

Development of a Regional Framework for Fish & Fisheries Research and Monitoring Related to Offshore Wind (Fish FORWRD)

Project Report and User Manual

ROSA Report No. 22-02

Submitted to

**Responsible Offshore Science Alliance (ROSA)
Washington, D.C.**

December 2022

Submitted by

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Suggested Citation:

Responsible Offshore Science Alliance (ROSA). 2022. Development of a Regional Framework for Fish & Fisheries Research and Monitoring Related to Offshore Wind (Fish FORWRD). ROSA Report 22-02. Prepared by WSP USA, Inc., New York.

**ROSA
FISH AND FISHERIES DATABASE**

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1.0 INTRODUCTION

The Responsible Offshore Science Alliance (ROSA) in conjunction with its Advisory Council, enlisted WSP USA, Inc. (WSP) to further one of its fundamental projects: a regional framework for fisheries research and monitoring related to offshore wind development. This project would support multiple entities in understanding the current state of research on fish and fisheries and informing future actions related to offshore wind development. The New York State Energy Research and Development Authority (NYSERDA) has initially expressed interest in this project to help guide New York State and offshore wind developers of leases in the New York Bight in allocation of funds for fish and wildlife research required as conditions under New York State's procurement agreements with offshore wind developers. ROSA envisioned this framework as a publicly accessible database that would contain information on ongoing research related to offshore wind development and fish and fisheries, and research questions/needs, and provide the user with the ability to search the database based on specific criteria. The intent behind creating this Fish and Fisheries OffshoRe Wind Research Database (FORWRD) was to provide a platform for which new and existing projects and research needs could be added as offshore wind development increases on the U.S. east coast.

2.0 BUILDING THE FISH FORWRD DATABASE

2.1 DATABASE STRUCTURE

The Fish FORWRD database is an Excel spreadsheet containing eight tabs (see Figure 1). See Table 1 for a description of the information contained in each tab of the database.

