5.0 Impact Assessment

5.1 PERMITTING

The section broadly outlines the major permitting requirements for the design, construction and deployment of a “Stepping Stone” wind farm, an up to 30 MW wind farm located 10 – 50 nmi offshore in federal waters, also referred to as Phase 3 of the University of Maine (UMaine) and *DeepCwind* Consortium’s Offshore Wind Energy Project Plan (“Plan”). This Plan is illustrated in Figure 5-1.

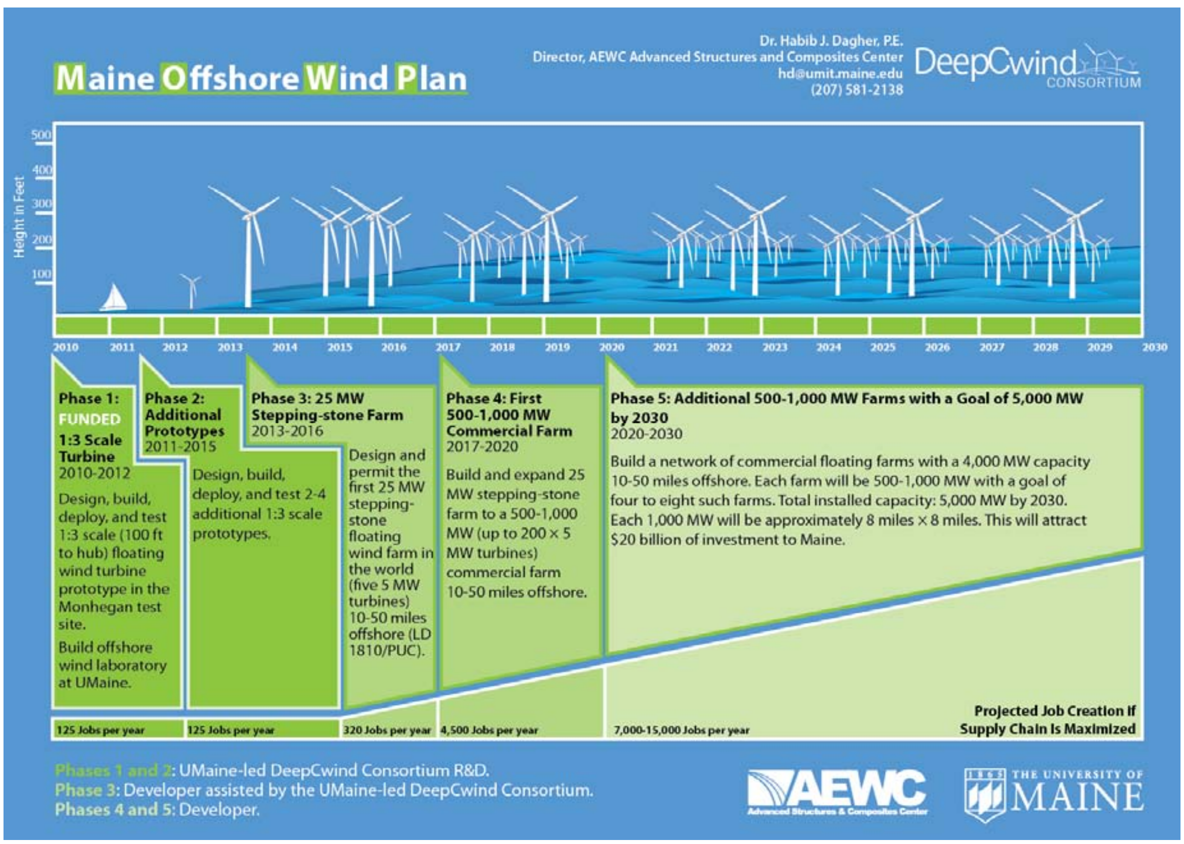


Figure 5-1: DeepCwind Consortium's Offshore Wind Energy Project Plan

Phase 3 will likely involve a transmission line that will run along or under the seabed from a project site onto shore to connect with the electrical grid, and an onshore laydown area where project materials will be stored.

The permitting overview that follows is a preliminary assessment of the permits and other approvals required for the Phase 3 project. Permitting of Phase 3 (up to 30 MW Offshore Wind Energy Project on the Outer Continental Shelf) will include state, federal, and municipal/local permits or authorizations. These are discussed in more detail in Sections 5.1.1 through 5.1.4. Separate discussion of permitting an onshore assembly and staging area may be found in Section 5.1.5.

Because the up to 30 MW Project itself will be located in federal waters, it will not need state or municipal approvals other than Coastal Zone Management Act (CZMA) consistency review (see Section 5.1.2). It is likely, however, that many, if not all, of the state and municipal approvals discussed in Section 5.1.1 will be required for the electric transmission line that will run through state waters and onto the shore, as well as any assembly or deepwater area located in state waters.

5.1.1 State Permits and Approvals

1. Maine DEP Site Location of Development Permit for Offshore Wind Power Project That Impacts State Waters or Lands

The Site Location of Development Act ("Site Law")[4] regulates any "development of state or regional significance that may substantially affect the environment" (Development). An Offshore Wind Power Project[5] with an aggregate generating capacity of three (3) MW or more is a Development that requires Site Law approval.[6] However, an Offshore Wind Power Project (Project) would not fall within the expedited permitting area and therefore must go through the traditional and more rigorous Site Law approval process rather than the expedited process, which has relaxed standards.[7]

[4] 38 M.R.S. § 481 *et seq*.

[5] "Offshore wind power project" means a project that uses a windmill or wind turbine to convert wind energy to electrical energy and is located in whole or in part within coastal wetlands as defined in 38 M.R.S. § 480-B(2). "Offshore wind power project" includes both generating facilities as defined by Title 35-A, Section 3451, Subsection 5 and associated facilities as defined by Title 35-A, section 3451, Subsection 1, without regard to whether the electrical energy is for sale or use by a person other than the generator. 38 M.R.S. § 482(8).

[6] 38 M.R.S. §§ 482(2)(J), 484.

[7] The expedited permitting area includes coastal islands or "all islands in waters subject to tidal influence in the unorganized and deorganized areas" of Maine, but does not include the water itself. 35-A M.R.S. § 3451(3); P.L. 2008, Ch. 661, Sec. C-6.

a. Application Requirements and Review Period

The Site Law approval standards include provisions addressing technical and financial capacity, "no adverse impact on the natural environment," soil types, storm water management and erosion control, groundwater, infrastructure, flooding and blasting.[8] A developer must also demonstrate sufficient right, title and interest to the development area,[9] which may be established through the submerged land lease process discussed below. The "no adverse effect on the natural environment standard" requires a developer to make "adequate provision for fitting the Development harmoniously into the existing natural environment"[10] and to show that the Development will not adversely affect scenic character, air and water quality, or other natural resources in the area.[11] Furthermore, Projects of at least three (3) MW must be designed and sited to avoid unreasonable adverse shadow flicker effects, constructed with adequate setbacks to protect public safety.[12]

Although the Site Law application is filed with the DEP, since the location for the 3-5 MW offshore wind turbine does not fall within the expedited area set forth in statute, the Bureau of Environmental Protection (BEP) may assume jurisdiction over the Project permit application as long as it satisfies one of several criteria, including, but not limited to, (1) involving a policy, rule or law that the Board has not previously interpreted or (2) generating substantial public interest.[13] An application for Site Law approval of a Project would likely satisfy both of these criteria, so the BEP would likely assume jurisdiction.

b. Permit Details

[8] 38 M.R.S. § 484.

[9] 06-096 Maine Department of Environmental Protection (DEP) Ch. 372(9).

[10] Wind Energy Developments that are in the expedited permitting area are not required to meet the standard that the Development "fits harmoniously into the existing natural environment in terms of scenic character and existing uses related to scenic character." 35-A M.R.S. § 3452. However, since an Offshore Wind Power Project is not in the expedited permitting area, that standard would be required for Site Law approval.

[11] DEP regulations further address the "no adverse environmental effect" standard of the Site Law in Chapter 375. Chapter 375 requires, among other things, the preservation of historic sites, noise control, no unreasonable effect on scenic character, and the protection of wildlife and fisheries, including no adverse effect on wildlife and fisheries lifecycles and no unreasonable disturbance to the habitat of threatened or endangered species, seabird nesting islands, or shorebird nesting, feeding and staging areas. 06-096 Me. Dept. of Env. Prot. Ch. 375. Offshore Wind Projects of at least three (3) MW are exempt from the Site Law requirement to the extent that DEP determines the Bureau of Parks and Lands (BPL) is considering pertinent existing use issues in its review of the Development area. 38 M.R.S. § 488(25).

[12] 38 M.R.S. § 484(10). The Site Law statute also provides that expedited wind energy developments must provide significant tangible benefits as defined in 35-A M.R.S. § 3451(10) and 3454, but this requirement would not apply to an Offshore Wind Power Project because it does not fall within the expedited area.

[13] 38 M.R.S. § 341-D(2).

The Site Law approval is valid on an ongoing basis but the approval is void if construction of the Project does not begin within two years from the date of the Site Law approval. If the approved development is not completed within five years from the date that the approval is granted, the BEP may reexamine the development approval and impose additional terms or conditions to respond to significant changes in circumstances that may have occurred during the five-year period.[14]

The BEP may approve a Development in phases, but the application for approval must include plans for all phases of the development to be undertaken. Even if the BEP approves one of several phases of the development based on the available evidence for those phases, the entire proposed development must comply with the Site Law standards in order for each phase to be approved.[15]

c. Applicability of Other Laws and Approvals

Although most Developments located entirely within LURC jurisdiction are exempt from Site Law approval, Projects of at least three (3) MW located within LURC jurisdiction are expressly subject to the Site Law requirements.[16] The DEP may review and approve the entire Project under the Site Law process if there is a portion of the project area that is located in DEP jurisdiction (e.g., the transmission line that comes ashore) and that portion of the project area constitutes a "Development."[17] Although it is not expressly stated in the Site Law statutes, it appears from the LURC statutes that LURC will retain jurisdiction of a Project only if (1) it is located within one nautical mile (1 nmi) of an island within the unorganized and deorganized areas and (2) if a project qualifies as a community-based offshore wind energy project.[18] Therefore, it is likely that even though the wind turbine will be within LURC jurisdiction, DEP will assume Site Law review of the entire Project. This reflects the general intention from the Governor's Ocean Energy Task Force to have the DEP review commercial Offshore Wind Power Projects.

---

[14] 06-096 Maine Department of Environmental Protection Ch. 372(12).

[15] 06-096 Maine Department of Environmental Protection Ch. 372(10).

[16] 38 M.R.S. § 488(9).

[17] 38 M.R.S. § 488(9).

[18] 12 M.R.S. § 685-B(2-C). A "Community-based offshore wind energy project" means a wind energy development with an aggregate generating capacity of less than three (3) MW that meets the following criteria: the generating facilities are wholly or partially located on or above the coastal submerged lands of the State; the generating facilities are located within one nautical mile of one or more islands that are within the unorganized and deorganized areas of the State and the project will offset part or all of the electricity requirements of those island communities; and the development meets the definition of "community-based renewable energy project" as defined by Title 35-A, section 3602, subsection 1. 12 M.R.S. § 682.

If DEP does review and approve the Project, no permit is required from LURC for any aspects of the Project that are covered by the DEP approval.[19] In the unlikely event that LURC retains jurisdiction over the Project, it would be reviewed under LURC's development review and approval statute.[20]

An applicant may appeal a decision of the DEP to the BEP or to the Superior Court. A decision by the BEP may be reconsidered by the BEP or appealed directly to the Superior Court. Any decision of the Superior Court may be further reviewed by the Maine Supreme Judicial Court sitting as the Law Court.[21]

2. Natural Resource Protection Act Approval (NRPA)

The Natural Resources Protection Act (NRPA), 38 M.R.S. § 480-A, *et seq.*, regulates certain activities in, on or over any protected natural resource or adjacent to certain protected natural resources. The developer would need to obtain a NRPA permit for such activities as dredging, bulldozing, removing or displacing soil, sand, vegetation or other materials, filling, or any construction of any permanent structure.[22] Protected natural resources likely to be impacted by an Offshore Wind Power Project (including the turbines, the transmission line, the assembly area or the onshore laydown area and substation) include coastal wetlands and areas of significant wildlife habitat.[23] Coastal wetlands are defined in pertinent part as tidal and subtidal lands and all areas with vegetation present that is tolerant of salt water and occurs primarily in a salt water or estuarine habitat.[24] "Significant wildlife habitat" means, among other things, wildlife areas as mapped by the Department of Inland Fisheries and Wildlife (DIFW) or within any other protected natural resource, habitat for threatened and endangered species, critical spawning areas for Atlantic Salmon, shorebird nesting, feeding and staging areas and seabird nesting islands.[25]

a. Application Requirements and Standards

Although NRPA includes a permit by rule process for certain limited activities,[26] it is more likely that the developer of a Project will need to file an individual application for a NRPA permit. All NRPA permit applications for Projects must be filed with the DEP (rather than

[19] 38 M.R.S. § 488(9); 12 M.R.S. § 685-B(1-A)(B).

[20] 12 M.R.S. § 685-B.

[21] 38 M.R.S. §§ 341-D(4), 346.

[22] 38 M.R.S. § 480-C(2).

[23] 38 M.R.S. § 480-B(8). Keep in mind that with respect to onshore activities, there are other protected natural resources that may also qualify for protection under NRPA, such as freshwater wetlands.

[24] 38 M.R.S. §§ 480-B(2), (8). Under NRPA, an Offshore Wind Power Project is defined as a project, including generating and associated facilities, that uses a windmill or wind turbine to convert wind energy to electrical energy and is located in whole or in part within coastal wetlands. 38 M.R.S. § 480-B(6-A).

[25] 38 M.R.S. § 480-B(10).

[26] 06-96 Maine Department of Environmental Protection Ch. 305.

LURC), unless the Project is a Community-Based Offshore Wind Energy Project.[27] To obtain an individual permit, the applicant must demonstrate that the proposed activities will not unreasonably interfere with existing scenic, aesthetic, recreational or navigational uses; will not unreasonably harm any significant wildlife habitat, threatened or endangered plant habitat, aquatic or adjacent upland habitat, travel corridor, freshwater, estuarine, or marine fisheries or other aquatic life; and that the proposed activities meet standards relating to soil erosion, natural water flow, water quality, flooding, sand supply, outstanding river segments, and dredging.[28]

Applicable rules set forth by the DEP describe more specific standards for activities affecting wetlands and water bodies (Chapter 310) and significant wildlife habitat (Chapter 335), as well as processes for evaluating impacts to scenic and aesthetic uses resulting from activities in, on, over or adjacent to protected natural resources (Chapter 315).

b. Review Period

There is no statutory deadline for the DEP Commissioner to make a decision on the NRPA application, but he must render the decision as expeditiously as possible after acceptance of the permit application.[29]

As with the Site Law Permit, decisions by the DEP may be appealed to the BEP or to the Superior Court; a decision by the BEP may be reconsidered by the BEP or appealed directly to the Superior Court; and any decision of the Superior Court may be further reviewed by the Maine Supreme Judicial Court sitting as the Law Court.[30]

3. Erosion and Sedimentation Control Law

Maine's Erosion and Sedimentation Control Law, 48 M.R.S. § 420-C, does not require a permit but requires erosion control measures be put in place prior to commencing any activity that involves filling, displacing or exposing soil or other earthen materials in a project or portion of a project located in the organized area of the State.[31] The goal of this Law is to prevent unreasonable erosion of soil or sediment beyond the project site or into a protected natural resource. Since the requirements only apply to organized areas, the erosion control standards may not apply to the offshore wind turbines themselves, but would likely apply to a transmission line as it comes onshore, or to an onshore substation or laydown area.

[27] 38 M.R.S. § 480-E-1(3).

[28] 38 M.R.S. § 480-D. NRPA contains additional requirements for Offshore Wind Power Projects that do not require a Site Law permit (e.g., less than three (3) MW), but that is not applicable to this case which will require either the Demonstration Permit (which dispenses with a NRPA permit requirement) or a Site Law permit. 38 M.R.S. § 480-D(11).

[29] 38 M.R.S. § 344.

[30] 38 M.R.S. §§ 341-D(4), 346.

[31] 38 M.R.S. § 420-C.

4. Stormwater Program

Maine's Stormwater Program is made up of the Stormwater Management Law set forth in 38 M.R.S. § 420-D, and Waste Discharge License Law set forth in 38 M.R.S. § 413.

a. Stormwater Management Permit

Maine's Stormwater Management Law, 38 M.R.S. § 420-D, and the implementing regulation, Chapter 500 (stormwater management), provide stormwater standards for projects located in organized areas that include one or more acre of disturbed area. Since an Offshore Wind Power Project would be located primarily in the unorganized areas of the State, the DEP is evaluating the applicability of this law to these projects, but if the transmission line disturbs more than an acre as it comes onshore, this law will likely be triggered.

b. Waste Discharge Permit (Maine Construction General Permit)

Maine's waste discharge law, 38 M.R.S. § 413, *et seq.*, provides that "no person may directly or indirectly discharge or cause to be discharged any pollutant without first obtaining a license therefore from the [DEP]." The DEP will only issue a permit if it finds that the discharge by itself, or in combination with other discharges, will not lower the quality of the receiving waters below the existing or anticipated quality-based water classification, or, if it does, that there will be an important economic or social benefit to the State.[32] It is not clear whether this law would apply to an Offshore Wind Power Project, but further consultation with the DEP is needed before ruling it out.

c. Relationship of Stormwater Approvals with Other Laws

The DEP has consolidated the application process for the Stormwater Management Permit, the Waste Discharge Permit (Maine Construction General Permit) and the Site Law Permit. If a developer applies for a Site Law Permit, then they are not required to apply separately for a Stormwater Management Permit, but the Project may be required to meet standards set forth in the Stormwater Management Law.[33] If a developer pursues a Demonstration Permit in collaboration with UMaine for the Offshore Wind Energy Research Center site near Monhegan Island, however, it will not be required to obtain Site Law approval and in that instance, it is possible that the University would have to get separate a Stormwater Management and/or Maine Construction General Permit.

5. Maine Endangered Species Act

Under the Maine Endangered Species Act (MESA) as amended, a state agency or municipal government may not permit, license, fund or carry out projects that will significantly alter the essential habitat or violate protection guidelines for an endangered or threatened species listed under MESA, unless a variance is granted.[34] This restriction only applies to species

[32] 38 M.R.S. § 414-A(1).

[33] 38 M.R.S § 420-D(5).

[34] 12 M.R.S. § 12806(1).

that are listed as endangered or threatened pursuant to 12 M.R.S. § 12803. A variance from this restriction can only be granted if the DIFW Commissioner certifies that the proposed action would not pose a significant risk to any population of endangered or threatened species in the State and a public hearing is held on the proposed action.[35] Additionally, MESA prohibits the "taking" of any endangered or threatened species as a result of an activity, even if the activity is otherwise permitted, unless the activity falls within an exception prescribed by DIFW or an incidental take permit is obtained for that activity.[36]

The Department of Marine Resources (DMR) also maintains a list of state endangered and threatened marine species, but that list only includes federally listed endangered and threatened species under the federal Endangered Species Act (ESA).[37] A "take" of a state listed marine species is governed by the federal ESA and MESA's "take" provisions described above do not apply.

DEP considers DIFW and DMR's comments and recommendations regarding a project's impact on listed species as part of its review of a development project for a Site Law or NRPA Permit.

6. Maine Historic Preservation Commission

The Maine State Historic Preservation Officer (SHPO), who is under the umbrella of the Maine Historic Preservation Commission (MHPC),[38] advises state agencies responsible for permitting projects that may impact historic or cultural resources, including potential archeological resources that are beneath coastal waters. Additionally, the SHPO reviews impacts of federal projects on resources listed or eligible for listing in the National Register of Historic Places. If the MHPC and/or the SHPO determine that a project will result in an adverse effect to a cultural or historic resource, they will consult with the project proponent to find ways to avoid, minimize or mitigate such effects.

7. Submerged Lands Lease

Developers of ocean energy projects will need to obtain a state submerged lands lease or easement from the Maine Bureau of Parks and Lands (BPL) pursuant to 12 M.R.S. § 1862(13). A lease or easement applicant must engage in a joint interagency pre-application meeting with BPL, DMR, and DEP/LURC, and the process must take into account comments from the Marine Resources Advisory Counsel and relevant lobster management policy counsels. Full-term leases last 30 years. However, under the renewable ocean energy submerged lands lease program, prior to issuance of a 30-year lease, if requested by the applicant, BPL may issue a 30-year lease and a 2-year lease option, or 3-year or 5-year leases

---

[35] 12 M.R.S. § 12806(2).

[36] 12 M.R.S. §§ 12808(2), (3).

[37] 12 M.R.S. §§ 6973, 6975.

[38] 27 M.R.S. § 501 *et seq*.

for specific project start up activities as set forth in 12 M.R.S. § 1862(13)(B)(5). Annual rent for leases will be established through BPL rulemaking, but a Demonstration Project in the UMaine Test Site is exempt from payment of annual rent for a submerged land lease.[39]

8. Public Utilities Commission Approval

Maine Public Utilities Commission (PUC) approval is not required for generator leads.[40] However, if a public utility such as Central Maine Power, Bangor Hydro Electric Company or even a merchant transmission company were to own and construct the transmission line running from the Project to the grid, the PUC will need to issue a Certificate of Public Convenience and Necessity, which would involve a separate proceeding at the PUC and a determination of public need for the line.[41]

5.1.2 Federal Permits, Leases and Approvals

1. Bureau of Ocean Energy Management, Regulation and Enforcement (formerly Minerals Management Service) – OCS Lands Lease

The Bureau of Ocean Energy Management, Regulation and Enforcement (Bureau of Ocean Energy or BOEMRE), is the agency that was, until very recently, the Minerals Management Service (MMS). The Energy Policy Act of 2005 (EPAct 2005) designates BOEMRE as the lead federal agency for Projects in federal waters (a development located in, on, or over federally owned Outer Continental Shelf (OCS) lands from the three (3) nmi limit of state jurisdiction to the outer limits of the United States Exclusive Economic Zone (EEZ) at 200 nmi.

BOEMRE has an Alternative Energy Program that includes regulations to govern the leasing of OCS areas for wind power and other forms of renewable energy development on the OCS. The regulations covering renewable energy leases are codified in 30 C.F.R. Part 285. The renewable energy lease regulations set forth a two-tiered system of leases: (1) a limited lease that lasts only five (5) years and limits the amount of electricity that can be sold on the grid, and (2) a commercial lease that lasts for approximately 30 years (with possible renewals) that does not limit the amount of electricity sold. While a commercial lease will convey preferential rights to project easements on the OCS for the purpose of installing transmission and distribution systems, a limited lease will not convey any preferential rights to obtain a commercial lease in the leased area (although the regulations recognize that the limited lessee will be recognized in the process). The BOEMRE process for issuing a lease

[39] Although the Submerged Land Lease statute exempts a University Demonstration Project from annual rent for a lease, it does not expressly exempt it from the requirement of applying for a lease in the first place. Since the Demonstration Project technically falls within the definition of a Renewable Ocean Energy Project subject to the lease requirement, further investigation is needed to clarify whether a University Demonstration Project is exempt from the lease requirement itself in addition to the lease payment.

