutions, and at institutions that have not historically received BOEM studies funding.

3. **Develop and implement a plan for extending effective information dissemination, ensuring that information is accessible to audiences with varying degrees of technical expertise.**[10] *(Corresponds to Finding 2)*

[9] At the time of writing, BOEM had recently released an Environmental Studies Program Hub (ESP Hub) to improve the searchability of BOEM ESP reports. Also, GovInfo houses all ESP reports, and the information can now be found through Google Scholar.

[10] While BOEM already has communication plans in place for specific purposes (e.g., BOEM ESP's 50th Anniversary, ESP Quarterly Reports), the Bureau does not have an ESP-wide communication plan under which specific communication plans can be tailored to specific needs.

3.1. Develop an environmental studies communication plan to identify key audiences and tailor research products for those audiences to make it easier to understand the science.

3.1.1. Synthesize key findings from past and present research in BOEM's new ESP Hub themes on a biennial basis to provide users with a synopsis of the state of the science in each research topic area.

3.1.2. Encourage brief and clear communication of study findings by principal investigators and scientists (e.g., factsheets, graphical abstracts, or summary presentations to stakeholder groups).

3.2. Improve stakeholders' ability to locate BOEM science.

3.2.1. Encourage sharing of BOEM study findings widely to broad audiences and beyond traditional outlets like journals, reports, and conferences (e.g., trade association meetings, or public seminars).

3.2.2. Direct stakeholders to BOEM's website or listserv for more information.

3.2.3. Improve the searchability of BOEM products on BOEM's website.[11]

3.2.4. Share reports through ResearchGate or Google Scholar.

4. Continue targeted outreach and engagement with other governments and organizations around offshore renewable energy issues. *(Corresponds to Finding 3)*

4.1. Increase collaboration with other federal agencies and national organizations.

4.2. Continue to participate in regional consortia or working groups.

5. Continue to fund studies to advance knowledge and create opportunities for emerging scientists. *(Corresponds to Finding 3)*

5.1. Consider conducting studies in topic areas with key knowledge gaps (e.g., cultural studies), or areas with less coverage and high rates of external citations (where external stakeholders rely heavily on the studies that BOEM has published on the topic, and knowledge gaps remain).

5.2. Continue to fund students to improve student opportunities and exposure to BOEM science.

[11] BOEM is already taking steps to address this item. BOEM's new ESP Hub improves searchability of BOEM study products, such as the inclusion of BOEM studies as search results on Google Scholar. This was not the case at the time of research and writing of this report.

1 INTRODUCTION AND PURPOSE OF THE EVALUATION

BOEM's mission is to manage the development of U.S. Outer Continental Shelf (OCS) energy, mineral, and geological resources in an environmentally and economically responsible way. The OCS Lands Act (OCSLA) of 1953 granted the Secretary of the Interior the authority to oversee the exploration and development of mineral resources on the OCS, and the Energy Policy Act of 2005 expanded the Secretary's authority to include management of renewable energy resources.[12]

Section 20 of the OCSLA directs BOEM's Environmental Studies Program (ESP) to develop studies that establish information needed for the assessment and management of environmental impacts of oil and gas and other mineral development on the human, marine, and coastal environments. In fulfilling its mission, BOEM must comply with a range of environmental requirements. In so doing, BOEM develops environmental assessments, consultation documents, and other analyses that use the best available information. Much of that information flows from BOEM-sponsored scientific research, particularly studies sponsored by the ESP.

BOEM has described this process as a "feedback loop" in which studies inform assessments and assessments inform studies. The goal of the feedback loop is that BOEM science informs BOEM decisions through assessments (i.e., science to policy), and vice versa. BOEM initiated this evaluation to understand how ESP-funded science is used within and outside of BOEM. Through this evaluation, BOEM aims to understand the extent to which study results are incorporated into assessments, information needs are identified through the assessment process, and studies and assessments are informing policy decisions and broader scientific understanding. The project covers the period between 1999 and 2019.

The evaluation is a three-year project. The first two years focused internally (i.e., within BOEM). Key topics of the internal evaluation included how well BOEM is communicating information needs and study results across the Bureau, the extent to which results from studies are being incorporated into assessments and informing BOEM's policy decisions, and the extent to which information needs identified through the assessment process inform future studies. Specifically, Year 1 (September 2019–September 2020) focused on designing the internal evaluation methodology and resulted in Volume 1 of this report. Year 2 (September 2020–October 2021) focused on implementing this methodology, collecting evaluation data, and developing evaluation findings, conclusions, and recommendations. During Year 2, the team also began preparing for the external evaluation. Year 2 efforts resulted in Volume 2 of this report.

The Year 3 external evaluation (October 2021–September 2023) looks outside of BOEM, including how well BOEM is communicating science to external users, how BOEM collaborates with other federal and state agencies, and whether and how federal and state agencies are using BOEM's science to inform their own environmental policy and planning documents and decisions. This volume of the final report presents the findings and recommendations for Year 3.

[12] Since the evaluation research was conducted for this report, BOEM has added carbon sequestration as an additional area of study under the ESP in response to Executive Order 14008 and the Infrastructure Investment and Jobs Act.

This document is organized into six sections. Following this introduction, Section 2 provides a description of the ESP as well as BOEM's environmental assessment work. Section 3 presents the evaluation questions that guide this study. Section 4 presents a summarized methodology including the proposed data sources and analytical approaches for answering the evaluation questions, and the evaluation challenges and mitigation approaches. Section 5 presents the findings by evaluation question. Section 6 synthesizes the results across evaluation questions and presents the overall findings and recommendations.

2 DESCRIPTION OF THE ESP AND BOEM'S ENVIRONMENTAL ASSESSMENT WORK

2.1 ESP

BOEM's ESP develops, funds, and manages scientific research to inform decision-making. For example, ESP studies provide information on the status and trends of the human, marine, and coastal environments, as well as the potential impacts on marine biota from chronic pollution, oil spills, and activities related to offshore development. The ESP prepares an annual Studies Development Plan (SDP), which documents proposed studies for the two upcoming fiscal years. Recent SDPs also provide context and articulate upcoming decisions that drive selected study topics for each office. The SDP includes a profile of each proposed study. This profile describes the study's relevance to BOEM's information needs and outlines study objectives, methods, research questions, and approximate cost.

The SDP serves as an internal planning document for BOEM, and typically BOEM does not conduct all proposed studies included in the SDP. Drawing from the SDP, BOEM develops the annual National Studies List (NSL), which narrows down the list of studies from the SDP to the list of new and continuing studies set to receive BOEM funding in the upcoming fiscal year.[13] This process is described in fuller detail in the Year 1 and Year 2 reports (Volumes 1 and 2 of this report).

Consistent with Years 1 and 2 of this project, the scope of this external evaluation encompasses all ESP-funded studies; it does not include studies funded solely through other BOEM funding mechanisms (e.g., through a program office). While recognizing that other (non-ESP-funded) studies also contribute to scientific advancements and inform decisions and policies within and outside of BOEM, the evaluation scope reflects the need to draw clear boundaries around the studies to be included.[14] The criterion that studies must be funded in whole or in part by the ESP provides clear parameters for inclusion and facilitates access to the studies, which are housed within BOEM's Environmental Studies Program Information Systems (ESPIS) database.[15] This contrasts with the assessments, which the evaluation team collected from various sources with substantial input from BOEM staff.

2.2 ENVIRONMENTAL ASSESSMENTS, PLANNING, AND POLICY DOCUMENTS

A key part of BOEM's mission is ensuring environmental protection through compliance with environmental statutes, regulations, and executive orders. This typically requires detailed analysis of potential environmental impacts of activities authorized by BOEM on the OCS. For purposes of this project, the term "environmental assessment" encompasses the full suite of analyses that BOEM

[13] There is also a process to add studies outside of the SDP process on an as-needed basis.

[14] Although this project excludes studies that received no ESP funding, we understand based on discussions with BOEM that the excluded studies represent a small fraction of BOEM's scientific studies over the past 10 to 20 years.

[15] ESPIS is a database with ESP-funded studies, BOEM reports, and associated publications. BOEM recently launched the Environmental Studies Program Hub (ESP Hub) to make ESP research more accessible through straightforward website navigation and an interactive web map. For each research theme, users can select from regional bookmarks and focus in on specific areas of interest to find relevant completed ESP research, along with associated reports and publications.

undertakes related to compliance with environmental statutes, regulations, and executive orders and is not restricted to environmental assessments conducted pursuant to NEPA. Relevant statutes and regulations include the following:

- National Environmental Policy Act (NEPA)
- National Historic Preservation Act (NHPA)
- Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA)
- Endangered Species Act (ESA)
- Air Quality Act (1967) or the Clean Air Act
- Coastal Zone Management Act (CZMA)
- Marine Mammal Protection Act (MMPA)
- Migratory Bird Treaty Act (MBTA)
- OCS Lands Act (OCSLA)

BOEM must comply with these and other statutes and regulations to carry out its mission of managing the development of OCS energy, mineral, and geological resources in an environmentally and economically responsible way. To do so, BOEM conducts environmental assessments of the potential impacts (including environmental, social, and economic) of its programs in conventional energy resources, renewable energy resources, and non-energy minerals (e.g., sand, gravel, and critical minerals). BOEM also provides oversight, policy guidance, and direction through consultations within the Bureau and with other agencies. The related environmental assessments were considered part of the universe of assessments during the Year 1 methodology development (Volume 1) and Year 2 analysis (Volume 2).

In addition, other federal and state agencies conduct environmental assessments to comply with the statutes and regulations listed above, among others, as well as to inform resource planning and management efforts, provide an understanding of a project's potential impacts for decision-makers and the public, and avoid or minimize potential environmental impacts. For example, the U.S. Army Corps of Engineers (USACE) and National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) prepare environmental assessments to satisfy the requirements of NEPA, ESA, MMPA, CZMA, and NHPA. State natural resource agencies often prepare environmental assessments to satisfy state-specific requirements for natural resource protection and minimize environmental impacts.

For the purposes of this Year 3 external evaluation, the inventory of assessments, planning, and policy documents includes federal and state agency environmental assessment documents prepared pursuant to the statutes and regulations listed above, as well as other coastal and marine resource planning and management documents. Generally, the federal and state agencies that rely on BOEM science are coastal and marine resource management and stewardship agencies. The evaluation team collected the following types of assessment documents for this evaluation:

- NEPA environmental impact statements (EISs)
- NEPA environmental assessments (EAs)
- NHPA documents (including Section 106 Evaluations of effects on historic properties and Programmatic Agreements)
- Essential fish habitat assessments for MSFCMA consultations

- ESA Section 7 biological opinions
- Analyses and assessments prepared for Clean Air Act, CZMA, and MMPA, including Section 109 State assessments and strategic plans
- Tribal resource planning documents
- Section 106 NHPA State Guidelines
- Economic and other analyses of proposed rulemakings (e.g., Regulatory Impact Analyses and analyses under the Regulatory Flexibility Act/Small Business Regulatory Fairness Enforcement Act)
- State-specific equivalents of the types of documents listed above, to comply with regulations promulgated at the state level
- Other regional, state, or local planning and policy documents

Some documents in the inventory of assessments align with the types of assessments that BOEM prepares, such as those that assess the potential environmental effects of a proposed action on the OCS or other marine areas, including activities related to energy and mineral development, and documents prepared with BOEM as a lead or cooperating agency. Other documents provide an external review of a BOEM proposed project, such as NMFS' ESA Section 7 biological opinions, while another category of document includes state-level guidelines influenced or informed by BOEM science and internal documents (e.g., notices to lessees) that coastal states may adopt or use to inform their guidelines and regulations. Further, environmental assessments that examine the effects on resources within BOEM's purview are a portion of the assessment inventory. IEc also included Tribal resource planning documents as part of our inventory of assessments. In addition to the types of documents listed above, the inventory of assessments, planning, and policy documents include other planning, policy, and resource management documents drafted by non-governmental organizations (NGOs), regulatory bodies (e.g., fishery management plans), and others, with a focus on documents that are likely to rely upon BOEM-funded science.

3 EVALUATION QUESTIONS

As specified in the Statement of Work, the external evaluation addresses the overarching evaluation question: **What is the impact of BOEM's scientific research on the external environmental community (e.g., other federal agencies, state agencies, academia)?**

The Statement of Work included several sub-questions, which IEc updated based on Year 3 scoping discussions with Office of Environmental Programs (OEP) management and the BOEM Evaluation Team.[16] The evaluation sub-questions are the following:

1. How does BOEM science impact external stakeholders and decision-makers?
2. How is information on BOEM science communicated to and among external stakeholders?
3. Are BOEM's environmental products used externally and how?
    a. Which BOEM environmental documents are cited in external products, such as assessments produced by other federal or state agencies?
    b. Which peer-reviewed publications resulted from ESP-funded projects?
    c. What is the system for tracking BOEM's impact on the external environmental community and how can it be improved?
4. How do external stakeholders contribute to BOEM's environmental products?
5. What are BOEM's impacts on the career of young and emerging scientists, including how BOEM has supported graduate education?

The next section describes the proposed methodology including the data sources and analytical approaches for answering the questions.

[16] The BOEM Evaluation Team included the two BOEM project co-leads, who engaged regularly with IEc throughout the evaluation process, and representatives from OEP and program and regional offices, who provided substantive input at key junctures.

4 EVALUATION METHODOLOGY

Our approach for understanding and measuring the impact of BOEM's science on the external environmental community is informed by the work completed during the internal evaluation, communications with BOEM staff, and other work focused on BOEM's science programs, in particular the National Academies of Sciences, Engineering, and Medicine (NASEM) 2022 report, *Attributes of a First-in-Class Environmental Program: A Letter Report Prepared for the Bureau of Ocean Energy Management* (NASEM 2022). Specifically, we captured data to evaluate the impact—defined as informing and influencing users and advancing the state of knowledge—with a focus on external users. These external users include BOEM collaborators on assessment and study work, including other federal agencies, states, Tribes, and academics.

Definitions of Knowledge Use

This evaluation focuses on two types of knowledge utilization (use):

- *Instrumental use:* An ESP study (or set of studies) directly informed management, planning, or policy decisions.
- *Incremental (conceptual) use:* BOEM's research advanced the state of knowledge or frame of reference.

The evaluation defines two types of knowledge utilization, or "use," of BOEM studies.[17] The first type of use, *instrumental use*, is based on whether the study or set of studies directly informed one or more management, planning, or policy decisions. The second type of use, *incremental use*, is based on whether the study or set of studies advanced the state of knowledge or frame of reference for a particular field of interest (scientific, technical, policy), without a direct connection to a decision.

The rest of this section explains the data sources, analytical approaches, and evaluation challenges and limitations.

[17] The field of social science that studies how knowledge is utilized debates the most appropriate measurement of "use," on a spectrum that includes reception, cognition, discussion, reference, effort (adoption), and influence (Knott and Wildavsky 1980, cited in Landry et al. 2003). Recent research indicates the public's consumption and use of publicly funded science is varied across fields but generally aligns with what scientists consider to be impactful (Yin et al. 2022). Two types of use are often considered. Instrumental use is defined as empirical knowledge that informs a decision-making process and contributes to the outcome (e.g., Caplan 1979). Scholars believe it is a rarer type of use and is less likely to occur than conceptual use, defined as the incremental advancement of the state of knowledge (Caplan 1979; Landry et al. 2003; Shafer 2005). Conceptual, or incremental, use is highly relevant to the way scientific information is typically used, with incremental change in a knowledge base that does not necessarily have direct applicability to decision making processes (Shafer 2005).

4.1 DATA SOURCES

Environmental studies, environmental assessments, a web-based survey of external stakeholders, and interviews of external stakeholders were the primary data sources for addressing the evaluation questions.[18]

Environmental Studies. IEc relied upon three main sources of information related to environmental studies: BOEM's ESPIS (a database with ESP-funded studies and associated BOEM reports and external publications); the NSL; and the SDPs (which contain the proposed study profiles). Each of these sources is maintained separately and focuses on specific types of information about BOEM environmental studies; combined, they provide a robust dataset for understanding BOEM study topics and information needs over time. For purposes of this evaluation, IEc refers to the combination of the data contained in these sources generally as "environmental studies." Once consolidated, IEc established criteria, in consultation with BOEM, to determine which studies were within the scope of and relevant for the evaluation. Criteria for removal included the following:

- **Conference.** The study reflects BOEM support for a conference, meeting, symposium, forum, working group, or other type of general meeting support. BOEM and IEc acknowledge these are important mechanisms for sharing information about BOEM studies. However, for the purposes of this evaluation, this "study type" does not reflect BOEM-supported research studies.
- **Management.** The study is general management, administrative, or logistical support. Studies falling into this category may include Coastal Marine Institute management support.
- **Non-research effort.** The study is otherwise a non-research effort. Studies in this category include BOEM's support for a children's activity book.
- **Unverified study.** Several studies that IEc initially included in scope only had accompanying NSL and study title information. Unfortunately, IEc was unable to match these studies with additional sources using the available information. IEc sent this list to BOEM for review where a determination was made to exclude these items since they could not be traced to actual studies.
- **Environmental Assessments.** IEc searched for citations of ESP-funded study documents and associated publications referenced in the inventory of external assessments, as a direct measure of how BOEM environmental documents are cited in external assessment products, including the following:
    - U.S. Environmental Protection Agency (EPA) NEPA repository
    - NOAA and NMFS publications and policy documents available online
    - USACE District web pages

[18] IEc obtained an Information Collection Request (ICR) for the survey and interviews in fulfillment of the requirements of the Paperwork Reduction Act. The Paperwork Reduction Act requires that federal agencies obtain approval from the Office of Management and Budget (OMB) before collecting the same or similar information from 10 or more members of the public. In the context of our evaluation, "the public" includes representatives from state agencies, academics, and other non-federal stakeholders that we sought to interview or survey. Specifically, ICR approval was required to conduct the external, non-federal interviews and the external survey of non-federal employees. BOEM and IEc worked together closely on the ICR process. We obtained ICR approval from OMB in June 2022. Evaluating Connections: Environmental Studies and Assessments - OMB 1010-0194.

- U.S. Coast Guard website
- Bureau of Safety and Environmental Enforcement (BSEE) website
- State coastal management websites
- External documents previously identified through scraping the BOEM website in Year 2
- Other assessments, policy, and planning documents, including but not limited to state-level archaeological guidelines, state-level guidelines informed by BOEM Notices to Lessees, and documents from data repositories focused on resource management

IEc worked with BOEM staff to identify key resources for assessments, policy, and planning documents based on BOEM's experience with collaborating agencies and the external scientific community. The inventory comprises the following types of documents: 1) assessments, policy, and planning documents that rely upon BOEM science related to specific locations, habitats, and natural resources (e.g., a biological opinion drafted by NMFS for a project led by USACE; fishery management plans); 2) assessments led by another agency but focused on BOEM projects or activities (e.g., ESA Section 7 consultation with NMFS); 3) assessments in which BOEM participates but is not the lead agency (e.g., NEPA EISs focused on liquified natural gas project licensing in which the U.S. Coast Guard is the leading agency); and 4) assessments related to BOEM activities (e.g., NEPA EIS on the designation of dredged material disposal sites in which EPA is the leading agency). Documents that meet one or more of these criteria are more likely to be informed by BOEM studies, and IEc therefore used these criteria to bound our searches for assessments, policy, and planning documents. The inventory reflects the breadth of external documents that rely upon BOEM science to meet regulatory needs or other stated goals.[19]

Survey. The evaluation team used the survey results to understand how program partners use BOEM's study and assessment information and the network through which this information is disseminated. IEc sent the survey to 164 external partners of BOEM's ESP and assessment program (e.g., public agencies, academic institutions and scholars, and consultants) and received 58 responses, a response rate of 35.4%. Most of the target respondents were identified by BOEM staff who completed the survey for the internal evaluation in Year 2. Figure 1 depicts the distribution of survey respondents by organizational type. Most survey respondents are in the federal or academic respondent categories, 30 and 17 respondents, respectively. This distribution aligns with the survey target population. There were fewer survey respondents that were from NGOs and nonprofit or private organizations (6) and from state governments (3), but again this aligns with the distribution of the survey target population.

[19] The inventory of external assessments relied on communication with BOEM to identify agencies and activities that may overlap with BOEM science. Assessments were only added to the inventory if we had reason to believe they could use information related to BOEM studies. The inventory includes assessments that cited BOEM studies as well as assessments that did not. It is not a comprehensive inventory because the total universe of external assessments that *could have* incorporated BOEM science is unknown, and the identification and sampling was largely opportunistic. Ratios and findings presented in this report should be viewed in this context.

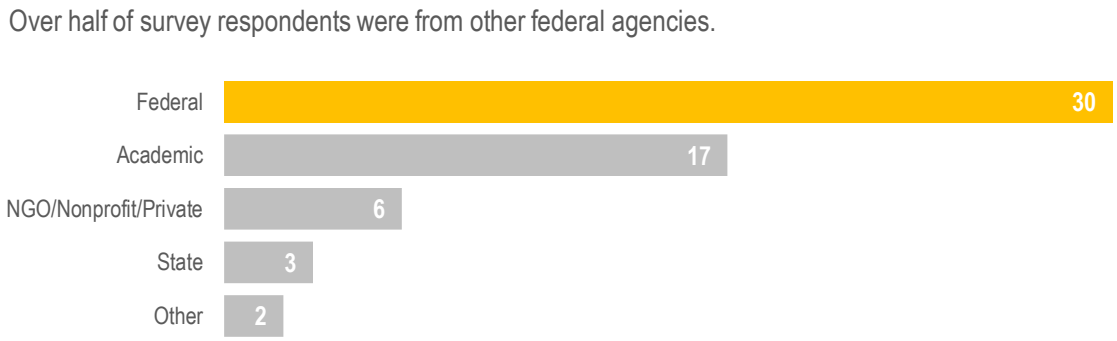

FIGURE 1. DISTRIBUTION OF SURVEY RESPONDENTS BY ORGANIZATIONAL TYPE
Respondents' organizations are categorized as "other" when there is lack of identifying information from the response.

Figure 2 depicts the roles in which survey respondents primarily communicated with BOEM within the last 24 months. Respondents could select more than one option for this question. Over half of respondents (53%) communicated with BOEM in their role as a principal investigator. The top three categories (principal investigator, research team, or other research program) suggest that the dominant type of survey respondent is one engaged with BOEM in a research capacity and likely involved in the environmental studies side of the feedback loop.

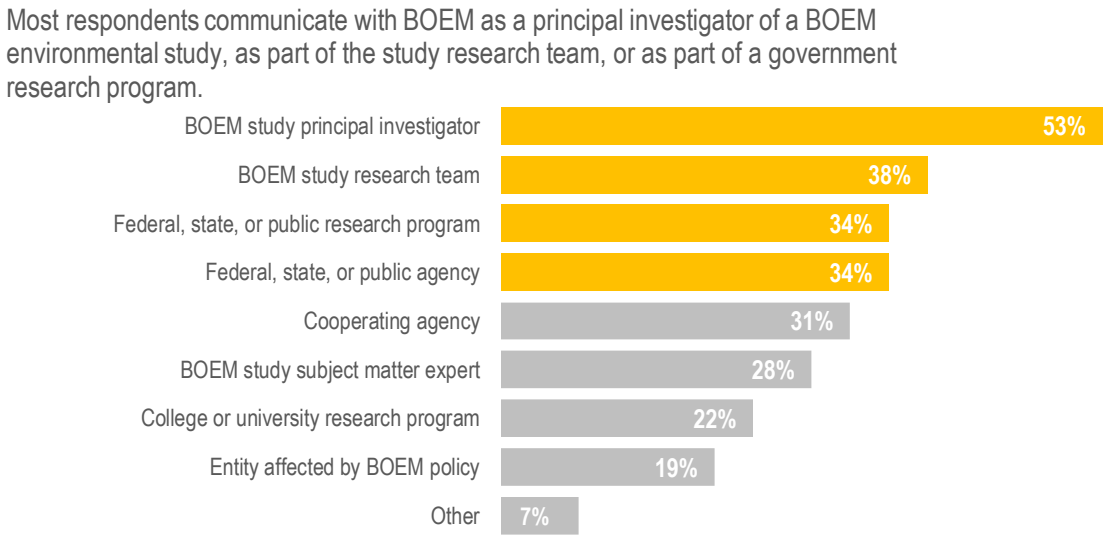

FIGURE 2. ROLE IN WHICH RESPONDENTS COMMUNICATED WITH BOEM IN THE LAST 24 MONTHS

Interviews. IEc conducted 86 semi-structured interviews. IEc sought interviewees who could speak to the use of BOEM science to inform policy decisions and research external to BOEM, including representatives from federal and state agencies, as well as academics and consultants. The interviews were particularly important for identifying examples of instrumental use of BOEM studies, given the absence of a comprehensive central repository of external assessments and planning documents, and the

challenge of establishing the context for the use of BOEM science based solely on available documents (e.g., external assessments that cite one or more BOEM studies). The interviews provide additional depth and nuance to the survey responses (described further in Appendix C). The interviews also complement the external SNA. All agencies, organizations, and institutions that BOEM identifies as important for understanding the feedback loop were contacted for an interview. Respondents were asked questions tailored to their type of organization. Interviewers asked respondents to provide insight into how and why linkages between BOEM and respondents are (or are not) present, and how and why respondents are (or are not) using study and assessment information from BOEM. Using the semi-structured interview format created opportunities for the interviewer to ask follow-up questions based on initial responses. The interviewers asked about the respondents' roles or positions within their organizations, how they use BOEM's environmental studies and assessment information in their organizations' work, and how their organizations contribute to studies and assessments. Additionally, the interviewers requested the respondents' recommendations on ways to strengthen linkages moving forward. The interview guides are available in Appendix A.

The interviews were conducted via Microsoft Teams. The interview questions were emailed to respondents in advance to allow them time to review the questions and get an idea of the type of information sought.

To develop the list of interview candidates, IEc included the contacts provided by BOEM staff during Year 2, when we requested information from each office about the use of BOEM science by external stakeholders. Additionally, IEc compiled a list of prospective interviewees from the Year 2 interviews, including an additional list of potential contacts sent from the Marine Minerals Program (MMP). These lists together provided a core set of interview candidates from which to build. IEc also used Year 2 survey respondent-identified individuals and organizations to add to the core set of interview candidates where individuals were identified by multiple regions. During implementation, the IEc team determined that interviewees from BOEM's Gulf of Mexico (GOM) Region were underrepresented compared to the size of the GOM Region and requested additional names from BOEM. These names were added to the list of potential interviewees.

Of the 86 completed interviews, 29 were recommended by GOM Region, 21 by Office of Renewable Energy Programs (OREP), 14 by the Pacific Region, 8 by the MMP, 7 by the Alaska Region, and 7 did not have a regional or office affiliation. When comparing the type of interviewee, 34 were state or local, 27 were other federal agencies, 24 were academic or consulting, and 1 was not specified.