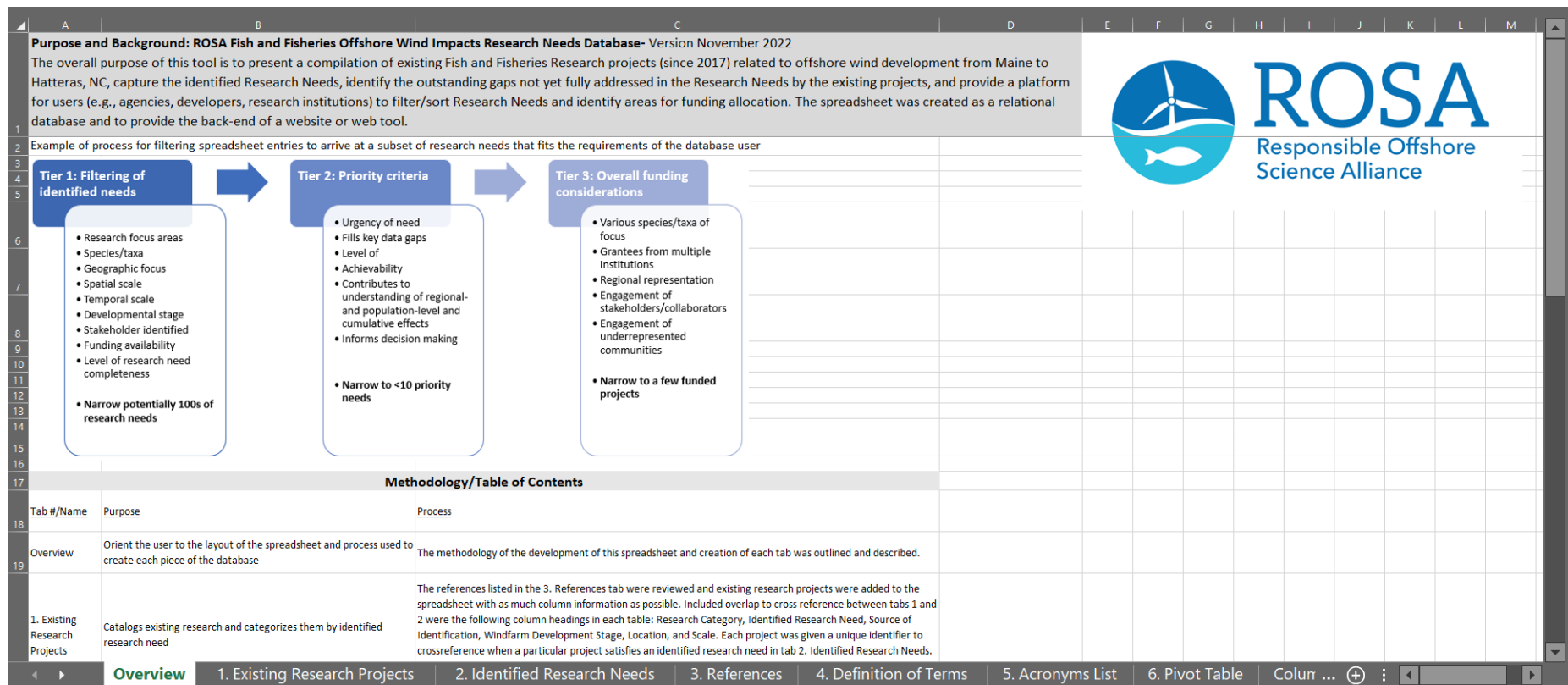


Figure 1. The Fish FORWRD Database – Overview Tab

Table 1. Fish FORWRD Tabs

Tab #	Tab Name	Purpose	Methodology Used to Populate
0	Overview	To orient the user to the layout of the spreadsheet and process used to create each component of the database.	The overall methodology for the development of the Fish FORWRD database was outlined and described.
1	Existing Research Projects	To catalog existing research projects and categorize these projects by identified research needs.	<p>Each existing research project (defined as occurring since 2016) was added to the tab as a new row with a unique alphanumeric identifier (e.g., Ex-1). For unavailable project-specific information, columns were completed following directions in “<i>Tab 4. Definition of Terms</i>”.</p> <p>Tab to be updated at regular intervals to capture new projects.</p>
2	Identified Research Needs	To catalog identified research needs and categorize them using various qualifiers, as well as house the data gap analysis.	<p>Each identified research need was added to the tab as a new row with a unique alphanumeric identifier (e.g., RN-1).</p> <p>Each research need was categorized to the extent possible. Categories used are outlined in Table 2 of this report.</p> <p>A data gap analysis was conducted for each identified research need through the following steps:</p> <ul style="list-style-type: none"> • All documented existing research projects in Tab 1 were reviewed for projects that satisfied any portion of the identified research need. • Existing research projects that partially or adequately addressed an identified research need were listed. • A determination of “Adequately Addressed”, “Partially Addressed”, or “Not Addressed” was made based on the list of relevant existing research projects. • If an identified research need was determined to be “Partially Addressed”, a description of the results of the pertinent existing project(s) were recorded and

Tab #	Tab Name	Purpose	Methodology Used to Populate
			the outstanding portions of the need were listed.
3	References	To capture the references reviewed for and cited in the Fish FORWRD database.	The list of references for review was developed based on initial input from ROSA. References included were reviewed as part of populating “ <i>Tab 1. Existing Research Projects</i> ” and “ <i>Tab 2. Identified Research Needs</i> ”.
4	Definition of Terms	To provide definitions of terminology used in the Fish FORWRD database.	Definitions of drop-down items for data entry and terminology to use when data was not available were refined through discussion with ROSA.
5	Acronyms List	To house a list of all acronyms used in the Fish FORWRD database.	All acronyms used were listed and defined.
6	Pivot Table	To help the user tabulate and sort database contents.	Several pivot tables were added and pre-populated to summarize database contents in a way that may be useful for RFP creation, narrowing down options for mitigation funding, or a high-level picture of existing research projects related to fish, fisheries, and offshore wind. Basic instructions were included so the user could create their own pivot table for a more specific output.
NA	Column List Options	Not a tab with contents for the user. This tab houses the drop-down column options for other tabs.	Contains drop down options for other tabs in Fish FORWRD database.

2.2 POPULATING THE DATABASE

Prior to project kickoff, ROSA provided WSP a copy of “Table 1: Synthesis of research topics from several sources related to offshore wind development along the Atlantic Coast” (ROSA Research Topics), which was the initial list of references reviewed to populate the database. Following project kickoff, WSP developed a list of additional references for review, which was approved by ROSA. The final list of references reviewed is located in “*Tab 3. References*”.

The list of references reviewed covered a wide variety of sources. Existing research projects were typically gleaned from databases (i.e., Tethys) or agency announcements of request for proposals (RFP) award allocations. Identified research needs were typically identified in National Marine Fisheries Service biological opinions for windfarms with records of decisions, fishery management councils,

ROSA internal documents, state fishery agency briefings, U.S. Offshore Wind Synthesis of Environmental Effects Research educational briefs, or Sea Grant documents. References reviewed were filtered to focus on a geographic region of the Atlantic Ocean extending from Maine to Cape Hatteras, North Carolina. Existing research projects and identified research needs were included that were more recent than 2016.

For each new entry in “*Tab 1. Existing Research Projects*” or “*Tab 2. Identified Research Needs*”, key information was recorded, as outlined in Table 2. See Figures 2 and 3 for a depiction of these two tabs. Definitions of prepopulated dropdown options outlined in Table 2 are included in Table 3.

Each entry was also assigned a unique alphanumeric identification code to quickly cross reference existing research projects and identified research needs between different tabs of the database. These unique identification codes were specifically used in the data gap analysis, described in Section 2.3.

Following population of these two tabs of the database, WSP conducted a quality assurance check to remove duplicate entries that may have been identified in multiple sources. Identified research needs deemed to be complementary and overlapping were also combined.

Table 2. Fish FORWRD Columns

Column Name	Column Definition	Fish FORWRD Database Tab	
		Tab 1. Existing Research Projects	Tab. 2 Identified Research Needs
Research Project ID #	Unique identifier for associated research project used to related between tabs in the database.	Yes	-
Research Need ID #	Unique identifier for associated research need used to relate between tabs in the database.	-	Yes
Research Category	<p>Categorizations used for existing research projects and identified research needs. Dropdown options for this column are (definitions for these options are provided in Table 3):</p> <ul style="list-style-type: none"> • <i>Fish</i> • <i>Fisheries</i> • <i>Other</i> <p>This column appears three times for each entry to account for entries that encompass up to all three categories.</p>	Yes	Yes

Column Name	Column Definition	Fish FORWRD Database Tab	
		Tab 1. Existing Research Projects	Tab. 2 Identified Research Needs
Identified Research Need	<p>Further thematic categories to assign each existing research project and identified research need entry. Dropdown options for this column are (definitions for these options are provided in Table 3):</p> <ul style="list-style-type: none"> • <i>Changes in Light Level</i> • <i>Cultural Impacts</i> • <i>Cumulative Impacts</i> • <i>Economic Impact</i> • <i>EMF Impacts</i> • <i>Fishery Access</i> • <i>Fishing Industry Communication</i> • <i>Habitat Fragmentation/Modification</i> • <i>Heat Impacts</i> • <i>Infrastructure Impacts</i> • <i>Other</i> • <i>Resource Monitoring</i> • <i>Sound/Vibration Impacts</i> • <i>Species Distribution/Composition</i> • <i>Community Engagement</i> • <i>Null</i> <p>This column appears twice so that each entry may be classified using up to two thematic categories.</p>	Yes	Yes
Source of Identification	Lists the reference source listed in “ <i>Tab 3. References</i> ” where the existing research project or identified research need was found.	Yes	Yes
Fixed or Floating	<p>Identifies the turbine foundation type that an identified research project focuses on. Dropdown options for this column are:</p> <ul style="list-style-type: none"> • <i>Fixed</i> • <i>Floating</i> • <i>Both</i> 	Yes	-
Wind Farm Development Stage	Identifies which wind farm development stage the existing research project or identified	Yes	Yes