[40] 35-A M.R.S. § 3132(1)(B).

[41] 35-A M.R.S. § 3132(2).

includes both a competitive and a non-competitive track. Both tracks include National Environmental Policy Act (NEPA) review and a Coastal Zone Management Act (CZMA) consistency determination.

Under the regulations, the applicant for a renewable energy lease on the OCS must submit specific plans at the requisite times. Applicants for a limited lease must submit a General Activities Plan (GAP) that describes the site assessment and/or development activities. Applicants for a commercial lease must submit a Site Assessment Plan (SAP) which covers resources and other data gathering activities and the testing of technology devices that would be conducted to gather information to develop the project, and a Construction Operation Plan (COP) that describes the construction and operations for the project itself, covering all activities for the project and all planned facilities, including onshore and support facilities, and all anticipated project easements.

At the present time, the State of Maine is in consultation with BOEMRE to develop the Maine Deepwater Wind Energy Pilot Project that creates and implements a streamlined, three-year process for the environmental review and siting of an advanced, deepwater wind energy project, including lease issuance and approval of a project-specific assessment plan. Note that the three-year process does not include the two-years of prior environmental studies or surveys necessary for filing. Additionally, the goal would be to have all other applicable state and federal environmental reviews and approvals made and completed within three years from when BOEMRE either (a) determines no competitive interest in an RFI or if competitive interest is identified, then (b) selects a potential lessee through its competitive process.

2. Clean Water Act/Rivers and Harbors Act Approvals (USACE)

The installation of wind turbine generators and an electric service platform (if applicable), the installation of submarine cable systems and the cable landfall transition structures (if applicable) would be subject to regulatory permitting review and approvals under Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act (RHA). The Army Corps of Engineers (USACE) is the agency primarily responsible for permitting under both of these sections. Additionally, the RHA permit requirement, or any other federal permit requirement, may trigger Section 401 of the CWA, which would in turn require the DEP to issue a water quality certification.

Section 404 of the CWA requires a permit for the discharge of dredged or fill material into the navigable waters of the United States.[42] In order to obtain a Section 404 permit, an applicant must demonstrate that the proposed discharge would not significantly degrade waters of the United States, that there is no less damaging practical alternative to the proposed discharge, and that steps have been taken to avoid, minimize and in some cases mitigate for unavoidable adverse effects, and the project is not contrary to the public interest.

[42] 33 U.S.C. § 1344.

Section 10 of the RHA requires authorization to build any structure in any water of the United States and to excavate or fill, or in any manner alter or modify the course, location, condition or capacity of any port, harbor, or the channel of any navigable water of the United States.[43] To obtain Section 10 approval, the applicant must show that the proposed activity will not significantly obstruct or alter navigable waters and the project is not contrary to the public interest. The USACE has very detailed application forms and requirements that spell out what an applicant must submit for review.

Under Section 401 of the CWA, any applicant for a federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into the navigable waters, shall (1) provide the licensing or permitting agency a certification from the state in which the discharge originates or will originate, or, if appropriate, from the interstate water pollution control agency having jurisdiction over the navigable waters at the point where the discharge originates or will originate; and (2) demonstrate that such discharge will comply with the applicable provisions of the water quality standards and effluent standards and limitations set forth in the CWA.[44] Thus, if the Offshore Wind Energy Project requires an USACE Permit pursuant to Section 404 of the CWA or Section 10 of the RHA, it is likely that the developer would need to get a water quality certificate from the Maine DEP.

Finally, the CWA also prohibits discharge of pollutants into waters of the United States unless a National Pollutant Discharge Elimination System (NPDES) permit has been issued.[45] However, the power to issue this permit has been delegated to the Maine DEP and it is incorporated into Maine's waste discharge permit process discussed above.

3. Department of Energy/Federal Energy Regulatory Commission

At this preliminary stage, it appears that United States Department of Energy (DOE) or Federal Energy Regulatory Commission (FERC) approval is not required for an Offshore Wind Energy Project located in state or federal waters. This should be confirmed as the project advances. FERC does make sure that the interconnection does not compromise reliability standards and, depending on the terms of the interconnection agreement between the developer and the public utility into whose system the generator lead line will connect (likely Central Maine Power), FERC approval may be required.[46] It should also be noted that the electric reliability coordinator for the New England region, ISO-NE, will also need to approve the interconnection agreement.

[43] 33 U.S.C. § 403.

[44] 33 U.S.C. § 1341.

[45] 33 U.S.C. § 1342.

[46] FERC approval may also be required if the transmission line is owned by a public utility or a merchant transmission line company (not the generator) and the line travels through Federal waters. However, additional research will be needed to confirm.

4. Federal Aviation Administration

Federal Aviation Administration (FAA) notification is required for any structure that rises more than 200 ft above the ground or is located within a certain distance from an airport or heliport.[47] Since the wind turbine generator will likely exceed the 200 foot threshold, it will require permitting with FAA and FAA-approved lighting and marking.[48]

5. United States Coast Guard

The United States Coast Guard (USCG) has safety and regulatory jurisdiction over projects located in the navigable waters of the United States. A permit for private aid to navigation on fixed structures in waters of the United States may be required to allow placement of wind turbines and related structures in marine waters.[49] The wind turbine generators and substation platform(s) (if applicable) are subject to USCG review for authorization to mark and light them. A navigational risk assessment prepared by the USCG may be required.

6. Other Federal Review of the Project

a. National Environmental Policy Act

Under the National Environmental Policy Act (NEPA), before the federal government issues a permit for a proposed activity, it must evaluate the environmental impacts of its proposed action.[50] As part of the review process, the lead federal agency, in this case BOEMRE, must prepare environmental review documents (either an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) depending on the expected level of environmental impact) and obtain state and federal agency review and comment on the proposed project. Thus, federal agencies such as the United States Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS) and the Environmental Protection Agency (EPA), among other agencies, will have an opportunity to coordinate environmental review of a proposed Project, even those portions located in state waters.

b. Endangered Species Act

The Endangered Species Act (ESA) prohibits any action that results in the "take" of any member of a species federally listed as threatened or endangered.[51] To "take" a member of a listed species means to harass,[52] harm,[53] pursue, hunt, shoot, wound, kill, trap, capture or

---

[47] 49 U.S.C. § 44718(a); 14 C.F.R. § 77.13(a).

[48] FAA Advisory Circular 70/7460-1k.

[49] 14 U.S.C. § 85; 33 C.F.R. Parts 62-67.

[50] 42 U.S.C. § 4321, *et seq*.; many Federal agencies also have NEPA regulations or guidance.

[51] 16 U.S.C. §§ 1538(a)(1)(B), (C) (ESA section 9).

[52] "Harass" is an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. 50 C.F.R. § 17.3.

collect the endangered species, or to attempt to engage in any such conduct.[54] If the construction or operation of a Project may result in a take of federally listed species, an incidental take permit should be obtained for such activities. In order to obtain an incidental take permit, the applicant must develop a habitat conservation plan in concert with the relevant federal environmental agencies.[55] The ESA is jointly administered by the USFWS and NMFS. Listed fish species in the GoM include Atlantic Salmon and Atlantic Sturgeon.

The Bald and Golden Eagle Protection Act also prohibits the taking of bald and golden eagles.[56]

c. Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) prohibits the "taking" of marine mammals (e.g., whales, dolphins), unless there are specific exceptions under the statute. Similar to the ESA, the MMPA contains an incidental take provision and is jointly administered by USFWS and NMFS. Marine mammals such as the Northern right whale and marine turtles are also on the ESA list, and therefore also on the MESA list.

d. Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) prohibits the taking of migratory birds.[57] The Act protects all common songbirds, waterfowl, shorebirds, raptors (eagles and hawks), owls, ravens, crows, native doves and pigeons, swifts, martins, swallows and other migratory bird species.[58] Protection extends to species' feathers, plumes and other body parts, as well as nests and eggs, but a "take" under the MBTA is not applied as broadly as in the ESA and it does not include habitat modification or alteration.[59] Unlike the ESA, there does not appear to be a mechanism under the MBTA to obtain an incidental take permit for activities related to offshore wind power that may result in unintended death or harm to covered species.[60] An unintentional violation of the MBTA can be a misdemeanor and can result in fines of up

---

[53] "Harm" is an act which actually kills or injuries wildlife. Such acts may include significant habitat modification or degradation by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. 50 C.F.R. § 17.3; 50 C.F.R. § 222.103.

[54] "Take" through "harm" can occur by means of habitat modification. HCP Handbook at 3-18; *Babbitt v. Sweet Home Chapter of Communities for a Great Oregon*, 515 U.S. 687, 707 (1995).

[55] 16 U.S.C. § 1539(a)(1)(B), (2); FWS/NMFS, Habitat Conservation Planning Handbook.

[56] 16 U.S.C. § 668.

[57] 16 U.S.C. §§ 703, *et seq*. The definition of take includes "to pursue, hunt, shoot, wound, kill, trap, capture, or collect." 50 C.F.R. § 10.12.

[58] See 50 C.F.R. 10.13 (list of protected species).

[59] 50 C.F.R. § 10.12.

[60] Special purpose permits are available for take of migratory birds, but at first blush, they do not appear to be applicable to activities related to wind power. Further investigation is needed to confirm. 50 C.F.R. §§ 21.11, 21.27.

to $15,000 or up to 6 months of imprisonment, or both.[61] The MBTA is administered and enforced by USFWS.

e. Magnuson-Stevens Fisheries Conservation and Management Act

Under Section 305 of the Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA), federal licensing and permitting agencies are required to consult with NMFS and consider its recommendations regarding a proposal's potential impact on "essential fish habitat." The New England Fishery Management Council (NEFMC) has taken an active interest in wind power projects proposed for New England's ocean waters and provided comments regarding potential fisheries impacts. The Atlantic States Marine Fisheries Commission (ASMFC) may also participate in environmental reviews.

f. National Historic Preservation Act

The National Historic Preservation Act (NHPA) aims to direct federal agencies to act as responsible stewards of the nation's resources when their actions affect historic properties.[62] Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertakings. Historic properties include, among other things, sites (both prehistoric and historic), buildings, structures, and objects that are included in or eligible for inclusion in the National Register of Historic Places.

Historic preservation consultations may also involve the State Historic Preservation Officer (discussed above), Tribal Historic Preservation Officers of federally recognized tribes, and the National Trust for Historic Preservation (NTHP), local governmental agencies and other interested parties. These entities may consider, among other factors, any visual impacts from the proposed Offshore Wind Energy Project upon a historic property.

g. United States Department of the Navy

The United States Navy has shown interest in being consulted early on in the development review process undertaken by state agencies for Offshore Ocean Energy Projects located in Maine waters. The Navy may also choose to comment through the NEPA or other federal review processes.

h. Coastal Zone Management Act – Federal Consistency Review

Under the federal Coastal Zone Management Act (CZMA), Maine has the authority to review federal actions for consistency with the enforceable policies of its federally approved coastal zone management program.[63] Federal actions potentially subject to

---

[61] 16 U.S.C. § 707.

[62] 16 U.S.C. § 470.

[63] 16 U.S.C. § 1451, *et seq*.

CZMA review include federal agency activities, federal license and permit decisions, and federal funding. Under the CZMA, federal agency activities, including leasing decisions, must be "consistent to the maximum extent practicable" with applicable enforceable policies; and a federal agency may not issue a federal license or permit if, in exercising its federal consistency review authority, the state objects that its issuance is inconsistent with one or more specified enforceable policies.

The Maine State Planning Office (SPO) is the point of contact and coordinator for this federal consistency review process. State land use and environmental laws, primarily those administered by DEP and LURC, provide Maine's enforceable policies for CZMA purposes and to the extent practicable the State implements its federal consistency review authority through review and issuance of pertinent licenses and permits under these core laws. Following the state review process and in accordance with DEP and LURC decisions, as applicable, SPO provides the State's consistency concurrence with or objection to the federal agency's or federal applicant's consistency determination or certification, as applicable. The Secretary of Commerce has jurisdiction to hear an appeal of an objection to an applicant's consistency certification *de novo* under national interest criteria. The State's decision regarding a federal agency's consistency determination may also be appealed. Additional, detailed information regarding Maine's CZMA review process may be reviewed on-line at the following website: http://www.maine.gov/spo/coastal/permitting.htm.

i. Oil Pollution Act

The Oil Pollution Act of 1990 (OPA) amended the CWA and addressed the wide range of problems associated with preventing, responding to, and paying for oil pollution incidents in navigable waters of the United States.[64] The OPA created a comprehensive prevention, response, liability and compensation regime to deal with vessel- and facility-caused pollution to United States navigable waters. The OPA requires vessels to submit to the authorizing federal agency plans detailing how they will deal with a worst-case discharge and contingency plans to prepare and plan for oil spill response regionally. The OPA may or may not be applicable to an up to 30 MW wind farm depending on the role of installation and construction vessels in the project.

j. Clean Air Act

The Clean Air Act (CAA) contains provisions relating to air emissions from certain OCS activities in order to control air emissions from sources on the OCS.[65] An OCS "source" includes any equipment, activity or facility that, among other things, is regulated under the Outer Continental Shelf Lands Act (this may be triggered by the OCS land lease), or is located on the OCS or in or on waters above the OCS. While vessels are not an OCS source, they are considered a "source" when they are physically attached to an OCS facility,

---

64 33 U.S.C. §§ 2701-2761.

65 42 U.S.C. 7627.

and when within 25 miles from the source when en route to or from the source. At that time, emissions from vessels associated with the "source" will be considered direct emissions from the "source." Therefore, activities of vessels on the OCS during the construction phase may trigger a requirement for a CAA permit. The EPA is the administrative agency for the CAA.

5.1.3 Municipal and Local Approvals

1. Shoreland Zoning

The Mandatory Shoreland Zoning Act requires municipalities in Maine to protect shoreland areas through adopting shoreland zoning maps and ordinances that provide for allowable activities in certain areas. The shoreland areas covered by the law include areas within 250 ft of the normal high-water line of any great pond, river or saltwater body, areas within 250 ft of the upland edge of a coastal wetland, areas within 250 ft of the upland edge of non-forested freshwater wetlands ten or more acres in size, and areas within 75 ft of the high water line of a stream. The Act also gives a municipality the authority to regulate land-based structures that extend over and onto state-owned submerged lands. Municipalities are primarily responsible for administering the shoreland zoning law, but the municipalities' shoreland ordinances must be at least as stringent as and may be more protective than DEP's model ordinance guidelines (DEP Rules Ch. 1000).

2. Local Approvals

Local land use approval will be determined by the ordinances in the affected towns. For example, local land use approval may be required for the transmission line as it comes ashore, the substation (if a new one is constructed or existing one is expanded), and any newly constructed onshore laydown area. Obtaining local land use approval may require a zoning change, variance or other project-specific approval. However, a municipality is prohibited from enacting or enforcing a land use ordinance that prohibits the siting of ocean energy projects, including but not limited to, their associated facilities, within the municipality.[66] A local building permit could also be required, and further investigation will be needed to determine if any loading and unloading activities during construction will require municipal, harbor master or shellfish commission review and/or approval.

A permit for the transmission facilities to travel in the public way may also be required, depending on the configuration of the project. If the transmission facilities or the transmission line, once it comes ashore, need to be constructed and/or maintained along a road, street or other public way, the developer will need to obtain a license from the applicable licensing authority in charge of that road (either the municipality or Maine Department of Transportation).[67]

---

[66] 30-A M.R.S. § 4361.

[67] 35-A M.R.S. §§ 2305-B, 2501, 2503.

5.1.4 State and Municipal Approvals

Although the up to 30 MW pilot project itself would not need state or municipal approvals (other than the CZMA consistency review discussed above) because it will be located in federal waters, it is likely, however, that many, if not all, of the state and municipal approvals discussed above will still be required for the electric transmission line that will run through state waters and onto the shore, as well as any assembly or deepwater area located in state waters. Further examination will need to be conducted to determine whether the state permitting for the transmission line will fall within the jurisdiction of the DEP or LURC, as it will likely travel through both jurisdictions.

Additional municipal approvals may be required for an assembly site located in municipal waters such as, for example, Rockland, if the site falls within Rockland's municipal jurisdiction (though likely this will also be state jurisdiction).

5.1.5 Permitting of Onshore Assembly and Staging Area

1. Natural Resources Protection Act

The land-based assembly and staging area required for the proposed offshore wind development project may trigger the NRPA, as described above in Section 5.1.1(2), if the project will be located in, on, or near a protected natural resource as defined by the Act.[68] Given the expected need for the land-based support area to be located near the coast to facilitate transport of the completed towers, it is possible that the project will be located on or near a coastal wetland. In addition, construction of support areas may include certain activities that require a permit under NRPA, including dredging, bulldozing, removing or displacing soil, sand, vegetation or other materials, as well as the construction of a permanent structure.[69] Therefore, to meet the permit requirement, the project will have to conform to the standards required by NRPA.[70]

2. Site Location Development Act

The land-based construction project will also likely trigger the Site Law requirements as described above in Section 5.1.1(1). Site Law requires construction of "any development of state or regional significance that may substantially affect the environment" to meet the required standards for development before approval of the project.[71] Construction of the support area may trigger the permit requirement because any new buildings, parking lots, roads and paved areas for the project will likely cover an excess of three (3) acres – meeting the definition of a "structure" under Site Law and therefore qualifying as a development of

[68] 38 M.R.S. § 480-C; 38 M.R.S. § 480-B(8).

[69] 38 M.R.S. § 480-C (2).

[70] 38 M.R.S. § 480-D

[71] 38 M.R.S. § 483-A.

significance.[72] In addition, it is possible that power transmission requirements for the area may trigger additional permitting requirements under Site Law.[73]

3. Erosion and Sedimentation Control Law

Construction of the land-based support area will likely require filling, displacing or exposing soil and will therefore trigger the erosion and sedimentation control requirements under Maine law, as described above in Section 5.1.1(3). Though the law does not require permit approval, the law does require construction projects to have erosion control measures in place before beginning activities that may result in soil erosion.[74] This may require additional measures to be taken to prevent erosion during the construction of the assembly and staging area or the roads leading into such an area (if applicable).

4. Storm Water Program

a. Storm Water Management Permit

Construction of the staging area will require approval of the project's storm water management system by the Maine DEP, as noted above in Section 5.1.1, because the project will likely include one acre or more of disturbed area. To receive approval, storm water management must meet standards adopted by the DEP, and may have to conform to particular rules if the project is located near a watershed of a body of water most at risk for development.[75]

b. Waste Discharge Permit

The land-based construction and staging area will require a waste discharge license, as described in Section 5.1.1(4)(b) because it is likely that construction of the wind turbines and tower will result in some waste which may qualify as a pollutant under the statute. The DEP will issue a license if it finds that the project conforms to the requirements identified by statute.[76]

5. Maine Endangered Species Act

If any of the activities related to the construction and/or operation of the land-based construction and staging area result in the taking of any endangered or threatened species, or adverse impact to their designated habitat, those activities would likely be prohibited by the Maine Endangered Species Act, as described in Section 5.1.1(5).

---

[72] 38 M.R.S. § 482 (6).

[73] 38 M.R.S. § 487-A.

[74] 38 M.R.S. § 420-C.

[75] 38 M.R.S. § 420-D.

[76] 38 M.R.S. § 414-A.

6. Maine Historic Preservation Commission

As described in Section 5.1.1(6), the Maine Historic Preservation Commission may be involved in permitting a project that has potential impacts on historic or cultural resources, including archaeological resources. Therefore, it may be necessary to consult with the Commission to determine whether this project will have such an impact and what will be required to meet the Commission's approval and perhaps mitigate the effects of the project.

7. Mandatory Shoreland Zoning Act

If the land-based construction and staging area is located near a shoreland area as defined by the Mandatory Shoreland Zoning Act, described in Section 5.1.3(1), the project may trigger a municipal ordinance regulating construction and activity near the shore. Once a site is chosen, research should be done to determine the exact requirements of the local municipalities' applicable ordinance. This ordinance may, or may not, be part of a larger municipal zoning scheme, as municipalities may treat shoreland areas differently.[77]

8. Local Zoning Ordinances

Municipalities within Maine may have their own municipal zoning requirements, which may dictate the potential locations for the land-based construction and staging area within the municipality, in conformation with the municipality's comprehensive plan.[78] Once a site (or potential sites) has been chosen, research will be required to determine the exact requirements of a particular municipality. In addition, municipalities may assert that water-based activities within the three (3) nmi limit are within their boundaries and thus subject to local regulation.

9. Waste Management

As both the construction and operation of the land-based construction and staging area will likely result in waste, management and disposal of such waste will have to comply with the requirements of Maine's waste management laws.[79] Municipalities may provide waste disposal services for industry, but regardless, waste disposal efforts will likely have to conform to the requirements of the municipality in which the site is located.[80] Certain activities are prohibited, such as discharge of hazardous waste, and other activities are highly regulated, such as fluids from motor vehicles and construction and demolition debris.[81]

10. Minimum Lot Size

Maine's Minimum Lot Size statute may dictate requirements for disposal of waste.[82] The support area would likely be defined as "other land use activity" which would require an

[77] 38 M.R.S. § 435.

[78] 30-A M.R.S. § 4352.

[79] 38 M.R.S. § 1302

[80] 38 M.R.S. § 1305

[81] 38 M.R.S. § 1306

[82] 12 M.R.S. § 4807-A

actual measurement or computation of waste generated or likely to be generated to determine requirements for disposal of waste by means of subsurface waste disposal.[83] This may or may not apply to the site because it would depend on the methods used for waste disposal.

11. United States Army Corps of Engineers Wetlands Permit

Depending on the location of and the sizes of the onshore assembly and staging area, an USACE wetlands permit under CWA Section 404 may also be required. Note that DEP, LURC, USACE and other federal agencies work cooperatively on wetlands permitting under the terms of the Maine Programmatic General Permit.

12. Federal Aviation Administration Requirements

The Federal Aviation Administration (FAA) has specific requirements for construction of tall structures that may apply to the construction and staging area.[84] In particular, any construction of more than 200 ft in height above the ground requires notification to the FAA Administrator.[85] If the wind turbine towers will be raised while at the staging area, this may require notification to the FAA and the installation of aircraft warning lights.[86] Even if the project does not require raising the towers at the staging area, there are additional FAA notice requirements that may be site-specific as they relate to "any construction or alteration of greater height than an imaginary surface extending outward and upward" based on the slope of the landscape and proximity to airport runways.[87]

5.1.6 Key Statutory Definitions Related to Offshore Wind Energy

1. Wind energy development

"Wind energy development" means a development that uses a windmill or wind turbine to convert wind energy to electrical energy for sale or use by a person other than the generator. A wind energy development includes generating facilities and associated facilities. [35-A M.R.S. § 3451(11) (definition of wind energy expedited permitting act)]

2. Associated facilities

"Associated facilities" means elements of a wind energy development other than its generating facilities that are necessary to the proper operation and maintenance of the wind energy development, including but not limited to buildings, access roads, generator lead lines and substations. [35-A M.R.S. § 3451(1) (definition of wind energy expedited permitting act)].

---

[83] Id.