Other Data Sources. Other data sources such as program documents, databases, and permits for offshore construction activity provided information to characterize the influence of BOEM science on external entities and their research, strategic planning, or decision-making. IEc requested that BOEM staff from each office send readily available examples of other data sources that use BOEM science, as well as examples of students who have benefited from BOEM science in their training or early scientific careers. As examples, BOEM staff shared an offshore wind geodatabase data portal for a coastal state planning authority, and Endangered Species Act consultations used by other federal agencies (NOAA NMFS and

the U.S. Fish and Wildlife Service [USFWS]), among others.[20] Other data sources, such as the examples shared by BOEM staff, also provide information for understanding current processes, supplementing other sources of information, and providing context when interpreting findings. IEc uses the general term "other data sources" to refer to multiple data sources including (but not limited to) the following:

- Information on agencies' websites
- Strategic guidance documents
- Scholarly publications
- External databases used by agency offices, academics, NGOs, or the public

4.2 ANALYTICAL APPROACHES

IEc used multiple analytical approaches to address the evaluation questions, including an external assessment citation analysis, external publication citation analysis, interview coding and qualitative analysis, survey analysis, and SNA. Table 1 summarizes which analytical approaches IEc used to answer each evaluation question; additional detail on each approach is provided below the table.

TABLE 1. ANALYTICAL APPROACHES TO ADDRESS EACH EVALUATION QUESTION[21]

Evaluation Question	External Assessment Citation Analysis	External Citation Impact Analysis	Interview Coding and Qualitative Analysis	Survey Analysis	Social Network Analysis
What is the impact of BOEM's scientific research on the external environmental community (e.g., other federal agencies, state agencies, academia)?	✓	✓	✓	✓	✓
1. How does BOEM science impact external stakeholders and decision-makers?	-	-	✓	-	-
2. How is information on BOEM science communicated to and among external stakeholders?	-	-	✓	✓	✓
3. Are BOEM's environmental products used externally and how?	-	-	✓	✓	-
a. Which BOEM environmental documents are cited in external products, such as assessments produced by other federal or state agencies?	✓	-	-	-	-

[20] BOEM environmental consultations relating to renewable energy are a growing area of work, and the studies used to inform the consultations are used by multiple federal and state agencies. More information on this emerging research area can be found at https://www.boem.gov/environmental-consultations.

[21] Data sources contributing to the available information on environmental studies include ESPIS, BOEM reports, and associated publications; the NSL; and the SDPs.

Evaluation Question	External Assessment Citation Analysis	External Citation Impact Analysis	Interview Coding and Qualitative Analysis	Survey Analysis	Social Network Analysis
b. Which peer-reviewed publications resulted from ESP-funded projects?[22]	-	✓	-	-	-
c. What is the system for tracking BOEM's impact on the external environmental community and how can it be improved?	-	-	✓	-	-
4. How do external stakeholders contribute to BOEM's environmental products?	-	-	✓	✓	-
5. What are BOEM's impacts on the career of young and emerging scientists, including how BOEM has supported graduate education?	-	-	✓	-	-

Assessment Citation Analysis. IEc searched for citations of ESP-funded study documents and associated publications referenced in the inventory of external assessments, as a direct measure of how BOEM environmental documents are cited in external assessment products (sub-question 3a). IEc conducted the citation analysis in R software using an automated query written in R code that searched each assessment's reference list for specific BOEM study products (i.e., BOEM-published report(s), datasets, and external publication titles). The output was a list of all assessment reference files that included the document title as well as the specific page, line, and surrounding text for each positive query result. To identify unique BOEM reports and publications, we matched these results to unique identifiers and summarized the results by year and other identifying information (e.g., topic, office/region). IEc conducted multiple automated and manual quality control steps to ensure the queries identify accurate citations, including identifying and removing duplicates. In addition to this analysis, IEc manually reviewed a sample of the assessments to understand the context for the citations. This step was important to confirm and validate the R queries.

External Citation Impact Analysis. To help address the evaluation question "Are BOEM's environmental products (studies and/or assessments) used externally and how?," IEc captured the total citation count value for all journal publications resulting from BOEM studies that fall within the scope of this study and are readily available using SerpAPI, an automated service to web scrape Google

[22] IEc expanded on the first two years of the evaluation by analyzing citations in the scholarly literature of journal publications that resulted from BOEM studies. IEc's work as part of the Year 1 evaluation approach methodology (Volume 1) identified the body of publications associated with ESP-funded projects between 1999 and 2019 (the evaluation timeframe), using a version of the ESPIS database from October 2020 and additional complementary searches. This effort resulted in the addition of several publications from *Alaska OCS Region, Fully/Partially Funded or Data/Sample Contribution Peer Reviewed Publications* list, publications reported in ESP-PAT, and publications identified through a Google Scholar search of BOEM (or its predecessor agency, the Minerals Management Service) obligation number for inclusions in the acknowledgments of the report. Additional, detailed information on our methodological approach is available in the *BOEM Published Documents and Outside Publications Associated with Studies* section of Volume 1 of this report. This step was necessary prior to conducting the Year 2 internal evaluation. Specifically, IEc used this list of publications to conduct the internal assessment citation analysis. For consistency with the internal evaluation, IEc used the same suite of peer-reviewed publications resulting from ESP-funded projects in the Year 3 analysis.

Scholar.[23,24] Google Scholar is a freely accessible web search engine that compiles "journal and conference papers, theses and dissertations, academic books, pre-prints, abstracts, technical reports and other scholarly literature from all broad areas of research."[25] While the search engine functions similarly to a standard Google search, the outputs are organized by article, providing users with a "top" choice, which provides the link to a version of a given publication that Google's algorithm believes is the most likely to be publicly accessible. The search results also provide links to additional versions of each publication, links to each author's profile (if they have a Google Scholar account), and a count of the number of times that article has been cited by other publications.[26] Figure 3 shows the output for a search of one BOEM publication.

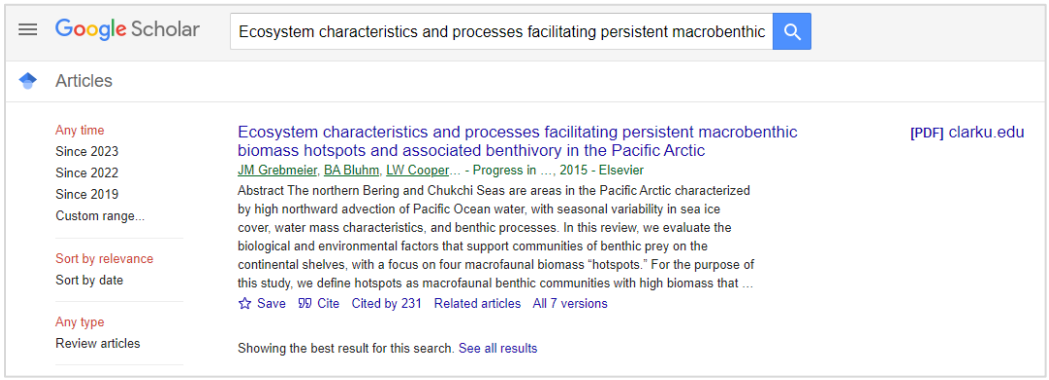

FIGURE 3. SELECTED GOOGLE SCHOLAR SEARCH OUTPUT[27]

To determine the number of citations across all documents produced by BOEM's ESP program, IEc used SerpAPI to automate a search in Google Scholar of the roughly 2,100 in-scope journal publications. SerpAPI is a paid service offering monthly subscription plans, designed to automate Google searches. SerpAPI returned the top search result in Google Scholar for each article title in the query. However, since some publications are not available online, some of these results were not actual matches to the intended article. To correct for this, IEc developed code in the open-source software R to automate a matching process based on a "fuzzy" match of the publication title entered in the search and returned

[23] https://serpapi.com/

[24] https://scholar.google.com/

[25] https://scholar.google.com/intl/us/scholar/help.html#coverage

[26] It is difficult to determine the exact coverage of citations for a given article that Google Scholar captures. Google provides the following statement about their tracing metrics: "Overall, Scholar Metrics cover a substantial fraction of scholarly articles published in the last five years. However, they don't currently cover a large number of articles from smaller publications" (https://scholar.google.com/intl/us/scholar/metrics.html#coverage). From our review of the outputs, there seems to be substantial coverage of articles and citation from periods far beyond the past five years (with citations available going back to at least the 1980s), although it is likely that the smaller publications, along with any internal publications by any organization, are not captured.

[27] Source: https://scholar.google.com/scholar?hl=en&as_sdt=0%2C27&q=Ecosystem+characteristics+and+processes+facilitating+persistent+macrobenthic+biomass+hotspots+and+associated+benthivory+in+the+Pacific+Arctic.+Progress+in+Oceanography&btnG=

from SerpAPI, along with the publication year from each source.[28] IEc then conducted a manual check to ensure that publications that were not matches would be excluded from the analysis. Following this process, IEc determined that 1,123 of the publications returned in the search were matches with the original 2,084 articles that we searched in Google Scholar (54 percent).

In addition to conducting the Google Scholar analysis, IEc conducted a targeted manual search of publications in Dimension and Wizdom.ai, two abstract and indexing (A&I) services that provide citation counts and impact rankings for select articles.[29] To choose the subset of publications to manually query in Dimensions and wizdom.ai, we purposefully selected publications including the top 15 articles that were available in these databases based on results from the Year 2 internal assessment citation analysis; 15 articles based on the top 15 most-cited list retrieved from the R-based Google Scholar tool; 15 articles based on feedback obtained from the interviews suggesting influential publications; and another 15 based on the most-referenced publications from the assessment citation analysis.[30] This deep dive into the subset of purposefully selected publications provides BOEM an understanding of the impact of its 'top' publications (defined in four different ways). It also demonstrates the benefit of potentially tracking these metrics for all BOEM publications moving forward.

Survey Analysis. Survey responses were analyzed and summarized quantitatively based on the percentage of respondents answering each of the possible responses for the individual questions. Responses were summarized overall and broken out by type of respondent (e.g., for multiple-choice questions about the means through which respondents obtain information about BOEM study results). IEc also conducted a thematic analysis of responses to open-ended survey questions.

Interview Coding and Qualitative Analysis. IEc analyzed responses to each interview question to identify themes and summarize responses. Each response could be applicable to more than one evaluation question. The evaluation team analyzed the interview results using a qualitative data analysis software package (i.e., NVivo). IEc developed a codebook for deductive text coding in NVivo,[31] and adjusted using an inductive text coding approach when necessary (i.e., with emergent code identification). We parsed the interviews by question using NVivo's autocoding feature, which can assign codes using formatting cues such as headers in Microsoft Word. IEc then assigned three analysts individual interview questions for analysis using the codebook. We quality-checked our process by periodically swapping assigned questions, as a way to ensure that analysts were applying codes in a consistent manner. We

[28] Fuzzy matching, also known as approximate string matching, is the technique of finding strings that match a pattern approximately (rather than exactly). IEc selected a filter of matches with a distance of less than 0.2 to keep from the search results.

[29] IEc worked closely with the BOEM project managers to explore options to access these databases by retrieving cost estimates from these services and reaching out to other Federal Family organizations, including one agency that currently subscribes to one of the citation databases. Despite these efforts, IEc was not able to obtain access to these services; instead, IEc manually retrieved data that was freely accessible for a subset of publications to indicate the types of additional information that can be gleaned from citation services.

[30] For the articles obtained from the interviews, interviewees often referenced a general topic and author of importance rather than reference a specific journal article. In that case, IEc searched the in-scope BOEM publications with that topic and author and identified the most relevant publications based on the interviewee's background (geographic area or topic of study).

[31] Deductive coding approaches use a pre-existing set of codes developed thoughtfully (and in advance of the analysis) to limit the need for recoding necessitated by late-stage additions to the codebook based on emerging patterns (i.e., inductive coding). This type of approach was necessary to keep the codebook manageable across the 86 sets of interview notes and consistent across multiple analysts.

analyzed the interview responses overall and by type of respondent (e.g., state, federal, academic, etc.). IEc summarized the frequency with which each theme was raised overall and by different types of interviewees and identified illustrative quotations that capture issues that interviewees frequently raised. We also summarized the interview findings with charts, graphs, and tables where appropriate.

Social Network Analysis (SNA). IEc conducted an SNA to better understand interactions between external stakeholders and BOEM, and to determine if these external stakeholders were sharing BOEM study and assessment results with others. SNA involves mapping and characterizing a network, which can be defined as relationships between people or organizations (including offices within an organization). SNA identifies pathways for transmitting ideas, knowledge, information, and resources. As part of this network analysis, we looked at the connections (edges) between individuals (nodes) and quantified the number and characteristics of those relationships. This analysis relies primarily on the 58 survey respondents, comprised of 30 federal, 17 academic, and 11 other types of respondents. Survey respondents were asked about internal and external contacts with whom they share BOEM study and assessment results, although they were each limited to reporting a maximum of five internal and external contacts. IEc also included targets for the interview portion of the evaluation (they did not and were not asked to complete the survey) for some analyses to better characterize the known external network universe. Because survey respondents reported only the offices of external stakeholders with whom they share information, we conducted this analysis in the following two ways:

- **Individual level**: analyzing the network of all survey respondents, interview targets, and additional external collaborators reported by survey respondents as unique individuals in the network
- **Organizational level**: analyzing the organizations represented in the survey and interview targets as single nodes in the network (i.e., collapsing all organizations with multiple representation in the network to a single point in the analysis)

For each of these analyses, we present network maps and metrics that illustrate the presence and strength of relationships in the BOEM network. We use this to understand the network structure, possible network influence on outcomes, and people or organizations that could be targeted or connected to expand BOEM's communication with the external environmental community.

4.3 EVALUATION CHALLENGES AND LIMITATIONS

We expected some challenges would arise throughout the course of the evaluation. Early identification of challenges, an experienced team of experts that cover all subject areas relevant to the analysis, and a clear approach to resolving these challenges allowed us to move the project forward efficiently and effectively through each analytic stage and prevent challenges from becoming obstacles. We highlight the following key evaluation challenges and how we addressed them:

Opportunistic approach to collecting external assessment, planning, and policy examples. By necessity, the external evaluation was opportunistic in identifying examples of the influence of BOEM's science on external assessments, planning documents, and policy decisions. Although we casted a broad net in terms of the types of external influence that we included in the external evaluation, we were not able to capture every example of where BOEM's science has influenced external stakeholders. First, the total universe of external (non-BOEM) assessments that could have potentially incorporated BOEM

science is unknown. External assessments are dispersed across multiple federal and state agencies and NGOs and may not be publicly available. Where we found examples of external assessments that cite BOEM studies, we describe the topics that the assessments covered and how they used BOEM science. However, unlike the internal evaluation, this was not a comprehensive inventory.[32] Similarly, although we conducted numerous interviews covering a broad group of external stakeholders who are well-positioned to use BOEM's science, the interviews were not able to comprehensively identify every example of BOEM's influence on the external environmental community. Overall, the interviews provide informative and compelling examples of how BOEM's science was disseminated to external stakeholders, the decision contexts in which external stakeholders used BOEM's science, and how and to what extent BOEM's science influenced external assessments, policies, and planning decisions. This method provides rich information to answer the evaluation questions and sets the stage for recommendations for how BOEM can effectively disseminate its science to the external environmental community and effectively track external use of BOEM science in the future.

Potential bias associated with purposive interview sampling. The external interviews were selected using a purposive sample to provide a cross-section of states in which BOEM operates and key agencies, academics, and consultants identified by BOEM. As this is not a statistical sampling approach, the interview findings are not intended to be extrapolated to the broader population of all of BOEM's external partners. However, this approach accounts for the important differences across multiple states and other external partners, who each have different contexts and objectives for using, and in some cases participating in, BOEM studies and assessments work, and who use studies and assessments differently in their respective decision-making processes. Interviewing multiple state agencies in each region prioritizes capturing differing perspectives over the most frequent or common interactions between BOEM staff and external partners. Interviewing 20 academics/consultants captures the most influential members of these groups as identified by BOEM's environmental studies and assessments programs. Because these academics and consultants are important and frequent collaborators in BOEM's studies work, and they bring a range of perspectives based on their individual experiences and subject matter expertise, ensuring their representation in the interviews was important for providing a comprehensive understanding of their interactions with BOEM.

Evolving policy context for the use of BOEM's science by external stakeholders. We conducted the external evaluation during a transition in federal policy from emphasizing oil and gas development to renewable energy development. This shift is likely to affect the emphasis of BOEM's scientific research, which in turn affects how external stakeholders interact with and use BOEM's science. As this shift is currently unfolding, the evaluation was not able to comprehensively capture BOEM's potential influence in this regard. However, we included questions in the interview guides asking respondents if and how they expected this shift in focus to change the importance of BOEM's environmental studies and assessments to their work. Overall, the current evaluation provides a retrospective assessment of the influence of BOEM's science on the external environmental community, supplemented with some forward-looking insights from the interviews.

[32] Moreover, the total universe of external assessments, planning documents, and policies that *could have* potentially incorporated BOEM science is unknown; therefore, we did not have a denominator by which to divide the number of assessments, plans, and policies that do cite BOEM studies. In contrast to the internal evaluation, the external evaluation was not able to provide the ratio of total assessments that cited BOEM studies.

Different tools calculate citation impact metrics using different databases; also, compiling citation impact metrics in a comprehensive manner requires access to a paid citation service, which was unavailable for this evaluation. There is known variation in the bibliometric results across different tools, an expected outcome considering the different databases each of these tools relies on for calculating the metrics. This outcome demonstrates the potential uncertainty surrounding the exact metric values retrieved from any of these tools and is a known limitation of any citation impact analysis. To address this uncertainty, instead of comparatively viewing the total citation counts across different tools, we present them as separate indicators. For example, the Google Scholar total citation value is a single metric, and the Dimensions total citation value is a separate metric. Beyond total citations, Dimensions and other paid citation services include more sophisticated and informative citation impact metrics. However, because we were unable to access a paid citation service during this evaluation, we were only able to compile these citation impact metrics for a subset of publications based on manual searches of publicly available information. Full access to a citation service would have allowed for a more comprehensive treatment of citation impact metrics for a larger portion of the universe of publications.

5 FINDINGS BY EVALUATION QUESTION

The following sections present the findings by evaluation question using the information gathered across analyses.

5.1 HOW DOES BOEM SCIENCE IMPACT EXTERNAL STAKEHOLDERS AND DECISION-MAKERS?

BOEM science often fills key knowledge gaps relating to changes from baseline conditions for habitat, acoustic environments, and other ocean features. BOEM science is also diverse, ranging from benthic communities to marine mammals, and from mineral resources to ice dynamics. Importantly, BOEM science (including studies, assessments, and data) is typically publicly available once it is peer-reviewed by other researchers, meaning that the results are open to anyone interested in accessing them, from academics to government entities. The in-depth interviews with contacts in academia, federal agencies, and state agencies indicate that BOEM science impacts external decision-makers and other stakeholders in a variety of ways:

- Advances basic scientific research
- Generates new information about the impacts of offshore renewable energy development
- Contributes to publicly available datasets and databases
- Informs natural resource decision-making and policy development at national, Tribal, state, local, and international levels
- Informs funding decisions taken by other government entities and research institutions
- Informs community understanding of ocean science and resource management

Based on information from the interviews, this section discusses the ways in which BOEM science enhances the greater body of scientific research, supports stakeholder learning, and informs decision-makers tasked with managing natural resources at the state and federal level.

BOEM studies advance basic scientific research. Interviewees noted the importance of BOEM science in establishing baseline data for ecosystems; oceanography (e.g., chemistry, geology, physics including sound); and other areas (e.g., historic sites or individual species). Interviewees also noted the importance of BOEM's science in filling knowledge gaps in basic science (e.g., sea floor mapping, substrate characterizations, sound catalogs, community assemblage identifications, and migration tracking).

For example, one academic interviewee explained that BOEM's scientific research on seismic impacts has been instrumental to understanding baseline acoustics. The study in question, the Sperm Whale Seismic Study (SWSS),[33] was "foundational" to their work related to the *Deepwater Horizon* oil spill. The interviewee described that although the SWSS was conducted prior to *Deepwater Horizon*, it is an

[33] Jochens AE, Biggs DC, Engelhaupt D, Gordon J, Jaquet N, Johnson M, Leben R, Mate B, Miller P, Ortega-Ortiz J, Thode A, Tyack P, Wormuth J, Würsig B. 2006. Sperm whale seismic study in the Gulf of Mexico, summary report, 2002-2004. 345 p. OCS Study 2006-034. Obligation No.: 1435-01-02-CA-85186.

instructive example of how BOEM-funded science can provide valuable knowledge that is transferable beyond the original context for the study. In this case, the research filled such an essential knowledge gap (e.g., how sperm whales are impacted by seismic activity) that it was useful in responding to the *Deepwater Horizon* oil spill which occurred years after the SWSS was finalized.

BOEM also takes advantage of natural "experiments" to re-create baseline conditions, where possible, for comparison against business-as-usual conditions (e.g., within or outside protected habitat). For example, one interviewee explained that during the COVID-19 pandemic, the GOM Region experienced reduced marine traffic, and BOEM launched a study of the reduction in traffic to compare animal behaviors from before the start of the COVID-19 pandemic (using previously collected information).[34] Understanding animal behaviors during a rare reduced-traffic period was an unexpected and valuable opportunity to learn about the conditions in the GOM, an area that typically has substantial marine traffic.

Interviewees also described the benefit of BOEM's studies often spanning several years, even decades. BOEM can conduct the basic scientific research in concert with more applied science studies (and vice versa) to understand the impacts of offshore wind siting and habitat disruption. For example, one academic interviewee explained their work on a project for BOEM that included a baseline geologic characterization, which was used to inform planning for offshore wind and identify sensitive habitats. The study was expected to lead to changes in protected area and fishing zone delineation. Another academic explained that past sand dredging work off the coast of Maryland and Delaware was relevant to their work in defining essential fish habitats and identifying shoal features that are important habitats for sand lances (a small fish that is the base of the food chain for larger fish). According to the interviewee, that work informed beach nourishment program practices.

BOEM science contributes to advancing research on renewable energy impacts. BOEM's contribution to advancing research on renewable energy impacts was by far the most frequently referenced impact of BOEM science by interviewees. In general, interviewees perceived this to be a growing area of research at BOEM, based on their understanding of the changing state of the science, the Bureau's emphasis on leasing offshore wind sites, and the changing frequency with which non-renewable energy studies are funded by the Bureau. Interviewees expressed interest in or identified the importance of BOEM studies on topics ranging from offshore wind construction activities and habitat disruption to impacts on ocean circulation patterns (e.g., upwelling) and the indirect effect of offshore wind on the fishing industry.

Several interviewees expressed a desire for BOEM to think more proactively when designing studies on renewable energy impacts. While interviewees acknowledged that BOEM science serves a critical role in filling gaps in marine research, specifically around offshore wind impacts, several expressed a need for studies to be more forward-looking—including treatment of issues that may not need to be addressed immediately but will become important in the future. There is a government-supported and industry-wide push to develop offshore wind, so impacts from construction and operation are a key concern and a focus of many BOEM studies (identified as one of the top-cited topic areas in the external publication citation analysis). However, several interviewees expressed an interest in anticipatory studies to understand possible impacts from wind turbine decommissioning (using oil production platforms as a proxy). State

[34] IEc was unable to identify the specific study in BOEM's ESP Hub at the time of writing.

agency interviewees also expressed a desire to better understand the impacts of decommissioning wind turbines, in addition to better understanding the baseline conditions in an area prior to renewable energy development.

BOEM science contributes to publicly available datasets and databases. Though interviewees raised this topic less frequently than the topics described above, there were a subset of interviewees who were emphatic about the importance of BOEM in contributing to publicly available datasets and databases. Interviewees identified MarineCadastre.gov multiple times both directly and indirectly (e.g., access to MarineCadastre.gov is available through Tethys and Data.gov) as a key resource in terms of public data access. BOEM also contributes critical data to other types of data portals, including NOAA's National Center for Environmental Information (NCEI). One academic explained that BOEM's contributions to NOAA's NCEI Passive Acoustic Data Portal have been a significant asset for their research. The interviewee underscored that the level of publicly available data that BOEM provides is truly unique: there is no terrestrial biology equivalent to the publicly available data on marine science.

However, interviewees did offer some critique of BOEM data portals. While many interviewees lauded the public availability of BOEM datasets, some interviewees identified challenges in navigating data portals. Interviewees identified Data.gov as a challenging resource to navigate, although we note that Data.gov is not controlled directly by BOEM. Some interviewees also described ESPIS as another data resource that is sometimes difficult to use and navigate. Notably, at the time of writing, BOEM had recently released an Environmental Studies Program Hub (ESP Hub) to improve searching and broaden the database functionality of ESPIS.

BOEM science informs decisions taken by other government entities and research institutions. State and federal interviewees alike emphasized the impact that BOEM's science has on resource management and policy decisions at the state and federal levels. Alaska is one region where state agency and academic interviewees identified the critical importance of BOEM studies to their work. Interviewees also reported that BOEM science impacts international decision-making. For example, the International Whaling Commission, International Seabed Authority, and others use BOEM studies to inform management decisions. Interviewees of all types (academic, consulting, federal, state, and local) identified impact studies as important for informing policy, including pre- and post-energy extraction and generation operations studies and baseline characterization studies (habitat, community assemblages, species behavior).

Federal and state agency interviewees also described using BOEM science to inform their own studies and assessments, from scoping (e.g., defining their process and methodology) to comparing their results with BOEM's results. For example, an interviewee explained that they reviewed BOEM's methods for conducting paleolandscape studies, to understand possible options to study how offshore wind or oil and gas operations might impact prehistoric archaeological landscapes. Agencies at the state and federal levels take cues from BOEM on best practices, including technology use and modifications (some BOEM studies are focused on technology development and deployment). For states, aligning with BOEM's methods can help ensure they are consistent with federal actions.

Coastal state agency interviewees indicated that BOEM's marine environmental impacts research and environmental assessments inform their own marine natural resource management and spatial planning decisions. States also rely on BOEM science to interact meaningfully with BOEM in the NEPA process.

The timing of BOEM assessments and scientific information included in BOEM assessments informs states' formal comments on BOEM EAs, EISs, or other guidance documents as a part of the NEPA process. State interviewees emphasized that their agencies make a point of submitting comment letters on BOEM's EAs and EISs to initiate a formal dialogue with BOEM toward resolving or making progress on marine and even coastal zone issues.

Prospective decision-making was a major sub-topic in state agency interviews, as many coastal states are either planning for or actively issuing permits for offshore wind development. One state interviewee explained that BOEM science will support future offshore wind and other renewable energy development decision-making in their state because BOEM has the data and studies to help the state understand the magnitude and impacts of construction and operations activity on the marine environment. Some interviewees in states with a history of offshore oil and gas development voiced concern that a shift to renewable energy development will lead to fewer BOEM-funded studies in their region.

BOEM science informs funding decisions taken by other government entities and research institutions. Federal interviewees reported that they often work in collaboration with the Bureau to fund larger research studies or find ways to leverage existing planned studies; for example, a research vessel's time on the water may be maximized by including an additional sampling component. Multiple academic and federal interviewees mentioned that cooperating federal agencies including the U.S. Geological Survey (USGS), USFWS, and DOE sometimes contribute funding for BOEM-led studies (and vice versa).

States occasionally use BOEM decisions on studies funding as a signal of coming changes in regional-level decision-making. Interviewees explained that state agencies sometimes try to align their own funding decisions based on what BOEM is or is not funding. One state interviewee contacted BOEM directly to ask about what types of species impact studies BOEM might consider funding at the state level, given the Bureau's interests in electromagnetic field (EMF) impacts. BOEM was able to contribute as a collaborator and funder on a study of particular interest, inspired by stakeholder interest in the impacts of EMFs to horseshoe crabs. The focus of the study was timely and fell within a research area of interest to BOEM, so the research proved useful to both BOEM and the state agency.