Column Name	Column Definition	Fish FORWRD Database Tab	
		Tab 1. Existing Research Projects	Tab. 2 Identified Research Needs
	research need focuses on. Dropdown options for this column are (definitions for these options are provided in Table 3): <ul style="list-style-type: none"> • <i>All</i> • <i>None</i> • <i>Pre-construction</i> • <i>Construction</i> • <i>Operation/Maintenance</i> • <i>Decommissioning</i> • <i>Undetermined</i> 		
Spatial Scale	Identifies the generalized geographic scale of effect/impact examined for the existing research project or identified research need. Dropdown options for this column are (definitions for these options are provided in Table 3): <ul style="list-style-type: none"> • <i>Individual Turbine</i> • <i>Offshore Wind Project</i> • <i>State</i> • <i>Regional</i> • <i>National</i> • <i>Undetermined</i> 	Yes	Yes
Location	Identifies the specific geographic extent of the existing research project or identified research need.	Yes	Yes
Temporal Scale of Project	Identifies the temporal scale of study for existing research projects. Dropdown options for this column are: <ul style="list-style-type: none"> • <i>Short [0-3 years]</i> • <i>Medium [4-5 years]</i> • <i>Long [6 years or more]</i> • <i>Undetermined</i> 	Yes	-
GIS Data Available (Y/N)	Documents if GIS data for the existing research project is available. Dropdown options for this column are: <ul style="list-style-type: none"> • <i>Yes</i> • <i>No</i> • <i>Undetermined</i> 	Yes	-
Project Title	Title of the existing research project	Yes	-

Column Name	Column Definition	Fish FORWRD Database Tab	
		Tab 1. Existing Research Projects	Tab. 2 Identified Research Needs
Partner Entities	<p>List of partner organizations participating in an existing research project.</p> <p>This column appears four times so up to four cooperating partners can be listed.</p>	Yes	-
Project Objectives	Listed objective(s), goal(s), or hypotheses for an existing research project.	Yes	-
Methodology	A short description of methodology and/or equipment used for an existing research project.	Yes	-
Animal Group	<p>Categorization of the subject of biological research subject for an existing research project. Dropdown options for this column are (definitions for these options are provided in Table 3):</p> <ul style="list-style-type: none"> • <i>Pelagic fish</i> • <i>Demersal/Ground fish</i> • <i>Shellfish</i> • <i>Other benthic invertebrates</i> • <i>Zooplankton</i> • <i>Phytoplankton</i> • <i>All Reported</i> • <i>Highly migratory species</i> • <i>Not Applicable</i> • <i>Null</i> <p>This column appears three times so up to three animal groups per existing research project can be listed.</p>	Yes	-
Animal Group Value	<p>Qualifier for the animal group categorization(s) that identifies if the animal group(s) identified as research subject(s) has a particular value to a user group (i.e., an agency, commercial or recreational fishery). Dropdown options for this column are:</p> <ul style="list-style-type: none"> • <i>State- or federally listed threatened or endangered</i> 	Yes	-

Column Name	Column Definition	Fish FORWRD Database Tab	
		Tab 1. Existing Research Projects	Tab. 2 Identified Research Needs
	<ul style="list-style-type: none"> Commercially or recreationally important Not applicable 		
Project Start Year	The start year for an existing research project. Project start year may be filled in as “ <i>Undetermined</i> ” if information is not available.	Yes	-
Project End Year	The end year for an existing research project. Project end year may be filled in as “ <i>Undetermined</i> ” if information is not available.	Yes	-
Status of Research	<p>The current status of research for an existing research project or assessment of progress for an identified research need. Dropdown options for this column are:</p> <ul style="list-style-type: none"> Complete Ongoing Not yet started Undetermined 	Yes	Yes (Note that in the Identified Research Needs tab, this column contains the status of research for multiple projects applicable to the associated research need)
Project Budget	The identified budget for an existing research project. May be filled in as “ <i>Undetermined</i> ” if information is not available.	Yes	-
Project Funding Source	<p>Identified funding source(s) for an existing research project. May be filled in as “<i>Undetermined</i>” if information is not available.</p> <p>This column appears twice so up to two funding sources may be listed for an existing research project.</p>	Yes	-
Project Website	Public-facing website for an existing research project, if available.	Yes	-
PI Name	Name of the lead principal investigator (PI) for an existing research project.	Yes	-
PI Contact Info	Email or phone number for the lead PI of an existing research project.	Yes	-
PI Affiliation	Organization or group the lead PI of an existing research project is associated with.	Yes	-