[84] 14 C.F.R. § 77.5

[85] 14 C.F.R. § 77.13

[86] Id.; 14 C.F.R. § 77

[87] 14 C.F.R. § 77.13

3. Generating facilities

"Generating facilities" means wind turbines and towers and transmission lines, but not including generator lead lines, that are immediately associated with the wind turbines. [35-A M.R.S. § 3451(5) (definition of wind energy expedited permitting act)]

4. Development of state or regional significance that may substantially affect the environment

"Development of state or regional significance that may substantially affect the environment," in this article also called "development," means any federal, state, municipal, quasi-municipal, educational, charitable, residential, commercial or industrial development that . . . is an offshore wind power project with an aggregate generating capacity of three (3) MW or more. [38 M.R.S. § 482(2)(J) (SLODA Defs.); *see also* PL 615, Sec. E-15]

5. Offshore wind power project

"Offshore wind power project" means a project that uses a windmill or wind turbine to convert wind energy to electrical energy and is located in whole or in part within coastal wetlands as defined in 38 M.R.S. § 480-B(2). "Offshore wind power project" includes both generating facilities as defined by Title 35-A, Section 3451, Subsection 5, and associated facilities as defined by Title 35-A, Section 3451, Subsection 1, without regard to whether the electrical energy is for sale or use by a person other than the generator. [38 M.R.S. § 482(8)]

6. Offshore wind energy demonstration project

"Offshore wind energy demonstration project" or "project" means a wind energy development in one of three designated areas in state waters that uses a wind turbine to convert wind energy to electrical energy and that employs no more than two (2) wind energy turbines, each of which may use different technology, for the primary purpose of testing and validating a turbine blade design, floating platform or other support structure, mooring or anchoring system or other offshore wind energy technology that the applicant certifies is designed for use in ocean waters and is not in use elsewhere in the GoM for commercial production of electricity and that may also include:

i. Up to three (3) meteorological towers per wind energy turbine proposed;

ii. One submerged utility line that is sized to transmit:

  1. An amount of electricity less than or equal to that produced by the offshore wind energy demonstration project; or
  2. Up to 25 megawatts of electricity if the line is intended to serve multiple offshore wind energy demonstration projects located within the Maine Offshore Wind Energy Research Center and the department has not previously granted approval for such a submerged utility line pursuant to this section; and

iii. A wave energy test project. [38 M.R.S. § 480-HH(1)(H); see also P.L. 270 (LD 1465)]

5.1.7 Application Schedule

The critical path for state and federal permitting of an up to 30 MW Project in federal waters is anticipated to be the Outer Continental Shelf (OCS) leasing and permitting process through BOEMRE. As noted previously, the State of Maine is in consultation with BOEMRE to develop the Maine Deepwater Wind Energy Pilot Project, which would develop and implement a streamlined, three-year process for environmental review and siting of an advanced, deepwater wind energy project, including lease issuance and approval of a project-specific assessment plan. The other major state (e.g., Site Law) and federal (e.g., CWA Section 404/Section 10) permits are anticipated to require six (6) to 18 months for permit review and approval. All of these timelines are predicated on the development of "complete" permit applications that sufficiently address the permitting requirements. As part of the development of all of these permit applications, a minimum of two (2) seasons (spring and fall), and likely four (4) seasons, of bird and bat monitoring will be required. Conservatively, the time required to perform these studies, as well as additional required surveys, and prepare the permit applications is estimated to be at least two (2) years. Therefore, at a minimum, developers should expect a five-year permitting process from the start of necessary environmental studies and surveys (two (2) years) to permit issuance (an additional three (3) years beyond studies and surveys under streamlined permitting). An example timeline for BOEMRE and other state and federal approvals is included in Section 8.0. If the Maine Deepwater Wind Energy Pilot Project proposed to BOEMRE is not finalized, and current BOEMRE OCS leasing procedures are followed, then this permitting period could increase upwards to nine (9) or ten years.

5.2 PHYSICAL ENVIRONMENT AND INFRASTRUCTURE CHARACTERIZATION

Developing sufficient information regarding key characteristics of the physical environment surrounding potential test park sites, assembly areas, grid interconnection points, and associated subsea cable and tow routes is essential to determining the feasibility of an offshore wind project. This section provides a summary of a desktop-level survey of available data describing the physical

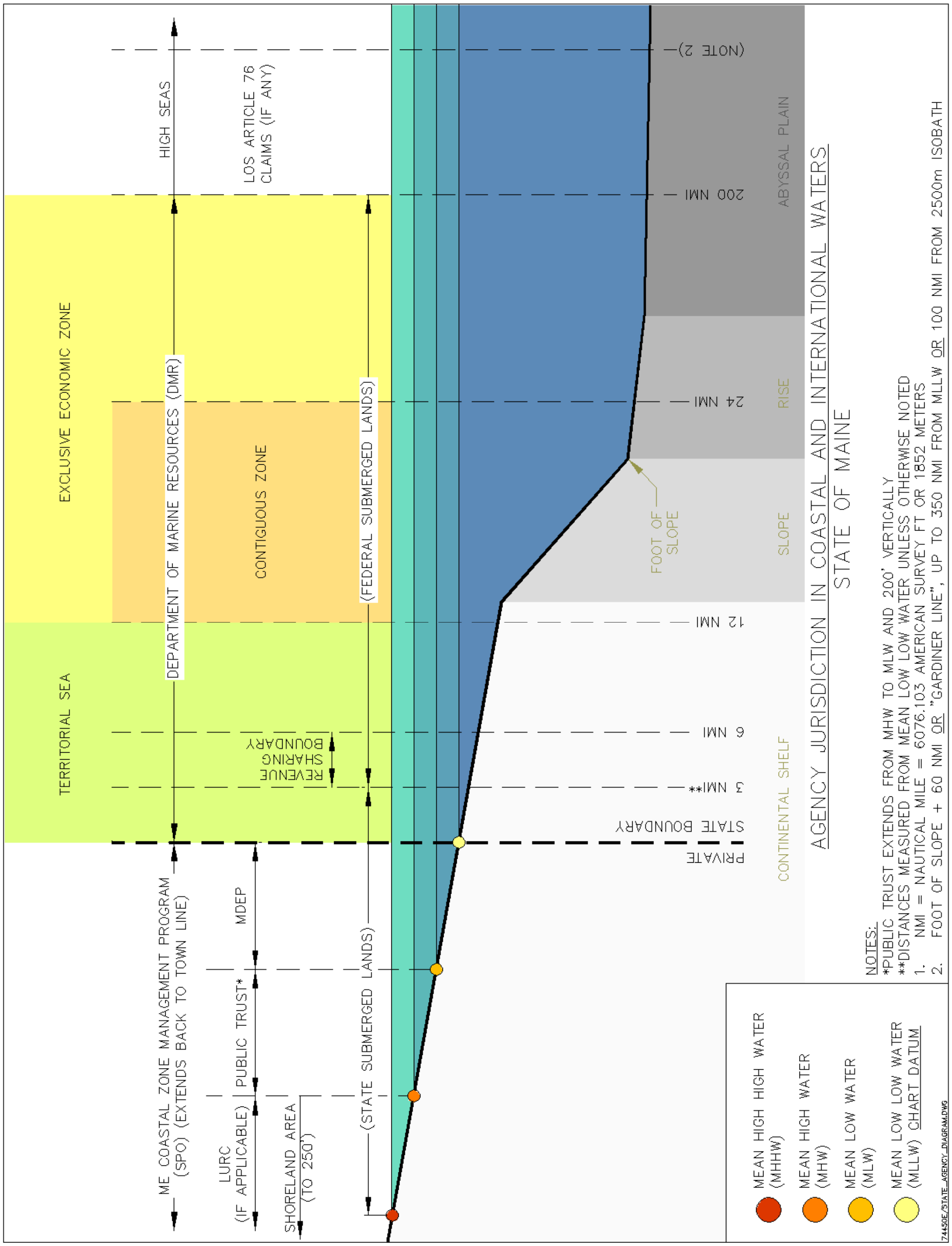


Figure 5-2: Jurisdictional boundaries for coastal and international waters

environment and existing infrastructure within the GoM. Potential impacts to the physical environment and infrastructure from offshore wind development are described in the following subsections. Data described was generally obtained as digital geospatial files for use and analysis in GIS software, unless specified otherwise.

5.2.1 Jurisdictional Boundaries

state and federal regulatory boundary information was obtained from a review of legislation and relevant agency sources. These boundaries are critical to determining regulatory and permitting jurisdictions. A visual depiction of pertinent coastal boundaries may be seen in Figure 5-2. Jurisdictional boundaries were obtained from the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) (formerly the Minerals Management Service (MMS)) for use in this feasibility study.

Different jurisdictional zones represent different permitting and regulatory requirements. Per Maine law LD 1810, offshore wind energy projects must be situated a minimum of ten (10) nmi from state lands, measured from Mean Lower Low Water (MLLW), not including uninhabited islands or coastal wetlands. Sites greater than three (3) nmi from MLLW are subject to federal permitting and regulation. Subsea cables and other permanent offshore structures that cross into state waters will be subject to state and federal permitting and regulations.

A schedule of permitting requirements has been prepared for the proposed site and described in Section 5.1.7. Early and regular communication with state and federal agencies will be crucial to the smooth development of an offshore wind facility.

5.2.2 Wind Resource

Offshore wind turbines should be situated in an area that has mean annual wind speeds of 8 m/s or greater to maximize commercial viability. Sources of wind data for this study include the Gulf of Maine Ocean Observing System (GoMOOS) and National Data Buoy Center (NDBC) buoy systems, providing data at the ocean surface (discussed further in Section 5.2.3 – Met-ocean Data), and the National Renewable Energy Laboratory (NREL), a division of the Department of Energy (DOE). NREL data provides information regarding wind speeds and trends in upper levels of the atmosphere. Figure 5-3 shows mean annual wind speeds at 50 m for the GoM based on wind speed data provided by NREL.

Areas with mean annual wind speeds of less than 8 m/s are not likely to support a commercially viable offshore wind farm and should not be considered. With that said, almost all areas located ten (10) nmi from the coastline exhibit Class 6 or better (i.e., ≥ 8 m/s) wind speeds on annual average. As specific areas of interest are selected for development, further investigation of wind speeds should be considered if an area of interest does not appear to have enough data to support this criterion. This may include deployment of additional buoy instrumentation consisting of traditional

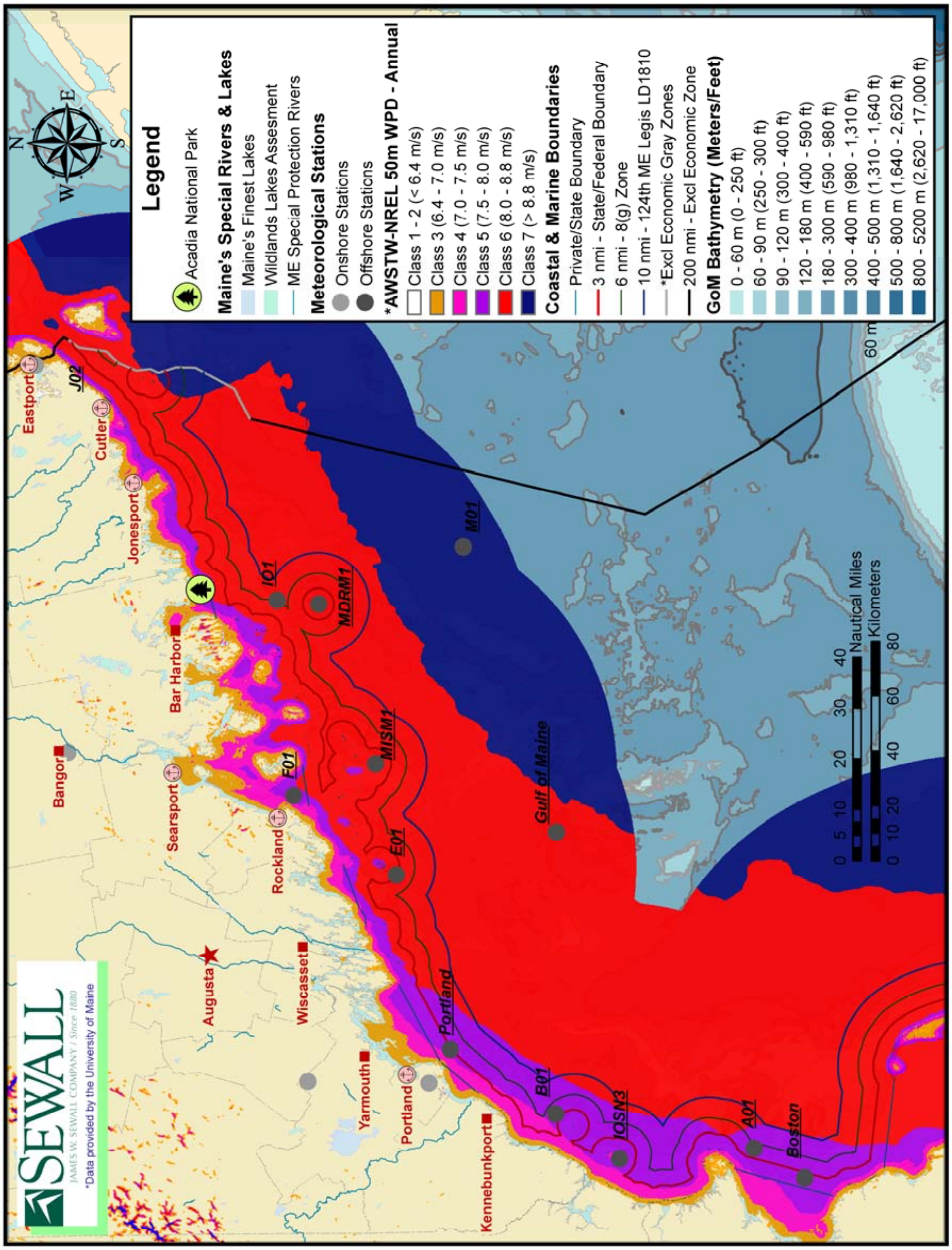


Figure 5-3: Mean Annual Wind Speed (m/s) at 50 meter height above mean sea level

anemometers and/or LiDAR or SODAR-based wind measurement devices to develop wind speed profiles with height at the specific location of interest.

5.2.3 Met-ocean Data

Met-ocean data includes meteorological and oceanographic information important for project siting and design, including currents, significant wave height, temperature and salinity. The primary source of met-ocean data for this study is from five buoys in the GoM operated by UMaine/GoMOOS and the National Oceanic and Atmospheric Administration (NOAA) National Data Buoy Center. These five buoys are part of the Northeastern Regional Association of Coastal Ocean Observing Systems (NERACOOS) and labeled: E01, F01, NOAA Buoy 44005, NOAA Buoy 44007 and NOAA Station MISM1 – Matinicus Rock, Maine.

The availability of wind, current, wave, salinity and temperature data from these buoys is summarized in Table 5-1. For more information regarding met-ocean data and data sources, see Sections 3.1, 3.2, and 3.3. Additionally, refer to Figure 3-1 for a map of the buoy and NOAA weather station locations and Appendix B.1 for a summary of wind speed and significant wave height for selected buoy locations in the GoM.

Table 5-1: Gulf of Maine (GoM) buoy data availability

DATA DESCRIPTION	E01	F01	NOAA 44005	NOAA 44007	Station MISM1 – Matinicus Rock, ME
Wave Time History	Y	Y	Y	Y	
Wave Height	Y	Y	Y	Y	
Current at 2 meters (m)	Y	Y			
Current at all depths	Y				
Average Wind Speed	Y	Y	Y	Y	Y
Salinity at 1 m	Y	Y			
Salinity at 20 m and 50 m		Y			
Water Temperature at 1 m	Y	Y	Y	Y	
Water Temperature at 2 m	Y	Y			
Water Temperature at 20 m and 50 m		Y			

Extreme wave data is essential for the design of the turbines in order to assess potential impact forces on the turbine structures. The turbine structures must be designed to withstand the toppling effects of extreme wave conditions. Another design issue is the destabilization of the turbine and floating platform due to wave and wind conditions, including failure of the anchoring and mooring system.

Gathering sufficient data to adequately assess the forces of wind and waves on the turbine structures is essential to the design process of a successful offshore wind farm project. Turbines and anchoring systems should be designed for worst-case situations. The most efficient method for gathering more site-specific data for an area of interest would involve relocating one of the currently inactive NERACOOS buoys and repurposing the buoy for use with the Hywind II project. A similar process was recently followed in June of 2010 by UMaine to deploy the E02 buoy in the DeepCwind project area south of Monhegan Island.

5.2.4 Bathymetry

Bathymetry consists of seafloor topographic data for use in determining water depths. PUC RFP requirements dictate that offshore project locations must have a minimum water depth of 300 ft (91 m). Currently, the primary sources of data for desktop-level analyses include digital bathymetric contours of the GoM from the USGS and NOAA electronic navigational charts.

For this study, existing bathymetric contour data was supplemented with a field hydrographic survey by Sewall of a discrete portion of an approximately 1.75 miles by 1.75 miles area of the Penobscot Bay, located at an area of particular concern within the Bay that is known Junkin's ledge. For a complete description of this data, and USGS bathymetric data, see Section 3.7.

Sites that largely do not meet these bathymetric criteria will not be feasible. Changes to the ocean floor to deepen towing routes or wind farm locations would be prohibitively expensive and would require significant additional permitting and environmental monitoring. Further hydrographic survey of discrete areas along potential towing routes within wind farm sites may be warranted if the overall area of interest meets water depth criteria. A comprehensive hydrographic survey of any proposed tow out route is recommended after the project progresses to the design and permitting phase.

5.2.5 Topography

Topographic data represents the elevations of land areas of the state that are above mean sea level. Primary sources of topographic data for desktop analyses include contour files and digital elevation models based on USGS topographic quadrangle maps. The maps generally represent 10-ft to 20-ft contour intervals. The low-resolution USGS topographic data can be easily supplemented with site-specific topographic surveys, including use of traditional land surveying techniques as well as aerial photography and photogrammetric mapping.

For general project planning and scoping, USGS digital elevation data is sufficient to support project decision-making. However, once the project progresses to the design and permitting phase, additional site-specific topographic surveys will be necessary, particularly for the transmission line route and electric substation interconnection. Typically, for land-based wind projects, the transmission line topographic data is generated using aerial photography and photogrammetric mapping techniques. The use of aerial mapping is much more efficient and cost-effective than traditional land surveying. The accuracy of aerial mapping is severely affected by leaf cover and other obstructions that prevent a good view of the ground surface. As a result, the planning of aerial surveys is very important to make sure that the surveys are conducted during the spring and fall "leaf-off" time periods to maximize the potential accuracy of the survey. The aerial mapping may also be supplemented by traditional land surveys of the substation site and potential sites for an operations and maintenance facility.

5.2.6 Geophysical Survey Data and Surficial Bottom Sediments

The geophysical composition of the surficial soils along the ocean floor is needed for the design of any structures that may rest on or be embedded in the seabed, including anchoring systems. Primary existing data sources for surficial sediments include USGS East Coast Sediment Texture Database, USGS Continental Margin Mapping, USGS BARNHARDT: Maine Inner Continental Shelf Sediment Data, and MGS Surficial Geology of the Maine Inner Continental Shelf map series. These datasets provide information about general trends in the geology of surficial sediments. For a complete description of these data and their accuracy, see Section 3.10. Figure 5-4 shows the surficial sediment distribution for the GoM based on USGS Continental Margin Mapping work of Poppe et al (2005).

Surficial sediment conditions in the GoM include mud, sand, gravel and rock. Anchoring or foundation systems will need to be designed according to the seafloor geology in the areas ultimately selected for project development. As anchor and foundation design is contingent upon surficial sediment conditions, it will be necessary to perform geophysical and geotechnical engineering investigations at project-specific locations for any proposed offshore wind turbines. These investigations would include, but would not be limited to, in-situ testing, surficial sediment sampling, core sampling of deeper sediments (not reflected in the surficial data presently available), and subsequent classification and analysis of engineering parameters of sample sediment/rock.

Comparatively small areas of the sea floor will be impacted by the presence of the anchors for each turbine, but by their nature, proposed anchoring system will likely become permanent fixtures on the ocean floor. As a result, the type of anchor/foundation will need to be fully described in project permitting documents (e.g., descriptions of dimensions, material, estimated lifetime, etc.) for review and approval by federal regulatory authorities and commenting agencies.

5.2.7 Wetlands and Coastal Marshland

Wetlands and coastal marshland information is needed to assess landside and nearshore impacts for grid interconnection and service facilities. General wetlands geographic information was obtained from the National Wetlands Inventory (NWI), supported by the United States Fish & Wildlife Service. The NWI data consists of broad-scale wetland delineation from aerial imagery and topographic mapping that is suitable for desktop-level screening, research and planning activities, but is of insufficient detail for project design and permitting. The location of the grid interconnection point may require the crossing and/or trenching of coastal marshland or wetlands along the transition from subsea cable to overhead power main. Permanent impacts may include, at a minimum, trenching and filling of an underground electric cable run, the installation of utility poles for overhead lines, along with clearing a landside utility corridor to the interconnection point for maintenance and construction. There may also be wetland and coastal marshland impacts related to the landside storage and marine assembly areas that will be required for the construction of the proposed offshore wind farm. These impacts may range from temporary disturbance of staging areas, along the coast or inland, to semi-permanent or permanent structures or lay down areas constructed for storage of turbine components and associated materials. Wetland disturbance from these construction activities must be included in the total disturbance calculations.

The USACE should be notified regarding any wetland disturbance along the coastline. If wetland disturbance exceeds 4,300 square ft, a permit from USACE will be required. Maine Department of Environmental Protection also regulates inland wetlands and permitting will be required if disturbance exceeds one acre. Effort should be made to minimize wetland impact as much as possible to limit the amount of environmental disturbance and related permitting needed to construct the grid interconnection. For a detailed description of permitting requirements, see Section 5.1.