Academic interviewees explained that ESP funding decisions also inform scientific research more broadly by signaling ESP's research priorities. For example, a consultant who has an Indefinite Delivery, Indefinite Quantity (IDIQ) contract with BOEM attended BOEM's semiannual forum to learn what other studies the ESP was funding.[35] The forums provided some indication of ideas to consider as the researcher planned their time at sea for their other BOEM studies, leveraging data collection opportunities and resource commitments (vessel rental) to deliver timely information to BOEM. Multiple academic interviewees described their preparation to submit study ideas in response to the annual call for study ideas, in which they review active BOEM ESP studies and try to discern patterns in the types of studies BOEM is funding to develop a sense of the Bureau's priorities and try to align their own research accordingly. Academic interviewees also look to BOEM science to prepare future external research designs (Section 5.3).

[35] Although the interviewee did not specify which forum, IEc suspects that it is the National Academies Committee on Offshore Science and Assessment (COSA).

BOEM science informs community understanding of ocean science and resource management. Interviewees of all types identified that one outcome of BOEM science is informing community understanding of ocean science and resource management. Interviewees explained that they use BOEM science to communicate to the public about impacts of activities such as decommissioning oil and gas sites on fish stocks or to answer stakeholder questions about changes in the marine environment due to renewable energy development. However, some interviewees questioned the public's ability to digest BOEM's environmental studies due to the studies' dense and highly technical content. These interviewees explained that they regularly need to translate BOEM's material for a more general audience. While BOEM does have existing efforts to communicate to the public about ocean science topics (e.g., in children's factsheets), communication of ESP study findings does not appear to be formal or systematic, as part of an ESP communication plan, for example.[36]

Several interviewees recommended that BOEM require ESP-funded principal investigators and scientists to develop factsheets, videos, or other easily accessible and digestible products for non-technical audiences. Although BOEM studies contracts currently require information dissemination, they do not require a particular format or medium. One academic suggested using 5- to 10-minute videos to educate the public about how BOEM science is applied to management issues using a popular medium (e.g., YouTube videos). BOEM already produces some short YouTube videos, along with project posters and longer informational presentations regarding lease sales and environmental impacts (to name a few),[37] available on the Newsroom page of BOEM's website.[38] Academics working on BOEM studies might likewise consider producing video summaries of their findings as a possible way to fulfill the information dissemination requirement in their contracts. Some academics noted that they already make the additional effort to disseminate BOEM findings widely; for example, one academic worked on developing a curriculum module for middle schoolers based on their BOEM study. Interviewees expressed interest in these types of easily accessible and digestible formats for sharing study findings.

5.2 HOW IS INFORMATION ON BOEM SCIENCE COMMUNICATED TO AND AMONG EXTERNAL STAKEHOLDERS?

BOEM communicates science to external stakeholders through several methods including direct staff-to-stakeholder communication, online resources, and conferences. Survey results indicate that over three-quarters of respondents receive information on BOEM studies, while approximately half of respondents receive information on BOEM assessments (Figure 4). While survey respondents indicated that they access BOEM science through online resources (e.g., BOEM's website or ESPIS) or academic conferences, word-of-mouth communication with BOEM staff was their most reported method for receiving and sharing information. Interview responses reinforced the same top methods for receiving and sharing BOEM science. The SNA results suggest that external stakeholders are important disseminators

[36] BOEM does have non-public-facing communication plans in place for outreach to specific stakeholder groups, such as fishing industry and offshore wind stakeholders, but does not have an ESP-wide plan for information dissemination to multiple audiences.

[37] This is not a complete list of BOEM's information dissemination efforts.

[38] Other locations on BOEM's website with more digestible products include notification pages and document repositories for OCS energy lease sales and NEPA-related documents, which include recordings of public meetings, posters that explain individual projects or actions, and videos that explain the impacts of actions.

of BOEM study and assessment results, sharing information with their own networks and helping to expand the reach of BOEM science. In particular, academic researchers and federal agencies like NOAA, USGS, and USFWS play a critical role in disseminating BOEM science to other external stakeholders. BOEM's network is robust, but BOEM science may not easily reach all interested stakeholders. This section—based on information from the interviews, survey, and SNA—discusses the different types of scientific information that external stakeholders receive from BOEM, the main methods for communicating BOEM science, and BOEM's network of external stakeholders.

Survey Results

Over three-quarters (78%) of survey respondents receive information from BOEM studies (Figure 4). In contrast, only 48% of respondents receive information from BOEM assessments.

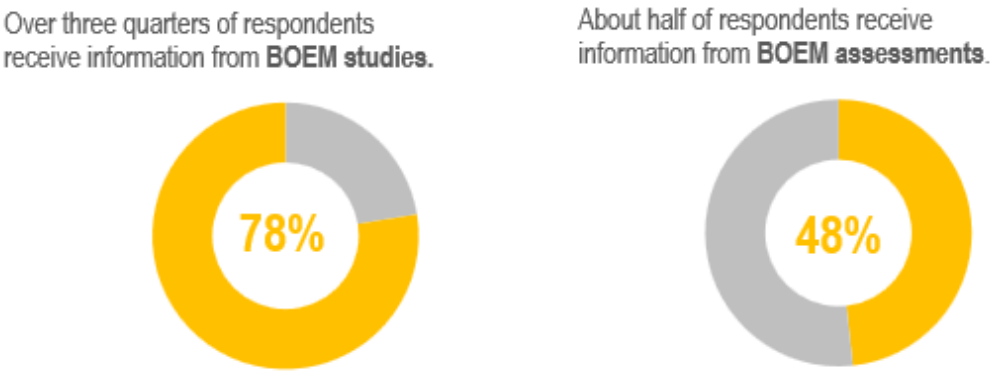

FIGURE 4. PERCENTAGE OF RESPONDENTS THAT RECEIVE INFORMATION FROM BOEM STUDIES AND BOEM ASSESSMENTS, RESPECTIVELY

External stakeholders who receive information on BOEM science primarily obtain it through direct interactions with BOEM staff. Eighty-seven percent of respondents indicated direct interaction with BOEM staff was the mechanism for receiving information on BOEM studies (Figure 5). Similarly, 93% of respondents indicated direct interaction with staff at BOEM was the mechanism for receiving information on BOEM assessments (Figure 6). That response was selected substantially more than the second most frequently selected option in the case of both studies and assessments, by 34% in Figure 5 and by 25% in Figure 6.

Respondents also indicated other direct interactions with non-BOEM federal staff (Figure 5: 47%, Figure 6: 50%) and with academics (Figure 5: 40%, Figure 6: 46%) as key methods of communication for studies and assessments. These results highlight the importance of direct relationships for accessing information about BOEM scientific research.

Online resources are another channel for communicating BOEM science to external stakeholders. Respondents indicated that BOEM's website (53%), ESPIS (51%), and internet searches (44%) are important sources of information for BOEM studies (Figure 5). The pattern is similar for respondents receiving information on BOEM assessments. Respondents indicated that the BOEM website (68%), internet searches (54%), webinars (50%), and the BOEM newsletter (25%) are also useful channels for receiving information on BOEM assessments.

Over half of respondents indicated they received information on BOEM studies (51%) from conferences, while only 32% indicated they received information from assessments via conference (Figures 5 and 6). This rate makes sense given that BOEM studies typically produce new science and information while BOEM assessments typically consolidate sources of information and science.

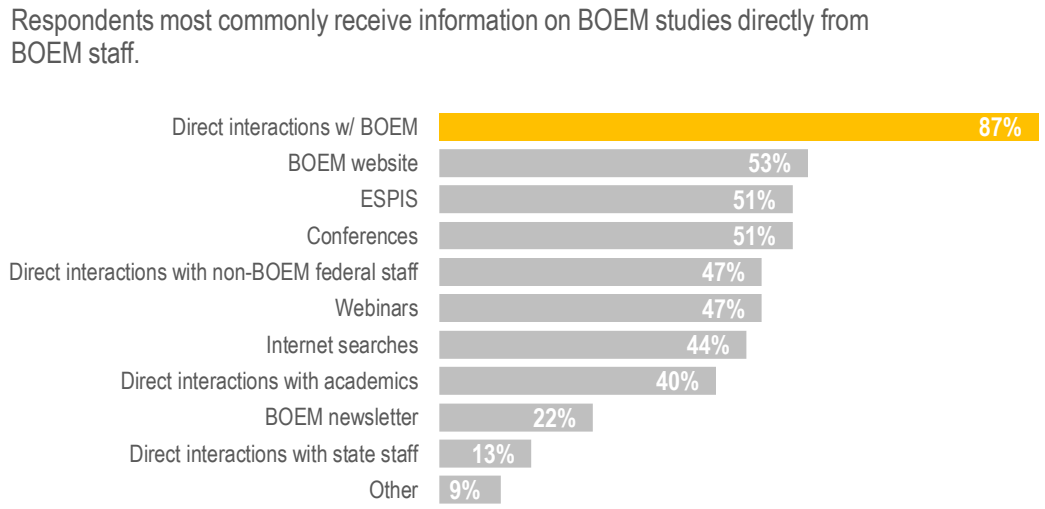

FIGURE 5. MECHANISMS THROUGH WHICH RESPONDENTS RECEIVE INFORMATION FROM BOEM STUDIES

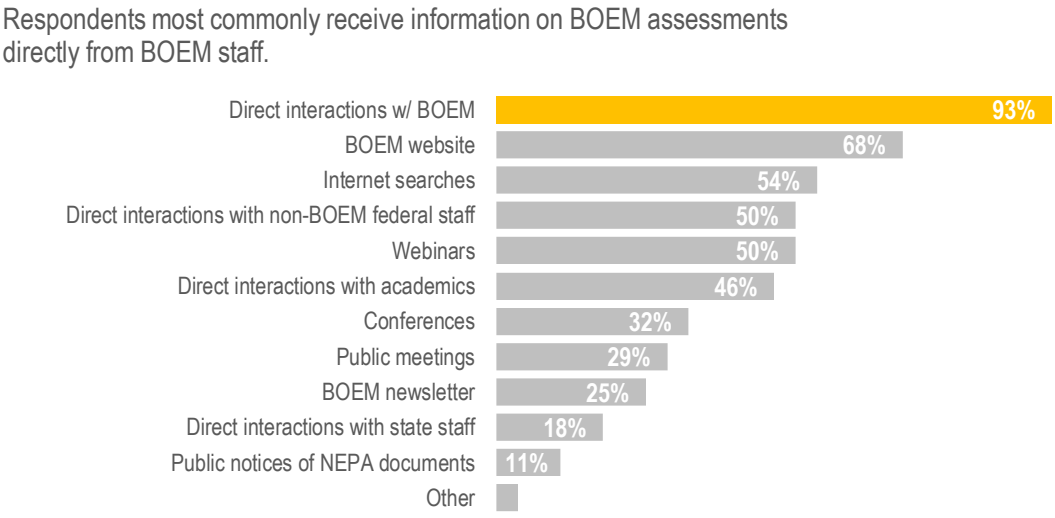

FIGURE 6. MECHANISMS THROUGH WHICH RESPONDENTS RECEIVE INFORMATION FROM BOEM ASSESSMENTS

SNA Individual-Level Analysis

Respondents reported interacting with multiple BOEM staff and external stakeholders regarding BOEM studies and assessments. On average, they reported interacting with nearly twice as many BOEM staff as external individuals. Figure 7 depicts the interactions that individual survey respondents (represented by

each node) had with BOEM offices.[39] Each line in the figure represents a respondent's interaction with a BOEM staff member in the given office. Survey respondents reported an average of 4.1 interactions with BOEM staff.[40] The network contains 161 total nodes. Node sizes represent the number of interactions that each respondent or BOEM office had with the rest of the network (e.g., OREP is the largest node with 108 total contacts). Survey respondents reported nearly twice as many interactions with BOEM staff as BOEM staff reported having with external stakeholders in the BOEM-specific survey (2.2 external contacts on average). Although this is likely explained by the survey being limited to BOEM-identified collaborators, it does indicate that frequent collaborators are communicating with multiple individuals and offices within BOEM. Of the 4.1 interactions, 1.4 were with staff at OEP, followed by those in the GOM Region (0.8), OREP (0.7), and the Alaska Region (0.5).[41] Respondents in state government positions reported the most interactions with BOEM staff (5.0 contacts on average), ahead of federal employees (4.3) and academics (4.1). Individuals from other organizations (i.e., NGOs, non-profits, and private companies) reported having fewer contacts with individuals within BOEM (3.0 contacts).

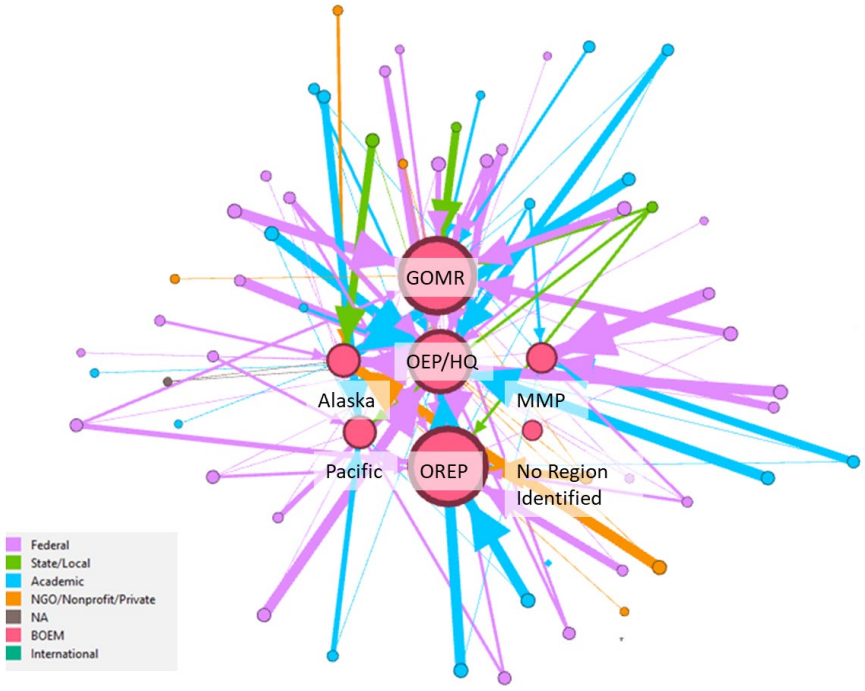

FIGURE 7. INDIVIDUAL SURVEY RESPONDENTS' INTERACTIONS WITH BOEM

[39] Survey respondents reported interactions as BOEM collaborators who they worked with in the development or implementation of BOEM studies, the development of analyses for environmental assessments, or from whom they received information about BOEM studies or assessments.

[40] Because survey respondents were limited to five spaces to identify BOEM staff with whom they collaborate in the survey, it is likely that this average value underestimates the true number of contacts that would have been reported across all respondents had there been unlimited spaces to populate. Survey respondents who also participated in an interview had one additional contact listed (e.g., their BOEM collaborator who recommended them for the interview, assuming this was not duplicative of their other listed contacts), resulting in up to six BOEM collaborators. Thirty-eight percent of survey respondents identified six BOEM staff with whom they communicate.

[41] These averages are calculated based on the survey respondents only; they exclude interview participants because interview participants were not asked to list collaborators during the interviews in the way that survey respondents were asked to list their collaborators. When including interview participants, OREP has the most total contacts across the entire network and is therefore the largest node size in Figure 7. We discuss the network with the inclusion of interview participants in greater detail below.

Most survey respondents (61 percent) indicated that they share results from BOEM-funded assessments and studies with individuals from other organizations outside of BOEM. Respondents reported sharing information with 121 additional external collaborators, an average of 2.2 contacts per respondent, or 3.7 when limiting this average to just respondents who reported at least one non-BOEM contact. Figure 8 depicts this expanded network with each added node representing an individual with whom the respondents reported sharing information. According to the survey results, BOEM collaborators in the academic fields share information with the most external contacts (2.6), ahead of federal (2.0), NGO/non-profit/private (2.0), and state (1.7) employees.[42] This finding is likely due to the multiple organizations and agencies who participate in studies alongside academics, along with the information that they share through publishing and other presentations. Survey respondents from academia reported an average of 4.1 contacts within BOEM and 2.6 external contacts.

Among other federal partners, NOAA's influence in disseminating information across the network is substantial. NOAA employees who completed the survey reported an average of 3.2 external contacts and 4.1 contacts within BOEM. This means that NOAA staff are speaking with more BOEM and external contacts than other organizations, on average. Alternatively, USGS respondents reported an average of 4.0 BOEM contacts but listed no external contacts, which suggests that USGS may play a smaller role in disseminating BOEM study and assessment results externally. USFWS, the second most frequently represented organization in the network (see the Organization Level section below), reported an average of 6.0 BOEM contacts, the highest of any organization (and the maximum allowed in the survey), with 2.5 external contacts. Overall, 39 percent of survey respondents reported speaking with no external contacts. This data suggests that different organizations and individuals have different uses for BOEM-funded studies and assessments, and the extent to which they share that information with other external parties varies given their specific roles and responsibilities.

[42] Survey respondents were given the space to provide up to five external collaborators. Twenty-eight percent of respondents provided five external contacts. It is likely that this led to undercounting the number of individuals because of this limitation.

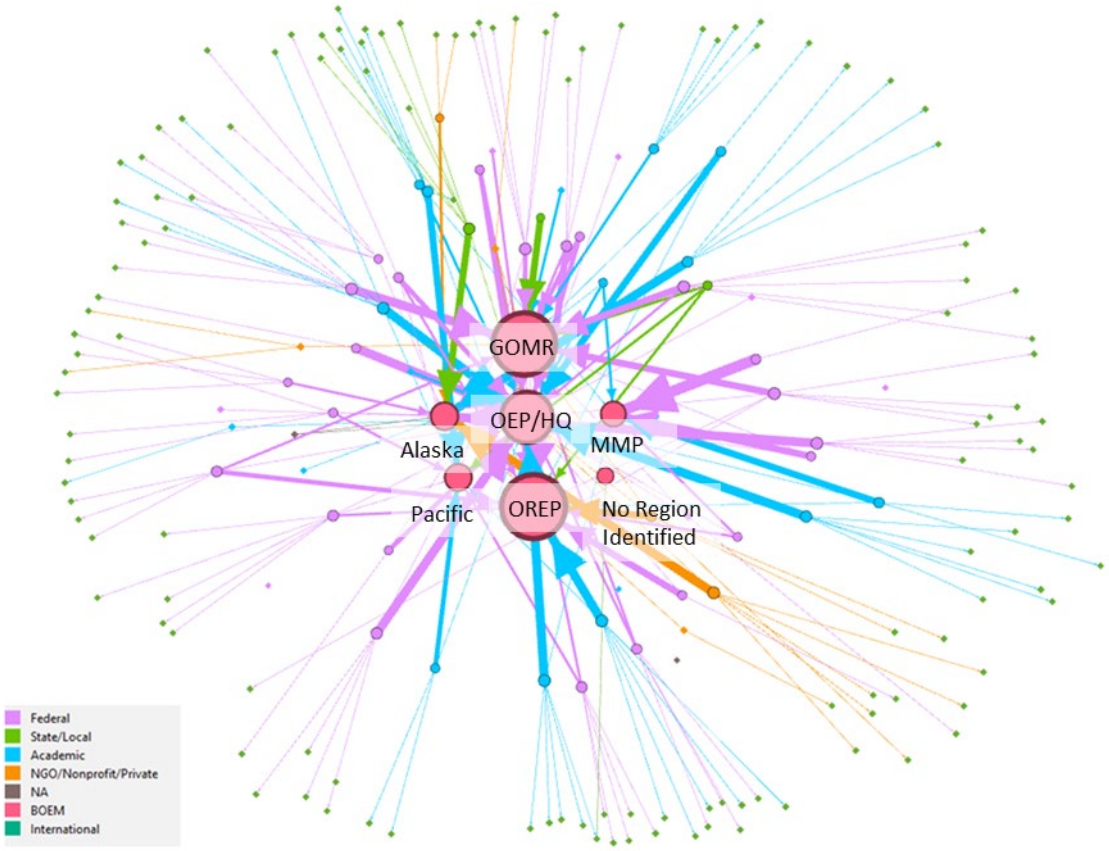

FIGURE 8. INDIVIDUAL SURVEY RESPONDENTS' INTERACTIONS WITH BOEM AND EXTERNAL COLLABORATORS

Figure 9 depicts another tier of BOEM's network, which includes interview targets and their contacts at BOEM, in addition to the survey respondents and their BOEM and external contacts from Figure 7.[43] This network includes 305 individuals from 155 organizations that are in direct contact with BOEM, along with another potential 127 external collaborator contacts from 73 organizations who are receiving information from individuals in direct contact BOEM (i.e., target survey respondents).[44] Because survey respondents only reported organizations with whom they share information (but did not report individuals' names), they may have referenced some of the interview targets, or two respondents may have been referring to the same individual. Therefore, it is likely that this network depiction includes some double counting of individuals. However, because interview respondents did not report BOEM or external collaborators, there is also an underrepresentation of contacts attached to each of their nodes in Figure 8. If the 247 potential interview targets shared information with the survey average of 2.2 external contacts, this would introduce an additional 553 nodes into the network. Though there is some uncertainty surrounding the true size of the network, the number of close contacts (i.e., within two connections from

[43] The colors in Figure 9 have been changed to differentiate survey respondents from interview targets. The interview target category includes 41 respondents who BOEM identified as close collaborators but IEc did not contact due to concerns including privacy and a desire to allow BOEM to manage relationships with specific organizations.

[44] This network includes all survey takers and interview participants, along with the BOEM and third-party contacts with whom they reported communicating.

BOEM) that this information is reaching suggests that direct collaboration with external contacts is beneficial to the spread of information, especially as external parties continue to disseminate study and assessment results.

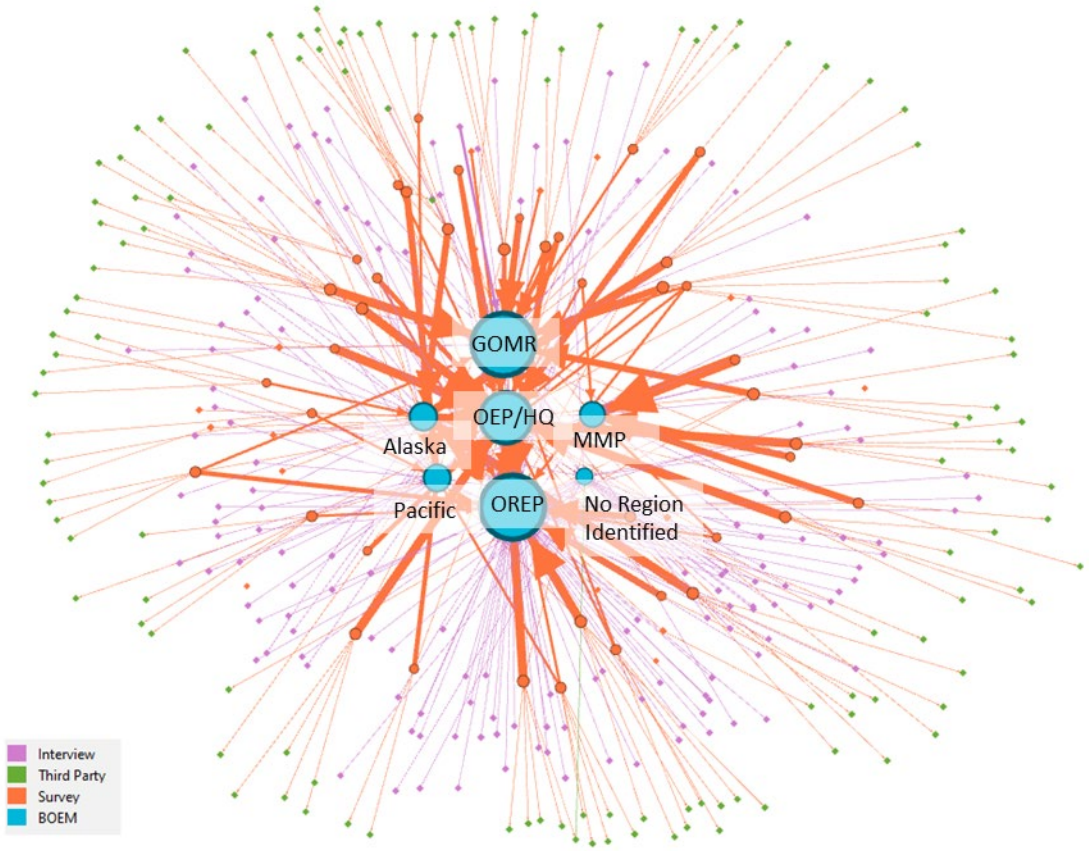

FIGURE 9. INDIVIDUAL SURVEY RESPONDENTS' INTERACTIONS WITH BOEM AND EXTERNAL COLLABORATORS, AND INTERVIEW TARGET INTERACTIONS WITH BOEM

SNA Organizational-Level Analysis

We also conducted an SNA at the organizational level.[45] Figure 10 depicts the network including survey respondents, external collaborators, and interview targets, with each organization combined into a single node. This process results in 196 unique organizations combined across BOEM and external organizations. Within this network, the 54 survey respondents reported sharing BOEM study or assessment results with 48 unique organizations, suggesting that each new collaborator with BOEM brings in close to one additional organization to the network.[46]

Among federal partners, NOAA (excluding NMFS) was the organization with the most connections represented in the network (81). Other federal agencies including USFWS (46), USGS (38), and NMFS (36) were the next most well connected. The U.S. Navy (19), EPA (15), and DOI (15) were also well represented. Academic institutions including Louisiana State University (19), Cornell (13), University of Maryland (12), Boston University (11), Rutgers University (11), University of Alaska-Fairbanks (10), and University of Maryland-Baltimore County (10) had the most connections of non-federal agencies. Overall, state-level and other organizations had fewer connections within the network. Cook Inlet RCAC (13), Alaska Department of Fish & Game (10), CSA Ocean Sciences Inc. (10), and the North Carolina Department of Environmental Quality (9) were the most connected of these entities.

SNA analysis indicates that there are six unique communities (e.g., clusters where nodes are more tightly grouped allowing easier dissemination of information within the cluster) within this network, and an average degree (i.e., number of connections between nodes) of 1.5. While this suggests that information can travel relatively quickly between organizations, it does not account for the need for information to pass between individuals within the same organization. The average distance between nodes that IEc found for the internal BOEM network was 2.3, meaning that for information to spread within organizations and beyond, it could require several additional connections.

[45] The organizational-level analysis partly accounts for double counting. We only asked survey takers to list the organizations with which they interact; we do not know whether they interact with the same individual(s) within an organization. This raises the potential for double counting connections at the individual level, but this issue does not apply at the organizational level.

[46] This would likely diminish as more organizations are represented, as there are only a finite number of organizations that work directly with BOEM collaborators.