Column Name	Column Definition	Fish FORWRD Database Tab	
		Tab 1. Existing Research Projects	Tab. 2 Identified Research Needs
Public Results (Y/N)	Indicates if the results for an existing research project will be made publicly available. Dropdown options for this column are: <ul style="list-style-type: none"> • Yes • No • <i>Undetermined</i> 	Yes	-
Public Data (Y/N)	Indicates if the project data will be made publicly available. Dropdown options for this column are: <ul style="list-style-type: none"> • Yes • No • <i>Undetermined</i> 	Yes	-
Summary of Research Need	Explanation of the identified research need. An identified research need may be a combination of similar research needs from multiple sources.	-	Yes
Existing Project Addressing Need (ID#)	List of identified existing research project unique IDs from “ <i>Tab 1. Existing Research Projects</i> ” that have been identified as partially or completely satisfying an identified research need. This is step 1 of the data gap analysis.	-	Yes
Data Gap Analysis Score	The qualitative “score” assigned to an identified research need based on the results of step 1 of the data gap analysis (above). Dropdown options for this column are: <ul style="list-style-type: none"> • <i>Not Addressed</i> • <i>Partially Addressed</i> • <i>Adequately Addressed</i> 	-	Yes
Explanation of Additional Research Needed	A detailed explanation of if/how the listed existing research projects “ <i>Partially Addressed</i> ” or “ <i>Adequately Addressed</i> ” the identified research need. If deemed “ <i>Partially Addressed</i> ”, this will also include a summary of additional research needed to adequately	-	Yes

Column Name	Column Definition	Fish FORWRD Database Tab	
		Tab 1. Existing Research Projects	Tab. 2 Identified Research Needs
	address the identified research need.		
Notes	Additional notes on the existing research project or identified research need.	Yes	Yes

Tab 1. Existing Fish and Fisheries Research Projects											
Research Project ID #	Research Category	Research Category2	Research Category3	Identified Research Need	Identified Research Need2	Source of Identification	Fixed or Floating	Windfarm Development Stage	Spatial Scale	Location	Temporal
Ex-1	Fish	Null	Null	Species Distribution/Composition	Null	CFRF 2022b	Fixed	All	Offshore Wind Project	South Fork Wind Farm Lease Area	short [0
	Fish	Null	Null	Species Distribution/Composition	Null	CFRF 2022a	Fixed	All	Offshore Wind Project	Revolution Wind Farm Area	short [0

Figure 2. The Fish FORWRD Database – Tab 1. Existing Research Projects

	A	B	C	D	E	F	G
1		Tab 2. Identified Fish and Fisheries Research Needs					
2	Research Need ID #	Research Category	Research Category2	Research Category3	Identified Research Need	Identified Research Need2	Source of Identification
3	RN-1	Other	Null	Null	Changes in Light Level	Null	NYSOS-EC
4	RN-2	Fisheries	Null	Null	Economic Impact	Null	SEAGRANT 2024
5	RN-3	Fisheries	Null	Null	Community Engagement	Null	SEAGRANT 2024
6	RN-4	Fisheries	Fish	Null	Cumulative Impacts	Cultural Impacts	RODA 2022

Figure 3. The Fish FORWRD Database – Tab 2. Identified Research Needs

Table 3. Fish FORWRD Dropdown Definitions

Dropdown Term	Definition	Tab Column Header
Changes in Light Level	Impacts to resources related to changes in the water column affecting the amount of light that penetrates through the water column.	Identified Research Needs
Commercially or Recreationally Important	Taxon/taxa that are commercially or recreationally fished.	Animal Group Value
Community Engagement	Methodology for exchange of information between communities (excluding the commercial and/or recreational fishing community), agency representatives, and offshore wind developers.	Research Category
Construction	Construction of the wind farm, including turbines, offshore substations, interarray cables, export cables. Includes any restoration activities associated with construction impacts.	Windfarm Development Stage
Cultural Impacts	Impacts to culturally important resources including, but not limited to, tribal and subsistence resources, etc.	Identified Research Needs
Cumulative Impacts	Impacts on resources resulting from development of multiple offshore wind projects over time in the same geographic area (i.e., Mid-Atlantic Bight).	Identified Research Needs
Decommissioning	All activities related to taking the wind farm out of service and removing components from the ocean. Includes restoration to pre-existing conditions.	Windfarm Development Stage
Demersal/Ground Fish	Fish that live and feed mainly on or close to the seafloor.	Animal Group
Economic Impact	Changes to the economic value of commercial and recreational fishing industries (e.g., revenues, landings, trips, employment) due to offshore wind development.	Identified Research Needs
Electromagnetic Fields (EMF)	Electromagnetic fields associated with cables that carry electricity from and between energy sources, such as wind turbines, to power stations.	Identified Research Needs
Fish	Research related specifically to the biology or ecology of a taxon/taxa of fish or their prey with or without including their surrounding environment and subsequent impacts on them.	Research Category
Fisheries	Research related to commercial or recreational fishing logistics, or management of a fishery stock.	Research Category
Fishery Access	Changes to access and operation within fishing grounds (e.g., impairment of navigational equipment, potential to catch buried cables in fishing gear and/or anchors, increased risk of collision with structures). Includes displacement and/or changes in location and timing of commercial and recreational fishing efforts.	Identified Research Needs
Fishing Industry Communication	Methodology for exchange of information between the commercial and/or recreational fishing community, agency representatives, and offshore wind developers.	Identified Research Needs