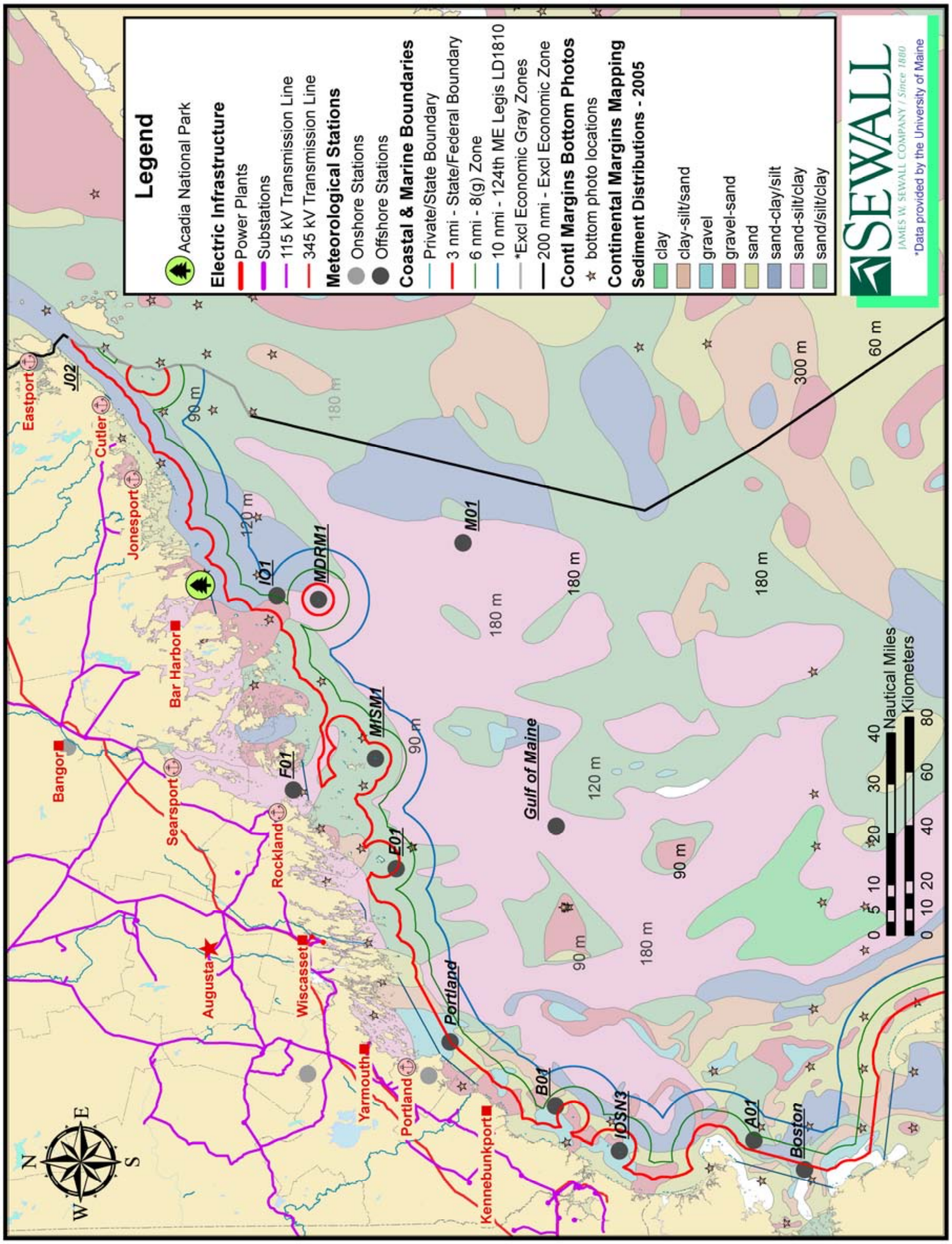


Figure 5-4: Gulf of Maine surficial bottom sediment distribution (after Poppe et al., 2005)

5.2.8 Grid Interconnection Points

The permanent landside portion of any proposed offshore wind project will include the transition from subsea cable to overhead power line and construction of a transmission line to the grid interconnection point. As summarized in Section 4.0 of this report, there are 79 substations that could serve as potential interconnection points within ten (10) miles of the coast. These locations were converted from a series of latitude and longitude points into a GIS shapefile by Sewall. List of potential interconnection sites was reduced from 79 to 21, and then down to a final 15 (see Table 4-8 in Section 4.2). The final location of the grid interconnection will play a major role in determining the subsea cable route and necessary transmission line construction.

Construction of the grid interconnection may encounter various obstacles. As discussed in Section 5.2.7, the presence of wetlands on or around the potential interconnection location may result in environmental impacts and additional permitting. See Section 5.1 for a detailed discussion on site permitting requirements.

Other items to note include the physical accessibility of the site, as well as the proposed corridor from the subsea cable route. The transition from subsea to overhead utility lines will require utility pole design and installation; potential coastal trenching for subsea cable; as well as the clearing of a corridor from the shore to the grid interconnection location. At the actual substation, grading and other aspects site development, such as vehicle accessibility and other utilities, will be site-specific. The degree of permitting and site design will depend on the final selection of grid interconnection point and the distance from the end of the subsea cable route to the interconnection substation.

5.2.9 Subsea Cable Routes

Existing subsea cables and permitted cable corridors need to be identified to evaluate areas of interest for potential conflicts with existing cables, as well as investigate the potential to reactivate unused cable routes. Additionally, areas on navigational charts where dragging is prohibited often represent cable routes and should be reviewed. The location of existing cable lines and no-dragging corridors was obtained from the NOAA Office of Coast Survey (NOAA-OCS). Figure 5-5 shows the cable routes identified within the GoM. Towing routes and potential project areas should be evaluated where they intersect cable areas and no-dragging corridors to verify that there will be no conflict. It may be beneficial, however, for the location of the proposed subsea cable from the wind farm to coincide with existing no-drag corridors, where possible. Anchoring locations for the turbines should be examined to remove any conflict with existing subsea utilities.

5.2.10 Military Activity/Restricted Zones

Certain areas along the coastline are designated for military activity and zones of restricted access. Geospatial information for these areas was obtained from electronic navigation charts (ENCs) from NOAA-OCS. The information obtained shows coastal restricted areas, military zones, unexploded ordnance areas, and other explosives dumping grounds information. Figure 5-5 shows the location of military and other restricted areas within the GoM.

It is essential to know the location of areas of military activity and restricted zones and identify areas of concern where towing routes, offshore wind farm location, subsea cable, or other construction activity may intersect or abut said areas. Unexploded ordnance and other explosives dumping grounds must be avoided in all aspects of the project. Activity within coastal restricted areas will be dependent on the types of restrictions imposed by the military branch, and will require explicit permission from the military branch. It is advisable to avoid conflicting with these restricted areas. Requirements for permission to conduct construction activities in other military zones will vary depending on the type of zone. A review of areas of concern, along with early communication with the jurisdictional military branch, is essential to ensure the smooth progression of the project.

5.2.11 Shipping Lanes and Ferry Routes

Shipping lanes need to be identified in order to evaluate any potential impact on transportation in state or federal waters. The location of established shipping lanes was obtained from NOAA-OCS. As part of the navigable waters of the United States, shipping lanes are under the jurisdiction of the United States Coast Guard (USCG). Available data on shipping lanes includes harbor approach areas, traffic separation zones, and recommended vessel routes. Figure 5-6 shows the location of shipping lanes within the GoM.

The offshore wind farm project location should not interfere with established shipping lanes. Transportation of materials to marine assembly and storage areas and towing of turbine components to the offshore site will create additional marine traffic. Shipping and towing schedules and routes must be coordinated with the USCG to prevent conflicts or unnecessary delays on commercial waters. In addition, the turbine structures themselves are subject to USCG review, regarding navigational risks and marking and lighting. See Section 5.1 for additional permitting and review information.

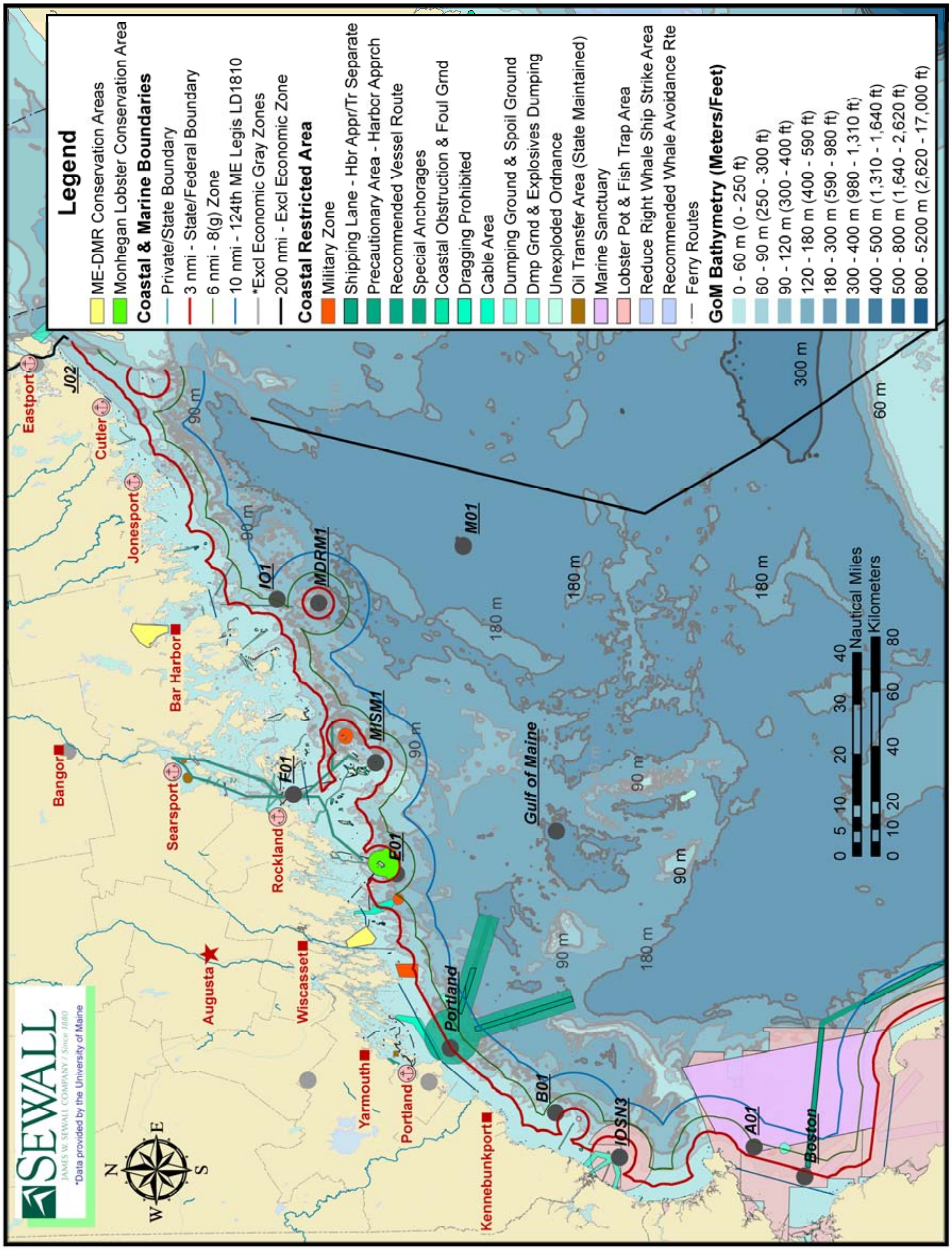


Figure 5-5: Restricted Areas and Coastal Hazards in the Gulf of Maine

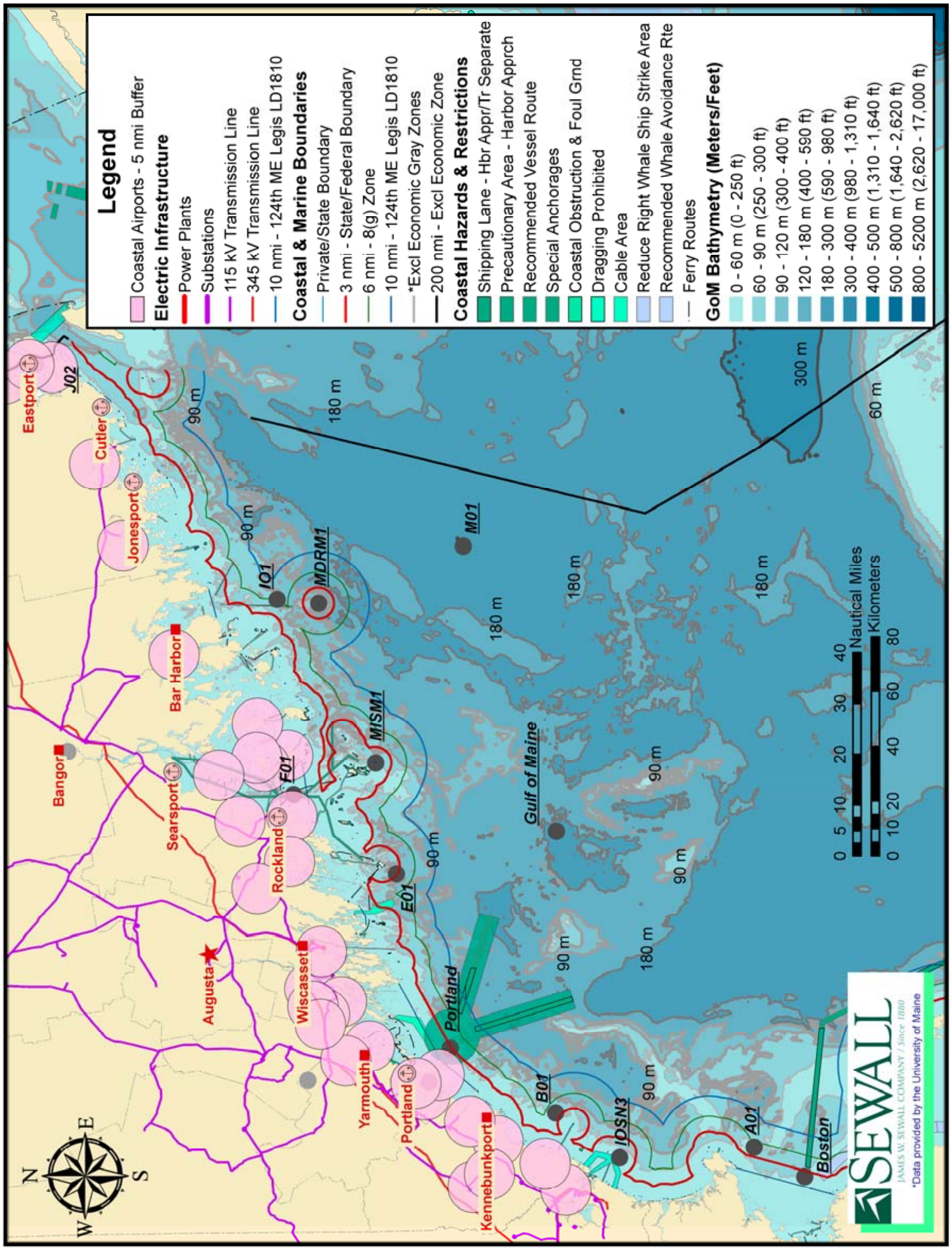


Figure 5-6: Infrastructure and Transportation Features in the Gulf of Maine

Ferry routes can also affect the selection of potential project areas and tow routes. Within the Penobscot Bay, there are three active ferry routes that cross the bay between Rockland harbor and Matinicus Island, North Haven and Vinalhaven. These ferry routes represent potential conflicts. There are also three ferry routes between Monhegan Island and the mainland, which could represent potential, although minor, conflicts with potential subsea cable routes. Figure 5-6 shows the location of ferry routes within the GoM.

5.2.12 Coastal Wildlife and Migratory Marine Species

The GoM contains numerous migratory marine species including, but not limited to, many species of fish, marine mammals, and some sea turtles. Some of these species have been listed as threatened or endangered and are protected under the Endangered Species Act. Reflective of the need to preserve critical habitat for these and other marine species, marine sanctuaries and other marine protected areas have been designated throughout the GoM. Other areas of critical habitat for coastal wildlife have also been identified by DMR, DIFW and NMFS, including inland waterfowl and wading bird habitat, coastal seabird nesting areas, and eelgrass beds. Geospatial information showing areas of concentration for highly migratory species, marine sanctuaries, marine protected areas, critical habitat and breeding grounds was obtained from NMFS and the Maine Office of GIS (MEGIS). Figure 5-7 shows the coastal wildlife and habitats while Figure 5-8 shows marine migratory species of concern. Current information on marine protected areas can be obtained from the National Marine Protected Areas website: http://www.mpa.gov.

It is important to look at the offshore wind farm site, subsea cable route, towing routes, and marine assembly and storage areas to identify impacts, if any, on designated critical habitat or marine protected areas. It is possible that if towing routes cross a protected area, towing components may be restricted to certain times of the year to prevent disruption of migratory routes or other marine life activity. Some protected areas may restrict development or moorings, which would directly affect offshore wind farm construction. If the offshore wind farm location itself overlaps a marine protected area, in-depth environmental monitoring and assessment may be required to determine the extent of impact on the protected species. For this reason, and to minimize impact on the environment, it is advisable to avoid encroaching on these areas with permanent offshore structures. For a detailed discussion of environmental impacts, see Section 5.3.

5.2.13 Economic and Extractive Resources

Commercial fishing is a very important industry to the State of Maine and an important part of the local economy in the coastal and island communities where many fishermen live and work. Areas of restricted fishing are therefore important not only from an environmental conservation standpoint, but also from an economic perspective. There are a number of areas of restricted fishing activity in the GoM, ranging from year-round closures to seasonal closures to one or two-week closures for certain protected species. Figure 5-9 shows many of the areas that restrict commercial fishing activities. Geospatial information for these areas was obtained from NMFS and MEGIS.

There are also dynamic and seasonal management areas that restrict the speeds of certain sized vessels (greater than or equal to 65 ft) to reduce the likelihood of collisions with endangered right whales. Dynamic Area Management (DAM) and Seasonal Area Management (SAM) zones reflect areas of historic right whale and other marine mammal activity that have restricted fishing and the use of floating rope in previous years. Figure 5-9 shows the DAM zones in the GoM for the past two years. As of April 2009, commercial fishermen have been required to use sinking rope, and the DAM/SAM zones have been renamed as Dynamic Management Areas (DMAs) and Seasonal Management Areas (SMAs). The DMAs and SMAs still represent areas of restricted commercial fishing and boating activity. In SMAs, all vessels 65 ft or longer must travel ten (10) knots or less. For DMAs, mariners are requested, but not required, to avoid either the DMA or travel through them at ten (10) knots or less.. Updated information on current DMAs and SMAs can be obtained from the NOAA Fisheries Office of Protected Resources (http://www.nmfs.noaa.gov/pr/shipstrike/).

5.2.14 Cultural and Archaeological Resources

Maine's nearshore coastal zone has the potential to host a variety of cultural resources. A long history of fishing and marine commerce produced many shipwreck sites along the Maine coast. Maine's complex sea level history resulted in subaerial exposure of regions between the modern day coast and depths of 60 m between 13,000 and 5,000 years ago. Human occupation of these areas is established by the recovery of artifacts from Maine's nearshore region. Cultural and archaeological resources in the GoM include, but are not limited to, shipwrecks, lighthouses, significant viewsheds and recreational areas. The primary source of data for coastal shipwrecks is from the NOAA Automated Wreck and Obstruction Information System (AWOIS). Lighthouse data was compiled from information from the National Park Service (NPA), Maritime Heritage Program (MHP), Lighthouse Heritage, National Historic Lighthouse Preservation Act (NHLPA) of 2000, Great American Lighthouse Resource (GALR), and other local sources. Figure 5-10 shows the location of lighthouses and shipwrecks in the GoM.