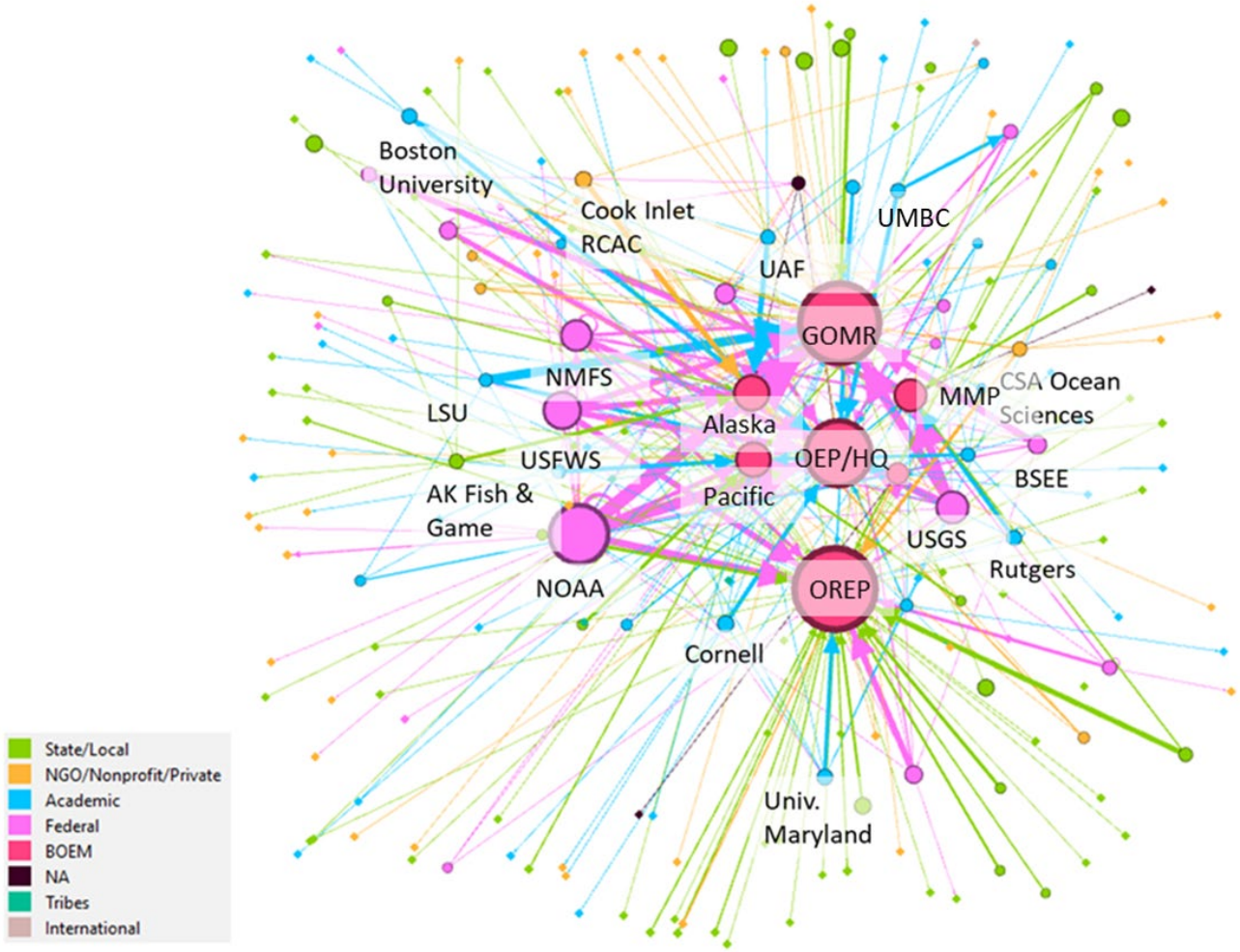

FIGURE 10. ORGANIZATIONAL CONNECTIONS WITH BOEM (SURVEY, INTERVIEWS, OTHER EXTERNAL COLLABORATORS)

"Other external collaborators" are contacts outside of BOEM with whom survey respondents reported sharing BOEM information, but who did not themselves take the survey.

Key Takeaways

- **External stakeholders are important disseminators of BOEM study and assessment results.** Survey respondents shared BOEM study and assessment results with over two external contacts on average, helping to expand the reach of the BOEM network. Most respondents (61 percent) reported sharing information with organizations outside BOEM. These respondents also collaborated with an average of 4.1 BOEM employees, usually spanning multiple offices, opening further channels of communication through which information can be shared.

- **Federal and academic stakeholders are the most frequent spreaders of BOEM's study and assessment information.** Survey respondents from these backgrounds were the most likely to report numerous contacts and collaborators both within and external to BOEM. State, local, and other types of contacts tended to report fewer contacts.

- **BOEM's network is robust, but information may not easily reach the full network.** With nearly 200 organizations and close to 500 individuals represented, the network that we observed is robust, and likely still underestimates BOEM's true reach. However, 39 percent of survey respondents reported having no external contacts, while 15 percent reported interacting with just one BOEM employee.

Interview Findings

BOEM communicates with stakeholders using a broad range of methods, demonstrating a considerable breadth of outreach from the Bureau, either directly or through its ESP awardees. Interviewees most frequently identified word-of-mouth as the information dissemination method for information sharing to *and* among BOEM stakeholders. This communication method speaks to the direct connection between BOEM staff and the network of academic researchers and federal or state agencies engaged with ocean energy research and marine spatial planning. This result is also consistent with both the external survey and SNA findings described above.

Interviewees described their reliance on word-of-mouth information gathering as complementary to other methods for receiving information from BOEM, such as visiting BOEM's ESP web page or a BOEM-sponsored data portal. Word-of-mouth communication should be considered a *component* of interviewees' information gathering workflows. In some cases, interviewees described direct communication with BOEM staff as a primary step in refining the interviewee's search criteria for published reports or data before visiting BOEM's website, while in other cases they described outreach to BOEM staff as a follow-up step after reviewing the website, as a means of seeking additional information.

While the word-of-mouth pattern of information sharing speaks to the strength of the relationships that BOEM has built with academics and consultants and other federal, state, or local agencies, it may also stem from the limitations of other information-sharing modes identified by interviewees. For example, interviewees explained that BOEM reports were not always easy to locate, even if (in some cases) the user knows they exist. Often interviewees request documents directly from BOEM program staff who have been involved with specific studies or assessments, or from the principal investigator who was contracted to lead a specific BOEM-funded study. One academic told us that BOEM's website search engine challenged them, so they often contact BOEM staff for support in locating studies, assessments, or data after they have visited BOEM's website or ESPIS with no result.[47]

As noted in the survey results, interviewees indicated that BOEM's web pages (e.g., the ESP landing page and ESPIS) were another top mode of *receiving* information about BOEM science. Interviewees also frequently mentioned conferences and meetings (e.g., stakeholder meetings, subject matter expert working group meetings, etc.) as avenues for *sharing* ESP study results both to and among stakeholders. Conferences also likely extend the reach of BOEM science beyond the connections mapped in the SNA (e.g., Figure 10). This was an expected result, as BOEM utilizes the contracting mechanism to require funding recipients to disseminate study findings. Conferences and meetings are traditional means of information dissemination in the sciences, along with white papers and peer-reviewed publications.

[47] Note that search functionality should increase substantially with the recent release of BOEM's ESP Hub, through which ESPIS-housed reports are now discoverable through popular internet search engines like Google or Bing.

Social media is a less traditional mode of communication that has the potential to both raise awareness of existing studies and support the location of study information. Interviewees described social media as one possible (new) way of sharing findings more broadly. BOEM staff traditionally share BOEM assessments directly with state agencies for comment, or point agencies to the Federal Register notice, though interviewees also mentioned that they learn about assessments open to public comment through popular social media channels (e.g., Twitter). There are also more academic "social media" channels such as ResearchGate,[48] a platform for academics to share their research more broadly. ResearchGate functions as a digital *curriculum vitae* with their list of citations and coauthors, like a version of LinkedIn for academics. One interviewee mentioned that a good way of amplifying the reach of BOEM report findings is for contributing scientists to share the report on their ResearchGate page. Often, lead authors will post their peer-reviewed journal articles on their ResearchGate profile (if the journal guidelines allow cross-posting) to remove the barrier of a paywall to their studies. ResearchGate users can download the PDF version of the journal article if they are registered with the site (free). Anecdotally, the interviewee who identified ResearchGate as an option for information sharing mentioned that much of their own ResearchGate audience is international. Google Scholar is another internationally recognized citation-sharing resource like ResearchGate. These platforms both reach wider audiences that BOEM could encourage ESP-funded scientists to tap into as they disseminate BOEM findings.

Though interviewees mentioned it less frequently than some of the other methods of science communication, interviewees lauded BOEM's practice of widely sharing scientific data. In fact, this method of information communication stood out as an area of notable achievement for the Bureau. BOEM data are typically accessed directly through marine spatial data sharing portals like MarineCadastre or Tethys,[49] a new portal for marine renewable energy data hosted by the Pacific Northwest National Laboratory that pulls information from MarineCadastre. BOEM also contributes acoustics data to NOAA's NCEI (described further in Section 5.1). Interviewees mentioned BOEM's connection to centralized data repositories as a point of success that the Bureau should consider pursuing for other data types and formats. However, interviewees also mentioned that data portal user-friendliness could be improved. In summary, BOEM collaborators and stakeholders faced a two-tiered issue in locating information on BOEM science:

1. *Awareness of the existence of a particular study or assessment*: Researchers and other stakeholders directly connected to BOEM benefit from multiple points of exposure to BOEM science. The same may not be true for individuals and organizations on the periphery or outside of BOEM's network. One state agency interviewee explained that they are interested in BOEM science to inform their agency's future decision-making about offshore wind siting; however, they have not yet been able to develop connections with individual staff within the Bureau or identify resources that could inform their own policymaking and struggled to understand how to do that.[50] This issue is tied with the dissemination of BOEM science through its various channels

[48] ResearchGate can be accessed at https://www.researchgate.net/.

[49] BOEM is a Tethys contributor. Tethys can be accessed at https://tethys.pnnl.gov/.

[50] For context, this interviewee was from a state agency with a nascent offshore wind program and may not have been the ideal connection for the interview. While many interview candidates were identified directly by BOEM staff, others were not, and there were some contacts at state agencies that IEc had to locate based on the agency name alone.

and points to a need to expand the methods of information sharing to include a wider range of audiences.

2. *Locating the information:* If a stakeholder or collaborator knows that the information exists, they may still encounter difficulty in finding the information on BOEM's web page or ESPIS. This difficulty in locating information is a barrier to stakeholders not already connected to BOEM. A recommendation from the internal evaluation (Year 2) was to improve the search algorithm functionality in ESPIS. BOEM recently launched ESP Hub, which improves not only the search functionality within the ESPIS database, but also the user experience, with ESP "themes" grouped by type (e.g., biophysical, chemical, physical, and social sciences). Themes are study topics like shipwrecks, subsistence, or environmental justice studies. While BOEM is actively working to improve public accessibility to studies and assessments, encouraging the use of academic networking channels like ResearchGate and Google Scholar by BOEM staff, contractors, and awardees could further improve the searchability of BOEM reports.

5.3 ARE BOEM'S ENVIRONMENTAL PRODUCTS USED EXTERNALLY AND HOW?

Survey results and interview findings alike indicate that stakeholders frequently use BOEM environmental products to inform their own future research studies (e.g., in their literature reviews to identify data gaps or understand the state of the science). BOEM's environmental products, including environmental studies and assessments, are used for environmental analyses, policy, and planning. Some interviewees also reported using BOEM study products and assessments to inform their external environmental assessments, a finding supported by the external citation analysis (though the use of BOEM assessments varied considerably among external citations). BOEM science informs planning and policy decision-making, as well as industry operations, resource use, and management practices—especially for ocean renewable energy, a fast-growing area of research at BOEM. However, BOEM does not have a formal system for tracking the impact of BOEM science on the external environmental community. This section, based on information from the interviews and survey, discusses in detail the types of BOEM environmental products that external stakeholders use, and how they use them.

Survey Results

External stakeholders and decision-makers use BOEM science to inform environmental analyses and for planning and policy decisions. Most (87%) of the respondents who conduct environmental analyses found information from BOEM studies "somewhat useful" or "very useful" in providing scientific information to inform environmental analyses (Figure 11). Additionally, 65% of respondents found information from BOEM studies "somewhat useful" or "very useful" in informing policy and planning decisions (Figure 12). In Figure 11 and Figure 12, "not applicable" responses indicate the respondent does not use BOEM studies for those purposes.

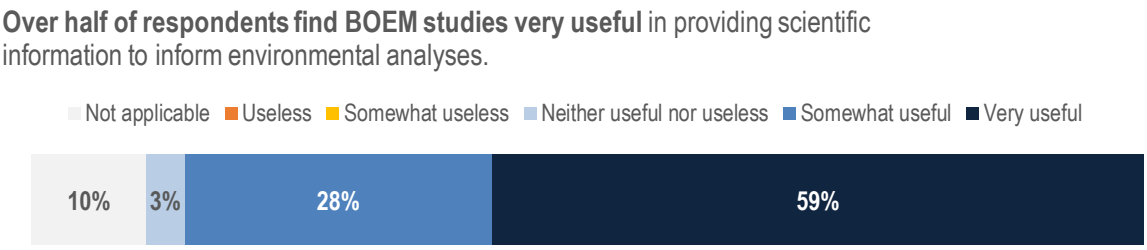

FIGURE 11. USEFULNESS OF BOEM STUDIES IN PROVIDING SCIENTIFIC INFORMATION TO INFORM ENVIRONMENTAL ANALYSES

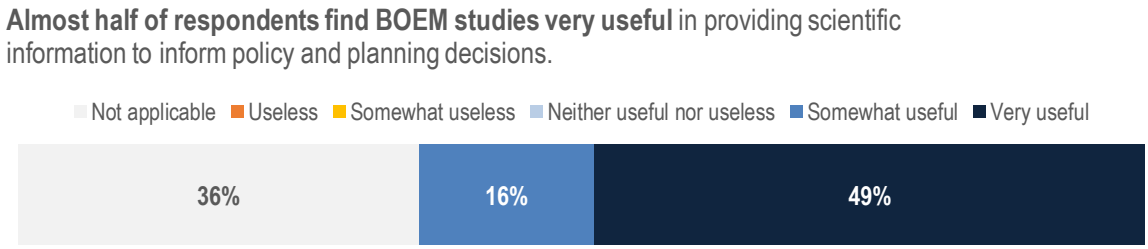

FIGURE 12. USEFULNESS OF BOEM STUDIES IN PROVIDING SCIENTIFIC INFORMATION TO INFORM POLICY AND PLANNING DECISIONS

Survey respondents primarily use BOEM's environmental studies and assessments to inform future research. Eighty-four percent of respondents who received information from studies use it to inform their future research (Figure 13). Analysis on open-ended responses indicates that respondents are using BOEM environmental studies covering subject areas such as renewable energy development, oil and gas surveys and extraction, fish, benthic communities, and marine mammals.

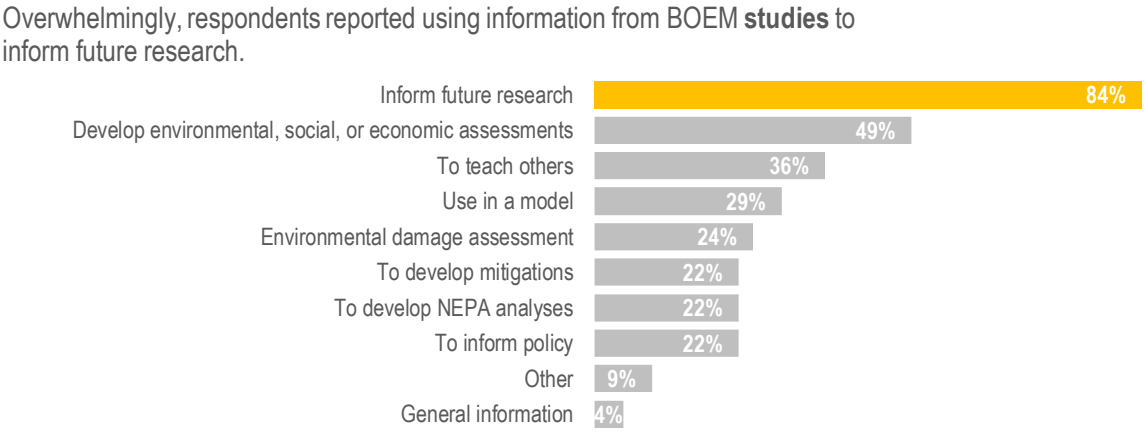

FIGURE 13. REPORTED USES OF INFORMATION FROM BOEM STUDIES

Survey results also indicate that 68% of respondents who received information from assessments use it to inform their future research (Figure 14). Although this was the most common use of assessments, it was

lower than the 84% who use BOEM studies to inform future research. When comparing the use of BOEM products (studies vs. assessments) across the other types of uses, there are more similarities between the use of studies and assessments. For example, developing environmental, social, or economic assessments was the second most selected response for respondents who receive information from studies (49%) and respondents who receive information from assessments (46%).

Other differences in the use of information from studies vs. assessments indicates 36% of respondents use information from BOEM studies to teach while only 25% use information from assessments to teach. This is not a surprising finding given the collaboration between principal investigators/academics and their graduate students on BOEM studies. Respondents indicated that they used BOEM assessments to develop mitigations at a higher rate (36%) than information from studies (22%). This emphasizes that although some key uses are the same between studies and assessments, there are also differences in the type of information needs they fulfill.

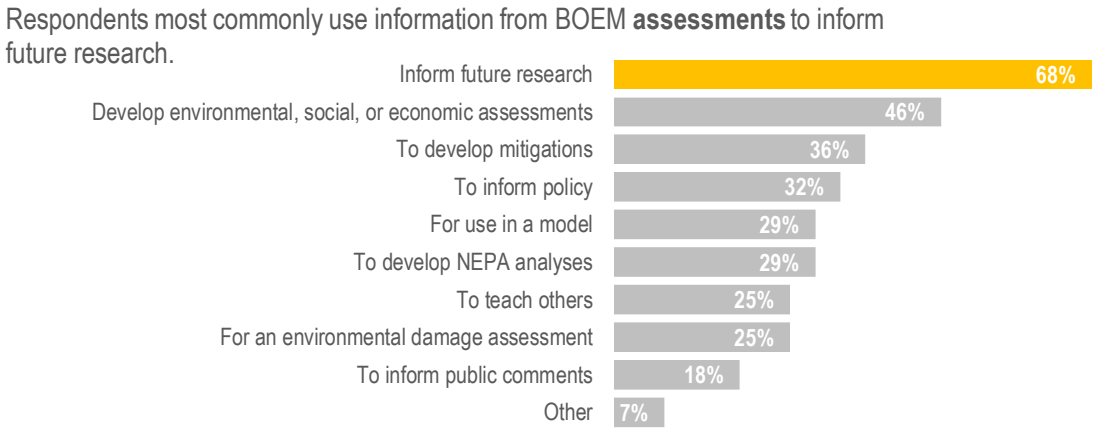

FIGURE 14. USES OF INFORMATION FROM BOEM ASSESSMENTS

Interview Findings

Academics and external federal and state agencies use BOEM studies in their research, datasets, and models. Interviewees of all types (though predominantly academics) described using BOEM studies and datasets to generate research ideas and address known data gaps. Academics also reported citing BOEM studies, data, and (to a lesser extent) assessments in peer-reviewed publications authored by themselves or their non-BOEM colleagues. When academic interviewees reported contributing to BOEM studies, they typically identified using these studies in their other research and academic publications. Researchers commonly use self-citation to build on their earlier work and ensure broad reach of their science.

The interviews included a series of questions exploring the use of BOEM study products to inform research studies and products derived from research (e.g., integrated datasets or models) conducted by the non-BOEM federal and state agencies. Federal and state agency interviewees frequently reported using BOEM studies to inform both i) external products derived from research studies conducted by their agency (e.g., integrated datasets) (Figure 15) and ii) external research studies (Figure 16). For example, one state agency interviewee identified that they use BOEM studies on EMF-related issues for whales and

other marine mammals for scoping research at their own agency. Similarly, BOEM science laid the groundwork for the state's research on marine mammal migration patterns and ambient and offshore wind related noise impacts. A federal interviewee described using BOEM studies as background and literature references for other reports that more closely relate to the federal actions with which they are involved.

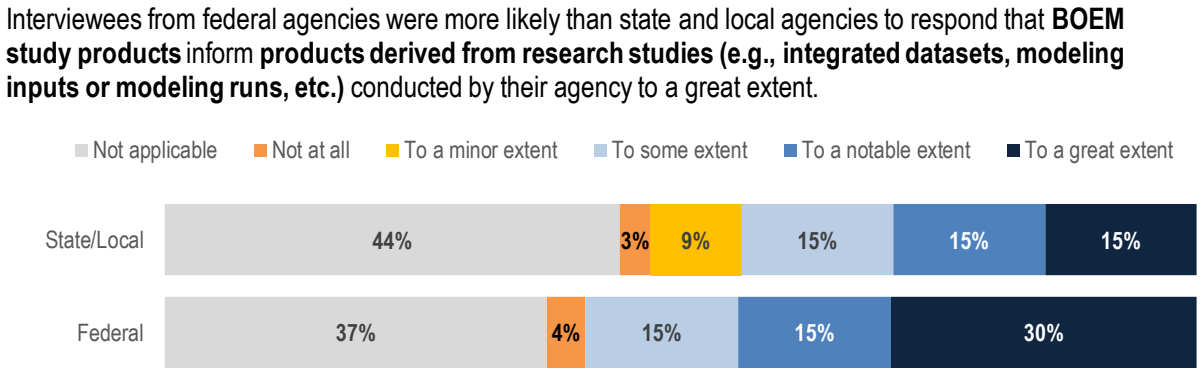

FIGURE 15. REPORTED STATE AND FEDERAL USE OF BOEM STUDY PRODUCTS TO INFORM PRODUCTS DERIVED FROM RESEARCH STUDIES (E.G., DATASETS)

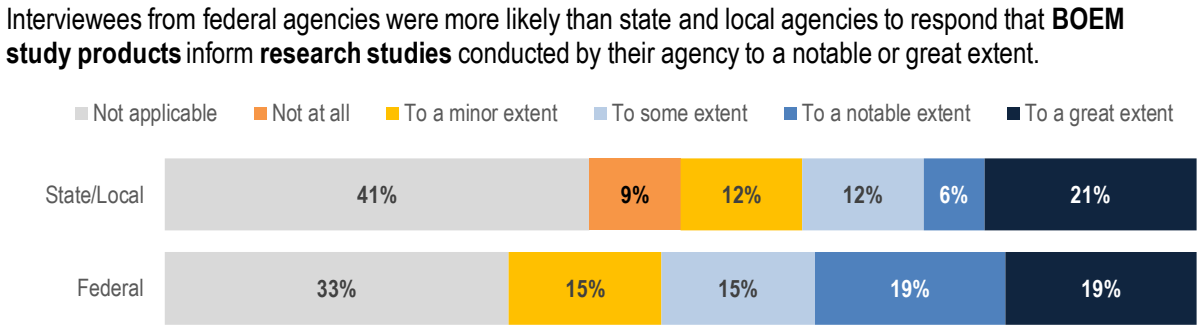

FIGURE 16. REPORTED STATE AND FEDERAL USE OF BOEM STUDY PRODUCTS TO INFORM RESEARCH STUDIES

Stakeholders use BOEM assessments to inform external research, including assessments and other environmental analyses. Federal and state interviewees explained that their agencies use BOEM assessments to inform their own assessment work, both in terms of scoping impacts and identifying studies for additional research. Few academics reported using BOEM assessments to inform their work. Context from the interviews suggest that state stakeholders are often interested in reviewing BOEM assessments to inform their own data analysis and interpretation as a part of their response to NEPA and other federal review processes. One state interviewee explained that understanding coastal effects is a part of their responsibility for the federal consistency review under the CZMA. When they evaluate the potential impact on coastal resources from federal lease sites offshore, they use BOEM assessments to help identify data gaps and potential impacts.

When asked about their use of BOEM-led environmental assessments to inform research, less than half of state and federal agency interviewees reported using BOEM-led environmental assessments to inform their own research studies and environmental analyses. Those that did report using BOEM-led environmental assessments to inform research most often explained that use was to some extent or to a minor extent. Few federal and state interviewees report using BOEM-led environmental assessments to inform environmental analyses, though it was somewhat more common for state agencies than federal agencies.

BOEM science informs policy and resource management decisions. Some state and federal interviewees reported using BOEM study products to inform their external environmental assessments (e.g., BOEM studies filled data gaps in their own datasets) (Figure 17), or even planning and policy decisions, often in the context of offshore wind and other renewable energy. Some state and federal interviewees reported that their agency uses BOEM assessments to inform planning and policy decisions for offshore energy and natural resource management. One state interviewee explained that BOEM studies inform the state's natural resource and marine spatial planning, as well as their feedback and formal comments on upcoming lease siting conversations. Other interviewees identified that BOEM studies on sand borrowing and extraction for construction and beach nourishment, marine acoustics, EMF, and large marine mammal behaviors filled specific data gaps that help inform their resource management decision-making and policymaking. Also, interviewees report that BOEM studies from the *Deepwater Horizon* spill in the GOM continue to inform state and federal-level policymaking decisions.

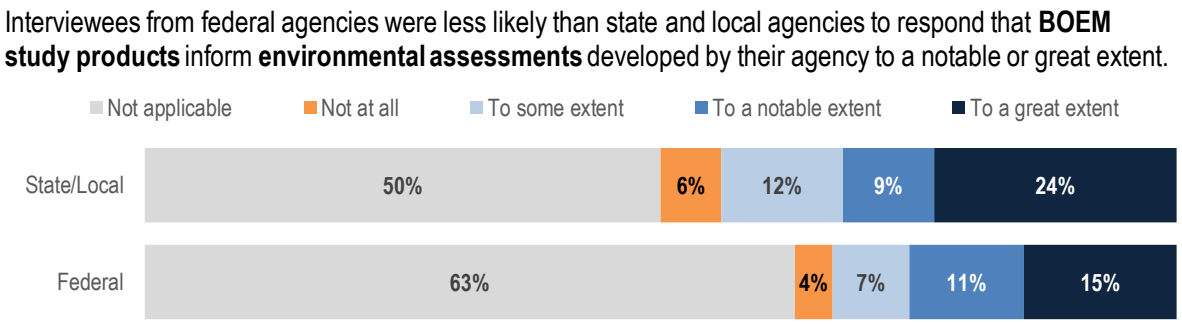

FIGURE 17. REPORTED STATE AND FEDERAL USE OF BOEM STUDY PRODUCTS TO INFORM ENVIRONMENTAL ASSESSMENTS

BOEM science informs industry operations, resource use, and management practices. Interviewees frequently mentioned that BOEM products are used by industry to inform offshore energy siting/leasing/operations. Interviewees in BOEM's Pacific Region typically mentioned oil and gas operations in the past tense, and sometimes described decommissioned or derelict offshore oil and gas platforms as artificial reefs, which is one possible use for the equipment after its original purpose is retired. One interviewee with an academic-style role in industry reported that the energy industry (broadly) uses BOEM studies to investigate new energy leasing opportunities (particularly offshore wind); assess potential uncertainties, known or suspected impacts, and risk; and understand what types of hurdles may lie in the way of permitting.

Interviewees also reported that BOEM products inform fishing industry practices or guidelines for indigenous subsistence hunting for marine mammals in the Alaska Region. Interviewees identified using BOEM study and assessment findings to inform the practice of beach nourishment and marine mineral resource use practices. Though interviewees mentioned deep-sea mining in a limited way (four mentions total across federal and state interviewees), they identified the topic as a new area of research for BOEM and for the broader scientific and regulatory communities as it is considered for commercial resource use. Interviewees described BOEM scientific research as critical to generating baseline information about this nascent natural resource management area, particularly because the topic is a "frontier topic" and stakeholders, including academics and government agencies from multiple jurisdictions, are eager to understand the state of the science on the topic.

5.3.1 Which BOEM environmental documents are cited in external products, such as assessments produced by other federal or state agencies?