Dropdown Term	Definition	Tab Column Header
Habitat Fragmentation/ Modification	Habitat fragmentation is the loss of suitable habitat that results in division of large, contiguous habitats into smaller disconnected habitat patches. Habitat modification is the change in size, composition, structure, or function of an existing habitat (e.g., wind turbines provide new substrate that can support encrusting organisms that would not otherwise be present in the same numbers or species composition in an area of predominantly soft bottom).	Identified Research Needs
Heat Impacts	An increase in water or air temperature above typical levels, potentially related to operation of export or interarray cables and discharge from offshore substations.	Identified Research Needs
Highly Migratory Species (HMS)	Species that travel long distances and often cross domestic and international boundaries. NOAA Fisheries manages HMS fisheries—tunas, sharks, swordfish, and billfish—in the U.S. Atlantic Ocean, Gulf of Mexico, and Caribbean waters.	Animal Group
Individual Turbine	Research need or project is examining localized effects at the scale of a single turbine/structure.	Scale
Industry	Includes offshore wind developers and other commercial operations.	Reference Category
Infrastructure Impacts	Effects to shoreside infrastructure such as, but not limited to access or availability to ports and docks, fueling stations, fish processing facilities, and other related systems associated with offshore wind energy development. Also includes situations in which vessel infrastructure and equipment such as engines, global positioning systems, radar, fishing gear, and safety equipment may be insufficient to account for changes in fishing vessel behavior caused by the need to navigate around or through offshore wind energy facilities.	Identified Research Needs
National	Project scope includes all onshore and offshore geography of the continental United States.	Scale
NGO	Non-governmental organization	Reference Category
Offshore Wind Project	Research need or project is examining effects of a specific offshore wind farm project.	Scale
Operation/ Maintenance	All activities that occur once the wind farm is in service.	Windfarm Development Stage
Other Benthic Invertebrates	Other invertebrates not included in shellfish that are specifically associated with the benthos (e.g., polychaetes, crustaceans).	Animal Group
Pelagic Fish	Fish that live and feed mainly in the water column.	Animal Group
Pre-construction	Includes all surveys and planning efforts leading up to commencing construction of a wind farm.	Windfarm Development Stage
Regional	Project scope includes onshore and offshore limits of multiple, adjacent states.	Scale

Dropdown Term	Definition	Tab Column Header
Regional Management Council	Includes fishery management councils, which are responsible for management of one or more fisheries.	Reference Category
Resource Monitoring	How, when, where fish and fishery resources are surveyed/monitored.	Identified Research Needs
Shellfish	Bivalves and molluscs.	Animal Group
Sound/Vibration Impacts	Sound is created by a vibrating object and travels as a pressure wave through a medium, and these pressure waves can be sensed by organisms using hearing or depth regulating organs. Activities that produce sound include, but are not limited to, exploratory surveys, pile driving, dredging, and vessel operation. Vibration is an oscillation of parts of a fluid. Vibration can result in particle motion, which is detectable by some marine organisms. Although sound usually has a vibratory component, it differs from vibration in general in that sound also contains a waveform and is perceived by hearing organs; sound is not included in this category. Research needs related to sound/vibration impacts are exploring the effects of increased sound/vibration related to all stages of wind farm development and operation on marine organisms.	Identified Research Needs
Species Distribution/Composition	Changes in target fish abundance, distribution, taxonomic composition, and or/behavior as a direct or indirect result of offshore wind energy development.	Identified Research Needs
Zooplankton	Other invertebrates not including adult shellfish categorized as drifters or weak swimmers. This may include larval fish or shellfish species, or jellyfish.	Animal Group
Definition of Blanks		
Null	The preceding Research Category columns sufficiently capture the category of research for the project/research need	Research Category
Null	The preceding Identified Research Need column sufficiently captures the specific identified research for the project/research need	Identified Research Need
Null	The preceding Partner Entities columns sufficiently capture the participating partnering entities identified research for the project	Partner Entities
Null	The preceding Animal Group columns sufficiently capture the type of animals researched in the project	Animal Group
Not Applicable	Animals researched in the project are not state or federally listed threatened or endangered, nor are they identified as being commercially or recreationally important	Animal Group Value
Null	The preceding Project Funding Source is the only identified funding source for the project	Project Funding Source
Undetermined	An affiliation was not identified for this particular PI	PI Affiliation

“*Tab 3. References*” serves as a record for all sources reviewed in order to populate the Fish FORWRD database. A list of columns and their contents for “*Tab 3. References*” is provided in Table 4.

Table 4. Fish FORWRD Columns for Tab ‘3. References’

Column Name	Column Definition
Reference ID #	A unique identifier for each reference used to populate Tab 1. Existing Research Projects and Tab 2. Identified Research Needs
Short Citation	A shortened version of the full citation. Formatting for the short citation is presented in the text box in columns H through R
Full Citation	Full reference listing author, year, title, and availability through either a website or journal article. Some references are not formally published and therefore do not have public links or full citations.
Link	A standalone, hyperlinked version of the web address location of the reference, if available.
Reference Category	The group type of the author of the reference. Drop-down options for this column include: <ul style="list-style-type: none"> • Academia • Federal Agency • Industry • Non-Governmental Organization (NGO) • Other • Partnership • Regional Management Council • State Agency
Notes	Used to provide notes about the reference on points such as location or about the review process.

“*Tab 4. Definition of Terms*” is a list of definitions used to categorize and sort existing research projects and identified research needs. See Figures 4 and 5 for a depiction of these tabs. A list of columns and their contents for “*Tab 4. Definition of Terms*” is provided in Table 5.

	A	B	C	D	E	F
1		Tab 3. References				
2	Reference ID #	Short Citation	Full Citation	Link	Reference Category	Notes
3	Ref-1	SEER 2022a	U.S. Offshore Wind Synthesis of Environmental Effects Research (SEER). 2022a. Benthic Disturbance from Offshore Wind Foundations, Anchors, and Cables. Available at: https://tethys.pnnl.gov/sites/default/files/summaries/SEER-Educational-Research-Brief-Benthic-Disturbance.pdf . Accessed on June 20, 2022.	https://tethys.pnnl.gov/sites/default/files/summaries/SEER-Educational-Research-Brief-Benthic-Disturbance.pdf		At the direction of the U.S. Department of Energy's Office of Energy Efficiency & Renewable Energy Wind Energy Technologies Office, Pacific Northwest National Laboratory and National Renewable Energy Laboratory are joining leading a multi-year collaborative effort to facilitate knowledge transfer for offshore wind research around the world.
4	Ref-2	NEFMC 2021	New England Fishery Management Council (NEFMC). 2021. NEFMC Research Priorities and Data Needs, 2021-2025. Available at: https://www.nefmc.org/library/nefmc-research-priorities-and-data-needs-for-2021-2025 . Accessed June 20, 2022.	https://www.nefmc.org/library/nefmc-research-priorities-and-data-needs-for-2021-2025	Regional Management Council	Located in ROSA Synthesis SharePoint Lauren K
			Sea Grant MIT Funded Projects (SEAGRANT). 2022. Incorporating Image Recognition and Machine Learning into the NE Multispecies Groundfish Electronic Monitoring Programs to Quantify Species and Sizes of Discards, 01/2022-02/2024. Available at: https://seagrant.mit.edu/projects/incorporating-image-recognition-and-machine-learning-into-the-ne-multispecies-			Located under "Funded Projects"-FY2022 Projects. This research assignment is l