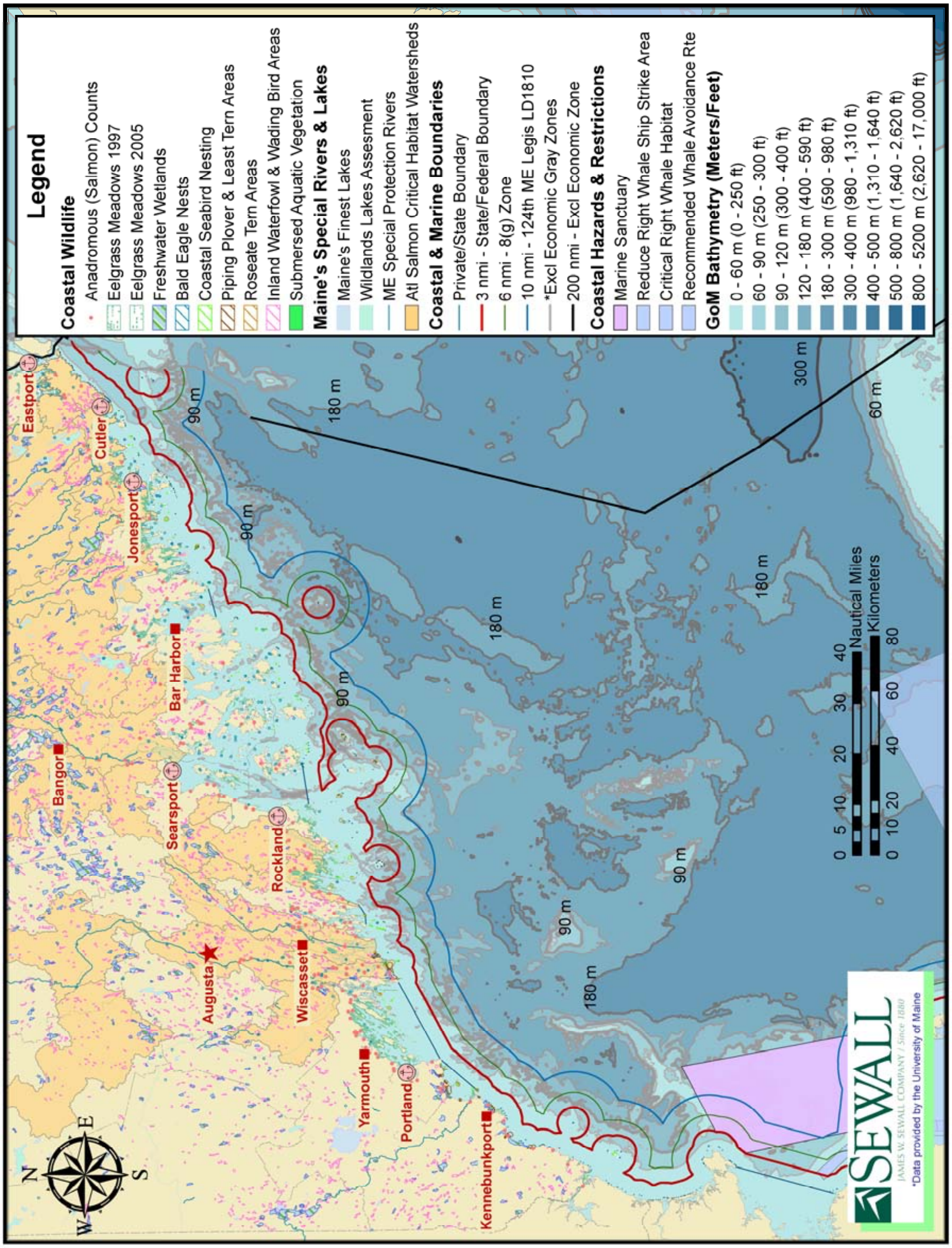


Figure 5-7: Coastal Wildlife in the Gulf of Maine

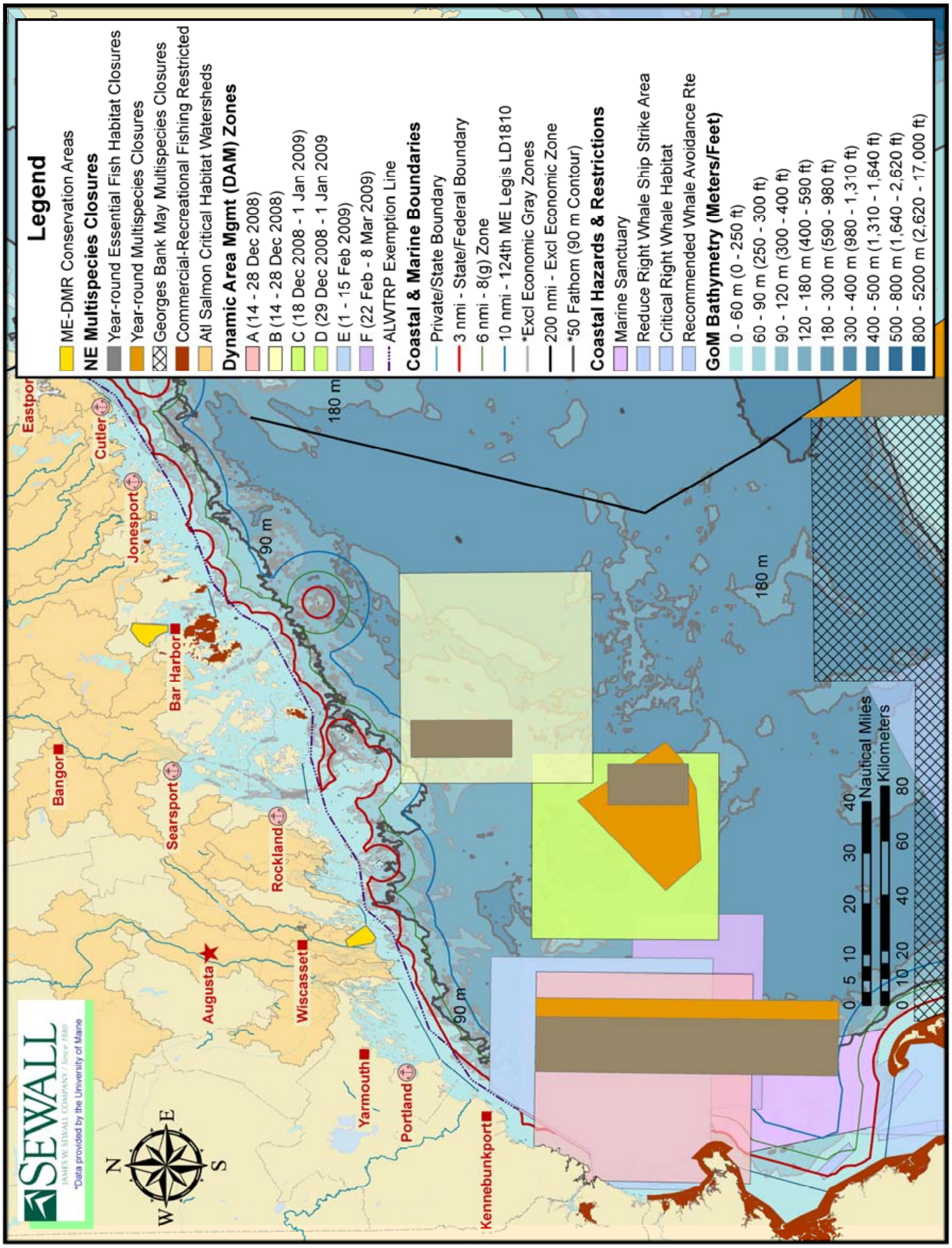


Figure 5-8: Marine Migratory Animals of Concern in the Gulf of Maine

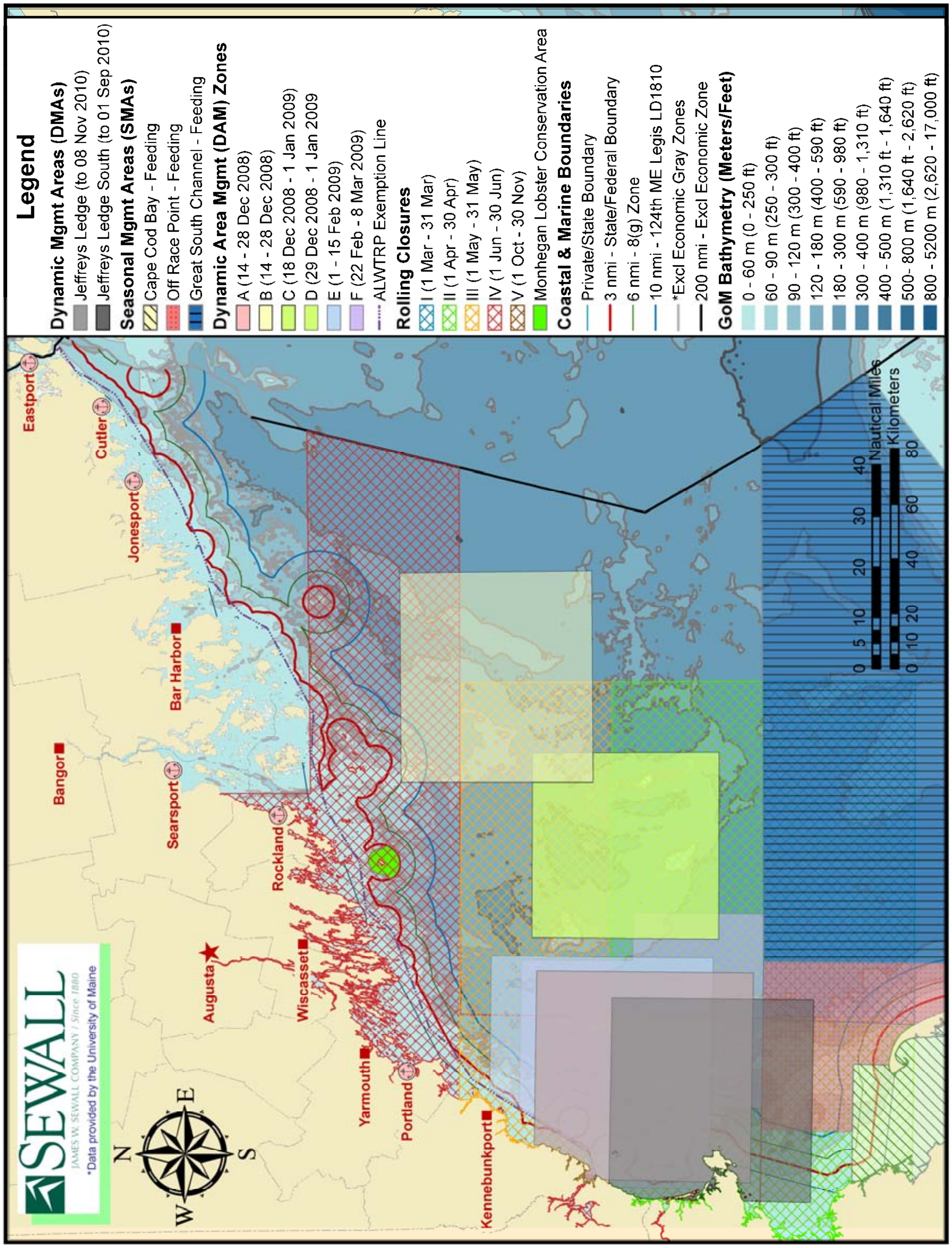


Figure 5-9: Coastal Economic and Extractive Resource Areas of Use in the Gulf of Maine

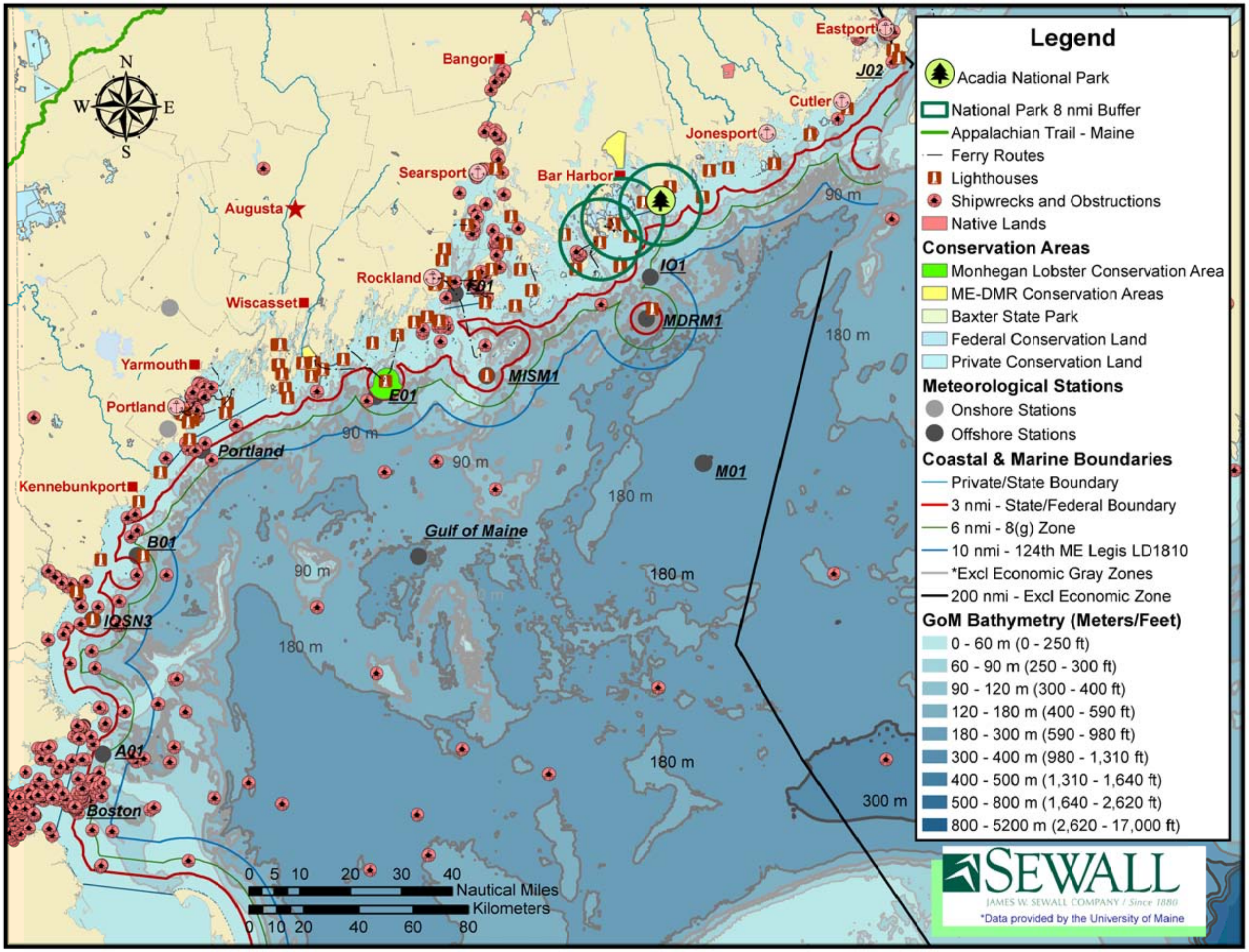


Figure 5-10: Cultural and Aesthetic Features in the Gulf of Maine

It is important to note that many lighthouses, all along the Atlantic coast, are being sold to private owners. As these lighthouses are sold and transition from active to private status, they are designated by the National Park Service as cultural features and then regulated under the National Historic Preservation Act. The regulated viewshed for these cultural resources is eight (8) miles, while the regulated viewshed for active lighthouses is typically only three (3) miles. Accordingly, viewshed analyses would need to be conducted for any private lighthouses within eight (8) miles of any of the components of a proposed offshore wind project, including the subsea cable route, tow out route and marine assembly area. The 8-mile viewshed would also apply to Acadia National Park.

Cultural and archaeological resources are unique and often historically significant. Therefore, it is important that any offshore wind development avoid detrimental impacts on these features. Considerations should include views of the turbines interfering with vistas from shore, behind lighthouses, or other areas where their presence may create aesthetic issues for observers. Legislative limits placed on developing closer than ten (10) nmi from land should obviate most of these concerns (see Section 5.2.1 and discussion of LD 1810). Depending on the location of landside marine assembly and storage areas, similar concerns with views or accessibility to cultural resources may need to be addressed on a case-by-case basis; however these would generally be considered to be temporary impacts. Other concerns may include navigating around cultural or archeological resources during construction. Towing routes should avoid subsea features such as shipwrecks. In the event that towing routes lie above recorded shipwrecks or other underwater feature, an evaluation will need to be performed to ensure that the towed turbine component will not collide with the structure. Turbines should not be located over shipwrecks or other underwater features as anchoring systems may damage the resource and the stability of the anchoring system may be compromised. Viewsheds and recreational areas are somewhat subjective and should be evaluated on a local level once the proposed wind farm site and towing routes have been established. Public meetings may be warranted in areas of high tourism to hear community concerns and allay fears that turbines might spoil the ocean coastline and its viewshed.

Section 106 of the National Historic Preservation Act requires that impact of projects on cultural resources must be assessed and plans to avoid, minimize or mitigate any adverse affects be implemented. This includes not only identification of submerged geoarcheological evidence of historical human occupation, but shipwrecks and other artifacts that may provide evidence of historic human life and culture. Identification of submerged cultural and historical resources of significance that may be affected by marine development should be evaluated using a successful Maine SHPO-approved strategy. This strategy relies on a trained geoarcheologist to analyze trusted data and images from (a) side scan sonar geophysical surveys, used to identify the presence of historic shipwrecks; and (b) detailed multi-beam bathymetric surveys and seismic reflection profiles, used to identify the presence of landforms and geomorphic settings that have a high potential to be submerged prehistoric cultural resources.

5.2.15 Recreational Uses

Recreational uses of the coastal zone include recreational boating, sailing, and tourism activities, including whale-watching tours and tours of historic lighthouses. Figure 5-11 shows the location of national parks, lighthouses and windjammer sailing cruises in the GoM. Recreational uses are not anticipated to significantly impact the siting of offshore wind turbines, the subsea cable route or the marine assembly area; however the USCG will require the project to have a navigation safety plan that establishes exclusion zones around the offshore structures (i.e., wind turbines, substation platforms).

5.2.16 Necessary Additional Surveys

In the previous Sections 5.2.1 through 5.2.15, potential actions or surveys that may be required for final development of an offshore wind farm in the GoM have been described. In summary, the following additional surveys will likely be necessary to support design and permitting of an up to 30 MW offshore wind pilot project:

- Site-specific wind measurements (e.g., anemometer supplemented with LiDAR or SODAR)
- Site-specific met-ocean measurements (e.g., repurposing of inactive GoMOOS/NERACOOS buoys)
- Bathymetric surveys of the project area, tow out route and subsea cable route
- Topographic surveys of the transmission line route
- Geophysical and geotechnical engineering studies of the offshore project area and subsea cable route to characterize the bottom substrate and the type and depth of surficial sediments
- Delineation of freshwater wetlands, vernal pools, coastal wetlands, coastal marshland and essential fish habitat areas in the vicinity of the construction/assembly area and along the subsea cable and transmission line route

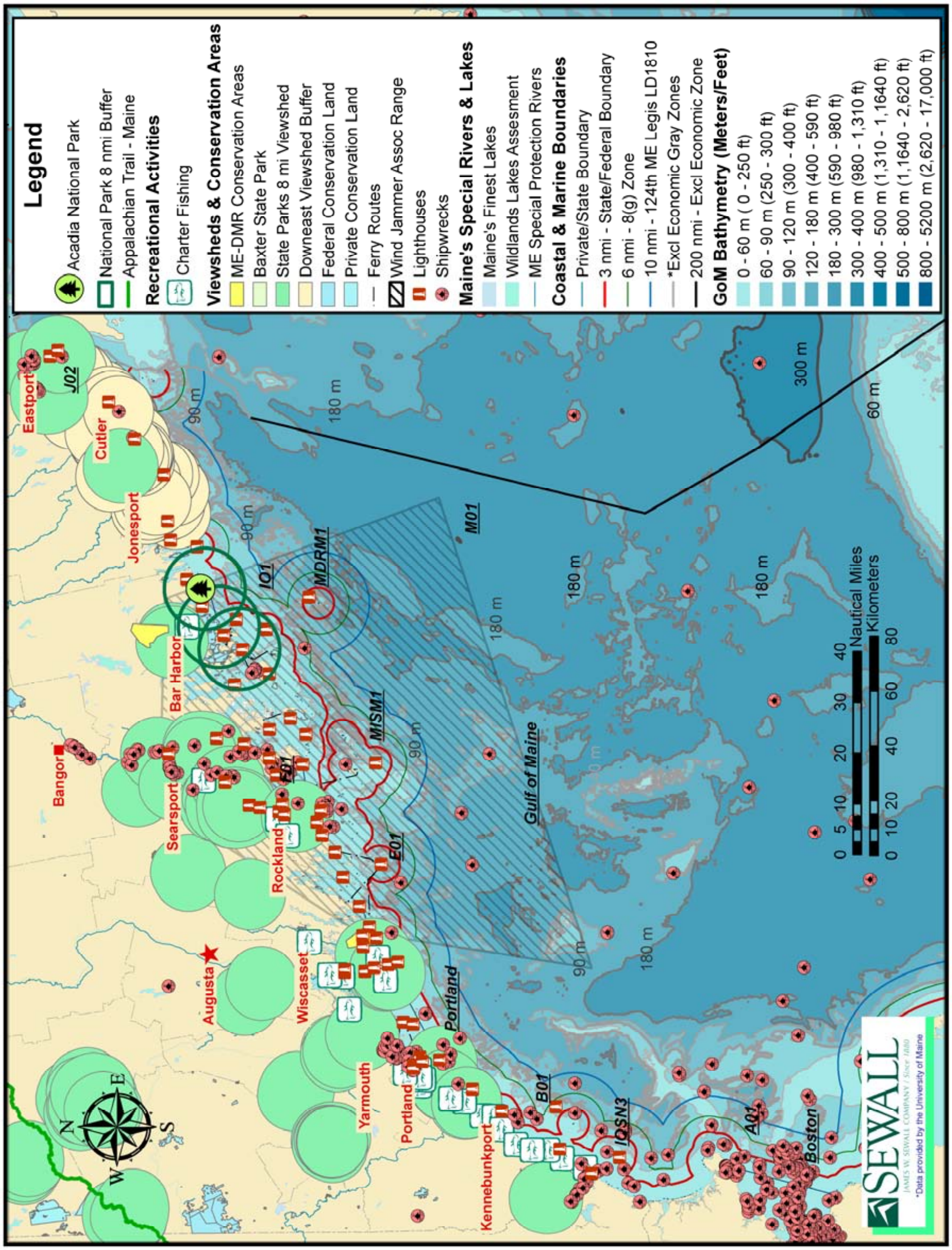


Figure 5-11: Recreational Uses of the Coastal Zone in the Gulf of Maine

5.3 ENVIRONMENTAL CONSIDERATIONS

5.3.1 Introduction of Environmental Considerations

The majority of studies to date of environmental impacts of wind turbines are based largely on the European experience. As of February 2011, no wind turbines have been installed in marine waters off the continental United States as compared with over 700 in marine waters off of the European coast. Most of the European installed turbines are on monopole platforms or use gravity-based structures or jackets; are all connected rigidly to the seafloor, and in waters depths of less than 45 m (and mostly less than 20 m).

Gill (2005) notes that offshore renewable energy development results in various interactions with the local environment and its biota. Potential modes of interaction are collision and avoidance; noise and vibration; electromagnetic fields (EMF); and changes in habitat heterogeneity, sediment transport and water movement. He further notes that such developments could: (1) affect sound and EMF-sensitive species at the individual or population level; (2) lead to changes in migratory patterns, fatalities and injuries to animals; (3) alter nutrient regimes, species diversity and abundance, production and biomass, community composition and size structure; and (4) have other indirect effects. This assessment is only partially transferable to floating, deepwater wind installations because the structures, the disturbances caused during installation, the initial and modified habitats, and the species in deep water are substantially different from those near shore. Consequently, the extent to which the European experience generalizes to deepwater wind development off the Maine coast is limited, leaving substantial information gaps. Nonetheless, with these important caveats, environmental impacts studies associated with European offshore wind installations will be valuable for assessing potential impacts in the GoM.

In an effort to consider and address potential concerns relating to the development of offshore wind in Maine coastal waters, Governor Baldacci of Maine established the Maine Ocean Energy Task Force (OETF) in November 2008. The primary objective of the OETF was to recommend strategies to meet or exceed the goals established in the Maine Wind Energy Act (i.e., 2,000 MW wind capacity by 2015; and 3,000 MW by 2020), including identification of potential economic, technical, regulatory and other obstacles to development of grid-scale offshore wind energy facilities off the coast of Maine. The Environmental Impacts Subcommittee Final Report to the Maine Ocean Energy Task Force (OETF) made several recommendations regarding offshore wind development. The report states the following:

> *There is a great deal of information concerning the habitat, species and existing uses in the Gulf of Maine. There is an even greater amount of information necessary to fill gaps in this information. Comprehensive data-gathering efforts must continue to add to current information about the ecosystem as a whole so public and private decision-making is guided*

by the best available information. Such information should be publicly available and used to supplement the Coastal Atlas as recommended by Subcommittee 2.

The Subcommittee also noted the following:

The Gulf of Maine is a dynamic ecosystem that has great value environmentally, economically and emotionally. Regulation and management of offshore renewable energy projects must take a precautionary approach and must be able to adapt to the best available data as it becomes available in order to minimize adverse impacts. This will require sustained monitoring of environmental impacts to identify and respond to unanticipated changes in the environment. Regulation must take into account not just the construction and operation of offshore renewable energy projects but also cumulative impacts of such projects.

We review in this section the environmental considerations related to the building, installation and operation of an up to 30 MW deepwater offshore wind project in federal waters, with connectivity to coastal areas of the State of Maine. Our review is organized into seven (7) parts, which are described in the following subsections:

- Section 5.3.2 briefly describes the physical environment and the large-scale biogeography of its communities;
- Section 5.3.3 provides an overview of major species groups found in the areas under consideration, highlighting environmentally sensitive or valuable sites and protected areas;
- Sections 5.3.4 – 5.3.7 discuss potential effects on major species groups in four primary impact categories:
    - physical interaction with turbines
    - alteration of benthic habitats
    - acoustic effects, and
    - electromagnetic field effects
- Section 5.3.8 summarizes the study findings in a risk matrix, articulates a series of priority questions and recommends site-specific and/or technology-specific surveys and studies

The study designs suggested in Section 5.3.8 are appropriate to fill the current knowledge gaps and extend understanding of potential development effects of moored, offshore wind turbines. The studies suggested are designed to be appropriate to the scale of a small wind farm but also helpful in anticipating effects of scaling up to a larger, more commercially viable installation and designing studies to test those predictions at the larger spatial scale and longer time scales.

In developing this assessment, recent studies conducted in association with permitting of the proposed Cape Wind development in Nantucket Sound, as well as initial environmental resource studies in anticipation of offshore wind development in New Jersey and Rhode

Island were considered. It is important to note that not all of the information related to the Cape Wind, New Jersey, and Rhode Island projects is transferrable because these installations are currently designed to be fixed rigidly to the seabed and will be deployed in waters shallower than those being considered for offshore wind development in Maine.

5.3.2 Physical Environmental and Large-Scale Biogeography

The geographic area considered in this chapter meets the criteria specified in LD 1810 for a deepwater wind pilot project, specifically sited in waters at least 300 ft deep and at least ten (10) nmi from the Maine coast and from any islands that are inhabited (Figure 5-12).