Assessments produced by other federal or state agencies, and external journal articles, cite BOEM study reports and journal publications. BOEM study products were consistently cited in external assessments: of the approximately 240 external assessments included in the inventory, approximately 56 percent cited at least one study. However, there were large variations across regions, topics, and sources. Assessments that BOEM contributed to have more citations compared to assessments where BOEM was not a contributor.

BOEM study products were consistently cited in external assessments, but there were large variations across regions, topics, and sources. External assessment documents cited approximately 250 unique studies and over 500 individual BOEM study products. This data reflected 31 percent of unique studies (11 percent of study products). This percentage is slightly lower than the comparable value from the Year 2 analysis of BOEM assessments (40 percent). On average, studies had four citations. Consistent with the Year 2 assessment citation analysis, older studies received more citations than newer studies. Figure 18 compares the two types of study products: BOEM study reports and journal publications. External assessments consistently cited the two types at similar rates over the period of the analysis. This trend contrasts with the internal assessments, where BOEM assessments cited study reports more frequently than publications.

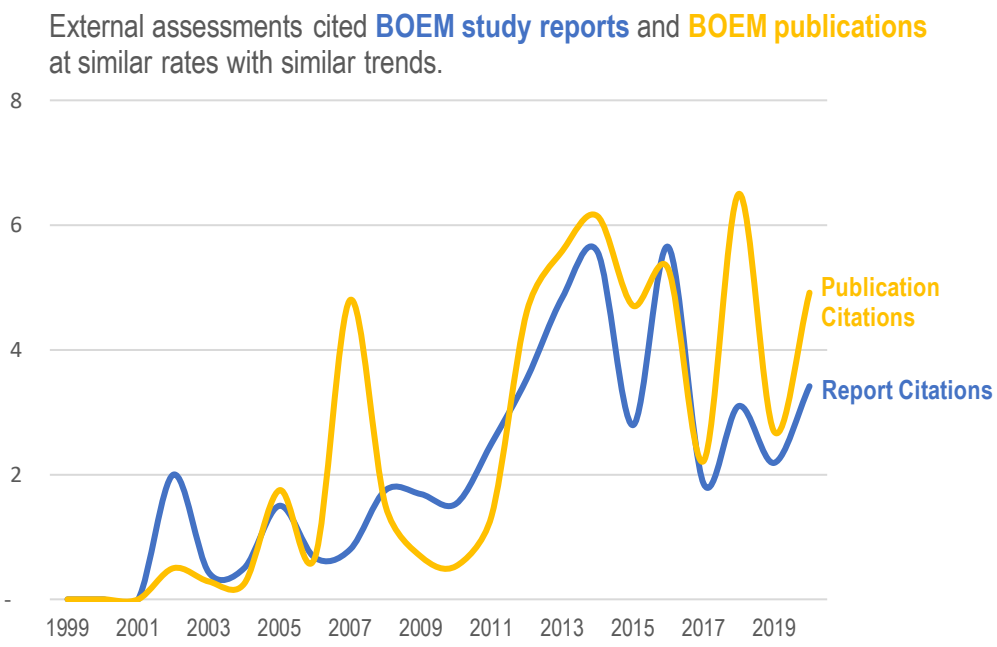

FIGURE 18. BOEM STUDY REPORT AND PUBLICATION CITATIONS PER EXTERNAL ASSESSMENT

Three study topics were above the average percent of studies cited in assessments: marine minerals (79 percent of studies cited at least once), endangered species (61 percent), and biology (35 percent). Socioeconomics and fates and effects (two of the larger study topic categories) were both slightly below the average, at 23 and 27 percent of studies being cited at least once. The citations identified were primarily from the Alaska Region (55 percent of total study citations) and GOM Region (22 percent). Figure 19 presents the percent of studies and assessments, as well as the percent of total citations for each category, by region. Alaska is the only region where the share of total citations for both assessments and studies represented a notably higher percentage than their share of total studies and assessments.

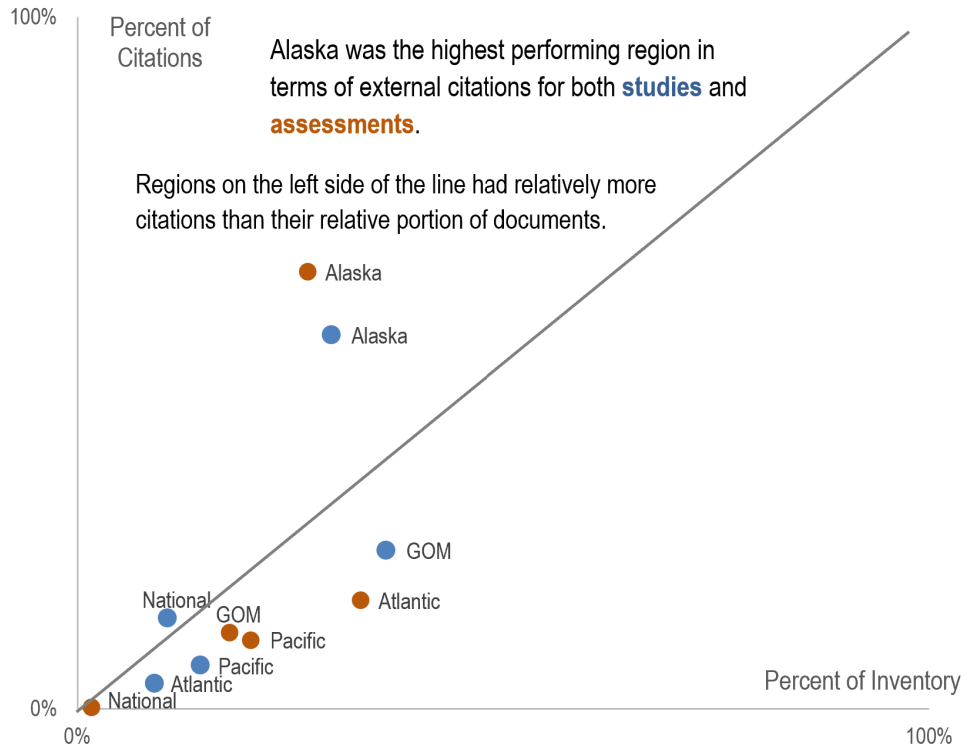

FIGURE 19. RELATIVE PERCENTAGE OF INVENTORY AND CITATIONS BY REGION FOR ASSESSMENTS AND STUDIES

This graph shows overall studies, not study products. If the average number of products per study varies across regions, this might explain some of the difference in the relative percentage of citations by region. As a hypothetical example, if Alaska studies have 10 study products on average, and GOM studies have four products on average, we would expect more citations for Alaska studies (all else equal).

Of the approximately 240 external assessments included in the inventory, approximately 56 percent cited at least one study. Assessments with at least one citation cited seven studies on average; the number of citations per assessment varied greatly. This data is consistent with the internal BOEM assessments, where many citations came from a small number of assessments. Figure 20 provides the distribution of citations across all assessments. The ratio of assessments that cited at least one study varied by region and agency. NMFS, the U.S. Navy, and the U.S. Coast Guard were the agencies with the highest percentage of assessments with citations to BOEM studies (Figure 21). State agency assessments had few citations and fewer than a quarter cited at least one study. Though the sample of state documents is relatively small, the difference between the ratio of federal assessments that cited at least one study (60 percent) compared to state assessments (22 percent) was notable. Federal agencies accounted for approximately 99 percent of total study citations.

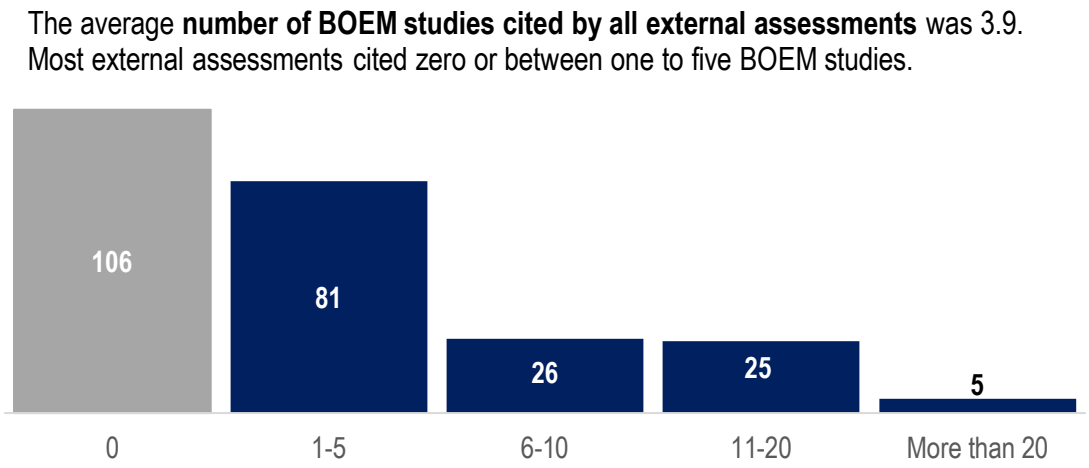

FIGURE 20. DISTRIBUTION OF ASSESSMENT CITATIONS

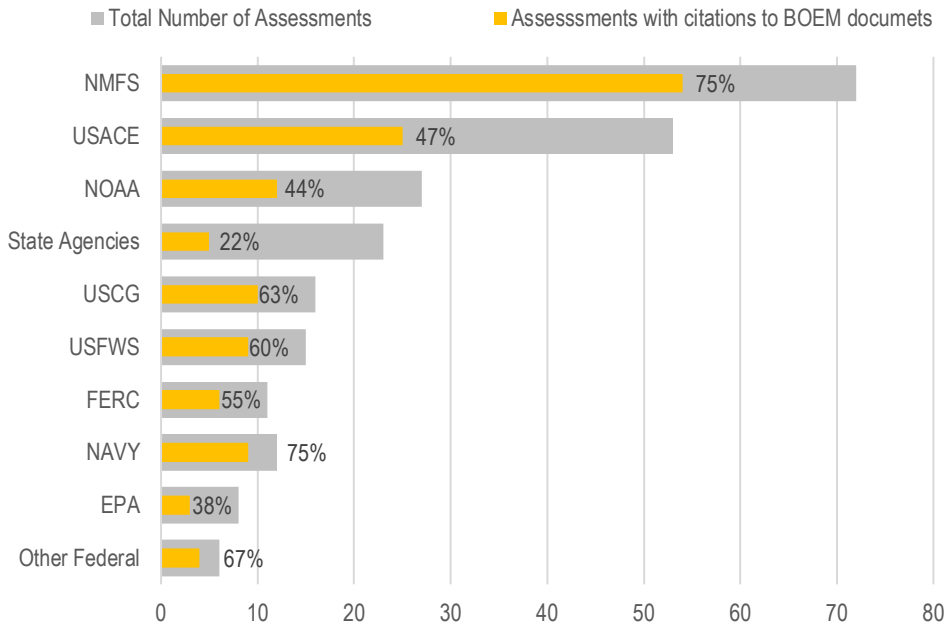

FIGURE 21. BREAKDOWN OF ASSESSMENTS AND CITATIONS BY AGENCY

Assessments that BOEM contributed to have more citations compared to assessments where BOEM was not a contributor. Assessments that involved BOEM in some capacity (e.g., as a cooperating agency) had a notably higher ratio of assessments that cited at least one study and number of citations compared to assessments that did not include BOEM as a lead or cooperating agency (e.g., an assessment for a BOEM-related activity). For all BOEM involved assessments, approximately 70 percent cited at least one BOEM study product. These assessments cited approximately nine studies on average. Forty-seven percent of other assessments for related activities that did not involve BOEM cited at least one study. These assessments cited approximately six studies on average. The percentage of assessments

that involved BOEM is also notable for being consistent with the findings from the Year 2 evaluation (Volume 2), where the percent of BOEM assessments citing at least one study was 73 percent. By source, the NOAA Alaska regional office had the highest ratio of assessments with at least one citation. Many of the other sources were around average (approximately 50 percent) except for State Coastal Management Programs, which were a small subset but had no study citations. Figure 22 provides the breakdown of assessments and citation by source.

It is important to consider the broader context of these results. BOEM would not expect every other federal or state agency to cite BOEM in all of their assessments. However, agencies with activities, interests, and programs that align with BOEM would be expected to have a higher percentage of assessments with citations to BOEM study products. Agencies with activities related to oceanography and ocean science should have higher percentages than agencies that are not focused on such topics. For example, it makes sense that NMFS has a high percentage of citations given its focus on national marine resources. Conversely, EPA, which regulates air and water quality (among other issues) and does not study ocean science, has a lower percentage of assessments citing BOEM science.[51] NOAA, with a slightly below average percentage, appears as an outlier to this logic. However, most NOAA documents without citations to BOEM study products were National Marine Sanctuary Conditions Reports (Figure 22), which are location specific and had relatively short reference sections (five pages or less). These factors also apply for state agency documents, such as Coastal Zone Management Plans.

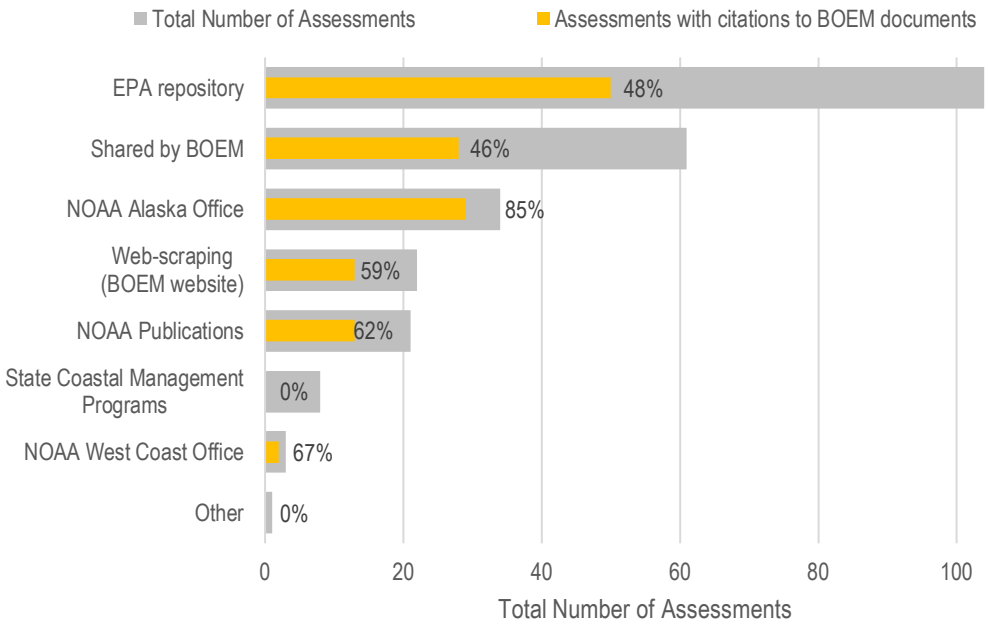

FIGURE 22. BREAKDOWN OF ASSESSMENTS AND CITATIONS BY SOURCE

[51] Although BOEM would not expect many EPA documents to cite BOEM science, this study's opportunistic collection of external assessments did focus on identifying EPA documents that overlap with BOEM research topics. All EPA assessments analyzed focused on either ocean dredging or discharge from offshore oil and gas facilities and plausibly could have cited BOEM studies.

5.3.2 Which peer-reviewed publications resulted from ESP-funded projects?

IEc's work as part of the Year 1 evaluation approach methodology (Volume 1) identified the body of publications associated with ESP-funded projects between 1999 and 2019 (the evaluation timeframe), using a version of the ESPIS database from October 2020 and additional complementary searches. This resulted in the addition of several publications, including *Alaska OCS Region, Fully/Partially Funded or Data/Sample Contribution Peer Reviewed Publications* list, publications reported in the Environmental Studies Program-Performance Assessment Tool (ESP-PAT), and publications identified through a Google Scholar search of BOEM (or its predecessor agency, the Minerals Management Service) obligation number for inclusions in the acknowledgments of the report. Additional, detailed information on our methodological approach is available in the *BOEM Published Documents and Outside Publications Associated with Studies* section of Volume 1 of this report. This step was a necessary prior to conducting the Year 2 internal evaluation. Specifically, IEc used this list of publications to conduct the internal assessment citation analysis. For consistency with the internal evaluation, IEc used the suite of peer-reviewed publications resulting from ESP-funded projects in Year 3. The full list of publications IEc identified from ESP-funded projects is available in Appendix D.

In Year 3, IEc expanded the analysis to look for citations in the scholarly literature of the journal publications associated with ESP-funded projects. Using SerpAPI to web scrape Google Scholar, IEc was able to find citation data for 1,123 journal articles associated with ESP-funded studies. This represented roughly 54 percent of the approximately 2,100 journal articles in the publication list.[52] These results showed that journal publications resulting from ESP-funded studies are being cited externally on a frequent basis. The average article was cited 67.5 times, with a maximum of 2,025 citations (this was an outlier as only four articles had more than 1,000 citations).[53] Though some journal publications were not cited externally, 94 percent of the publications had at least one external citation. Figure 23 shows the distribution of citations per article. These results suggest that the authors of external journal articles are frequently using information from BOEM-funded studies in their research.

[52] IEc removed internal reports from the search as Google Scholar's database primarily comprises journal articles.

[53] These four publications were (1) Steneck RS, Graham MH, Bourque BJ, Corbett D, Erlandson JM, Estes JA, Tegner MJ. 2002. Kelp forest ecosystems: biodiversity, stability, resilience and future. Environmental Conservation. 29(4); (2) Caley MJ, Carr MH, Hixon MA, Hughes TP, Jones GP, Menge BA. 1996. Recruitment and the local dynamics of open marine populations. Annual Review of Ecology and Systematics. 27; (3) Allison GW, Lubchenco J, and Carr MH. 1998. Marine reserves are necessary but not sufficient for marine conservation. Ecological Applications. 8(1); and (4) Fleeger JW, Carman KR, Nisbet RM. 2003. Indirect effects of contaminants in aquatic ecosystems. The Science of Total Environment. 317(1-3).

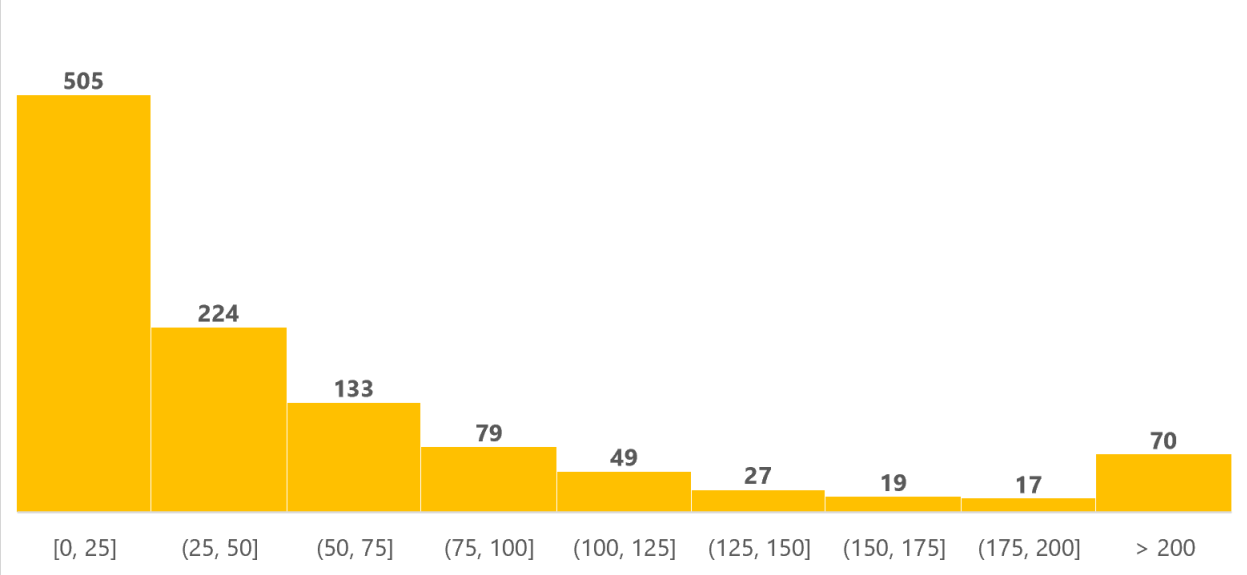

FIGURE 23. CITATIONS OF JOURNAL PUBLICATIONS RESULTING FROM BOEM STUDIES (GOOGLE SCHOLAR)

To better understand the reach and impact of journal publications resulting from BOEM studies, we looked at outputs from the A&I tools wizdom.ai and Dimensions alongside Google Scholar. For each A&I source, we reviewed metrics for the top 15 articles from four sources that we reviewed throughout this study (the assessment citation analysis, publications referenced in the Year 2 internal evaluation interviews, publications referenced in the Year 3 external interviews, and those found using the SerpAPI Google Scholar tool). Table 2 provides a summary of these results. We provide a full list of the articles we reviewed along with their individual citation counts and impact ratings as Appendix E.

TABLE 2. CITATION COUNTS AND IMPACT RANKINGS FOR TOP-REFERENCED JOURNAL ARTICLES RESULTING FROM BOEM STUDIES, ACROSS SOURCES

A&I Tool	Metric	Year 3 Assessment Citation Analysis	Year 2 Internal Evaluation	Year 3 Interviews	Google Scholar
	No. of Articles Analyzed[1]	15	16	15	16[2]
Wizdom.ai	Avg. Citations	36.0	57.1	33.7	466.3
	Max Citations	83	265	243	1,189
	Avg. RCR (OA)	1.1	1.5	2.3	10.6
	Max RCR (OA)	3.0	9.6	7.7	24.4
Dimensions	Avg. Citations	38.9	67.6	40.1	524.7
	Max Citations	94	298	278	1,300
	Avg. RCR (NIH)	0.2	0.5	0.5	9.1
	Max RCR (NIH)	1.6	5.5	3.1	13.0
	Avg. FCR	3.1	5.3	8.8	56.3
	Max. FCR	9.8	35.0	79.0	188.0
Google Scholar	Avg. Citations	141.3	126.6	69.4	867.4
	Max Citations	661	436	533	2,025

[1] IEc reviewed 16 articles in cases where there was a tie in the 15th most-referenced or cited publication.
[2] The Google Scholar metrics represented in this table are based on only the top 16 with the highest citation counts.
FCR = Field Citation Ratio; RCR = Relative Citation Ratio

Through this effort we found the following:

- **External publications frequently cite journal articles resulting from BOEM studies.** Across all four publication sources, we found average citation counts across the top 15 most-cited articles ranging from a minimum of 69.4 (Year 3 interview cited products) to a maximum of 867.4 (Google Scholar tool most-cited articles).[54] The most-referenced publication from Google Scholar had a citation count of 2,025 within Google Scholar.[55] This was substantially higher than the most-cited article from the Year 3 external interviews (533), Year 2 internal interviews (436), and assessment citation analysis (611).[56]

[54] These results are based on the total citations for each article in Google Scholar, which found the most citations for each article across any tool.

[55] Dimensions found 1,300 citations for this article, while Wizdom.ai found 1,189.

[56] The averages and maximums presented here reference the citation counts from Google Scholar, which consistently found the most external citations. We present this data because we believe Google Scholar to be a more comprehensive search engine for finding the full suite of external citations.

- **Google Scholar consistently yields more citation counts than other sources we reviewed.** When comparing the average and maximum number of citations across each publication source, Google Scholar consistently reported the most external citations. For example, Google Scholar found an average of 141.3 citations for the top 15 articles in the assessment citation analysis, compared to 38.9 found through Dimensions and 36.0 in wizdom.ai.

- **There was little overlap in the 'top publications' across all four publication sources.** Only two articles appeared in the top-15 lists of multiple publication sources (each occurring in both the assessment citation analysis and Year 2 internal interview products).[57] This finding may suggest that internal and external collaborators are using different sets of information when they are accessing BOEM science. Based on the average number of citations between the 'top publications' that Year 2 internal interview participants and the Year 3 external interview participants referenced, the publications that BOEM staff most frequently use are cited at a higher rate than those referenced by external collaborators; the average citation counts for publications referenced by Year 2 internal interviewees are higher than those referenced by Year 3 external interviewees, across all A&I tools. That BOEM interviewees referred to a higher number of cited publications might suggest that BOEM staff are more familiar with the most widely cited publications, and therefore in a strong position to share broadly relevant information with external stakeholders.

- **Relative Citation Ratio (RCR) and Field Citation Ratio (FCR) metrics produced by Dimensions and wizdom.ai suggest that the most frequently cited journal articles resulting from BOEM studies are highly influential publications in their respective fields.** Both wizdom.ai and Dimensions calculate RCR, a "citation-based measure of the scientific influence of a publication."[58] RCR values center around a score of 1.0, so that a publication with an RCR of 1.0 has received the same number of citations as would be expected based on a "typical" article across those tracked by each tool. Though the definition of a "typical" article varies across source (with wizdom.ai tying this to open-access articles in its database, and Dimensions anchoring to NIH studies), the top articles across each publication source often had RCRs substantially above 1.0 when measured by each A&I tool. Although average RCR values were below 1.0 in Dimensions for assessment citation analysis, Year 2 internal assessment, and Year 3 interview products, Google Scholar RCRs were substantially higher (with an average Dimensions RCR of 9.1). Furthermore, the FCR[59] that Dimensions calculates, which aligns more directly with publications within these articles' given fields, yielded substantially higher results. This metric, which also centers around 1.0, journal articles resulting from BOEM studies averaged FCRs of between 3.1 (assessment citation analysis referenced publications) and 56.3 (most-cited publications from Google Scholar), suggests that these articles were frequently cited at a substantially higher rate than other publications within the same year and field of research.

[57] We found many of the top 15 articles from the assessment citation analysis, Year 2 internal interviews, and Year 3 external interviews through the Google Scholar search, but these were not within the top 15 most cited articles from that analysis.

[58] https://dimensions.freshdesk.com/support/solutions/articles/23000018841-what-is-the-rcr-how-is-the-rcr-score-calculated-

[59] FCR is calculated by dividing the number of citations a paper has received by the average number received by documents published in the same year and in the same Fields of Research (FoR) category. https://dimensions.freshdesk.com/support/solutions/articles/23000018848-what-is-the-fcr-how-is-it-calculated-

Finally, we analyzed the number of times journal articles resulting from BOEM studies have been cited based on each publication's topic area using our Google Scholar results. Table 3 shows the total number of publications by topic, along with the average and maximum number of citations within that topic area from Google Scholar. Of the 1,123 articles we analyzed, roughly two-thirds could be categorized as "oil and gas surveys and extraction" (749 articles).[60] Publications centered around "oil spill" had the highest average citation count across all topic areas (86.4), followed by "marine minerals extraction" and "climate change" (82.9 and 76.4 average citation counts, respectively). While "marine minerals extraction" and "climate change" publications were frequently cited, the combined total number of publications in these categories represented less than 10 percent of the full publication list compared to 22 percent for "oil spill" documents.