Figure 4. The Fish FORWRD Database – Tab 3. References

	A	B	C
1	Table 5. Acronyms List		
2	Acronym	Definition	
3	ASA	Acoustical Society of America	
4	BOEM	Bureau of Ocean Energy Management	
5	CFRF	Commercial Fisheries Research Foundation	
6	EMF	Electromagnetic Field	
7	HMS	Highly Migratory Species	
8	MADMF	Massachusetts Division of Marine Fisheries	
9	NEFMC	New England Fishery Management Council	
10	NGO	Non-governmental Organization	
11	NJ	New Jersey	
12	NOAA	National Oceanographic and Atmospheric Administration	
13	NY	New York	
14	NYSERDA	New York State Energy Research and Development Authority	
15	NYSOS	New York State of the Science	
16	NYSOS-B	New York State of the Science Benthic Working Group	
17	NYSOS-EC	New York State of the Science Environmental Change Working Group	
18	NYSOS-FAI	New York State of the Science Fisheries and Aquatic Invertebrates Working Group	

Figure 5. The Fish FORWRD Database – Tab 5. Acronyms

Table 5. Fish FORWRD Columns for Tab ‘4. Column Definitions’ and ‘5. Acronyms List’

Column Name	Column Definition	Fish FORWRD Tab	
		Tab 4. Definition of Terms	Tab 5. Acronyms List
Term	The term used to categorize existing research projects or identified research needs.	Yes	-
Definition	The statement of meaning for the associated term by which an existing project or research need was assigned in order to categorize and sort projects and needs or the words that make up the initials in the associated acronym.	Yes	Yes
Column	The spreadsheet column in which the associated term appears within the spreadsheet.	Yes	-
Acronym	The word formed from initial letters or groups of letters of words in a set phrase or series of words pronounced as a separate word.	-	Yes

2.3 DATA GAP ANALYSIS

The ultimate goal of this project was to assess the current state of fish and fisheries research pertaining to offshore wind development. Following population of “*Tab 1. Existing Research Projects*” and “*Tab 2. Identified Research Needs*”, WSP conducted a data gap analysis. The data gaps analysis is contained within “*Tab 2. Identified Research Needs*”, columns L through P (see Figure 6). The general methodology of this analysis was as follows:

1. Filter entries in both tabs to focus on the same “Research Category” (e.g., Fish).
2. Filter entries in both tabs to focus on the same “Identified Research Need” (e.g., Species Distribution/Composition).
3. For the resulting subset of identified research needs in the filtered “*Tab 2. Identified Research Needs*”, review the subset of existing research projects in the filtered “*Tab 1. Existing Research Projects*” to identify which existing research projects (if any) partially or adequately address each identified research need. List the unique identifier for each existing research project in the column titled, “Existing Project Addressing Need”. Review completed list of applicable existing research projects and make a determination if the identified research need is “not addressed”, “partially addressed”, or “adequately addressed”. Under “Explanation of Additional Research Needed”, provide a summary: how the list of existing research projects satisfies the identified research need; and/or identify what portions of the identified research need are not satisfied.

The above steps were completed by two staff members and a third provided a spot check of the data gaps analysis to check for potential subjectivity. In the case of a

discrepancy between the third reviewer and initial score, further discussion on the research need and associated projects was held until a resolution was reached.

	A	L	M	N	O	
1						
2	Research Need ID #	Existing Project Addressing Need (ID #)	Status of Research	Data Gap Analysis Score	Explanation of additional Research Needed	Notes
3	RN-1	none	none	Not Addressed	none	none
4	RN-2	Ex-6	ongoing	Partially Addressed	This project looks like it address parts of this need related to broader impacts of OSW on communities, but is focused on Maine and does not look into community planning.	None
5	RN-3	none	none	Not Addressed	none	None
6	RN-4	none	none	Not Addressed	none	None
	RN-5			Not Addressed		a.Examine effective fish wind farms in Europe. fishability, including in spacing and orientation
	2. Identified Research Needs 3. References 4. Definition of Terms 5. Acronyms List 6. Pivot Table Column List Options					

Figure 6 . The Fish FORWRD Database – Data Gaps Analysis

2.3.1 Data Gap Analysis Results

At the time of the drafting of this report, a total of 138 and 56 identified research needs were categorized pertaining to fish and fisheries, respectively (Table 1). The data gaps analysis determined for fish research needs that (Table 6):

- None were adequately addressed;
- 57 were partially addressed; and
- 81 were not addressed.

The data gaps analysis determined for fisheries research needs that (Table 6):

- One was adequately addressed;
- 30 were partially addressed; and
- 25 were not addressed.

For fish, habitat fragmentation had the highest number of research needs which were not addressed (n=30) and species distribution/composition had the most research needs that were partially addressed (n=23; Table 6).

To understand the scope of research needs that are being addressed and whether certain specific research needs should be of greater priority, a pivot table for the count of existing projects and research need they address with the associated level of completeness of that research need was created (Table 7). Overall, projects that examine impacts on the regional and national scale are less addressed than those at the individual turbine or project scale.

To examine where most projects were occurring, a pivot table of projects by subject and location was created (Table 8). Given the current location of lease sales, it is unsurprising that most projects occurred off the northeast coast.