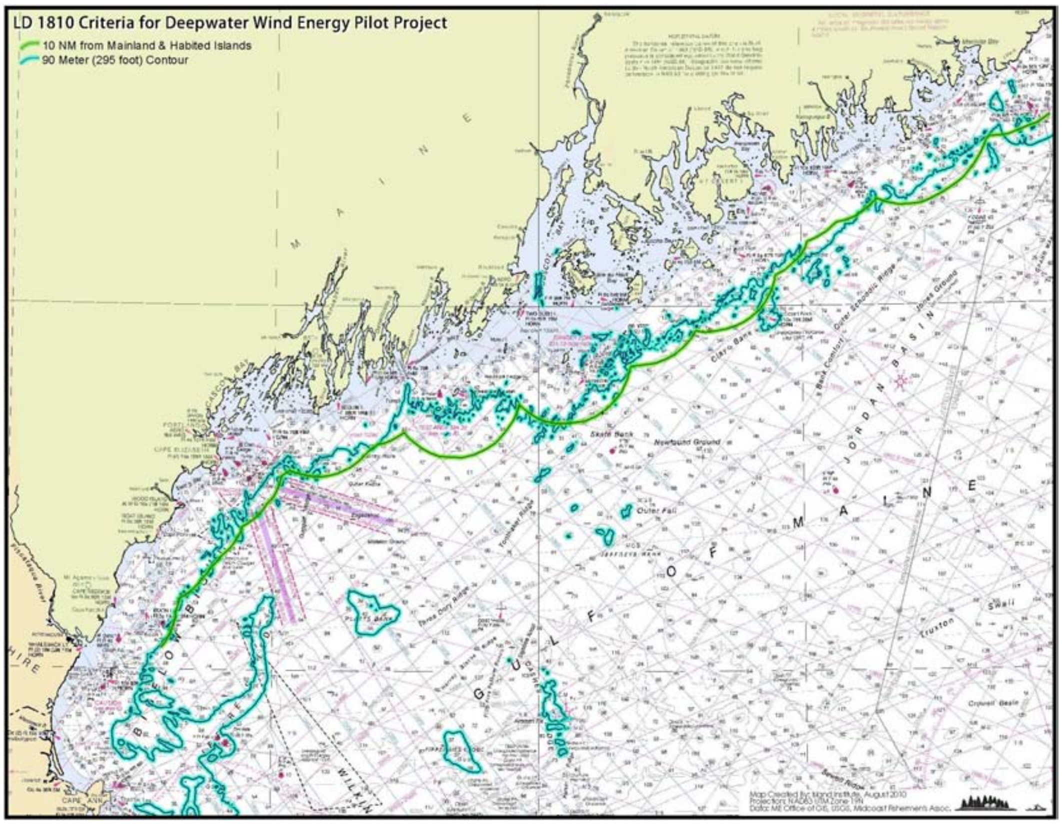


Figure 5-12: LD 1810 Criteria for Deepwater Wind Energy Pilot Project

This restriction places the proposed sites near the edge of the GoM's northern coastal shelf (Figure 5-12). Bottom type at this range of depths in the GoM is more than 70% mud. The midshelf front in the GoM generally follows the 50-m isobath, placing the proposed sites in the southwestward, isobath-following currents known as the Eastern Maine Coastal Current and the Western Maine Coastal Current. At the transition near the mouth of the Penobscot River and Jeffrey's Bank (not to be confused with Jeffrey's Ledge farther southwest), a partial flow separation and recirculation occurs at the division between the eastern gyre that circulates cyclonically around Jordan Basin and the western gyre that circulates cyclonically around Wilkinson Basin. In general, the warmer western gyre stratifies earlier in the year and more stably than the cooler eastern gyre. Mean coastal current velocities are of order 0.1 m/s, with substantially higher tidal velocities in some locations. Except where they are topographically focused, near-bottom currents will be substantially slower, as evidenced by the deposition of mud.

Summer nutrient limitation makes stratified seas sensitive to mixing and upwelling. Thus offshore sites can be more sensitive to mixing effects than are sites inshore where stratification breaks down frequently due to frictional effects at the seabed and injection of momentum at the surface from wind stresses and breaking waves. Islands have long been known to cause stirring; an island in a current is analogous to a stirring rod moving at the same relative speed in terms of its mixing effects, and the mixing can have interacting components due to tides and a steady current (Simpson et al., 1982). Islands also cause persistent structure in the curl and divergence of the wind stress that leads to upwelling (Chelton et al., 2004). Such island effects on phytoplankton abundance have been documented in the region of interest (Townsend et al., 1983). Broström (2008) has predicted, based on models of wind stress, that large, offshore, floating wind farms could produce upwelling velocities of one meter per day (1 m/d), sufficient to cause phytoplankton blooms. Nutrient alterations in this region are of interest because nutrient supplies are known to affect occurrence and persistence of harmful algal blooms. Local mixing is also feasible if the floating support structure for a turbine extends through the thermocline, although again the small horizontal dimension of the platform ("stirring rod") limits these effects.

Benthic megafaunal and macrofaunal densities decrease with water depth. The megafauna is usually defined loosely as those organisms large enough to see in bottom photographs; the term combines ideas of size and lifestyle on the surface of or just above the bottom. The macrofauna is defined more strictly in terms of animals larger than a size cutoff, usually 1.0 mm, 0.5 mm, 0.4 mm, and 0.3 mm, and operationally by retention on a sieve with openings of that mesh size. Macrofauna can be epifaunal (living outside the sediments as does the megafauna) or infaunal (living in the sediments). Sedimentary infauna is sampled by cores, grabs or dredges. Megafaunal species diversity in the target depth range is lower than on the shallow shelf and correlates with diversity in bottom type (rock, gravel, sand and mud). Macrofaunal diversity continues to increase to water depths greater than 1000 m, which are not reached inside the GoM. Ecosystems in the GoM cannot be considered to be in stable or steady "baseline" state. Fishing and climate change have elicited major changes whose future trajectories are poorly constrained by models (National Marine Fisheries Service 2009).

Although they are not in steady state, the GoM contains environments that are particularly sensitive for various oceanographic and biological reasons. Two areas have such broad significance to numerous species groups that they would likely require much more study before permitting would be considered there, and in our estimation results of those studies are likely to indicate prohibitive risk to both endangered species and others. These areas are the region surrounding and including Jeffrey's Ledge in the Western GoM south to Cape Cod and the eastern Maine coastal shelf and Jordan Basin area in the northeastern GoM to the Bay of Fundy.

Jeffrey's Ledge: The earliest seasonal blooms of phytoplankton occur in the shallow western GoM, where numerous species, including cod and northern shrimp, converge to release eggs and larvae into a productive milieu with abundant prey of a wide range of sizes. This early season (January-February) bloom generally occurs in the area from Jeffrey's Ledge to Cape Cod and is noted for its frequency of right whale sightings, especially in the fall when larger biomasses of more mature plankton have accumulated (Weinrich et al., 2000) (See Figure 5-13).

Eastern Maine shelf and Jordan Basin: The northernmost GoM, from about Jonesport northeastward, represents the other pole of right whale activity (Figure 5-13) and experiences the convergence of many migratory species, including endangered Atlantic salmon that move through the area after leaving natal streams. Slowest to bloom is the region in and surrounding the Bay of Fundy because of turbidity from sediments suspended by tidal mixing. The bloom here, however, persists once light levels are sufficient because that same tidal mixing constantly renews supplies of inorganic nutrients, which continue southwestward in the Eastern Maine Coastal Current. It is the site of late-season congregations of many species. North-south flyways intersect between Maine and Nova Scotia, giving this region a high density of bird traffic.

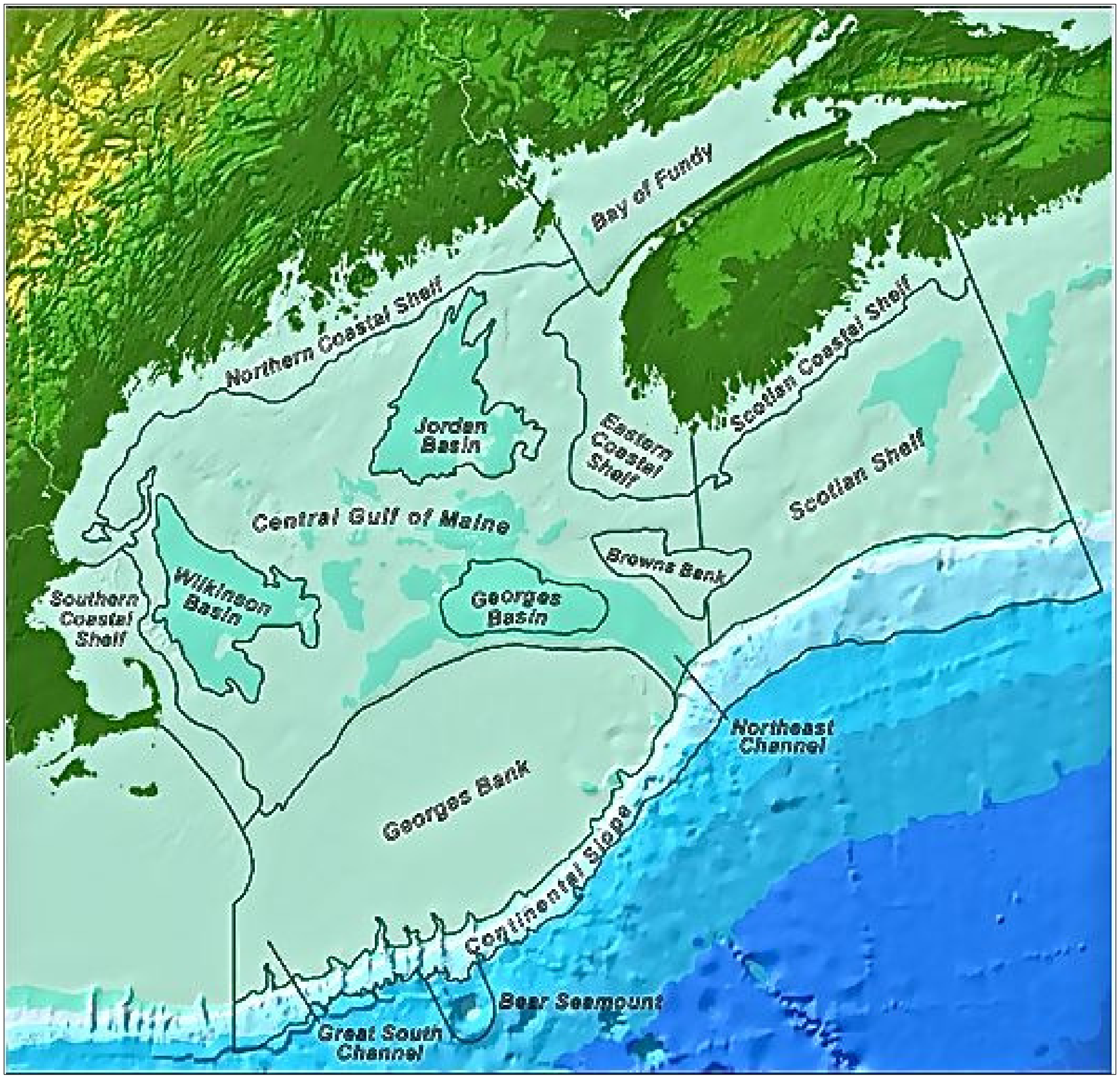


Figure 5-13: Gulf of Maine physioregions (from the Gulf of Maine Census of Marine Life). Note the outer boundary of the Northern Coastal Shelf is defined by the 100 meter depth contour.

5.3.3 Species Groups of Potential Concern in Considered Areas

Of particular relevance to offshore wind discussions are environmental concerns related to species listed as endangered, threatened, or protected that utilize the ocean and coastal region under consideration, particularly whales and seabirds (Source: Managing Maine's Nearshore Coastal Resources: Appendix B.2, p.65). Commercially valuable species are also of particular concern for consideration in terms of both environmental effects and existing uses. Commercially fished species are noted in Section 5.4, and included in the review of species groups, below.

Birds and bats (including threatened or endangered species), R. Holberton

The GoM region provides critical breeding grounds for birds and important migration routes for both birds and bats. Bats play a critical role in terrestrial ecosystems, and many species or populations within species are declining rapidly due to habitat loss and disease. Many populations of migratory birds, including shorebirds, waterfowl, seabirds, and songbirds, have experienced dramatic declines over the past half-century due to loss of wintering and breeding habitats needed during the stationary period of the annual cycle, as well as suitable stopover areas needed to rest and refuel during migration. The Gulf's islands provide essential nesting grounds for many seabirds, some of which are listed by state and/or federal agencies as endangered or of concern. Many landbird migrant populations have been listed by state and/or federal agencies as well.

The birds that inhabit the GoM region during some or all of their life cycles are diverse and comprise many species of freshwater and marine waterfowl, including ducks, geese and associates (approximately 40 spp.). These birds include seabirds such as gulls (28 spp.), gannets (1 sp.), alcids (6 spp.) and pelagic species such as shearwaters and petrels (7 spp.), cormorants (2 spp.), grebes (6 spp.), loons (3 spp.), shorebirds (40 spp.), and wading and marsh birds (17 spp.). They may be found along Maine's coastal and offshore areas, which depend on the time of year. In addition, over 150 landbird species occur in the region and breed and/or migrate along coastal and offshore areas, with many of them making extensive overwater flights on migration between the Canadian Maritimes and southern New England. In addition to their value to biodiversity and ecosystem structure, birds play an important economic role in the region's tourism industry, and a major activity in state and federal non-governmental organizations (NGOs) revolves around organizing birding activities at key breeding and stopover sites in Maine.

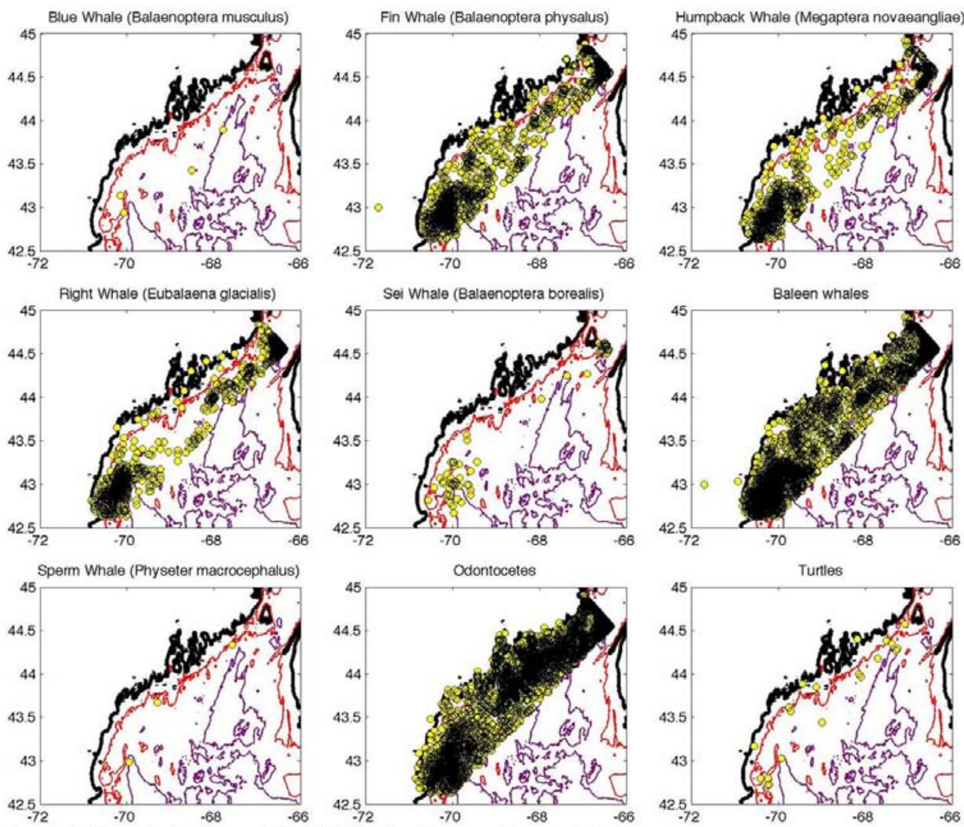
See Appendix B.2 (Section 10.2.2) for a list of birds that are documented to breed in the state, migrate regularly through the GoM region, or at some point in their life histories, spend part of their non-breeding period in the GoM region. Terrestrial and freshwater species are included as they can migrate along the coast (within three (3) nmi) and offshore (three (3) to 100 nmi) and have been documented doing so.

Surveillance radar studies 40 years ago in the GoM region (coastline and open ocean) showed that migrating and resident birds of all types can be expected across a wide range of altitudes that include the "rotor-swept zone" of both test and full-scale turbines. Thus, monitoring bird and bat activity related to offshore energy development requires extensive knowledge of movement biology (temporal and spatial movements with regards to foraging areas, breeding and stopover habitat use, flight patterns such as flight altitudes during ongoing, ascending and descending flights, flight direction, response to weather, etc.) of seabirds, shorebirds, waterfowl, landbirds, and bats during the breeding as well as the non-breeding (migration, winter) periods.

The GoM has extensive seabird nesting colonies, managed primarily by state and federal agencies or NGOs as important seabird restoration sites. The nesting season is a critical data period for any site within 30-50 km of any of the major seabird nesting refuge islands that line the entire coastline of the GoM. Much of the Gulf has been designated by Maine Audubon, in conjunction with Maine DIFW and under the guidance of Birdlife International, as "Important Bird Areas" (IBAs). IBAs are regions considered vital to bird populations on a world or regional scale. In Maine, at least 15 bird species are listed as threatened or endangered, and 50 are listed as species of conservation concern (see http://www.maineaudubon.org/conserve/iba/index.shtml) and Appendix B.2 (Section 10.2.2 – IBA site descriptions).

Recent studies by the UMaine Laboratory of Avian Biology (http://sbe.umaine.edu/avian/) and USFWS Maine Coastal Islands National Wildlife Refuge documented a major flyway in the GoM, with over a half-million birds estimated moving over Maine's Midcoast region as they head south across the Gulf from the Canadian Maritimes during fall migration. Several species of bats also live in and migrate through the GoM region and have been documented moving offshore as well as along the coast. It was shown in 2010 that this flyway is equally active during spring months.

Consideration with respect to birds and bats should include temporal patterns of presence and functional relationships between the proposed activities in a given region and how they may affect: (1) birds' access to resources for rest, refuge, nesting and ability to obtain food; (2) ability to hear conspecifics, prey, and predators in order to maintain critical social groups, find food, and evade predation; and, (3) ability to maintain energetic condition needed for optimal survival and reproduction, which may be affected by increased avoidance behavior of activities associated with turbine construction, deployment, and operation.



Whale sighting data from Right Whale Consortium database.
Note this data is NOT normalized by effort. Provided by A. Pershing 8/2010

Figure 5-14: Whale Sighting Data (Right Whale Consortium)

Marine mammals (including threatened or endangered species), A. Pershing

The same productivity that sustains the region's fish populations and fisheries also draws a wide variety of temperate and subpolar marine mammals to this region. The Right Whale Consortium Sightings Database has records of six (6) species of baleen whales, 11 species of toothed whales, and two (2) species of seals in waters along the coast of Maine. In addition to the mammals, two (2) species of sea turtles have been reported in the GoM. The majority of these species are most common during spring, summer, and fall, when prey is abundant.

All marine mammals are protected under the MMPA, and many are considered endangered and are listed under the ESA. In particular, all of the baleen whales except minke are endangered. Among all of the species in the database, right whales are of particular concern. The GoM and adjacent Scotian Shelf contain all of the known feeding areas for this critically endangered species, and it is likely that all of the approximately 400 right whales in the North Atlantic visit the Gulf each year.

From the point of view of site selection, it is impossible to declare any region of the GoM to be an area where marine mammals cannot be found. However, certain areas have clear seasonal associations with particular species (Figure 5-14). Within the region considered here, Jeffreys Ledge and the waters off Grand Manaan Island are the most consistent and active whale feeding areas, and all of the baleen whales with the exception of blue whales, can be observed in these areas. Other areas with consistent whale sightings include the waters east of Mt. Desert Rock and south of Boothbay Harbor. It is important to reiterate, however, that both the frequency of boat traffic and local whale abundance factor into the apparent density of whale sightings illustrated. The difficulty of surveying whales during winter means that we know very little about whale distributions during this season. For the last several years, however, there have been consistent sightings of right whales in northern Jordan Basin during early winter. There is growing evidence that this may be the first mating area identified for this population, and thus, should be considered an area of special concern.

Useful information on marine mammals is found in several ongoing databases:

- Right Whale Consortium Database – contains sightings of marine mammals and large fishes. The database is strongly biased towards areas and seasons where both right whales and boaters, including whale watching vessels, are common; however, it is the most comprehensive database for cetaceans in our region.
- The Maine DMR maintains a database of sightings in Maine state waters and nearby federal waters.
- OBIS-SEAMAP is an online database with worldwide whale sightings. It provides useful information on species ranges.
- The Marine Mammal Stranding Network provides information on marine mammal distributions based on the occurrence of injured or dead animals.

Sea turtles (including threatened or endangered species), R. Steneck

Three (3) turtle species are federally or state listed: leatherback, loggerhead, and Atlantic Ridley. All three (3) sea turtles know to inhabit the GoM (Atlantic Ridley, loggerhead and leatherback) are rarely encountered in Maine. The Atlantic Ridley turtle is "very rarely encountered in the Gulf of Maine" (Maine DIFW Wildlife assessment). The two most common sea turtles in the GoM (e.g., loggerhead and leatherback) are primarily tropical in their distribution. Nevertheless, sightings of both species extend up the eastern seaboard (Shoop and Kenney 1992). Loggerheads prefer warmer sea temperatures than leatherback (i.e., sea temperatures warmer than 22.2 ºC and 20.4 ºC, respectively) and sightings of both species are largely confined to summer (Shoop and Kenney 1992). Both sea turtles are rare in the GoM. Loggerhead turtles are most abundant south of Cape Cod. Leatherbacks are the world's largest sea turtles, and they have the largest geographic range. Sightings are concentrated south of Long Island, New York, but they have been seen as far north as Nova Scotia.

Benthic macrofauna (infauna and epifauna) in and on soft substrata, P. Jumars

The benthic macrofauna at depths between 100 and 250 m in the GoM is best known through historical surveys conducted by the United States National Marine Fisheries Service (Wigley and Theroux 1981; Theroux and Wigley 1998). Detailed species and abundance information on specific sites is scarce, with the exceptions noted below and a few other studies that included samples in this depth range (e.g.: Maurer and Leathem 1980, 1981).

Benthic megafauna including corals and epifauna — both hard and soft substrata, R. Steneck

Megafaunal dominance (i.e., dominant species or higher taxonomic divisions) changes, and diversity and abundance decline, with distance from shore and water depth. Species also vary with substrate composition.

Away from the coastal shelf (100-m contour) the dominant epibenthic invertebrate megafaunal taxa are (in order of abundance) sedentary brittlestars (*Ophiuroidea*), seastars (*Asteroidea*) and sessile anemones (*Cerianthus, Pennatula, Bolocera*). An additional 13 species constitute only a few percent of the remaining total from a large ROV survey at depths ranging from 144 to 381 m conducted in the Central GoM physioregion (n=27,276 organisms; Langton and Uzmann 1989).

Closer to the shelf edge and in shallower water, large decapods such as crabs (*Cancer borealis*) and the lobster (*Homarus americanus*) become more abundant (Figure 5-15 and Figure 5-16). Maine's inshore trawl survey records lobster densities two orders of magnitude higher than is reported in the NMFS trawl surveys in the Central GoM physioregion. Closer to shore, rock outcrops increase and species diversity and abundance increase with the added habitat heterogeneity.