TABLE 3. NUMBER OF ARTICLES AND CITATION COUNTS FOR TOP-REFERENCED JOURNAL ARTICLES RESULTING FROM BOEM STUDIES, BY TOPIC AREA

Topic Area	Publications[61]	Avg. No. of Citations (Google Scholar)	Max No. of Citations (Google Scholar)
Oil and Gas Surveys and Extraction	749	71.2	2,025
Oil Spill	246	86.4	2,025
Renewable Energy Development/Wind	72	36.8	535
Climate Change	56	76.4	800
Marine Minerals Extraction	50	82.9	664
Submarine Transmission Lines	43	16.7	53
General BOEM Activities	21	37.7	126
Fisheries Use and Management	19	17.9	76

5.3.3 What is the system for tracking BOEM's impact on the external environmental community and how can it be improved?

BOEM does not appear to have a structured, comprehensive system for tracking its impact on the external environmental community. While BOEM can trace its impact using metrics like the number of published articles in peer-reviewed journals developed from BOEM studies (e.g., these data can be gleaned from ESPIS or the new ESP Hub), the number of working groups BOEM staff participate in, the number of conferences at which BOEM-funded scientists present their findings, or the number of data portals drawing directly from or linking directly to MarineCadastre.gov, these do not capture the broader impact of BOEM science. Similarly, BOEM can measure its impact on the external scientific community based in part on the number of scientists funded by BOEM's ESP and IDIQ contracts, number of studies conducted annually, number of assessments, number of public forums held, and number of public

[60] Multiple topic areas were allowed per publication.

[61] Some publications fell within multiple topic areas.

comments received. BOEM could also track ESPIS or ESP Hub site visitation or data downloads as one way to gauge the users of BOEM science, but this too is an incomplete metric, given the number of stakeholders and regular contributors to BOEM science that expressed challenges with using the ESPIS database.[62] Also, these types of metrics (mostly simple counts) do not fully capture BOEM's influence on the state of the science or how BOEM science informs policy and planning decisions. Interview data also suggest that, to some extent, BOEM's impact on the external environmental community can be characterized through the total number of principal investigators, scientists, and students funded by BOEM's ESP (discussed in Section 5.5).

Although external interviews did not reveal any specific system for tracking BOEM's impact on the external environmental community, interviews did provide some recommendations for improving the tracking of BOEM's impact externally:

- *Engage (virtually) with principal investigators, scientists, and stakeholders on a regular basis.* A small number of interviewees suggested using regular webinars, "meet and greet" sessions (especially with university programs), or "virtual office hours" to connect with individuals interested in collaborating with BOEM. They offered the example of the National Science Foundation, whose program managers host virtual office hours on specific topic areas and when a new request for proposals is announced. Virtual office hours are open to the public so people can ask questions before submitting a proposal. NOAA hosts a webinar series that has featured BOEM presentations in the past. One interviewee suggested that BOEM could periodically host a panel discussion or Question & Answer session on a specific subject, such as Traditional Ecological Knowledge, cultural resources, archaeology, or issues specific to states or regions. BOEM staff could estimate attendance at these events as a simple measure of impact.

- *Publish studies and calls for study ideas to more listservs and track the number of posts and recipients.* Listservs, or email recipient lists that individuals may opt into to receive communication, are one way that existing BOEM connections receive calls for study ideas and requests for proposals (RFPs). BOEM offers email list signups on its website: the user can select a specific type of mailing list (or multiple types), and then receive direct communication from BOEM. If BOEM expanded its reach to include a broader set of stakeholder-hosted listservs, then a wider audience could learn about the opportunities. For transdisciplinary or applied research areas (e.g., offshore wind), publishing BOEM calls for study ideas to a listserv could reach state or federal contacts as well as academic contacts. Interviewees also mentioned tapping into academic or university newsletters as a way of sharing this information. BOEM could use listserv posts of study reports or calls for study ideas as another measure of impact, with the number of recipients as an indicator of the overall visibility of those posts.[63]

[62] Note that interview data were collected prior to the release of the ESP Hub, so the reported user perceptions of ESPIS are based on the database itself, rather than the Hub. ESP studies are now discoverable using internet search engines like Google or Bing.

[63] Occasionally, listserv sign-up sites list the total number of recipients on the list (sometimes as a ballpark figure or as of a specific date) as part of sharing best practices for using the listserv (e.g., to not reply all).

5.4 HOW DO EXTERNAL STAKEHOLDERS CONTRIBUTE TO BOEM'S ENVIRONMENTAL PRODUCTS?

External stakeholders and collaborators contribute to BOEM's environmental products primarily by conducting research for studies and participating in environmental assessments. Survey results and interview findings converge on this topic. Interviewees—often (but not always) academics—described that they are primarily submitting study ideas through BOEM's ESP annual call for ideas and then conducting the studies with their own teams if they are awarded a contract.[64] State and federal interviewees explained that they participate in environmental assessments through formal channels, such as submitting comments through the NEPA process. Interviewees also explained that they also contribute to BOEM's environmental products by identifying knowledge gaps and generating new study ideas (e.g., through the ESP annual call for ideas). This section, based on information from the interviews and survey, discusses in detail the ways in which external stakeholders contribute to BOEM's environmental products.

Survey Results

Survey results indicate that external stakeholders contribute to BOEM's environmental products by participating in research efforts and environmental assessments. In open-ended responses, survey respondents reported participating in BOEM-funded science related to offshore wind impacts, marine mammal habitats, and physical oceanography, and assessments related to the environment and archaeological and historic resources. Interview findings provide more specific, in-depth information on this topic.

Interview Findings

BOEM stakeholders conduct studies. External stakeholders primarily contribute to BOEM's environmental products by conducting or participating in ESP-funded studies. Scientists submit study ideas through the annual call for ideas and study proposal process, publicized on BOEM's website. Some academic interviewees also noted that they often receive BOEM's annual call for study ideas through their various listservs. BOEM requires scientists to present their ESP-funded study results to an audience, and they are also encouraged to publish in peer-reviewed scientific journals. Most, though not all, of the academic interviewees received ESP studies funding. Scientists who can anticipate BOEM's data needs based on the range of past and presently ESP-funded studies (as well as BOEM's five-year program for oil and gas leasing and the new five-year program for renewable energy leasing) and propose their own research in the context of ESP's priorities appear to be successful in continuing to win contracts with the Bureau. Scientists with a BOEM staff connection ask for feedback on their proposed study ideas and modify study plans accordingly.

BOEM's federal partners sometimes contribute to BOEM environmental products through interagency agreements, where they leverage the overlap between BOEM priorities and their own and plan for future work together. One example of such an interagency agreement is among BOEM, NOAA, and USGS (along with five universities and the National Oceanography Centre, a nonprofit based in the United

[64] In some cases, consulting firms compete for "Indefinite Delivery, Indefinite Quantity" (IDIQ) contracts through BOEM, where they collect data, conduct analyses, and publish white papers on various ocean science topics.

Kingdom) for research in the Escanaba Trough.[65] Occasionally BOEM's federal and state stakeholders offer study ideas without the intention to compete for funding. Where BOEM can fund an idea as a study or integrate it with an existing funded study, the state or federal stakeholder benefits from the science.[66]

BOEM stakeholders identify knowledge gaps. Some academic interviewees explained that they occasionally participate on BOEM-hosted conference panels to not only disseminate BOEM science, but also synthesize information on a topic of interest, including knowledge and data gaps and future research needs. Some academic interviewees also described interpreting findings from past ESP studies (i.e., as a subject matter expert) to help BOEM staff describe the importance of features like environmental phenomena, species-specific behaviors, or unique habitats, for example. State and federal agency interviewees reported that they occasionally participate in interagency discussions on ocean research agenda-setting and priorities. For example, NOAA and BOEM have several overlapping research needs. Federal agencies sometimes meet formally to discuss the intersections of their work and places where they (or BOEM) can leverage resources to gather data or conduct analysis "based on mutual interests" to fill important knowledge gaps.

BOEM stakeholders generate new study ideas. Closely related to the identification of knowledge gaps, external interviewees reported their role in generating new study ideas for BOEM. Interviewees who have submitted study ideas through BOEM's annual call for ideas reported that they sometimes discuss potential ideas with BOEM staff as a way of gauging interest or understanding BOEM's studies agenda. During the study itself, BOEM collaborators work to fill holes within a dataset or collect additional data to complement existing datasets. Multiple scientists explained that they submit study profiles every year in response to BOEM's annual call for ideas. Multiple interviewees described a frequent exchange of ideas with BOEM staff in the interest of ESP science. In some cases, the ideas shared were incorporated into a request for proposals, while in others the ideas were more nascent, requiring refinement.

Idea sharing also impacts BOEM at a higher level, even guiding BOEM's research priorities. One interviewee reported developing a list of 15 questions that BOEM should answer before decommissioning oil platforms. The list was reportedly offered to OEP, where the 15 ideas were scored and later funded by the ESP. Another interviewee observed a change in BOEM's research priorities in response to a comment at an industry meeting or trade association conference that the industry was shifting toward drilling in deep water and needed more data on offshore impacts. These anecdotes were less common compared to the other methods of idea sharing and illustrate BOEM's responsiveness to stakeholder research interests.

Importantly, not all scientists are so forthcoming with their study ideas. One interviewee reported that they have colleagues that are skeptical, even distrustful, of this process and therefore are less openly

[65] See for example NOAA's webpage: NOAA. 2022. Escanaba Trough: exploring the seafloor and oceanic footprints. *Ocean Exploration.* Accessed online Jan. 2023: https://oceanexplorer.noaa.gov/explorations/22escanaba/welcome.html

[66] BOEM also awards IDIQ contracts to consulting firms who compete for funds with bid proposals explaining their firm's strengths and areas of expertise in environmental engineering or biophysical ocean science. IDIQ contracts are not a part of the annual ESP call for study ideas and award cycle; rather, IDIQ-contracted firms manage task orders assigned by BOEM within their contract period. When the contract period expires, firms recompete for the IDIQ contract. IDIQ tasks may support ESP-funded studies or other BOEM work. Interviewed IDIQ-contracted scientists report that they primarily contribute to BOEM studies through data collection, sharing of ideas for new study components, and generating white papers.

collaborative. The interviewee explained that their colleagues (faculty at universities) were hesitant to provide ideas to BOEM in the RFP process because the scientists do not want *others* to be awarded with contracts to study *their* ideas. This potential barrier to the ESP process is new to this evaluation and was not captured in the Year 2 report (Volume 2).

BOEM stakeholders contribute to BOEM assessments. Some interviewees described their contracted work with the Bureau to prepare EISs and EAs.[67] Importantly, these contracts are not awarded to the same individual or organizations who conduct the studies. Therefore, another way that interviewees contribute to BOEM science is through the interpretation of BOEM studies for use in BOEM assessments. EISs and EAs, for example, sometimes require significant analysis based on the available science and data. BOEM also calls upon external subject matter experts to identify additional information needs for BOEM assessments where existing scientific information is limited.

Commenting on BOEM assessments is another way that stakeholders contribute to BOEM environmental products. For example, some federal agencies are charged by their agency mission to formally comment in the NEPA process. Comments are provided on a draft EIS or EA; BOEM and relevant cooperating agencies address applicable comments in the final EIS or EA.

Additionally, federal agencies sometimes provide in-kind resources. For example, scientists at a federal agency with which BOEM has a memorandum of understanding sometimes provide expert methodological input or data collected through ongoing environmental monitoring work to help BOEM design its assessment methodology. This collaboration allows BOEM to use the most current science in its assessments. States also sometimes provide methodological input for BOEM assessments. A state interviewee identified one instance where they provided commentary on BOEM's method for a corrective purpose; the Bureau had stopped using the available large marine mammal tagging data for an analysis, and the state agency questioned this approach because it informed an EIS for the NEPA process. BOEM reportedly revisited the analysis in response to the state agency's critique.

5.5 WHAT ARE BOEM'S IMPACTS ON THE CAREER OF YOUNG SCIENTISTS, INCLUDING HOW BOEM HAS SUPPORTED GRADUATE EDUCATION?

Academic interviews included a list of questions about BOEM's support of student education. Academic interviewees identified a total of nearly 200 students funded through BOEM studies. While the bulk of the questions focused on graduate student support, several interviewees identified that they support students as young as highschoolers or even elementary schoolchildren. Interviewees also described that BOEM provides students with exposure to applied science and marine resource management in action, research ideas for their theses or dissertations, and even job prospects at the Bureau. This section, based on information from the interviews, discusses the impacts of exposure to and participation in advancing BOEM science on the career of young scientists.

Academic interviewees identified that BOEM supports young scientists (e.g., graduate students) through funding. Interviewees recalled that BOEM funded a total of nearly 200 young scientists, including

[67] NEPA assessments are only one type of BOEM assessment but were commonly mentioned in interviews.

4 Postdoctoral, 40 Ph.D., 56 Master, 22 undergraduate, and more than 77 unknown[68] students on past or current studies. It is important to note that many academic researchers shared student estimates only for their most recent projects, as they had been involved with BOEM for many years and had lost track of students funded through BOEM studies. Though individual interviewees often reported small numbers of students funded through BOEM (e.g., 1–3 students per academic interviewee), one academic estimated that 20 percent of their funding from BOEM went to supporting graduate student research, and they reported supporting 10–15 graduate students since 2016 with studies contracts from BOEM. However, not every academic supported their graduate students with their BOEM funding. One interviewee explained that the timing for BOEM studies was incompatible with their biophysical research area at the university, and thus "not suitable" for students. However, they acknowledged that their other biophysical colleagues have had more success in supporting graduate students with BOEM funding. Where consulting firms held an IDIQ contract, students (where involved) were supported by the firm, rather than directly by BOEM through a contract.

One consulting firm noted that it occasionally funds students to work on BOEM studies contracts as a part of their regular academic studies. In two cases, this type of work-study relationship with BOEM led to full-time employment at the consulting firm, where the employees then continued to contract with BOEM. Other academic interviewees identified that they use BOEM data in teaching. These academics reported that BOEM's public datasets serve as the basis for lessons and homework assignments in their college-level or graduate-level classes, exposing students to government-sponsored applied research as a part of their traditional academic training.

BOEM science provides young and emerging scientists with:

- *Exposure to applied science and marine resource management.* Research with BOEM provides students with exposure to applied science, government-academic collaborations, and public datasets. Interviewees emphasized the importance of substantive student engagement in scientific studies with BOEM because of the range and value of the professional exposure. The hands-on aspect of writing, data analysis, and sea time helps students understand how to engage in "real-world science." This engagement is especially novel for undergraduates, as not every undergraduate biophysical science student gets the hands-on experience of conducting scientific research (e.g., designing methodology, collecting and analyzing data) during their program of study; the value to BOEM-supported student careers is invaluable in this respect. Some interviewees also identified that beyond the professional exposure to real-world science, BOEM provides students with mentorship opportunities and an improved awareness of marine resource management and policy. This type of exposure can help students in the biophysical sciences understand other possible avenues for their research careers beyond the academy. Exposure to BOEM science may even help students determine their course of study at university. One interviewee mentioned that they occasionally work with local high school students designing their capstone research projects around past BOEM studies.[69] Another interviewee suggested that

[68] Interviewees could not recall the distribution between Ph.D., M.S., and undergraduate.

[69] For example, BOEM staff have met directly with high school students to explore different options for college and graduate degrees in marine science. Source: BOEM.2019. Public outreach through BOEM Ocean Science Journal: BOEM biologists meet with high school student exploring a career in marine biology. [accessed 2023 Feb]. https://www.boem.gov/about-boem/stakeholders/public-outreach-through-boem-ocean-science-journal.

student research opportunities are an important public relations opportunity for BOEM, because students may not be aware of BOEM without this direct experience.[70]

- *Research ideas.* Where students were supported by BOEM studies contracts, many interviewees identified research ideas as a key contribution to student careers; students were able to build on their research with BOEM to develop a topic for their thesis or dissertation. In other cases, students were exposed to novel applied scientific research through data collection efforts, even if the efforts were not directly related to their own thesis or dissertation work. Where this exposure does not result in student projects, it is still helpful to students to understand the types of research and policy work going on at the federal level. This exposure can also come from BOEM publications and data, which provide information on a variety of marine resource management and ocean science topics.

- *Job prospects.* In some cases, working on BOEM science has introduced graduating students to job prospects, whether or not the student works at BOEM after completing their studies. Several interviewees mentioned that students had applied to BOEM for positions in the past, and some of these students were successful in securing job offers at BOEM. For other students, exposure to BOEM work encouraged students to pursue government research careers. Exposure to applied science and research ideas generates its own positive results for student careers because it broadens student horizons both within and outside academia.

[70] There are a few other avenues for exposure to BOEM science, including BOEM internships, the government "Pathways" program, and government fellowships like the Presidential Management Fellows Program.

6 OVERALL FINDINGS AND RECOMMENDATIONS

This overall findings and recommendations section summarizes the high-level findings across all sub-questions under the overarching evaluation question: **What is the impact of BOEM's scientific research on the external environmental community (e.g., other federal agencies, state agencies, academia)?** High-level findings and recommendations are divided into two separate sections for clarity. The high-level themes described herein synthesize findings that emerged from multiple data sources (e.g., interviews, survey, SNA) cutting across individual evaluation questions. Recommendations reflect the collective evaluation question findings and high-level thematic findings, with attention to BOEM's goal for improving and tracking the impact of its science on the external environmental community moving forward.

6.1 HIGH-LEVEL CROSSCUTTING THEMATIC FINDINGS

6.1.1 BOEM staff engage regularly with trusted stakeholders/collaborators in the external science community, which helps extend the reach of BOEM science beyond the Bureau but can also make it difficult to expand BOEM's network.

Survey and interview findings emphasize the importance of direct interactions between BOEM staff and members of the broader scientific community.[71] In fact, survey respondents primarily receive information on BOEM studies and assessments directly from BOEM staff. Interviewees indicated that these direct connections are important to access emerging science and new data and to learn about studies opportunities. This finding is reinforced by the SNA, which suggests that BOEM's network has the potential to have broad reach, but that interactions generally occur among a more limited group of organizations and individuals. The stakeholders and collaborators most closely involved with BOEM science are generally aware of relevant new studies and important results.

Conversely, reliance on closely held relationships with a group of recurrent collaborators may limit expansion of BOEM's network and therefore the reach and influence of BOEM's science. Additionally, that most of BOEM's close contacts receive information directly from BOEM staff may indicate that it is not readily accessible for other members of the external science community. Interviewees discussed the inherent challenge of sharing scientific findings in a centralized network: it can be difficult to connect to audiences beyond the immediate network. This gap is where BOEM's academic partners and federal collaborators currently play an essential role. The SNA findings suggest that academic researchers and federal agencies like NOAA, USGS, and USFWS are important for disseminating BOEM science outward to other external stakeholders. Beyond communication of scientific findings, some academic interviewees shared their perception that BOEM offers few opportunities for early career scientists in particular. It may also be challenging for more established scientists who are unaware of BOEM's ESP to

[71] It is important to acknowledge the context of relationship longevity between the sample of interviewees and BOEM. Because interview candidate names were provided by BOEM staff, the interview sample predominantly included interviewees who have more established, long-term relationships with BOEM. The sample of survey respondents was focused on respondents who have worked with BOEM recently, but many of these were long-term connections, as well.

learn about BOEM opportunities, such as the annual call for study ideas. This sense of limited opportunity for those without a direct BOEM staff connection was also shared by some state agency staff who were newly involved in planning for offshore wind and not yet familiar with where to find past BOEM studies, assessments, or data.

Though a stakeholder's long-term connection with BOEM staff contributes to the institutional knowledge of the Bureau at the stakeholder's organization or institution, long-term connections may, over time, lead to entrenchment in BOEM's operations or ways of thinking about ocean science. Repeated studies by the same set of collaborators may provide the same types and caliber of information, while potentially missing important emerging topics or new approaches for conducting marine science. BOEM science could benefit from new perspectives from emerging scientists with new research questions or methodological approaches and from relationships with policymakers and other stakeholders from coastal states that may not yet be actively engaged with the Bureau.

BOEM is actively expanding its network with state agency stakeholders to establish new relationships for information sharing and collaboration. Many coastal state agencies are currently focusing on offshore wind development and the scientific- and policy-related questions surrounding the associated environmental impacts. As this is also a priority study area for BOEM, broadening partnerships with state agencies will provide opportunities for cooperative learning. Interviewees spoke positively about BOEM's work with state agencies to improve and share understanding of the impacts of offshore renewable energy.

See Recommendation 6.2.2.

6.1.2 BOEM study reports and data target more technical audiences in the science community but may not be readily understood by less technical stakeholders, including decision-makers.

BOEM science is communicated to multiple types of stakeholders (audiences) with different levels of technical expertise. Interviews suggest that BOEM is successfully communicating scientific findings to more experienced technical or scientific experts, including state environmental resource agencies and deeply engaged environmental organizations (e.g., Natural Resource Defense Council). However, BOEM could improve the use of its science with additional attention to communicating scientific findings in an accessible way to more general audiences. For example, effective science communication enables a broad range of stakeholders to engage more with BOEM science and advance their understanding of environmental implications of projects and policy directions, enabling more informed discourse. Effective science communication additionally facilitates bringing science to policy for decision-makers.

BOEM communicates high-level studies priorities (e.g., five-year plans) and information about key topics in ways that general audiences can readily understand. For example, the BOEM ESP web page has a pair of easily digestible factsheets to help the public understand the purpose of the Bureau's environmental studies and the importance of environmental stewardship, and how BOEM is managing the impacts of human activity-generated sounds on marine life.[72] Both topic areas are broad and speak to the types of

[72] While BOEM may have other factsheets, these two were the most readily available on the ESP website at the time of writing.

questions that BOEM and its stakeholders regularly address. In contrast to the ESP factsheets, BOEM study reports were frustrating for some interviewees, who indicated that the reports are complex and difficult to digest without a distilled synthesis of key takeaways for a general audience. The limited extent of BOEM's non-technical communication of study findings can be challenging for external stakeholders who may rely heavily on BOEM science to inform policy (described in Section 5.3). Interviewees also commented that the length of BOEM's assessment documents makes it difficult to quickly identify issues of relevance to them, such as the potential impacts of offshore energy-related activities. Without changing the intended purpose or structure of the assessment documents, BOEM could make information in the assessments accessible to a broader audience through shorter, more digestible ancillary products geared toward interested stakeholders with varying degrees of technical expertise and limited time, such as state-level agencies and U.S. Congressional staff.

BOEM requires two-page technical summaries from ESP scientists, but the documents are not developed with broad public consumption in mind. Interviewees explained that they frequently needed to summarize salient study findings for a more general audience (described further Section 5.2). State agencies in particular identified a need for improved communication related to ocean energy and the marine environment. Some interviewees described encountering misquoted or mis-cited BOEM studies in published or otherwise publicly available documents. Interviewees connected this issue to the technically complex presentation of information in BOEM study reports, which can be confusing for stakeholders without a background in the study topic.

Relatedly, data portals are useful resources for learning about BOEM study results, but some interviewees indicated that BOEM data could be more user-friendly, such as datasets pre-packaged for use with geographic information system (GIS) software. Interviewees also had varying opinions on the accessibility and navigability of ESPIS. Importantly, the recently launched ESP Hub provides enhanced search functionality that should help to address this challenge.

See Recommendation 6.2.3.

6.1.3 BOEM studies fill critical knowledge gaps and meaningfully advance ocean scientific research.

The external environmental community's use of BOEM's scientific findings includes informing and furthering their own research, to teach others, for use in models, and for environmental analyses. The publication citation analysis identified that BOEM is a leader in key scientific topics including oil spills, marine minerals extraction, oil and gas surveys and extraction, and climate change. BOEM publications are frequently cited in external academic research: 94 percent of BOEM-funded publications had at least one external citation. Additionally, BOEM-sponsored publications in these topic areas have an average of more than 70 citations per publication. Interviews revealed that BOEM's studies are often essential to advancing the state of knowledge, filling ocean science knowledge gaps, and answering fundamental research questions about basic science for a range of non-academic stakeholders, from DOE to the International Seabed Authority. BOEM is also uniquely positioned to lead the advancement of the state of knowledge around offshore wind development. This finding builds on several related themes:

- *BOEM is advancing basic scientific research.* BOEM's studies on baseline conditions allows for the understanding of the full extent of impacts from human activities on the OCS for the entire

energy activity lifecycle, and of "frontier topics," such as deep-sea mining. BOEM's long-term field studies are important because so few studies extend over long periods of time. In the Alaska Region, BOEM plays a critical role in marine mammal science, ice dynamics, and cold-water habitats. Interviews and results from the citation analysis both support this finding.

- *BOEM's applied science for offshore wind fills important knowledge gaps.* States with nascent or early-stage offshore renewable energy programs seek to understand the scope and breadth of impacts from energy-related activities: construction, operation, and decommissioning. Interviewees from a variety of backgrounds explained that BOEM's studies cover a wide range of topics that can inform early thinking and planning about offshore wind impacts. Previous ESP-funded oil and gas construction and operation acoustics studies, as well as studies on platform impacts to habitats, community assemblages, population dynamics, and fishery dynamics may also be relevant to understanding the impacts of constructing offshore wind platforms.

- *BOEM's public release of datasets gives scientists access to the information they need for their analyses.* BOEM's publicly available data are a significant asset to marine scientists, students, and other stakeholder groups. Interviewees access BOEM data through several sources, including BOEM's website; data portals like MarineCadastre, a collaboration between BOEM and NOAA for sharing data to support offshore energy and marine spatial planning (the most frequently mentioned data portal in the interviews); Tethys (hosted by the Pacific Northwest National Laboratory, with BOEM listed as a contributor); Data.gov; and NOAA's NCEI.

See Recommendation 6.2.5.

6.1.4 BOEM science directly influences decision-making outside of the Bureau, particularly in the context of coastal and marine resource management for federal and state agencies.

Beyond informing BOEM planning and policy, BOEM studies and assessments influence external stakeholder decisions. BOEM science is used to inform industry, regulators, and policymakers about key topics. These stakeholders use BOEM science to inform mitigation options, develop BOEM analyses (e.g., for NEPA assessments), and inform other policy and management decisions, as evidenced by citations in other agencies' assessments and the interview findings. Stakeholders also pursue opportunities to collaborate on or co-sponsor studies with BOEM, when the proposed study is in their mutual interest but not necessarily within BOEM's studies plan (described in Section 5.4).

The external assessment citation analysis found that external assessments cited over 500 individual BOEM study products, with an average of almost four citations per assessment. NMFS, the U.S. Navy, and the U.S. Coast Guard had the highest percentage of assessments with BOEM study citations. However, determining the level of influence of BOEM studies on external decision-making is challenging, given that the specific role of any BOEM study in the ultimate decision is not always known or indicated publicly.

Select Uses of BOEM Science to Inform Offshore Renewable Energy Development

Stage 1: Scoping and Spatial Planning. When coastal state agencies are scoping their offshore areas to understand possibilities for renewable energy development, they turn to BOEM science for background information on renewable energy generation and transmission, impacts to humans and the environment, and data about candidate site locations. They may engage with BOEM in an introductory fashion to lay the foundation for a future formal regulatory relationship.

Stage 2: Permitting and Mitigation. When developers apply for permits to develop offshore renewable energy projects, the developers and state agencies may review previous BOEM assessments to understand the types of issues that can arise. Conversations with BOEM may be frequent at this stage as developers plan for mitigation measures. State agencies review and comment on BOEM EAs and EISs.

Stage 3: Construction and Operation. When coastal states have renewable energy developments under construction or in operation, they are formally engaged with BOEM on an ongoing basis. State agencies rely on BOEM studies and assessments for information on nearby shore impacts and potential areas of concern, and for scoping other sites and marine spatial planning, among other purposes. Some agencies use BOEM assessments to inform their own assessments and state guidance.