Table 6. Pivot table for number and subject of research needs and level of completeness

Count of Data Gap Analysis Score				
Column Labels				
Row Labels	Fully Addressed	Not Addressed	Partially Addressed (blank)	Grand Total
Fish		81	57	138
⊕ EMF Impacts		14	10	24
⊕ Fishery Access		1		1
⊕ Habitat Fragmentation/Modification		30	15	45
⊕ Other		1	1	2
⊕ Resource Monitoring		6	6	12
⊕ Sound/Vibration Impacts		7	2	9
⊕ Species Distribution/Composition		20	23	43
⊕ Cumulative Impacts		1		1
⊕ Heat Impacts		1		1
Fisheries	1	25	30	56
⊕ Economic Impact			6	6
⊕ EMF Impacts		1	2	3
⊕ Fishery Access		7	9	16
⊕ Fishing Industry Communication		1	1	2
⊕ Habitat Fragmentation/Modification		3	1	4
⊕ Other		2		2
⊕ Resource Monitoring			2	2
⊕ Sound/Vibration Impacts	1	1	8	10
⊕ Species Distribution/Composition		1	1	2
⊕ Community Engagement		1		1
⊕ Cumulative Impacts		2		2
⊕ Infrastructure Impacts		6		6
Other		22	10	32
⊕ Habitat Fragmentation/Modification		14	1	15
⊕ Resource Monitoring			1	1
⊕ Sound/Vibration Impacts		3	1	4
⊕ Species Distribution/Composition		1	2	3
⊕ Changes in Light Level		1		1
⊕ Cumulative Impacts		3	5	8
Grand Total	1	128	97	226

Table 7. Pivot table for count of research needs by subject and level of completeness

Count of Data Gap Analysis Score		Column Labels			
Row Labels		Fully Addressed	Not Addressed	Partially Addressed	(blank) Grand Total
[-] Changes in Light Level			1		1
+ Offshore Wind Project			1		1
[-] Community Engagement			1		1
+ Offshore Wind Project			1		1
[-] Cumulative Impacts			6	5	11
+ National			1		1
+ Offshore Wind Project				1	1
+ Regional			4	4	8
+ State			1		1
[-] Economic Impact				6	6
+ Offshore Wind Project				5	5
+ Regional				1	1
[-] EMF Impacts			15	12	27
+ Offshore Wind Project			10	9	19
+ Regional			4	3	7
+ State			1		1
[-] Fishery Access			8	9	17
+ Offshore Wind Project			1	3	4
+ Regional			4	6	10
+ State			3		3
[-] Fishing Industry Communication			1	1	2
+ Offshore Wind Project				1	1
+ Regional			1		1
[-] Habitat Fragmentation/Modification			47	17	64
+ Individual Turbine			10	3	13
+ Offshore Wind Project			19	8	27
+ Regional			16	6	22
+ State			2		2
[-] Heat Impacts			1		1
+ Offshore Wind Project			1		1
[-] Infrastructure Impacts			6		6
+ Regional			6		6
[-] Other			3	1	4
+ National			1		1
+ Offshore Wind Project			1		1
+ Regional			1		1
+ State				1	1
[-] Resource Monitoring			6	9	15
+ National				1	1
+ Offshore Wind Project			2	1	3
+ Regional			4	5	9
+ Undetermined				2	2
[-] Sound/Vibration Impacts		1	11	11	23
+ Individual Turbine			2		2
+ National			1	1	2
+ Offshore Wind Project		1	5	10	16
+ Regional			3		3
[-] Species Distribution/Composition			22	26	48
+ Individual Turbine			1	1	2
+ National				3	3
+ Offshore Wind Project			6	7	13
+ Regional			11	10	21
+ State			4	5	9
Grand Total		1	128	97	226

Table 8. Pivot table for existing research projects by subject and location

Row Labels	Count of Location
Cumulative Impacts	1
+ Not specified	1
Economic Impact	4
+ Atlantic Coast-wide	1
+ Atlantic surfclam fishery	1
+ Gulf of Maine	1
+ Southern New England	1
EMF Impacts	2
+ Not specified	2
Fishery Access	3
+ NY	1
+ NY Bight	1
+ Southern New England	1
Fishing Industry Communication	1
+ Southern New England	1
Habitat Fragmentation/Modification	7
+ Atlantic- Chesapeake Bay and Bush River	1
+ Atlantic Coast-wide	2
+ Block Island Wind Farm	1
+ MA	1
+ NJ	1
+ Southern Cape Cod to Delaware OCS	1
Other	7
+ New York Bight	1
+ Atlantic Shore Lease Areas	1
+ ME	2
+ NY	1
+ RI	1
+ Various	1
Resource Monitoring	26
+ Atlantic Coast-wide	1
+ Connecticut/Rhode Island	4
+ New Jersey Wind Energy Area	10
+ New York Wind Energy Area	9
+ Not specified	1
+ Sunrise Wind Farm	1
Sound/Vibration Impacts	5
+ Not specified	2
+ Southern New England	2
+ U.S. Atlantic Coast	1

Species Distribution/Composition	26
New York. Current and Proposed Artificial Reef Sites	1
Block Island Wind Farm	1
Delaware	1
Empire Wind Lease Area	1
Long Island, NY	1
MA	4
MA-RI Fisheries Research Projects	1
MA-RI WEA	2
Maryland	1
Mayflower Wind	1
ME	1
New England	2
New York Wind Energy Area	1
Not specified	3
Revolution Wind Farm Area	1
South Fork Wind Farm Lease Area	1
Southern New England	1
U.S. Northeast Continental Shelf	1
Virginia WEA, Sandbridge Shoal Sand Borrow Site	1
(blank)	
Grand Total	82

3.0 DATABASE FUNCTIONALITY

Through discussions with ROSA, the following three critical uses of the Fish FORWRD database were identified:

1. Review of research needs or general subject areas for future research by an offshore wind developer or regulatory agency to direct funding allocations, such as mitigation funds.
2. Review of existing and ongoing research projects by academic groups to identify potential research topics for grant applications.
3. Ability for users to update the database and add existing research projects or research needs.