Substrate characteristics affect species composition and population densities in many communities. Lobsters are shelter-preferring organisms, and they are often at highest population densities in boulder substrata (Steneck and Wilson, 2001). Since the extirpation of most natural predators of lobsters, they now can live in sediment habitats but at lower population densities than in rocky regions where lobster densities are aggregated (Steneck and Wilson, 2001, Butler et al., 2006). Unlike crabs that have a carapace fused to their sternum, lobsters cannot live in soft, flocculent mud that is common in areas that are frequently disturbed by trawling. It is likely that mooring chains anchoring the wind generators will create small areas that will be unattractive to lobsters. If frequent chain sweeps on the bottom do not occur, then the anchors and chains will probably attract lobsters since any hard substrate increases the habitat carrying capacity for this species (Steneck 2006a).

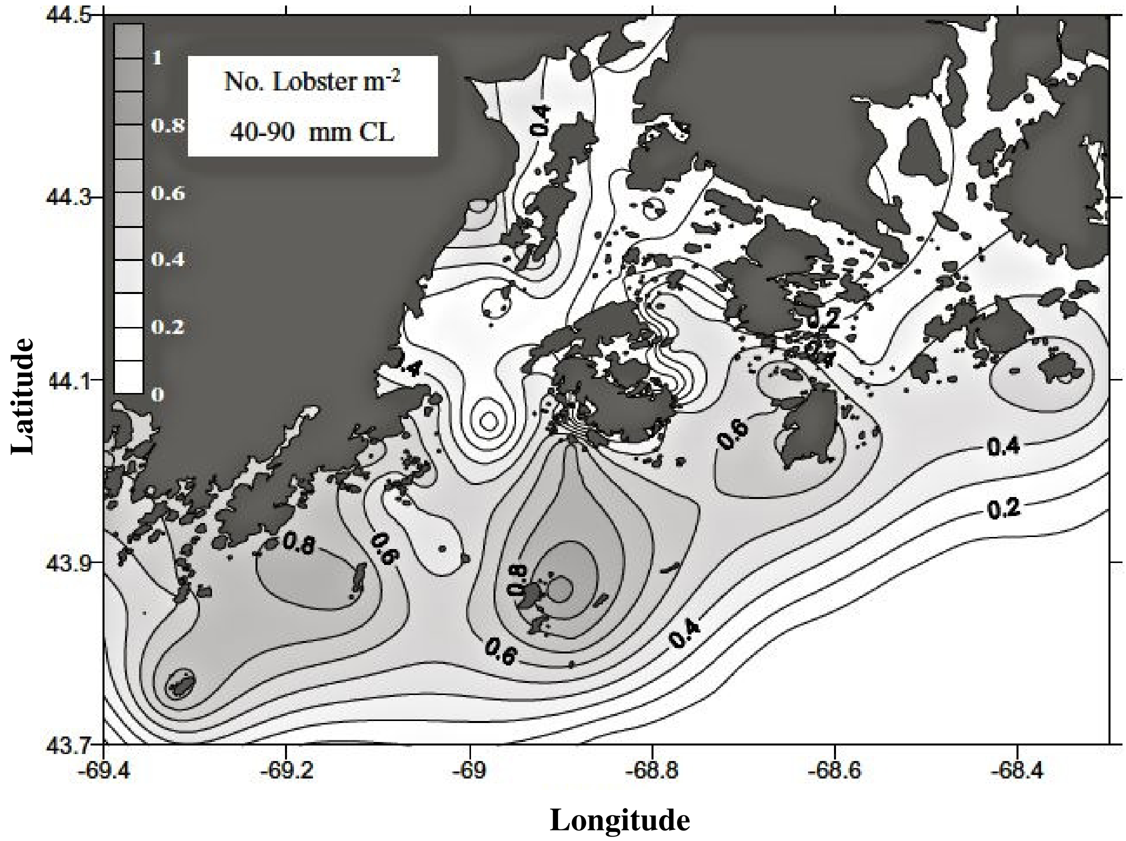


Figure 5-15: Lobster population densities in Midcoast Maine (from Steneck and Wilson, 2001)

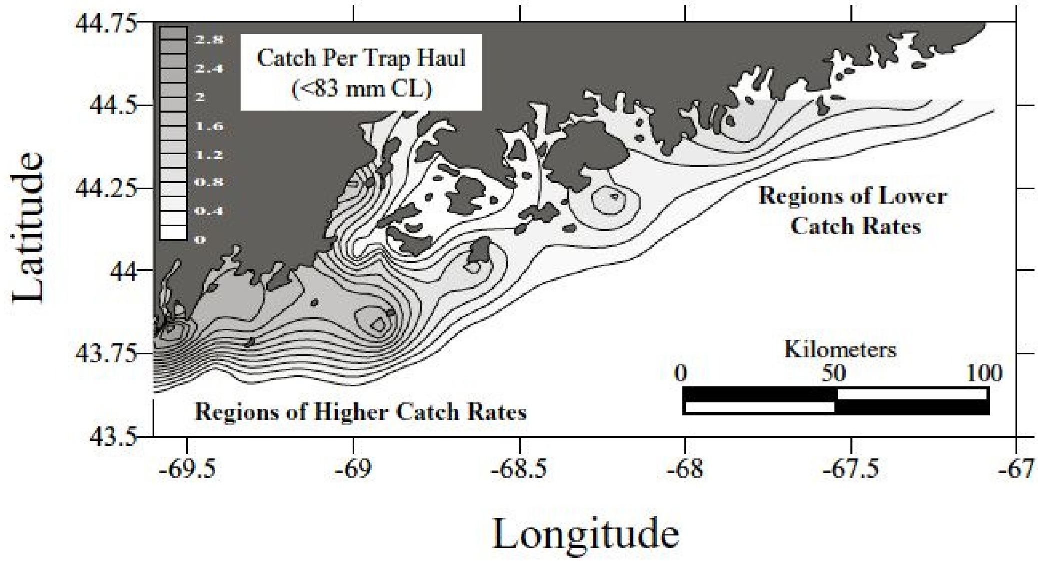


Figure 5-16: Catch per unit effort of pre-recruit lobsters in Midcoast Maine (from Steneck and Wilson, 2001)

In the central GoM physioregion, mud and silt habitats are strongly dominated by *Pennatula* (sea pen gorgonians) and *Ophiuroidea* (brittlestars). At larger sediment grain sizes (including sand and coarse sand), taxa with the highest densities were ophiuroids (brittlestars) and *Cerianthus* (anemones). Among gravel, cobble and boulder habitats, larger *Bolocera sp.* (anemones) and *Asteroidea* (seastars of the genera *Asterias, Hippasteria, Henricia, Crosaster and Solaster*) dominated the benthos (Langton and Uzmann 1989).

Corals occur in two taxonomic groups of Cnidaria; the stony corals (*Scleractinia*) and the soft corals (*Alcyonacea*). Deep- and cold-water corals are relatively rare in the western North Atlantic compared to the eastern North Atlantic (Figure 5-17). In fact, the most recent cold-water coral geographic database show no corals anywhere on the northern coastal shelf or the central GoM physioregions near Midcoast Maine (Scanlon et al., 2010).

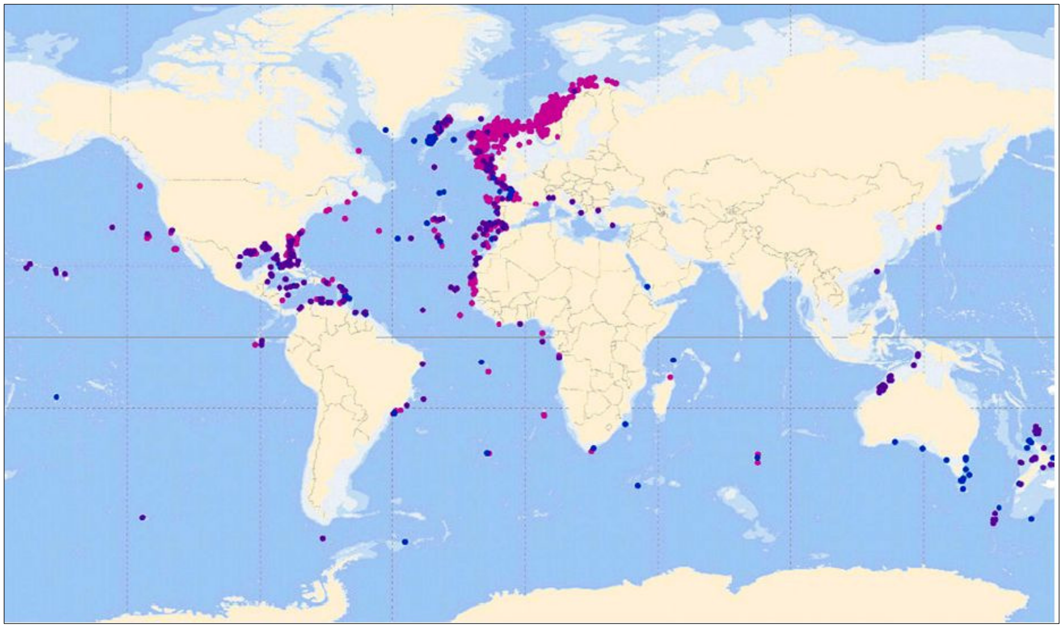


Figure 5-17: Global distribution of cold-water corals (Freiwald et al., 2004)

There are 15 species of scleractinian corals in the western North Atlantic within the continental shelf spanning from Cape Hatteras to the GoM, including Georges Bank (Cairns and Chapman, 2001). Most live on seamounts and the continental shelf (including Georges Bank) but not in water depths found in the central GoM (Cairns 1981). The most notable exception is *Lophelia prolifera* that is common in the western North Atlantic south of Nova Scotia, but still in relatively deep (280 – 2165 m) water. Thus, the relatively shallow GoM is not habitat for stony corals, and none were reported from the region's massive megafaunal survey (Langton and Uzmann 1989).

The gorgonian Alcyonacea soft corals coral are better represented in the GoM but still in low abundance. They have rigid axial skeletons, creating carbonate bioherms that can be habitats for fishes (Auster, 2005). Of the 17 soft coral species reported for the western GoM (Watling and Auster, 2005), three are common (Watling, pers. comm.). All three species live on rock habitats, and they are most abundant on Georges Bank and in the eastern GoM (Figure 5-18). Given this distribution, it is likely they could recruit to anchors and chains used for wind turbine mooring systems.

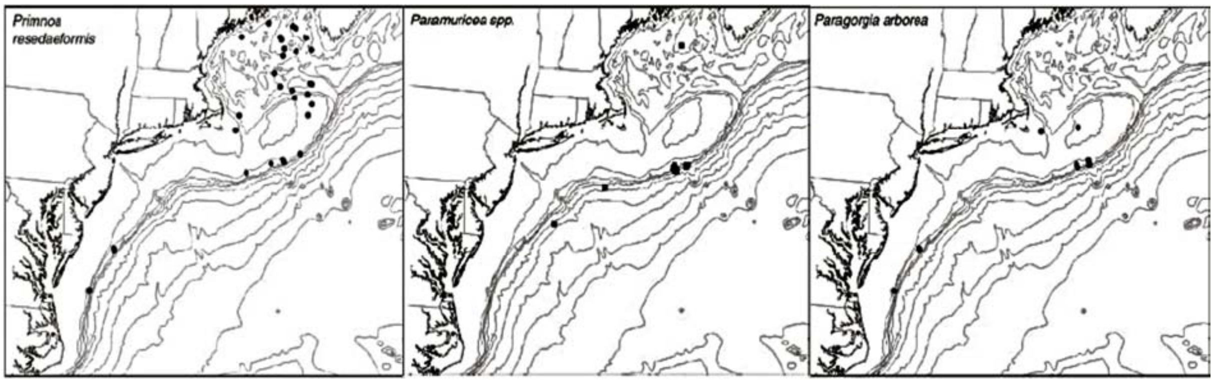


Figure 5-18: The distribution pattern of the three most abundant Alcyonacea species in the Gulf of Maine (after Watling and Auster, 2005)

Fishermen anecdotally report these species being found in the past near coastal Maine. While today, they are found in micro-refugia where fishing trawls cannot harm them, in the past they were believed to be more widespread (Watling, pers. com.). Shrimp trawls that frequent proposed wind energy sites undoubtedly have destroyed most coral colonies in recent decades. It is possible that the trawl-free zone required for the wind-generation area could become a refuge for colonization and development of deep-water corals in the future.

Beyond being regionally rare today, deep-water corals do not thrive in sediment-dominated benthic communities. All corals require hard substrate to settle (Cairns 1981), but the size of the clast can be small. Auster (2005) examined diversity of all deep-water corals in and around the GoM and determined that diversity of corals was greatest in boulder habitats without mud and lowest in boulder habitats with mud (Figure 5-19). Note that the curve with the highest species richness (BG 2) is from boulder substrates without mud whereas the lowest species richness (BG 1) was from the same habitats with mud.

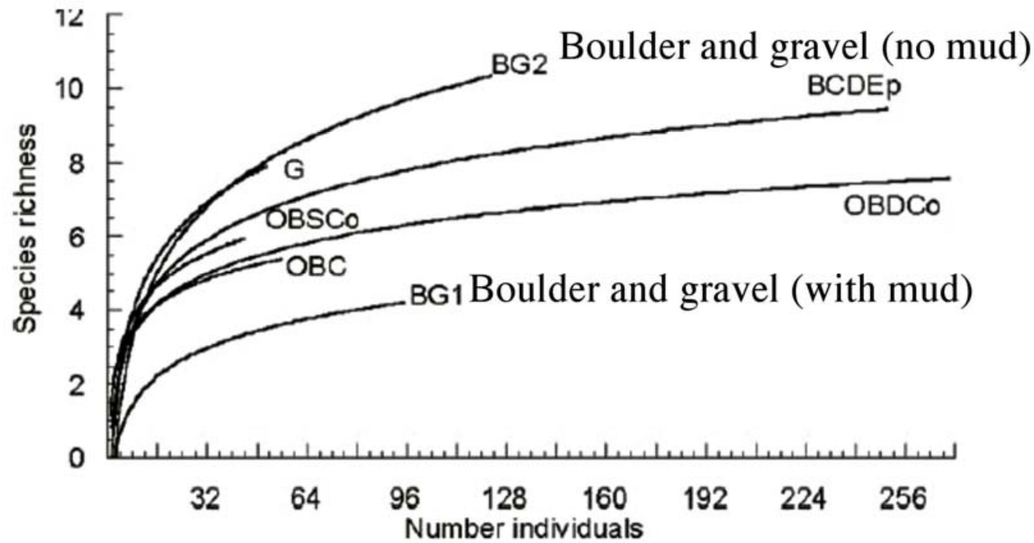


Figure 5-19: Deep-water coral species richness relative to the number of individuals encountered in the Gulf of Maine (modified from Auster, 2005)

Demersal faun – hard and soft substrata, R. Steneck

The raining of phytodetritus to the relatively shallow GoM maintains a relatively high carrying capacity for demersal fishes. Centuries of fishing have greatly reduced abundance of most fish stocks in the GoM (Jackson et al., 2001; Steneck and Carlton, 2001). Today, aggregate landings of groundfish constitute only 3% of all landed biomass in Maine (compared to 26% Atlantic herring and 35% American lobster; Maine DMR data for 2009).

Groundfish comprised fourteen of the 21 most abundant finfish species captured in Maine and New Hampshire's inshore spring and fall trawl surveys over the past decade. Of them, some species such as cod, haddock and winter flounder are primarily confined to the relatively shallow water of the northern coastal shelf and Georges Bank (Figure 5-20). On the other hand, silver hake, Acadian redfish, American plaice and witch flounder are most abundant in the central GoM physioregion (Figure 5-21).

Although no firm geographic boundary can be placed around any fish species, recent research suggests that many are more geographically confined than previously thought (reviewed in Steneck and Wilson 2010). Even in species such as Atlantic cod that undergo seasonal migrations, tagging information is emerging that indicates the "primary migration highways" are along the northern and southern coastal and Scotian shelves and Georges Bank (Figure 5-22; Tallack, 2009).

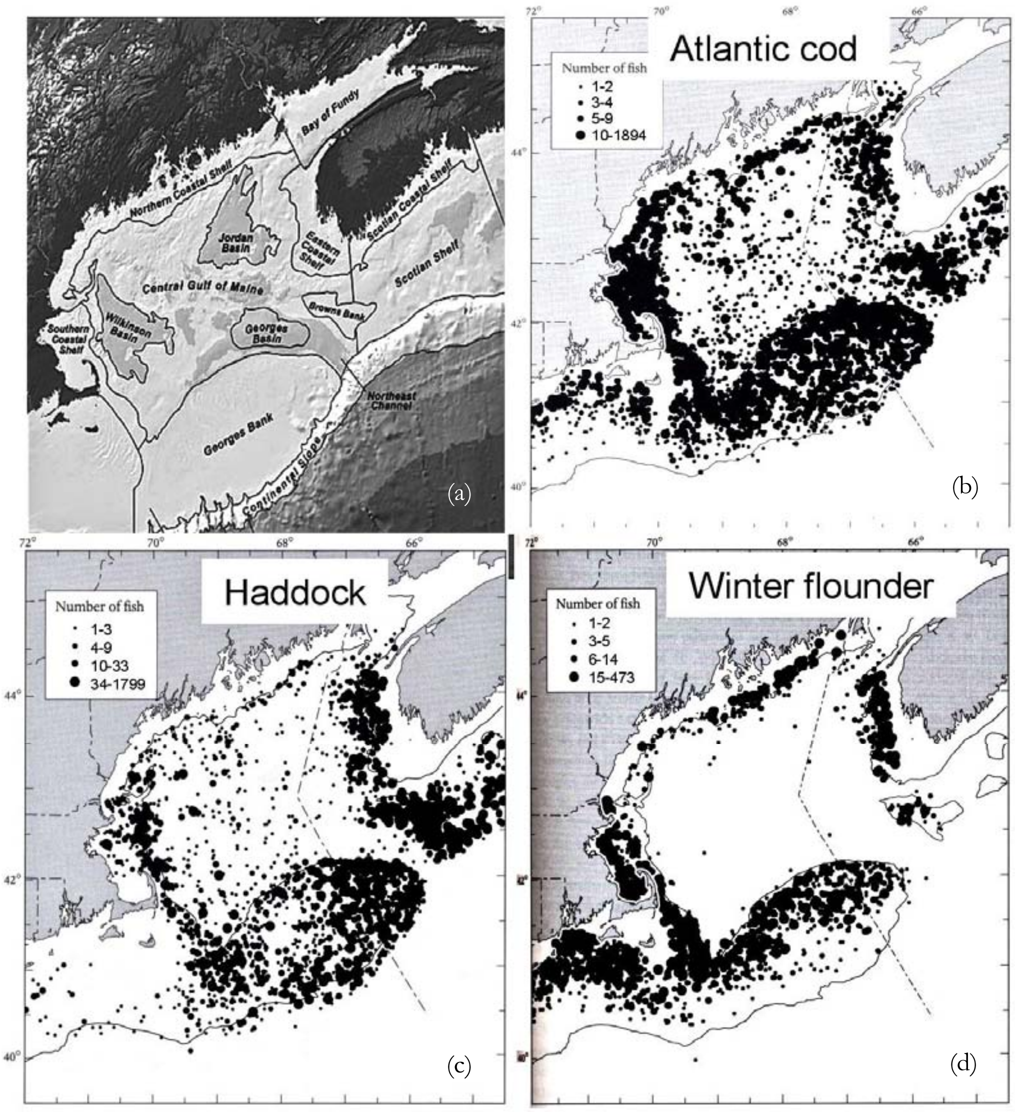


Figure 5-20: (panel a) The Gulf of Maine's physioregions (from the Gulf of Maine Census of Marine Life), and spatial distributions of groundfish species (panels b – d) with coastal shelf and Georges Bank physioregion association, as compiled from NEFSC bottom trawl surveys from 1968 – 1996 (compiled by Collette and Klein-MacPhee, 2002; after Steneck and Wilson, 2010)

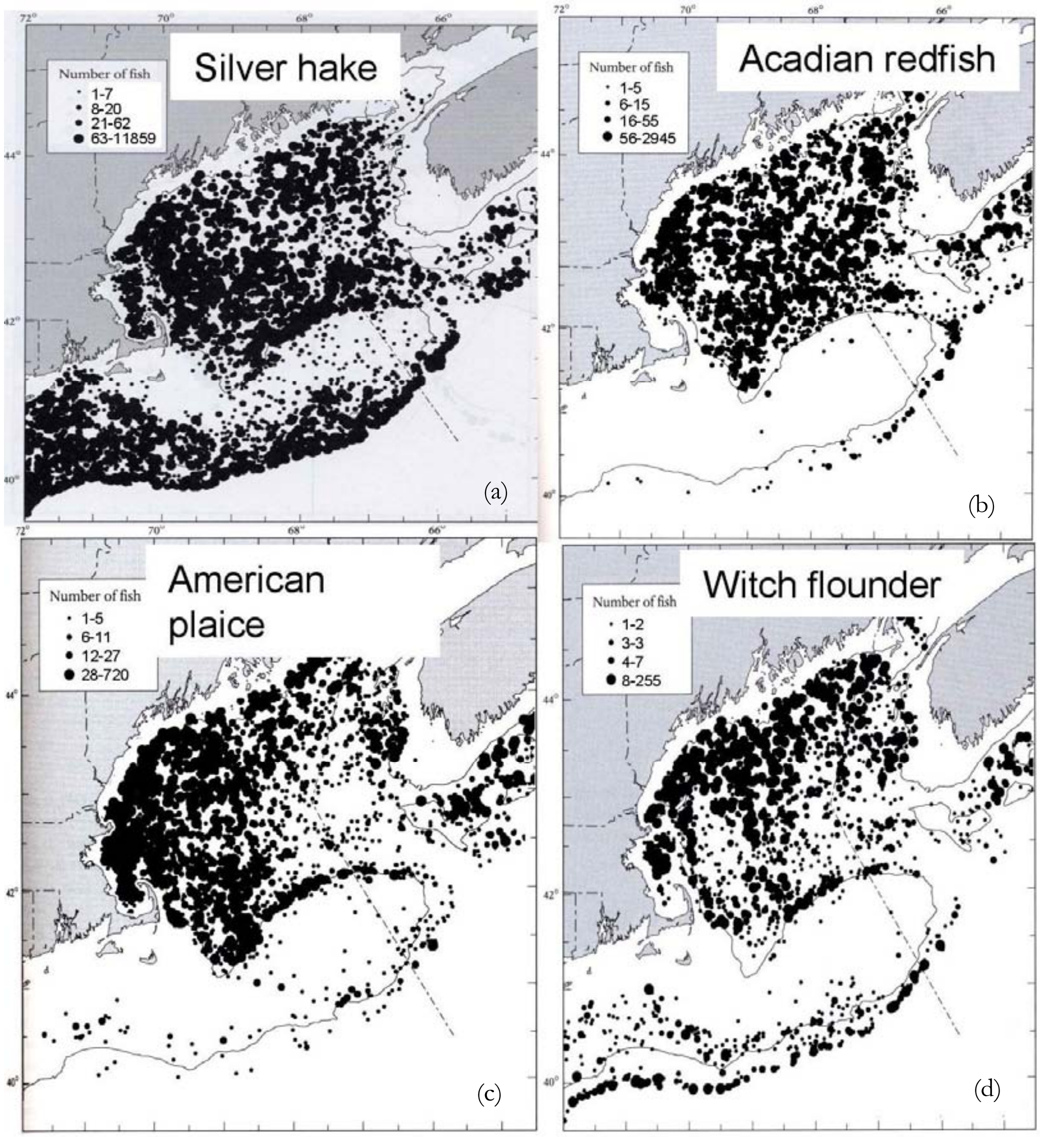


Figure 5-21: Spatial distributions of groundfish species (a – d) with affinities to the central Gulf of Maine physioregion (after Steneck and Wilson, 2010)