Interviews indicate that BOEM studies and assessments inform non-BOEM resource management and impact mitigation decisions at the federal, Tribal, state, local, and international levels. In particular, state agencies and other decision-makers use BOEM science to make decisions at different stages in their offshore wind/energy siting and permitting processes (see the callout box).

At the same time, interviewees involved in offshore renewable energy research and siting and permitting processes offered feedback about improvements that BOEM could make to further support stakeholder use of BOEM science in decision-making:

- *Timeliness of BOEM assessments was a key interest of academics and state agencies.* State agencies rely on BOEM assessments, but some interviewees explained that they sometimes receive the assessment document too late to conduct meaningful analysis prior to responding. For example, an offshore wind developer's submittal of a Construction Operation Plan to BOEM initiates a specified timeline for state agency comments on that specific project. BOEM begins developing a draft EIS for the specific project after receiving and reviewing the Construction Operation Plan. The compressed time for formal comment necessitates that external parties (e.g., state agencies) submit their critical environmental impact questions at the same time BOEM is developing the draft EIS. Interviewees underscored that environmental impact analyses are a considerable undertaking for state natural resource authorities that are understaffed and under-resourced, and the timeline for review and comment is too compressed to allow for their own independent research.
- *Several interviewees suggested that BOEM proactively develop a cohesive vision for future studies, including studies about decommissioning offshore wind projects*. While decommissioning

of offshore wind projects may still be decades away, external stakeholders expressed interest in understanding BOEM's plans for studying this important issue and learning about these impacts.

- *Interviewees commented on the geographic scope of BOEM studies but disagreed on what they wanted BOEM to do differently.* Some interviewees stated that BOEM should study more geographic areas; in particular, state agency interviewees shared a concern that they cannot always apply findings from other regions to their area. However, some interviewees favored studies over broader areas, while others favored place-based studies (in their area). In either case, the comments indicate a high level of demand by external stakeholders for BOEM science.

See Recommendation 6.2.4.

6.1.5 BOEM's impact on the broader scientific community is challenging to track and evaluate but obtaining access to a citation service would help.

BOEM's studies are designed to inform BOEM's assessments and decision-making. BOEM recognizes that ESP studies also benefit the broader scientific community, and the Bureau looks for ways to collaborate and leverage co-funding. However, ESP-funded studies must align with BOEM's study priorities to move forward. Other agencies' assessments use BOEM's studies to inform decision-making, but the role of the BOEM study is not always publicly indicated.

One area that can be tracked, however, is citations of journal publications associated with ESP-funded studies. BOEM encourages publication and tracks publications as BOEM study products, but currently does not track the external citations of those study products. IEc used a web-scraping method to analyze citation metrics using SerpAPI, Google Scholar, and R code, but access to a citation analysis service would provide a more systematic, in-depth, and repeatable approach for tracking BOEM's citation impact.

In addition to citation impact metrics, other trackable indicators of BOEM's influence on the external science community could include, as examples, ESPIS or ESP Hub site visits and downloads, the number of conferences at which BOEM-funded scientists present BOEM study findings, and the number of working interagency groups in which BOEM staff participate.

See Recommendation 6.2.1.

6.2 RECOMMENDATIONS

IEc's recommendations for BOEM are presented below and grouped into five main topics: 1) BOEM's impact on the wider environmental science community, 2) BOEM's network, 3) user-friendly information dissemination for general audiences, 4) outreach and engagement with other government entities, and 5) studies funding. These topics are described below in detail, with a set of potential action items for BOEM under each topic.

6.2.1 Improve the ways in which BOEM tracks impacts on the wider environmental science community.

BOEM does not systematically track its impact on the wider scientific community (see Section 5.3.3, Section 6.1.3, Section 6.1.4, and Section 6.1.5). The recommendations build on several recommendations from Year 2 (Volume 2):

- **Track citations of ESP studies and related publications, both in assessments and in the scholarly literature.** Citation analysis is a simple but useful tool for tracking the influence of BOEM science. The ability to track peer-reviewed publications that stem from BOEM's environmental studies is a necessary first step to identify study-related publications that were cited in assessment documents and/or in the scholarly literature. Identifying citations of BOEM studies or related publications in assessments is a partial, but useful and repeatable, measure of BOEM's influence. Linking peer-reviewed publications to BOEM's environmental studies—and then tracking citations in the scholarly literature—is useful for understanding BOEM's contributions to the advancement of science.
- **Require that study profiles clearly describe the information need targeted by the study, the origin of the information need, and co-developers.** Study profiles should be clear about the specific information need and potential uses of the scientific information that would be provided by the study. Study profiles should also include a sub-section to the current "BOEM Information Needs" section that documents the origin(s) of the information need. In addition to assessment documents, sources may include other technical publications, colleagues, and stakeholders, such as scientists at regional universities or other agencies. The study profile should also include a section that explains who was consulted in the development of the study profile, including internal and external stakeholders. If BOEM does not want to include certain information in a public-facing document, this information could instead be tracked in a separate location and tied to the unique study identifier.
- **Consider specifying within contracts that requirements for referencing BOEM obligation numbers in study publications extends beyond the period of performance for the contract.** To aid future efforts in measuring the use of studies both internally and externally, IEc recommends strengthening the requirement for funding recipients to reference the BOEM obligation number in publications emerging from the BOEM funding. This action should be consistently included as a requirement in contract language with a provision explaining that it applies after the period of performance is closed. For example, BOEM could consider specifying that it would view adherence to this request favorably in considering future bids or proposals for work with ESP (e.g., as a component of past performance). Referencing BOEM obligation numbers in publications would enable BOEM to better utilize citation tools to measure the use of ESP studies.

- **Create a streamlined process that allows Contracting Officer's Representatives (CORs) to easily update study information in ESPIS**.[73,74] After the initial submission of information into ESPIS, CORs should be able to update information about the study, especially pertaining to the addition of known peer-reviewed publications emerging from the work. This recommendation does not necessarily mean providing full editing access to all aspects of the study information for all CORs but may involve increased access at some permission level. BOEM should consider options that balance maintaining the security and integrity of the database with facilitating the need to accommodate regularly updating information. Related, BOEM should send CORs an annual prompt to update information for up to five years after completion of a study. This prompt should be automatically sent on the anniversary of when the information was initially submitted to ESPIS. This prompt would ensure that the database behind ESPIS is as up-to-date as possible and would provide the base information BOEM would need to conduct citation analysis.

Our analysis in Year 3 found that journal publications resulting from BOEM studies are cited in the external scholarly literature, signaling the incremental use of BOEM studies to advance the state of knowledge. To better understand this use over time, we recommend that BOEM invest in an A&I service to continue to track citation metrics. BOEM could also track metrics on the BOEM ESP Hub website with Google Analytics to understand web traffic and general exposure to BOEM scientific information, as well as downloads of BOEM-sourced data from data portals to which BOEM contributes. BOEM should consider developing an annual report summarizing and interpreting this collective set of metrics, similar to the Bibliometrics section of NOAA's Science Report, which is published annually. In addition, to track the potential for instrumental use of BOEM studies (e.g., in assessments, plans, or policy decisions), consider adding a request to study profiles for the anticipated uses of the information by internal and external stakeholders.

Potential Action Items

1. In addition to tracking study idea co-developers, consider adding a request for the anticipated uses of the information to assess (potential) instrumental use of BOEM science (e.g., in policymaking).
2. Invest in a citation analysis service and bibliometrics to assess the incremental use of BOEM science.
3. Use Google Analytics to track web traffic on BOEM ESP Hub.
4. Where possible, track downloads of BOEM-sourced data from data portals to which BOEM contributes.
5. Develop an annual report summarizing and interpreting tracked metrics, including citation metrics.

6.2.2 Expand BOEM's network.

This recommendation corresponds to the findings described in Section 6.1.1.

[73] IEc recognizes that since the Year 2 report (Volume 2), BOEM launched a replacement to ESPIS, as the ESP Hub at https://esp-boem.hub.arcgis.com/. These recommendations would also be applicable to this new ESP Hub.

[74] The new ESP Hub does not include ongoing studies; a study is only added once complete. IEc recommends that BOEM consider posting interim study findings on an internal BOEM-only website (e.g., Currents or SharePoint) so that the interim study findings can inform BOEM staff, even though the interim findings would not be publicly available and could not be cited.

Although the network analysis finds that the BOEM network has the potential to have a broad reach, it also confirms that the majority of BOEM's interactions are occurring with a more limited group of organizations and individuals. Many of the scientists and public servants in BOEM's network have been engaged with BOEM science for many years. As the connections within this network move on (e.g., retire, pass away), BOEM will run the risk of losing long-established institutional knowledge about the Bureau in organizations with which BOEM works regularly. Institutional knowledge is the awareness of how an institution works, the points of contact for different subject matter areas, and the body of science that the institution has produced in one field or across multiple fields of study. Though this concern may not be an issue in federal agencies, particularly BOEM's key collaborators like NOAA NMFS or USGS, BOEM could build some redundancy in its relationships with universities by establishing multiple contacts or relationships for a more robust organization-level connection. Building relationships with emerging or new-to-BOEM scientists is also critical to the long-term health of BOEM's network.

Expanding BOEM's network also includes improving the visibility of BOEM studies opportunities. While the direct nature of BOEM's relationships with its network is a key element of BOEM's success, it may pose a challenge for BOEM in terms of engaging with new organizations. For example, it may be difficult for emerging and early career scientists to learn about and become engaged with the network if they have not previously been engaged with BOEM. Widely publicizing BOEM's call for study ideas and RFP may improve the visibility of BOEM opportunities for new or emerging scientists. BOEM could cross-post calls for study ideas to multiple listservs, including but not limited to the university-specific listservs of its contract awardees.

To further facilitate the entry of new scientists into BOEM's network, we recommend that the Bureau work on improving the visibility of individual BOEM staff. One interviewee suggested mini biographies with individual photographs or *curriculum vitae* link for a "Who We Are" staff page, the way that some universities or scientific institutions have for faculty. For example, BOEM has a web page with information on Bureau leadership (https://www.boem.gov/about-boem/boem-leadership), but no staff directory information.[75] If scientists were able to find BOEM staff contact information with a quick internet search, this could help them make connections at BOEM. Scientists may be comfortable contacting BOEM staff outside of a conference or other traditional networking setting.

Relatedly, during preliminary findings discussions, BOEM staff expressed interest in opportunities for understanding diversity of investigators in their science program using existing data. At the institutional level, BOEM could track whether the scientist's institution is a Minority-Serving Institution, such as a Historically Black College or University. BOEM could also track changes in the network of funded colleges/universities over time. In addition to tracking whether the institution is a Minority-Serving Institution, BOEM could also track whether it is the first time someone from that institution has received BOEM funding, and in which state/region the institution is located. This recommendation aligns with the NASEM (2022) findings that a first-in-class research institution 1) adopts an integrative approach to fostering diversity, equity, and inclusion; and 2) encourages diverse investigators in research solicitations.

[75] Some examples of a simple staff directory include NOAA (https://nsd.rdc.noaa.gov/) or U.S. EPA (https://cfpub.epa.gov/locator/index.cf). NOAA's Northeast Fisheries Science Center has both a staff directory and a mini biography if the user clicks on a contact name (https://www.fisheries.noaa.gov/staff-directory/northeast-fisheries-science-center-staff-directory).

Both findings represent research program process attributes that foster deep diversity (including cultural and attitudinal diversity) and open the institution up to new perspectives.

Potential Action Items

1. Plan for institutional knowledge loss or staff turnover by building relationships and funding studies led by emerging or new-to-BOEM scientists.
2. Cross-post calls for study ideas to multiple listservs, including to listservs beyond universities where BOEM-funded scientists are currently employed.
3. Publish a "Who We Are" staff page with mini biographies, photographs, curriculum vitae, and contact information for all BOEM staff. At minimum, publish a staff directory with name, office, and contact information.
4. Actively target and track engagement with scientists at Minority-Serving Institutions and at institutions that have not historically received BOEM studies funding.

6.2.3 Develop and implement a plan for extending effective information dissemination, ensuring that information is accessible to audiences with varying degrees of technical expertise.

This recommendation corresponds to the findings described in Section 6.1.2.

To use BOEM's scientific findings, stakeholders must 1) know about the existence of BOEM studies or assessments on a particular topic, 2) be able to find the studies or assessments, and 3) understand the information contained in the scientific products. We recommend that BOEM develop an environmental studies communication plan to further these objectives. While BOEM already has communication plans in place that were designed for *specific* purposes (e.g., BOEM Environmental Studies Program's 50th Anniversary, ESP Quarterly Reports), the Bureau does not have an ESP-wide communication plan that can be tailored for different needs.

6.2.3.1 Develop an environmental studies communication plan to identify key audiences and tailor scientific products for those audiences.

BOEM should develop a communication plan for the ESP that includes high-level communication strategies to reach multiple audiences with consistent messages about BOEM science, events, and RFPs across the program. Such a communication plan could also include targeted strategies for packaging information for different stakeholder groups, including the public. More widely publicized information about BOEM, BOEM staff, ESP studies, and BOEM's existing engagement with various types of stakeholders would be useful as well. The communication plan should be developed with the following questions in mind:

- What does BOEM want to accomplish with its communication?
    - What learning outcomes does BOEM envision?
    - How do these outcomes differ across modes of communication (e.g., study reports vs. factsheets)?
- How easy or difficult is it to *find* BOEM science products?
    - Are documents easily searchable on title or author?
    - Are there ways to improve the "searchability" of BOEM products?

- Who are BOEM's key stakeholders?
    - How might communications need to differ across stakeholder groups?
    - What types of information might be useful for general distribution?
- Is the Bureau currently prioritizing any stakeholders (explicitly or implicitly)?
    - For example, what types of communication material has BOEM prepared for different groups on its website?
    - What are the relative volumes of these materials?
    - Where are the materials housed on BOEM's website?
- Who else should BOEM prioritize?
- What other venues can BOEM leverage to communicate to key stakeholder groups?

The Bureau may also need to consider how to package its existing communications for a wider audience. For example, BOEM could implement the following:

- *Encourage brief and clear communication of study findings by BOEM-funded scientists.* This could include using well-formatted two-page factsheets.[76] Brief and clear communication could also include abbreviated summary presentations to stakeholder groups, alternative deliverables (such as middle or high school curriculum modules on a series of related BOEM studies), or "packages" of information (e.g., scientific information for the fishing industry), such as graphical abstracts or short videos posted to YouTube to reach a more general audience.
- *Encourage BOEM-funded scientists to share study fundings with broader audiences beyond traditional scientific outlets* like peer-reviewed journals, reports, and raw data sharing to expand environmental studies information dissemination. These traditional outlets cater to an academic audience, but there are many other users of BOEM science. Conferences occasionally engage state agencies or nonprofit groups, but they also typically require a registration fee or membership in the organization, thereby restricting the types of groups and individuals that can access the science. BOEM-funded scientists could seek opportunities to share their research with graduate, high school, or even middle school students, at industry conventions (e.g., fishing industry trade association meetings), or in seminars that are open to the public.
- *Consider developing a distilled synthesis of scientific findings for each "theme" on ESP Hub on a biennial basis.* With the new ESP Hub, BOEM has an opportunity to steer audiences to a searchable repository of BOEM studies; in addition, BOEM could publish a distilled synthesis of scientific findings for each of the topic areas or "themes" already outlined on the ESP Hub every other year. ESP Hub topic area synthesis summaries could highlight key findings in each theme and reference other important contributing studies to provide the reader with a brief (two-page) synopsis of the state of the science in the particular study area. This recommendation aligns with the NASEM (2022), which suggests that a first-in-class program routinely produces knowledge products (scientific findings outputs) for general consumption and synthesizes findings in the context of past work and existing scientific knowledge to provide additional utility to users.

[76] As an example, the New York State Energy Research and Development Authority (NYSERDA) publishes succinct and aesthetically pleasing fact sheets for general audiences. See for example: NYSERDA. 2019. Geothermal success in an urban environment. [accessed 2023 May]. https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Case-Studies/clean-heating/GSHP-siano-cs.pdf

6.2.3.2 Improve stakeholders' ability to locate BOEM science.

As a component of the environmental studies communication plan, BOEM could improve the accessibility of its science by 1) amplifying the message about BOEM's rich body of science on a wide array of topics (so that more stakeholders can learn about BOEM's work), and 2) increasing the number of ways that stakeholders can find BOEM science. This recommendation also aligns with a NASEM (2022) finding, suggesting that a first-in-class institution encourages multiple types of outputs and communicates studies to multiple audiences.

For stakeholders beyond BOEM's immediate network, the Bureau may need to consider how to broaden its existing communication to reach a wider audience. For example, BOEM could implement the following:

- *Direct stakeholders to BOEM's website or listserv for more information.* BOEM already publicizes its science products. For example, BOEM's Newsroom web page includes searchable documents (by topic, year, and keyword), and BOEM's Ocean Science News page releases information specific to newly published BOEM studies, along with relevant links (e.g., final reports). However, the evaluation findings suggest that state agencies working on offshore renewable energy planning in particular have an appetite for more information about BOEM's scientific activities. When BOEM staff attend regional planning group or offshore wind forum meetings, they could promote existing BOEM resources. For stakeholders that have an interest in passively receiving information rather than actively seeking it out on BOEM's own website, BOEM staff could promote BOEM's listserv.[77]
- *Improve the user-friendliness and searchability of information on BOEM's website.*[78] Importantly, BOEM already provides some landing pages for specific stakeholder groups on its website, so those stakeholders navigate to information that is relevant to them. For example, BOEM has a dedicated "Fishing Industry Communication" web page that compiles links to website areas of interest, such as "Recent Fisheries Engagement" and "Frequently Asked Questions." This information is likely valuable to the fishing industry, but not all stakeholder groups have a BOEM concierge page such as this.
- *Share reports through ResearchGate or Google Scholar* to reach a more general audience interested in reading scientific papers. These portals function as a virtual *curriculum vitae* for the author and may provide another way for the Bureau to track impact of BOEM-funded or BOEM-supported publications.

Potential Action Items

1. Develop a communication plan to identify key audiences and tailor scientific products for those audiences.
2. Synthesize key findings from past and present studies in BOEM's new ESP Hub themes on a biennial basis to provide users with a synopsis of the state of the science in each study topic area.
3. Encourage *brief and clear* communication of study findings by scientists (e.g., factsheets, graphical abstracts, or summary presentations to stakeholder groups).

[77] We also refer the reader back to the recommendation in Section 6.2.3.1 regarding cross-posting to multiple listservs.

[78] Since the time of writing, BOEM has taken steps that address this recommendation. BOEM's new ESP Hub improves searchability of BOEM products, such as the inclusion of BOEM studies as search results on Google Scholar.

4. Encourage sharing of BOEM study findings widely to broad audiences and beyond traditional outlets like journals, reports, and conferences (e.g., trade association meetings, or public seminars).
5. Direct stakeholders to BOEM's website or listserv for more information.
6. Improve searchability of BOEM products on BOEM's website.
7. Share reports through ResearchGate or Google Scholar.

6.2.4 Continue targeted outreach and engagement with government agencies and other organizations around offshore renewable energy issues.

This recommendation corresponds to the findings described in Section 6.1.3.

Related to general network expansion, BOEM should continue its targeted outreach and engagement efforts with governments and other external organizations around offshore renewable energy as this issue grows in importance. BOEM already engages with multiple regional planning groups and offshore wind consortia—including the Regional Wildlife Science Consortium for Offshore Wind, Responsible Offshore Wind Alliance, and National Ocean Partnership Program, among others—but stakeholders are interested in engaging with BOEM in even more forums. BOEM should consider expanding the number of forums in which BOEM staff participate, and also increase collaboration with other federal agencies and organizations. This recommendation aligns with the NASEM (2022) finding that a first-in-class research program partners and collaborates effectively on scientific endeavors with multiple organizations. Partnerships and collaborations are valuable for leveraging resources and subject matter expertise and bringing together people with multiple perspectives and experiences in research.

BOEM is a participant in the U.S. Integrated Ocean Observing System and engages with multiple other federal entities including BSEE, NOAA, USFWS, USGS, DOE, Office of Naval Research, U.S. Coast Guard, and the Smithsonian Institution. BOEM also has multiple Intergovernmental Renewable Energy Task Forces that were established for coordination in the identification of offshore renewable energy lease areas. As a secondary benefit, these task forces also provide an opportunity for relevant parties engaged in scientific studies, assessments, permitting, and stakeholder engagement for offshore renewable energy lease siting to share information such as studies. An auxiliary benefit of collaboration is educating governmental stakeholders about BOEM's mission, operations, and approach to scientific studies on ocean renewable energy development. Increasing the total number of collaborations, or the number of close intergovernmental collaborations can support BOEM in leveraging funds, provide non-financial resources, and improve visibility of the Bureau.

BOEM could also consider engagement with the Industry University Cooperative Research Center program through the National Science Foundation as one way to increase collaboration with other federal entities, academics, and industry stakeholders. Although there is a participant requirement for an interagency agreement and a fee, other participating federal partners including Department of Defense, DOE, and NMFS have reportedly found their participation in the program to be valuable. There are multiple cooperative research centers across the country and government agencies and industry provide funding for science.

In making these recommendations, we acknowledge this expanded level of engagement would need to be balanced with practical constraints (e.g., BOEM staff's time) and strategic considerations around which collaborations would mostly directly advance BOEM's mission and scientific interests.

Potential Action Items

1. Continue to participate in regional consortia or working groups.
2. Increase collaboration with other federal agencies and national organizations.

6.2.5 Continue to fund studies to advance knowledge and create opportunities for emerging scientists.

This recommendation corresponds to the findings described in Section 6.1.3.

Many interviewees lauded the coverage of BOEM studies and volume of available data, but interviewees also had some critiques about what they perceived to be gaps in BOEM study topics. The citation analysis also identified some possible misalignments between the number of BOEM publications on a particular topic (e.g., climate change or marine mineral extraction) and the number of external citations. BOEM studies are critical contributions to the greater body of science (Section 6.1.2) and should be positioned for greatest overall impact, provided they fulfill their primary purpose of meeting BOEM's information needs.

BOEM science also plays an important role in the careers of young scientists, whose research often uses BOEM data or is inspired by BOEM studies (Section 5.5). Continuing to fund student research (including conference attendance) is one way that BOEM can maintain a pipeline of emerging scientists into the BOEM network.

6.2.5.1 Consider conducting studies in topic areas with key knowledge gaps (e.g., cultural studies), and/or areas with less coverage and high rates of external interest.

BOEM could use citation analysis to consider the importance of topic areas when determining where to focus its studies funding (provided the study topic overlaps with BOEM's study priorities). This effort would entail an analysis to understand topic coverage in terms of the total proportion of studies, as well as the number of external citations (see for example Section 5.3.2), and then a crosswalk analysis with both BOEM's list of study priorities and the list of study idea submissions. This recommendation aligns with another finding from NASEM (2022): a first-in-class science program advances the state of science (broadly), producing knowledge (e.g., study reports, assessments, and data products) used by other investigators who individually work to push the scientific field forward. Currently, there are a few topic areas that have high rates of external citation with few corresponding BOEM study products, suggesting that the topic area may be rapidly evolving and/or external stakeholders rely heavily on the relatively few studies that BOEM has published on the topic (e.g., marine mineral extraction).

BOEM already makes valuable contributions to the greater body of science (Section 6.1.2), but external stakeholders identified the following areas where they would like BOEM to enhance its studies coverage:

1. Social science studies.

a. Cultural resources – Though BOEM has contributed to critical knowledge in this topic area, natural resources are the focus of the Bureau's scientific work. One interviewee suggested that BOEM could request cultural resource information from all project managers to better incorporate cultural impacts into BOEM science.
b. Environmental justice – In a similar vein, another interviewee suggested greater consideration of environmental justice issues in NEPA-related assessments.
c. Recreational resources – One interviewee suggested that BOEM could focus more attention and funding on understanding recreational resources (e.g., decommissioned oil and gas platforms as recreational fishing and diving destinations).

2. Monitoring the cumulative effects of marine uses on wildlife and humans (of growing importance under climate change).
    a. Habitat assessments, water quality assessments, and site or animal behavior characterizations.
    b. Prior to leasing construction or operations, particularly as new renewable technologies are developed (e.g., floating solar, offshore hydrogen, and carbon capture/usage/storage).
    c. After oil and gas operations have ceased (e.g., to what extent does the environment, habitat, or animal activity return to baseline).
3. Impact of water infrastructure on natural oceanographic processes, including changes to upwelling and circulation.

6.2.5.2 Continue funding students to improve student opportunities and ensure exposure to BOEM science.

Academic interviewees repeatedly stated that their students find value in engaging with applied science through BOEM contracts and by attending BOEM-sponsored conferences. Exposure to how the Bureau or, more broadly, government agencies engage in scientific studies to inform policy can create more informed future scientists, policymakers, and natural resource managers. BOEM already funds student research in its ESP; maintaining or expanding student funding is important for continuing the legacy of academic-government partnership.

Providing conference scholarships for students is another possible way to contribute to advancing the careers of young scientists. In the past, in-person conferences and meetings hosted by BOEM were a way for young and emerging scientists to build relationships with BOEM. Costs for travel and registration (hundreds to thousands of dollars, depending on the location) were prohibitive for most students and some faculty. BOEM-sponsored student scholarships for conference attendance could address this issue and help create opportunities for young and emerging scientists to establish themselves within BOEM's network.

Potential Action Items

1. Consider targeting studies in topic areas with data gaps, less coverage, or high rates of external interest (e.g., cultural assessments, cumulative effects of marine uses, pre-lease assessments, and impacts to natural oceanographic processes from water infrastructure).
2. Continue to fund students to improve student opportunities and exposure to BOEM science.

7 REFERENCES

Caplan N. 1979. The two-communities theory and knowledge utilization. American Behavioral Scientist. 22(3):459–70.

Knott J, Wildavsky A. 1980. If dissemination is the solution, what is the problem? Knowledge: Creation, Diffusion, Utilization. 1(4):537–578.

Landry R, Lamari M, Amara N. The extent and determinants of the utilization of university research in government agencies. Public Administration Review. 63(2):192–205.

[NASEM] National Academies of Sciences, Engineering, and Medicine. 2022. Attributes of a first-in-class environmental program: a letter report prepared for the Bureau of Ocean Energy Management. Washington (DC): The National Academies Press. https://doi.org/10.17226/26368.

Shafer M. 2005. Defining utilization. Norman (OK): Oklahoma Climatological Survey. 8 p.

Yin Y, Dong Y, Wang K, et al. 2022. Public use and public funding of science. Nature Human Behaviour. 6:1344–1350. doi:10.1038/s41562-022-01397-5.

APPENDIX A: INTERVIEW GUIDES

ADVANCE NOTIFICATION EMAIL FOR INTERVIEWS

The Bureau of Ocean Energy Management (BOEM) requests your participation in an interview to understand how stakeholders receive, use, and contribute to BOEM-funded environmental studies and assessments. These interviews are part of an ongoing BOEM-sponsored project on *"Evaluating Connections: BOEM's Environmental Studies and Assessments."* This important project aims to understand how BOEM's scientific research contributes to BOEM's environmental assessments and vice versa, as well as their influence on the external (i.e., non-BOEM) community.

During the internal portion of this project, BOEM identified you as a key contact at an agency, institution, or other organization that BOEM collaborates with on environmental studies and/or assessment work (e.g., NEPA, Section 106, etc.). The interviews will focus on how external stakeholders like you use BOEM studies and assessment information; how this information informs external environmental analyses, assessments, or policy decisions; and how external stakeholders contribute to BOEM's studies. We understand that you may have also received an invitation to complete an online survey for this study. A subset of survey participants and additional contacts identified by BOEM were selected for a more in-depth interview.