With these uses in mind, WSP created a series of pivot tables in “*Tab 6. Pivot Table*” to provide summary output for database users. For users that may need more detail than the prepopulated pivot tables, WSP drafted instructions located in the same tab on how to create a tailored pivot table.

For submitting additions to the database, WSP has provided data entry instructions in the *Overview Tab*. Submissions of new entries will be completed via a Google form.

4.0 INSTRUCTIONS FOR USE

Three desired outcomes were identified as representative examples of uses for the database.

1. Narrow down research need/subject area for research funding allocation.
2. Examine existing and ongoing research to identify potential academic research for grant application.
3. Add existing research projects or research needs to the database.

4.1 RESEARCH FUNDING ALLOCATION

A primary desired outcome could be executed by either a developer or state agency, for example, gathering input for requests for proposals (RFPs). To accomplish this outcome, the user could follow these steps:

1. Begin in “*Tab 6. Pivot Table*” and consult Pivot Table 2 “Count of research needs by subject and level of completeness” (see Figure 7 below for a depiction of the tab).
2. If the information in Pivot Table 2 does not provide the detail desired, the user should look at “How to Create a Unique Pivot Table” to create a pivot table with the categories of interest.
 - i. Once the pivot table is populated with values of interest, specific research needs can be examined by their unique research identification number in “*Tab 2. Identified Research Needs.*”
 - ii. If examples of projects that fit part of this need are required, navigate to column L “Existing Project Addressing Need (ID #)” in “*Tab 2. Identified Research Needs*” and look up listed projects in “*Tab 1. Existing Research Projects*” by their unique ID# in column A.

	A	B	C	D	E	F	G	H	I	J
1	Introduction to Pivot Tables:				Table 1. Number and Subject of Research Needs and Their Level of Completeness					
2	Pivot tables can be useful tools for summarizing datasets and identifying trends. For the Fisheries Offshore Wind Research Database, it can be used to identify topics and locations where most research is being done, areas that need more research, and major partnering institutions. The pivot tables to the right are overviews of identified Research Needs by level of completeness and scale and Existing Projects by location				Count of Data Gap Analysis Score					
3					Column Labels					
4					Row Labels	Not Addressed	Partially Addressed	(blank)	Adequately Addressed	Grand Total
5					Fish	81	57			138
6					EMF Impacts	14	10			24
7					Fishery Access	1				1
8	How to Create Unique Pivot Table:				Habitat Fragmentation/Modification	30	15			45
9					Other	1	1			2
10					Resource Monitoring	6	6			12
11					Sound/Vibration Impacts	7	2			9
12					Species Distribution/Composition	20	23			43
13					Cumulative Impacts	1				1
14					Heat Impacts	1				1
15					Fisheries	25	30		1	56
16					Economic Impact		6			6
17					EMF Impacts	1	2			3
18					Fishery Access	7	9			16
19					Fishing Industry Communication	1	1			2
20					Habitat Fragmentation/Modification	3	1			4
21					Other	2				2
22					Resource Monitoring		2			2
					Sound/Vibration Impacts	1	8		1	10

Figure 7. The Fish FORWRD Database – Tab 6. Pivot Table

4.2 OVERVIEW OF EXISTING AND ONGOING RESEARCH

For an overview of existing and ongoing research, potential interested users could be researchers at academic institutions, for example. To accomplish this outcome, the user could follow these steps:

1. Begin in “*Tab 6. Pivot Table*” tab and consult Table 4. Existing research projects by subject and location. If this does not provide the detail desired, the user should look at "How to Create a Unique Pivot Table" to create a pivot table with the categories of interest.
2. Once the pivot table is populated with values of interest, specific research needs can be examined by their unique research identification number in “*Tab 2. Identified Research Needs.*”
3. If examples of projects that fit part of this need are required, navigate to column L "Existing Project Addressing Need (ID #)" in “*Tab 2. Identified Research Needs*" and look up listed projects in “*Tab 1. Existing Research Projects*” by their unique ID# in column A.

4.3 ADD PROJECTS OR RESEARCH NEEDS ENTRIES

In order to add existing research projects or research needs to the database, the user would follow these steps:

1. Confirm the project or research need is not already contained within the database by querying the lead principal investigator (PI) or subject matter within the applicable tab.
2. If the project or research need is not within the database, instructions for submitting new data for inclusion are in the *Overview Tab*, which contains links to a Google form that provides the options for submitting data.
 - a. Existing Research Projects Data Entry Form:
<https://forms.gle/ye8u5SbSuSYk2RnKA>
 - b. Identified Research Needs Data Entry Form:
<https://forms.gle/Ma7DeDLF82x8J1RU9>

5.0 CONCLUSION

The ROSA Fish FORWRD database is the first known effort to synthesize and compile research needs and on-going research projects for fish and fisheries related to offshore wind development along the U.S. East Coast. The data gap analysis is also a valuable and unique analysis, which provides a level of completeness to each research need that is not commonly seen in other similar existing lists or databases. This

analysis provides users another lens and criterion for prioritizing future research needs and projects.

In order to keep the database relevant, it will require regular updating to incorporate new research projects and newly identified research needs. However, because this database has a limited scope focused on fish and fisheries as they pertain to offshore wind, WSP feels updates will be manageable through bi-annual or quarterly updates.

WSP recommends that all updates to the data gap analysis be conducted using a team of reviewers and spot checkers by independent reviewers for calibration and consistency.