Interview questions will be tailored to your organization. The interview questions will ask for your insights on topics such as linkages between BOEM and your organization, how you use BOEM's environmental studies in your work, how you contribute to BOEM studies and/or assessments, and your recommendations on ways to strengthen information sharing moving forward. Each interview session will be approximately 60 minutes and will be conducted using Microsoft Teams or another virtual or telephone platform.

BOEM has contracted with Industrial Economics, Incorporated (IEc), an independent contractor, to conduct the interviews. No BOEM personnel will participate in your interview session. The BOEM study team and/or IEc will contact you directly to schedule your interview. Please keep an eye out for follow-up information.

Your participation in the interview is voluntary. Your full and candid responses will help ensure that the study results are accurate and helpful. Individual names of interviewees **will not be disclosed** in the presentation of findings or analysis; responses will be aggregated and presented by type of respondent (e.g., state agencies, research institutions, academics/universities, etc.).

BOEM's Environmental Studies Program and Environmental Assessment Program

BOEM's mission is to manage the development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way. In fulfilling its mission, BOEM must comply with a range of environmental requirements, including but not limited to the National Environmental Policy Act (NEPA), Endangered Species Act, Magnuson Stevens Fishery Conservation and Management Act, Marine Mammal Protection Act, Coastal Zone Management Act, and the National

Historic Preservation Act. BOEM develops environmental assessments, including NEPA documents, consultation documents, and other analyses that use the best available information to comply with relevant statutes and policies. Environmental studies funded by BOEM's Environmental Studies Program (ESP) provide scientific information (including the biological, physical, and social sciences as broadly defined) to inform BOEM's environmental assessments.

For purposes of the current project, the term "environmental assessment" encompasses the diversity of analyses that BOEM's Environmental Assessment Program undertakes and is not restricted to NEPA environmental assessments. For example, the following types of documents are considered within BOEM's environmental assessments: NEPA environmental impact statements; NEPA environmental assessments; National Historic Preservation Act documents (including Section 106 evaluations of effects on historic properties and programmatic agreements); essential fish habitat assessments for Magnuson-Stevens Fishery Conservation and Management Act consultations; Endangered Species Act Section 7 biological evaluations or biological assessments; analyses and assessments prepared to comply with the Clean Air Act, Coastal Zone Management Act, and Marine Mammal Protection Act; and analyses and assessments such as engineering analyses, regulatory impact analyses, resource evaluations, additional NEPA-related analyses, site assessments, and cost-benefit analyses prepared for the Outer Continental Shelf Lands Act and other regulatory requirements.

Privacy Notice

We invite you to review the attached Privacy Notice, which provides information about the authority for the data collection, purpose of the collection, method of the collection, who will have access to the collected information, and how the BOEM Evaluation Team and contractor will maintain and use the collected information.

Paperwork Reduction Act of 1995 (PRA) Statement

BOEM is collecting this information subject to the Paperwork Reduction Act (44 U.S.C. 3501 et seq.) to gather feedback to better understand how stakeholders receive, use, and contribute to BOEM-funded environmental studies and assessments.

Responses are voluntary, and BOEM will not share the results publicly. BOEM estimates the interview will take you 60 minutes to complete either by using Microsoft Teams or another virtual or telephone platform.

BOEM may not conduct or sponsor and you are not required to respond to a collection of information unless it displays a currently valid OMB Control Number. OMB has reviewed and approved this interview letter and assigned OMB Control Number 1010-xxxx. Comments regarding the burden estimate or any other aspect of this form may be submitted to the Information Collection Clearance Officer, Bureau of Ocean Energy Management, 45600 Woodland Road, Sterling, VA 20166.

Information Collection Request

OMB Control Number 1010-0194

Expiration Date: 06/30/2025

Questions

If you have any questions about the project, please contact Megan Davidson at: Megan.Davidson@boem.gov.

INTERVIEW GUIDE

This is a consolidated interview guide. Questions that are specific to different types of stakeholders are designated in parentheses. IEc created separate (customized) guides for each type of stakeholder.

Background

1. Please briefly describe (1-2 minutes) your current position/role in your organization.

Use of BOEM-funded Environmental Studies

2. Have you used information from BOEM-funded environmental studies in your work? "Your work" refers to tasks and responsibilities that you personally carry out for your agency, institution, or organization.

   [*If yes, proceed; if no, move to next section*]

3. How have you used the information from BOEM-funded environmental studies in your work?
4. Are there specific BOEM environmental studies that have been, or currently are, of particular importance to your work? If yes, please explain.
5. In the years ahead, BOEM's scientific work will focus more than in the past on considerations around renewable energy development. Do you expect this shift in focus to change the importance of BOEM's environmental studies to your work?
   a. If yes, please explain.

[The next question is only for public agencies]

6. To what extent do study results inform any of the following at your agency?
   i. Research studies conducted by your agency
   ii. Products derived from research studies (e.g., integrated datasets, modeling inputs or modeling runs, etc.)
   iii. Environmental assessments developed by your agency
   iv. Planning or policy decisions taken by your agency
   a. If possible, please answer each item above on a scale from 1-5, where 1 means "not at all," 3 means "to some extent," and 5 means "very much."
   b. Can you think of one or more examples? If yes, please describe.
7. Where do you get information on BOEM-funded environmental studies? *[probe: grey literature vs. primary literature in the sourcing of information on BOEM-funded environmental studies]*
8. Are there information-sharing opportunities that BOEM could take advantage of to expand distribution and use of BOEM-funded environmental studies?

9. What, if anything, could increase the usefulness of BOEM-funded environmental studies in your work?

Contribution to BOEM-funded Environmental Studies

10. Have you contributed to BOEM-funded environmental studies? We are interested in intellectual contributions, which include but are not limited to: ideas for a new study, principal investigator, participation on a research team, etc.

    [*If yes, proceed; if no, move to next section*]

11. How do you or have you contributed to BOEM-funded environmental studies?
    a. *[Ask Academics and Consultants Only]* Do you conduct BOEM-funded environmental studies (e.g., as a principal investigator or as part of a team of researchers)? If yes:
        i. Does any of the funding you receive from BOEM support student research?
            1. If yes, does this include undergraduate, Masters, and/or PhD-level work?
                - Approximately how many students does this include? (Please break out by undergraduate, Masters, and PhD level, as applicable.)
                - Over approximately how many years has funding that you receive from BOEM supported student research?
                - Has the number of students included in this research increased, decreased, or stayed about the same over time? Please explain.
            2. Based on your direct observation and experience, how does participating in BOEM-funded research affect the students' academic careers? (examples: influences the student's focus of study; supports completion of the student's dissertation; etc.)
            3. Based on your direct observation and experience, how does participating in BOEM-funded research affect the students' post-academic careers? (examples: influences the type of work they do after graduating; influences the type of organization to which they apply for a job; etc.)
            4. Are there other ways that BOEM research supports the careers of young scientists? If yes, please explain.
    b. Have you contributed an idea for a BOEM-funded environmental study? If yes:
        i. What was the forum or format in which you contributed your idea?
        ii. As far as you know, did BOEM subsequently fund any studies that addressed your idea? Note that BOEM studies may address all or part of an idea, or a combination of ideas submitted by different people.
            1. If yes, did you participate in implementing the study? Please explain.
    c. How else, if at all, do you interact with BOEM on implementing or conducting BOEM-funded environmental studies?

12. Do you share the results of BOEM-funded environmental studies to which you contributed with other stakeholders inside and/or outside your organization?
    a. If yes, with whom, and how? (e.g., final report, other publications, conferences, presentations, informal communications with colleagues)?
13. What are some uses of the findings or information of the BOEM-funded environmental studies in which you have taken part?
14. What types of information needs do these studies fulfill (e.g., in environmental assessments or for planning, policy, and resource management decisions)?

Contribution to Science-informed Analyses and Environmental Assessments

15. Have you contributed to environmental assessments or analyses in cooperation with BOEM (e.g., for which BOEM is a co-lead agency, cooperator, or key stakeholder)? If yes:
    a. What types of assessments or analyses are they (e.g., NEPA, Endangered Species Act consultations)?
    b. Is your agency/organization the lead on the assessments/analyses?
    c. What is BOEM's role in these assessments/analyses?

    [*If yes, proceed; if no, move to next section*]
16. Do these assessments/analyses rely on information from BOEM studies? If yes:
    a. What types of information do they rely on from BOEM studies?
    b. Can you provide specific examples of BOEM studies fulfilling important information needs?
17. How else, if at all, do you interact with BOEM on environmental assessments or analyses?
18. How are these assessments used to inform resource planning, policy, and/or management?
    a. Do you have specific examples?

Use of BOEM Environmental Assessments or Analyses

19. Have you used information from BOEM environmental assessments or analyses in your work?

    [*If yes, proceed; if no, move to next section*]
20. How have you used the information from BOEM environmental assessments/analyses?
21. Are there specific BOEM environmental assessments/analyses that have been, or currently are, of particular importance to your work? If yes, please explain.
22. In the years ahead, BOEM's scientific work will focus more than in the past on considerations around renewable energy development. Do you expect this shift in focus to change the importance of BOEM's environmental assessments/analyses to your work?
    a. If yes, please explain.

[The next two questions are <u>only</u> for public agencies]

23. To what extent does information in BOEM-led environmental assessments/analyses inform any of the following at your agency?
    i. Research studies conducted by your agency
    ii. Environmental assessments developed by your agency
    iii. Policy decisions taken by your agency
    a. If possible, please answer each item above on a scale from 1-5, where 1 means "not at all," 3 means "to some extent," and 5 means "very much."
    b. Can you think of one or more examples? If yes, please describe.
24. Where do you get information on BOEM environmental assessments/analyses?
25. *(If not previously asked)* Do you share BOEM-led environmental assessments/analyses with other stakeholders inside and/or outside of your organization? If yes, with whom, and how?
    a. If yes, with whom, and how? (e.g., written reports, conferences, presentations, informal communications with colleagues)?

Wrap-up

26. Other than what we have already discussed, can you think of any other updates or changes that BOEM could make to share study and assessment results with you and your organization in a more useful way? If yes, please explain.

APPENDIX B: SURVEY QUESTIONNAIRE

ADVANCE NOTIFICATION EMAIL FOR THE SURVEY

The Bureau of Ocean Energy Management (BOEM) requests your participation in an online survey to understand how stakeholders receive, use, and contribute to BOEM-funded environmental studies and assessments. This survey is part of an ongoing BOEM-sponsored project on *"Evaluating Connections: BOEM's Environmental Studies and Assessments."* This important project aims to understand how BOEM's scientific research contributes to BOEM's environmental assessments and vice versa, as well as their influence on the external (i.e., non-BOEM) community.

During the internal portion of this project, BOEM identified you as a key contact at an agency, institution, or other organization that BOEM collaborates with on environmental studies and/or assessment work (e.g., NEPA, Section 106, etc.). The survey focuses on how external stakeholders like you use BOEM studies and assessment information; and how information is exchanged between BOEM and external stakeholders.

The survey will ask whether and how you receive and use information about the results from BOEM studies and assessments. It will also ask you to confirm individuals within BOEM with whom you communicate on studies and assessments, provide information about those connections, and indicate whether you disseminate information from your interactions with BOEM to other organizations. Your responses will be used to develop network maps and metrics that explain the structure of BOEM's "network" and how information flows throughout the network.

The PDF attachment includes the names of BOEM personnel in each BOEM office/region who work on studies, assessments, or both or who supervise staff who do. You may wish to review the attached list of personnel to refresh your memory prior to completing the survey regarding your connections to BOEM's studies and assessments.

Your participation in the survey is voluntary. Full and candid responses will help ensure that the study results are accurate and helpful. Please do not provide any Personal Identifiable Information (PII) that you view as sensitive or that viewed in the context of the survey would be considered sensitive (e.g., Social Security number, driver's license, etc.). BOEM has contracted with an independent consulting firm, Industrial Economics, Incorporated (IEc), to collect and analyze the survey responses. All responses will be presented at the organization level; individual names **will not be disclosed** in the presentation of findings or analysis.

Please complete the survey at the following link: {survey link}.

Please complete the survey within the next two (2) weeks. It should take 20 minutes or less to complete. We encourage you to take the survey on your laptop or desktop – not a mobile device – for a more user-friendly experience.

BOEM's Environmental Studies Program and Environmental Assessment Program

BOEM's mission is to manage the development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way. In fulfilling its mission, BOEM must comply with a range of environmental requirements, including but not limited to the National Environmental Policy Act (NEPA), Endangered Species Act, Magnuson-Stevens Fishery Conservation and Management Act, Marine Mammal Protection Act, Coastal Zone Management Act, and the National Historic Preservation Act. BOEM develops environmental assessments, including NEPA documents, consultation documents, and other analyses that use the best available information to comply with relevant statutes and policies. Environmental studies funded by BOEM's Environmental Studies Program (ESP) provide scientific information (including the biological, physical, and social sciences as broadly defined) to inform BOEM's environmental assessments.

For purposes of the current project, the term "environmental assessment" encompasses the diversity of analyses that BOEM's Environmental Assessment Program undertakes and is not restricted to NEPA environmental assessments. For example, the following types of documents are considered within BOEM's environmental assessments: NEPA environmental impact statements; NEPA environmental assessments; National Historic Preservation Act documents (including Section 106 evaluations of effects on historic properties and programmatic agreements); essential fish habitat assessments for Magnuson-Stevens Fishery Conservation and Management Act consultations; Endangered Species Act Section 7 biological evaluations or biological assessments; analyses and assessments prepared to comply with the Clean Air Act, Coastal Zone Management Act, and Marine Mammal Protection Act; and analyses and assessments such as engineering analyses, regulatory impact analyses, resource evaluations, additional NEPA-related analyses, site assessments, and cost-benefit analyses prepared for the Outer Continental Shelf Lands Act and other regulatory requirements.

Privacy Notice

We invite you to review the attached Privacy Notice, which provides information about the authority for the data collection, purpose of the collection, method of the collection, who will have access to the collected information, and how the BOEM Evaluation Team and contractor will maintain and use the collected information.

Paperwork Reduction Act of 1995 (PRA) Statement

BOEM is collecting this information subject to the Paperwork Reduction Act (44 U.S.C. 3501 et seq.) to gather feedback to better understand how stakeholders receive, use, and contribute to BOEM-funded environmental studies and assessments.

Responses are voluntary, and BOEM will not share the results publicly. BOEM estimates the survey will take you 20 minutes to complete. This includes the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the survey.

BOEM may not conduct or sponsor and you are not required to respond to a collection of information unless it displays a currently valid OMB Control Number. OMB has reviewed and approved this survey and assigned OMB Control Number 1010-xxxx. Comments regarding the burden estimate or any other

aspect of this form may be submitted to the Information Collection Clearance Officer, Bureau of Ocean Energy Management, 45600 Woodland Road, Sterling, VA 20166.

Information Collection Request

OMB Control Number 1010-0194

Expiration Date: 06:30/2025

Questions

If you have any questions about this project, please contact Megan Davidson at: Megan.Davidson@boem.gov.

SURVEY INSTRUMENT

Introduction

Thank you for participating in this survey. You received this survey because a BOEM scientist identified you as an external contact for studies and assessment work. The survey focuses on how external (i.e., non-BOEM) stakeholders like you use BOEM studies and assessment information and how information is exchanged between BOEM and external stakeholders.

Your participation in the survey is voluntary. Full and candid responses will help ensure that the study results are accurate and helpful. Please do not provide any Personal Identifiable Information (PII) that you view as sensitive or that viewed in the context of the survey would be considered sensitive (e.g., Social Security number, driver's license, etc.). All responses will be presented at the organization level; individual names **will not be disclosed** in the presentation of findings or analysis.

While taking the survey, it is possible that you will run across a question that is difficult to answer. Please answer to the best of your ability, using your professional judgment. Your responses are important to this research. The survey requires approximately 20 minutes or less to complete. Please ensure that you have ample time to complete the survey as it will reset automatically if you close the browser prematurely.

Note: To move backwards, do not use your web browser's back button as this will erase your responses. Instead, click the "previous" button at the bottom of the screen. The "next" button will advance you to the next page. Please take the survey on a laptop/desktop for a smoother experience.

OMB Control Number 1010-0194

Expiration Date: 06:30/2025

Respondent's Role in Communicating with BOEM

Note: Throughout this survey, "your work" refers to tasks and responsibilities that you personally carry out for your agency, institution, or organization.

1. In your work, in what role(s) have you communicated with BOEM **within the last 24 months**? Select all that apply.
    a. Principal investigator on one or more BOEM studies
    b. Member of a research team on one or more BOEM studies
    c. Subject matter expert for BOEM studies and/or assessments
    d. Federal, state, or other public agency that manages similar trust resources as BOEM
    e. Research program at a federal, state, or other public agency
    f. Research program at a college or university
    g. Cooperating agency that works with BOEM on assessments
    h. Organization/entity affected by BOEM policy or planning decisions
    i. Other – please specify *[open text]*

Receiving Information from BOEM Studies

2. Do you receive information from BOEM **studies?**
    a. Yes
    b. No *[skip to Question 9]*

3. How do you receive information from BOEM studies? Check all that apply.
    a. Conferences
    b. Webinar presentations
    c. Direct interactions with staff at BOEM
    d. Direct interactions with staff at federal agencies other than BOEM
    e. Direct interactions with staff at state agencies
    f. Direct interactions with academics collaborating with BOEM on a study
    g. Newsletter from BOEM office
    h. Internet searches for specific topical information which includes results from BOEM studies or assessments
    i. Visiting BOEM website
    j. Using the BOEM Environmental Studies Program Information System (ESPIS)
    k. Not applicable
    l. Other – please specify *[open text]*

Use of Information – Studies

4. How do you use the information that you receive from BOEM studies? Select all that apply. If you do not use information from BOEM studies, select "Not applicable."
    a. To inform policy
    b. To develop NEPA analyses
    c. To develop other types of environmental, social, or economic assessments
    d. To develop or implement mitigations
    e. For use in an environmental damage assessment
    f. To inform future research
    g. For use in a model
    h. To teach others
    i. Not applicable *[skip to Question 6]*
    j. Other – please specify *[open text]*
5. Please list **specific examples** for your answer to the previous question – i.e., specific policies, analyses, assessments, mitigations, damage assessments, research, models, teaching opportunities, etc. that were informed by information you received from BOEM studies. *[open text]*
6. Do you conduct environmental analyses?
    a. Yes
    b. No *[skip to Question 8]*
7. Overall, how **useful** are BOEM studies in providing scientific information to inform your **environmental analyses**? If you do not use information from BOEM studies to inform your environmental analyses, or you do not conduct environmental analyses, select "Not applicable."
    a. Useless
    b. Somewhat useless
    c. Neither useful nor useless
    d. Somewhat useful
    e. Very useful
    f. Not applicable
8. Overall, how **useful** are BOEM studies in providing scientific information to inform your organization's relevant **policy and planning decisions**? If your organization does not use information from BOEM studies to inform its policy and planning decisions, or if your organization does not make policy and planning decisions that relate to BOEM study topics, select "Not applicable."

a. Useless
b. Somewhat useless
c. Neither useful nor useless
d. Somewhat useful
e. Very useful
f. Not applicable

Receiving Information from BOEM Assessments

9. Do you receive information from BOEM **assessments**?
    a. Yes
    b. No *[skip to Question 13]*
10. How do you receive information from BOEM assessments? Check all that apply.
    a. Conferences
    b. Webinar presentations
    c. Direct interactions with staff at BOEM
    d. Direct interactions with staff at federal agencies other than BOEM
    e. Direct interactions with staff at state agencies
    f. Direct interactions with academics collaborating with BOEM on a study
    g. Newsletter from BOEM office
    h. Internet searches for specific topical information which includes results from BOEM studies or assessments
    i. Visiting BOEM website
    j. Public meetings
    k. Public notices on availability of NEPA documents
    l. Not applicable
    m. Other – please specify *[open text]*

Use of Information – Assessments

11. How do you use the information from BOEM **assessments**? Select all that apply. If you do not use information from BOEM assessments, select "Not applicable."
    a. To inform policy
    b. To develop NEPA analyses
    c. To develop other types of environmental, social, or economic assessments
    d. To develop or implement mitigations
    e. For use in an environmental damage assessment
    f. To inform public comments submitted on specific agency actions
    g. To inform future research

h. For use in a model

i. To teach others

j. Not applicable *[skip to Question 13]*

k. Other – please specify *[open text]*

12. Please list **specific examples** for your answer to the previous question – i.e., specific policies, analyses, assessments, mitigations, damage assessments, public comments, research, models, teaching opportunities, etc. that were informed by information you received from BOEM assessments. *[open text]*

Information About You

13. Please provide your first name, last name, and organization. This information is needed for the survey analysis to describe connections between your organization and contacts in BOEM programs/regional offices. For example, your response may show if you identified the same contact(s) in your response as the BOEM contact(s) who identified you in their response. As a reminder, all responses will be presented at the organization level; **individual names will not be disclosed** in the presentation of the survey findings or analysis.

    First name: *[open text]*

    Last name: *[open text]*

    Organization: *[open text]*

14. What office or department do you work in? *[open text]*

BOEM Contacts

15. Please list **up to five (5)** people **at BOEM** that you interact with in the development or implementation of BOEM studies, the development of analyses for environmental assessments, or from whom you receive information about BOEM studies or assessments. If you interact with more than five (5) people at BOEM, include the five (5) that you consider the most important for your work. Consider people you interacted with at least once **within the last 24 months**.

    You may wish to refer to the PDF version of the list you received with the notification email to gather your thoughts about your most important connections (and limit scrolling).

    *[**Note for reviewers:** A PDF file with the names of BOEM personnel who work on studies and/or assessments will be attached to the survey notification email. Question 15 will include a drop-down menu with the list of names in the PDF file. Respondents will be allowed to select up to five names from the drop-down menu.]*

16. For each person in the table, please report the **subject of interactions** you have with the individual. Fill out the boxes as though completing the sentence, "I interact with this person to. . ." ***[Note for reviewers:*** *The survey will show the list of names reported in Question 15]*

Name	(a)…collaborate on BOEM studies	(b)…collaborate on BOEM assessments	(c)…receive information from BOEM studies	(d)…receive information from BOEM assessments
[Pre-filled]	*[Yes/No]*	*[Yes/No]*	*[Yes/No]*	*[Yes/No]*

17. For each person, please indicate how **often** you interact with the person related to your studies and/or assessment work. Please use the drop-down menus in each column to indicate your answer. ***[Note for reviewers:*** *The survey will show the list of names reported in Question 15]*

Name	Frequency of Interactions
[Pre-filled]	*[Drop-down:* *1) At least once a year, but less than once a month* *2) Once or twice a month* *3) More than twice a month, but less than weekly* *4) At least once a week]*

18. Did you interact with these contacts more often, less often, or about the same before the COVID-19 pandemic started? If you did not interact with any of these contacts before COVID-19 started, select "not applicable."

    a. I interacted with my contacts **more often** before COVID.

    b. I interacted with my contacts **less often** before COVID.

    c. I interacted with my contacts about **the same** amount before COVID.

    d. Not applicable.

Other Contacts

19. Please indicate up to **five (5) organizations** that you interacted with to **share** information about BOEM studies and assessments **within the last 24 months**. This includes sharing information from studies and assessments, even if you do not share the study reports or assessment documents themselves. If you shared information with more than five (5) organizations, please include the five (5) that you consider the most important for your work. Please consider contacts at federal agencies, state agencies, academics/universities, Tribes, regional organizations, and other external partners. If none, please indicate "None."

External Organization	Office
[Open text]	*[Open text optional]*

APPENDIX C: FULL METHODOLOGY

IEc submitted a report of the full methodology that they planned to execute for Year 3. This report was completed in 2023 and is published now in its original form with this Volume 3 document (April 2024). Download the report at https://www.boem.gov/environment/evaluating-connections-vol-3-appendix-cfull-methodology.

APPENDIX D: LIST OF PEER-REVIEWED PUBLICATIONS FROM ESP-FUNDED PROJECTS

The full list of publications IEc identified from ESP-funded projects is available as a Microsoft® Excel file for download at https://www.boem.gov/environment/evaluating-connections-vol-3-appendix-d-list-peer-reviewed-publications-esp-funded.

The spreadsheet includes information on each publication, as available, including the following:

- Author
- Publication title
- Publication year
- Journal title
- Contract ID
- Publication ID
- Publication number
- Report number
- Publisher
- DOI hyperlink

APPENDIX E: LIST OF PEER-REVIEWED PUBLICATIONS AND CITATION COUNTS

The full list of the articles the IEc reviewed, along with their individual citation counts and impact ratings, is available as a Microsoft® Excel file for download at https://www.boem.gov/environment/evaluating-connections-vol-3-appendix-e-list-peer-reviewed-publications-and-citation.

This spreadsheet provides results from IEc's citation analysis, including IEc's manual citation analysis and Google Scholar web scraping exercise, along with instructions on how to replicate the Google Scholar review.

APPENDIX F: ADDITIONAL RESULTS: SNA

Table F-1 shows the contacts survey respondents reported collaborating with, broken out by BOEM office or type of external organization. Academic and state respondents reported the most overall contacts (6.7) on average, just ahead of federal employees (6.5). These were both close to the overall average of 6.3 contacts, comprised 4.1 BOEM staff and 2.2 external collaborators. Federal to federal was the most frequent type of external contact (1.4), ahead of NGO/nonprofit/private communicating with the same types of entities (1.3), and academic to federal (0.9) and academic to academic (0.9) connections. Although federal, academic, and other respondents all reported individuals at OEP as their most frequent BOEM contacts, state agencies collaborating with GOM Region (2.0 contacts) was the most frequently reported interaction between groups of individuals.

TABLE F-1. SURVEY RESPONDENT BOEM AND EXTERNAL CONTACTS

Type	Federal	Academic	State	NGO/ Nonprofit/ Private	Total External	Alaska	OREP	OEP	MMP	GOM	Pacific	Total BOEM	Total
Federal	1.4	0.2	0.2	0.4	2.2	0.3	0.8	1.5	0.4	1.0	0.3	4.3	6.5
Academic[1]	0.9	0.9	0.1	0.6	2.6	0.4	0.5	1.8	0.5	0.4	0.6	4.1	6.7
State	0.3	0.3	0.3	0.7	1.7	1.3	0.7	0.3	0.0	2.0	0.7	5.0	6.7
NGO/Nonprofit/Private	0.3	0.3	0.0	1.3	2.0	1.3	0.7	0.5	0.0	0.5	0.0	3.0	5.0
NA	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	2.0	2.0
All	1.0	0.4	0.1	0.6	2.2	0.5	0.7	1.4	0.4	0.8	0.3	4.1	6.3

[1] One international external contact reported by an academic, not included in table (0.1 average)

U.S. Department of the Interior (DOI)

DOI protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation's trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

Bureau of Ocean Energy Management (BOEM)

BOEM's mission is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.

BOEM Environmental Studies Program

The mission of the Environmental Studies Program is to provide the information needed to predict, assess, and manage impacts from offshore energy and marine mineral exploration, development, and production activities on human, marine, and coastal environments. The proposal, selection, research, review, collaboration, production, and dissemination of each of BOEM's Environmental Studies follows the DOI Code of Scientific and Scholarly Conduct, in support of a culture of scientific and professional integrity, as set out in the DOI Departmental Manual (305 DM 3).