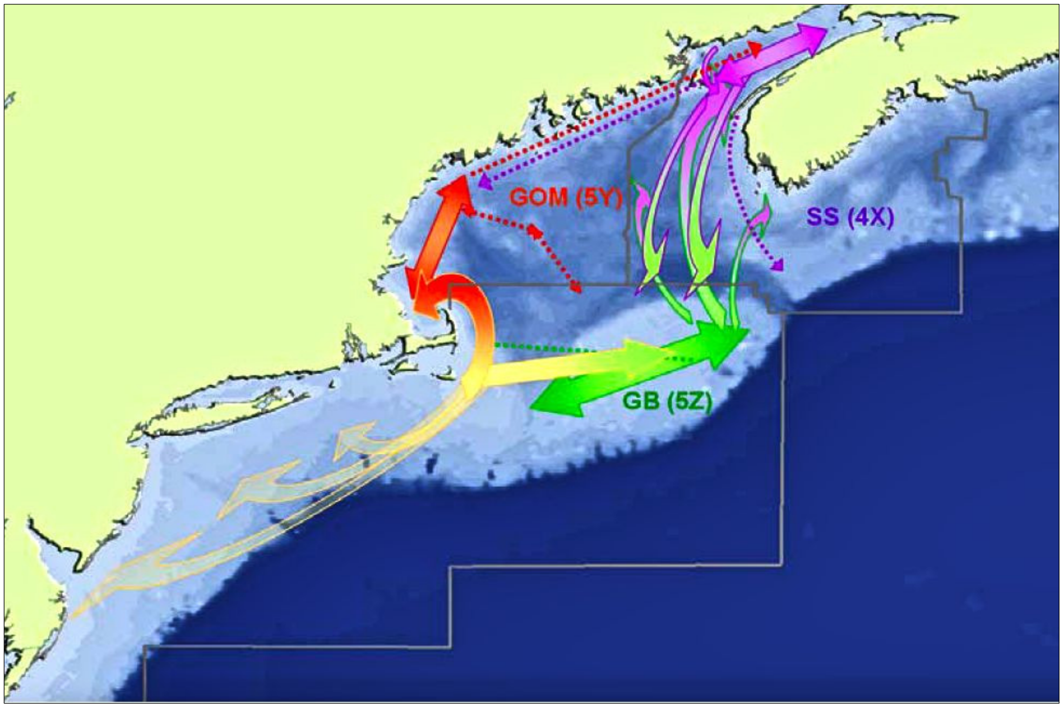


Figure 5-22: Summary results of Atlantic cod migrations in the Gulf of Maine for 2003 – 2007 (from Tallack, 2009)

Pelagic species, J. Stockwell

Species likely to be encountered greater than ten (10) nmi from shore and over 300 ft deep can be classified into pelagic and demersal/semi-pelagic groups. The pelagic group includes Atlantic mackerel (*Scomber scombrus*), Atlantic herring (*Clupea harengus*), Atlantic salmon (*Salmo salar*), bluefin tuna (*Thunnus thynnus*), northern shortfin squid (*Illex illecebrosus*), northern shrimp (*Pandalus borealis*), silver hake (*Merluccius bilinearis*), and pollock (*Pollachius virens*). The demersal/semi-pelagic group includes haddock (*Melanogrammus aeglefinus*), Atlantic cod (*Gadus morhua*), red hake (*Urophycis chuss*), white hake (*Urophycis tenuis*), Acadian redfish (*Sebastes fasciatus*), and spiny dogfish (*Squalus acanthias*).

Highly migratory species within these two groups include Atlantic mackerel, Atlantic herring, Atlantic salmon, bluefin tuna, northern shortfin squid, and spiny dogfish. Most of these species are seasonal, spending spring to fall in the GoM and then exiting to overwinter elsewhere. Some exceptions apply though, as larval and juvenile Atlantic herring do overwinter in the region, and Atlantic salmon are transient as they pass through the region quickly on their way to feeding grounds in the Northwest Atlantic as post-smolts (May-June) or to rivers to spawn as adults (summer and fall). Several of the demersal/semi-pelagic species have obligate pelagic larval/juvenile life-stages.

Species of particular concern include Atlantic salmon (endangered species listing), Atlantic sturgeon, and bluefin tuna because of depressed populations. Moreover, bluefin tuna (and other species) are known to aggregate around floating objects such as fish aggregating devices (FADs; Freon and Dagorn, 2000; Josse et al., 2000; Relini et al., 2000; Castro et al., 2002; Addis et al., 2006), which will likely cause some degree of concern or expectation by the fishery (Fayram and Risi, 2007). River herring (alewife *Alosa pseudoharengus* and blueback herring *Alosa aestivalis*) are listed as species of concern by NOAA. However, the distance from shore makes them unlikely to be encountered

Available information sources relevant to pelagic fishes include:

- NMFS bottom trawl surveys done in spring and fall
- ME – NH inshore bottom trawl surveys (spring and fall – maximum depth sampled to the east and west of Monhegan Island was 162 m)
- NOAA Atlantic salmon post-smolt, pair-trawl survey (2001-2005). This was done inside and outside Penobscot Bay. It may contain some useful information. Trawling was done during the day at the surface, targeting post-smolts.
- Essential Fish Habitat Source Documents (NOAA Technical Memoranda) provide information on biology, habitat, behavior, and distribution of many species listed above. They include maps of bottom trawl catches, MARMAP catches, and other sources of data.
- Fishery-dependent data. There is enormous potential here if one can get access to VMS (Vessel Monitoring System) data, from systems that are installed on all vessels that participate in specific fisheries in federal waters, and fishery catch records. [National Marine Fisheries Service (NOAA Fisheries) collects VMS data. The Maine State Planning Office recently acquired a subset of the VMS database].

5.3.4 Physical Interaction with Turbines, Platforms, Cables and Anchors

Direct interactions of interest include strikes and effects of blade-induced pressure fluctuations on birds and bats in the turbine's vicinity. Birds are in principle less sensitive to pressure fluctuations because of the flow-through structure and function of the bird lung. Offshore wind platforms have the potential to disrupt movement patterns of animals, act as attractants to birds and fish (reef effect) and disrupt migratory patterns of seabirds, turtles and marine mammals.

Birds and bats

Perturbations of offshore wind construction and operation include, but are not restricted to, direct loss of nesting, resting, and feeding habitat caused by placement of support structures related to construction, deployment and maintenance of onshore transmission lines as well as of the turbines. Birds are also subject to increased traffic to and from the sites.

Effects of wind farms on birds depend on the height of the hub, the rotor diameter, the distance between turbines (preferably 1-2 km), the total area of the wind park and the color and placement of the structures (Roth et al., 2004). Collision risks also correlate with weather conditions such as rain or fog. A Dutch publication (NL-012) on bird collisions calculates a maximum of one thousand to multiple thousands of extra mortalities per year, based on measurements on turbines on land for a wind farm area of 16 km^2 with 36 turbines.

Species with a high reproductive output and a correspondingly low annual survival rate will be less sensitive to added mortality than species with a high annual survival rate and a low reproductive output. The latter group typifies most marine-based species in the region. Flight altitude can vary significantly between species, time of year, and distance from the coastline. Assessment of collision risk during both day and night is greatly hampered by the lack of fundamental knowledge of the behavior of diverse species towards wind turbines and turbine arrays (see Roth et al., 2004).

Collision risk may be highest in connection with the annual migration between areas used for breeding and wintering. The frequency of collisions is expected to depend on ability of the birds to see the spar and blades and the bird's maneuverability, and is known to increase during periods of low visibility (precipitation, fog). Patterns of lighting (red versus white light, blinking or constant) will affect relative attraction to or avoidance of turbines by birds. Collision risk for birds and bats, and risks to bats of embolism from rapid pressure fluctuations near blades have been subjects of numerous terrestrial and nearshore marine turbine studies (e.g., Erickson et al., 2001), and collision risks depend very heavily and very locally on migration routes (e.g., Barrios and Rodríguez, 2004).

"Barrier effects" of wind farms have been found to vary across species, and, based on some European studies, to be important for Common scoters and eiders, which are numerous in the GoM. Reduced nocturnal flight activity near the wind farm and low number of flight movements through it, as documented in some radar studies offshore, indicate that turbine arrays function as a flight barrier. While collision risk is reduced, wind farm avoidance may impede birds from reaching critical foraging and resting areas and may increase interactions with commercial fisheries and other boat traffic. Few if any studies have measured these effects. Species presence or absence is not an adequate indicator of insignificant effects because individuals may be present in an area but fail to initiate or complete breeding. Monitoring impacts should include confirmation of effects, or lack thereof, on productivity for breeding birds in the area.

There is, therefore, a need to identify foraging areas of birds that rely on coastal and offshore environments at some stage of life and to identify temporal and spatial patterns of movement (flight paths, elevations, group sizes) for waterbirds (including seabirds, shorebirds, wading birds, and waterfowl) as well as landbirds (including songbirds and raptors). In addition to identifying which birds are likely to be present and when, differences in foraging behavior should also be taken into consideration with respect to turbine structures above and below the water (platforms, cables). Diving birds such as gannets and terns initiate dives well above the water surface, well within the rotor-swept zone of most commercial turbines, whereas deep-water divers, such as razorbills and puffins, initiate dives from the surface but dive much deeper. The proposed monitoring activities at potential wind energy sites should take into consideration direct and indirect effects on birds and bats during spring (April – June) and autumn (August – November) migration periods as well as throughout seabird breeding (May-August) and wintering (November – March), essentially throughout the year. Because of strong site and seasonal dependence of risk, NEPA compliance has tended toward acquiring two years of local migration or movement data prior to issuance of permits for installation to resolve site and seasonal dependence of risk.

Offshore migration patterns are poorly known because of range and resolution limitations of shore-mounted radar. Individual songbirds can be resolved only to distances of about 1.5 nmi or less [Mizrahi, pers. comm.]. Thus pre-installation radar data will be problematic to collect for offshore wind farms. The idea of using barge-based radar is problematic in many ways. It is impractical in heavy weather, and the small distance of the transducer above the waterline makes backscatter from waves a much bigger noise issue in extracting bird signals. Data processing and analysis is much more complex because the motion of the barge must be removed.

Long-range radar, such as WSR-57 weather station units, can be used to identify broad-scale flight patterns for flying vertebrates, but with multiple challenges and limitations. Only large flocks can be imaged, and it is difficult to distinguish bird targets from fog and precipitation. Nevertheless, a desktop analysis of broad-scale migration patterns in the northern GoM region, using multiple decades of available weather radar data, might be a helpful initial analysis to inform siting decisions (i.e., to determine areas and seasons frequented by large flocks).

Monitoring should include marine surveillance radar, using a horizontal and a vertical array. Analyses of such radar can reveal headings, tracks, altitudes, target sizes and target speeds, and provide information about movements and, in some cases identify, species or species group. Collectively, the two different orientations of units provide critical spatial information about where and how high animals are moving, and, depending on their placement, can be used to monitor behavior at the local (turbine site) as well as at the regional level. Ideally, one set of radar units would be placed within one to two (2) nmi of the test turbines.

Many birds call during flight, and acoustic monitoring helps identify many birds to species or species groups. Because radar data provide only a few clues to species identity, acoustic equipment should be used to sample at each radar site during key activity periods. It needs to be kept in mind that negative information is not useful in this mode; many species and individuals do not call. In addition, infrared cameras have been used to help identify bird and bat species and to record direct responses (avoidance behavior, physical impact, and ultimate trajectories of carcasses) to turbine blades, and such cameras would also be deployed at monitoring sites. In addition to pre-determined and planned visual surveys, these tools (surveillance radar, acoustic monitoring, and infrared photography) are commonly used in monitoring the impact of wind turbines on aerial animals. Standardized visual surveys should be established at key periods throughout the year to provide additional information on species identities and observable behaviors.

Tracking individuals via radio or satellite telemetry is critical in determining animal movement, particularly during the breeding period when individuals remain within the region but may change their spatial use of resources as they track the movement of fish stocks throughout the season. Terns (Common tern, *Sterna hirundo*, Arctic tern, *S. paradisaea*) and alcids (e.g., Atlantic puffin, *Fratercula artica*, Razorbill, *Alca torda*) would be fitted with radio transmitters, and two (2) to three (3) stationary receiver stations would be placed strategically to triangulate and determine coordinates. Birds would also be tracked from boats during other monitoring activities (e.g., buoy deployments, fish and mammal surveys).

Such proposed work takes into consideration direct effects, including primary (direct impact by the turbines) and secondary (avoidance response that may result in increased energy expenditure, predation risk) effects at the turbine site, but also indirect effects in how the food base and other resources in the ecosystem (plankton, fish, etc.) could change as a result of turbine structure and operation, including noise effects. While avoidance may reduce collision risk (direct effect) it may incur energetic costs that affect survival and reproduction (indirect effect). These latter costs have been little studied, but may influence population viability for many species.

Construction activities (e.g. transport, construction work) should be timed to avoid pre-breeding and breeding periods as well as the post-breeding period when young of the year are beginning to depart and adults are recovering (molting, regaining energy reserves) from breeding and preparing to leave for wintering areas.

Post-installation data on bird and bat collisions should be planned, probably with radar mounted on the wind platforms themselves, to assess behavioral amelioration of risk (e.g., bird avoidance of turbines cf. Desholm and Kahlert 2005). Direct studies of bird and bat injuries and mortalities due to turbine strike are complicated over water by collection difficulties.

Marine mammals

Whale entanglement with lobster trap lines and gillnets is an issue in this region (see Section 5.4), and this is a significant source of mortality in some species (Clapham et al., 1999, Johnson et al., 2005). The anchoring systems being considered for the floating turbines are superficially similar to these fixed-gear fisheries (a float connected to an anchor by a line or cable); however, there are significant differences that make entanglement in the turbine anchor system unlikely. For an animal to be entangled in a rope or cable, the rope or cable must be slack enough to form a loop around part of the animal. The rope used in the lobster fishery is thin, and the buoys are small. This means that the tension on the rope is low, especially relative to the inertia of a large whale. When a whale encounters and lifts the line, it is possible for the line to wrap around a portion of its body. The anchoring systems being considered for the floating turbines involve cables or chains much thicker than fishing rope and under much higher tensile loads, making it much harder hard to conceive of their curling around an animal. Because the platforms are stationary and will be making noise, the chance of a whale colliding with the platforms or their anchoring system is expected to be low, and any such interaction would be unlikely to result in serious injury. The risks would appear comparable to those of running into a large anchor chain or cable of an anchored vessel.

Seals are known to haul out on nearly any floating platform. Thus, the most common direct interaction between marine mammals and the turbines is likely to involve seals using new solid substrates above the water line. A seal hauling out on a turbine platform is unlikely to injure the seal; rather, it is more likely that seals could become a nuisance to operations and maintenance. True seals such as the ubiquitous harbor seal seem to be less of a nuisance than the sea lions that occur on the West Coast. It is likely that the turbine platforms could be "seal proofed" by limiting the horizontal surfaces, raising the platform deck to several feet above the water level, or by adding fences or other barriers.

Sea turtles

Risk of direct physical interaction between sea turtles and turbine system is predicted to be low based on the estimated infrequent use of the GoM by sea turtles and lack of any apparent mechanism for negative interaction.

Megafaunal species (including T&E and fishery resources – corals)

There is a minor risk to soft-bottom megabenthos from anchor installation and anchor cable movement. There is likely to be limited benthic habitat and species disturbance from cable installation and burial.

Demersal species and (including T&E and fishery resources)

Most demersal fish species are mobile and therefore at less risk than sedentary megafauna. Local attraction to anchors is expected for species that frequent hard substrata.

Pelagic species (including T&E and fishery resources), J. Stockwell

Very little is published on the effects of wind turbines, platforms, anchors, anchor lines, and cables on pelagic fish species. A number of studies have been conducted on the effects of wave and wind power foundations on fish and invertebrates. However, these studies necessarily focus on benthic and demersal species because of the shallow water depth (e.g., Wilhelmsson et al., 2006; Langhamer and Wilhelmsson, 2009; Andersson and Ohman, 2010). Direct physical damage to pelagic and demersal fishes from platforms, anchors, anchor lines, or cables is considered to be unlikely.

5.3.5 Alteration of Benthic, Demersal and Pelagic Habitats and Species

Direct alteration of benthic habitats

Below-water support structures for offshore wind turbines will differ substantially from the rigid structures used under nearshore wind platforms. All proposed designs use a small number of cables under tension loading from a buoyant surface structure to anchors at or in the seabed. In some designs the anchor is entirely buried in mud. Because of the limited surface area presented by these bottom structures and the generally slow currents at greater than 100 m depth, scour and alteration of depositional patterns should be much more limited than around nearshore wind platforms. It is also difficult to conceive of a mechanism for significant wave damping or focusing to reach the seabed in water depths greater than 100 m from an up to 30 MW wind farm. New habitat for fouling organisms is limited to the projecting portions of anchors, the cable and the area below the waterline on the buoyant platform. Thus a relatively small reef effect is expected, even in comparison to that of floating offshore oil platforms, because the latter present much more surface area below the waterline.

Many fish species have specific substrate and habitat requirements. Monkfish and many flatfish species such as American plaice, winter, witch and windowpane flounder prefer sediment habitats. Other species such as longhorn sculpin, Acadian redfish and Atlantic cod recruit to and often are associated with rocky habitats (Collette and Klein-MacPhee 2002). In some cases, organisms that recruit to hard substrates such as deep-water corals create preferred nursery habitats for recruiting groundfishes (Auster 2005).

Thus it is possible that the anchors and chains placed into soft-sediment habitats would diversify substrate heterogeneity that could increase the recruitment potential for some species of groundfish. Monitoring epifaunal succession on anchor-associated structures along with changes to the wind farm site benthos seems warranted. The development of benthic communities in largely untrawled wind farm sites could provide a means of assessing trawling effects on biogenic structure and the recruitment potential of undisturbed habitats along with assessing how trophic characteristics of these sites may change over time.

To determine impacts on megafauna from deploying offshore wind generators both the historical data, documenting species change with depth, distance from shore, and substrate type, as well as this habitat modification suggests that several sources of variance such as depth, physioregions, temperature and substrate will need to be controlled for statistically robust conclusions regarding turbine effects.

Indirect alteration of benthic habitat

Anticipated indirect effects can be separated conceptually into three modes: (1) reduction of trawling disturbance within the anchor field; (2) biodeposition from fouling organisms and attracted pelagic fauna; and (3) stimulation of local primary production through enhanced mixing and upwelling. Each of these effects can propagate through food webs, with additional consequences. Potential importance of these indirect effects varies greatly among the species groups. The last effect (benthic alteration due to increased primary productivity) is addressed below under pelagic habitats, where the effect begins.

In the depth ranges of the GoM where offshore wind devices are projected to anchor, trawling has substantially altered soft-bottom macrofaunal community structure. Under repeated trawling, structure-building animals, such as tube-building polychaetes, become conspicuously scarce. This trend has been most clearly documented by sampling programs that covered several years both inside and outside fishing closure areas in the western GoM in mud bottoms between 100 and 190 m deep (Grannis, 2005; Knight, 2005; Grizzle, 2008; Nenadovic 2009; Grizzle et al., 2009). Studies at least as deep as 232 m outside marine protected areas also indicate similar effects of trawling on community structure (Weissberger et al., 2008).

Anchors used for offshore wind platforms are incompatible with mobile fishing gear, so the area occupied by anchors will become a no-trawl zone. A reasonable hypothesis, but one that clearly merits testing, is that no-trawl zones created within wind farms will follow successional trajectories like those of marine protected areas at similar water depths. One caveat is that some mud bottoms in the region at depths of 84-102 m appear to be extensively affected by deep, biogenic sediment mixing (bioturbation) from benthic megafauna, and there the added effects of trawling, at least on the short term, are difficult to resolve (Simpson 2003; Simpson and Watling 2006). Where there is intensive habitat disturbance of this biogenic sort, trawling closure by anchor emplacements may have less effect on community structure.

Macrofaunas in water deeper than 100 m in this region depend on fluxes of particulate organic matter from above as a source of organic matter for growth. Biodeposition in the form of feces from fouling organisms and detaching fouling organisms (caused by weather events and predation attempts) can lead to local enrichment of organic matter under platforms with anticipated effects on growth rates and successional changes of the underlying community. The magnitude of fecal deposition can be estimated from filtering and other feeding rates of attached and attracted organisms. Biological interactions below a platform can be affected in unexpected ways, however. An oil platform off southern California, for example, was estimated to deliver an average of a cubic meter per day of mussels to the seabed, supporting extraordinary areal densities of sea stars on the bottom (Wolfson et al., 1979). This kind of effect should scale with the surface area on which fouling organisms will settle and the turnover rate for the attached community.

Direct alteration of pelagic habitat

Any structure in the offshore environment is expected to act as an attractant to fish and other marine species. The attraction of fish to wind turbine installations in shallow water has been documented to be similar to that for offshore oil platforms. Floating structures, called fish aggregation devices (FADs), can attract and retain fishes in localized areas. FADs are known to affect pelagic fishes, with most data coming from tropical regions (Dempster and Taquet 2004). FADs are particularly effective with mahi mahi, billfish and some species of tuna (i.e., yellowfin, skipjack and bigeye). It is expected that floating offshore wind platforms will act as FADs for multiple trophic levels (forage fish and predators). It is unknown whether this effect would lead to positive, negative, or no effects on pelagic species given the myriad potential effects on behavior, energetics and predator-prey interactions, as well as the degree of interaction with human systems (recreational and commercial fisheries, ecotourism, etc.). Avoidance of any physical structure, if it occurs, would likely result from other factors (e.g., noise, electromagnetic fields) other than the physical structure(s) itself. Note that direct attraction of fish and other species to platforms could attract larger predators, including seabirds and marine mammals.

Indirect alteration of pelagic and benthic habitat

Enrichment of organic matter delivered to the seabed may also occur if the turbine array enhances mixing or creates upwelling (Broström 2008). During nutrient-limited summer seasons, primary production may be increased in the wake of the wind farm. Delivery of this kind of input to the seabed will not be localized; slowly settling organic matter will travel farther than quickly settling organic matter. Most pelagic organic material that settles does so in the form of aggregates whose peak settling velocities are ≤ 100 m/d. Even at the high end of that velocity range, at the typical coastal current speed of 0.1 m/s, the aggregate would travel several kilometers, and more slowly settling particles would travel farther still. This simple calculation suggests that looking for a downstream organic enrichment effect on benthos is impractical before the existence, magnitude and geometry of any resulting phytoplankton bloom is measured more directly. In any case it is likely to be diffuse and diluted over a much larger region than the footprint of the anchor field. Enhanced primary productivity could contribute further to a species aggregation effect.

5.3.6 Acoustic Effects of Turbines and Other System Components

Acoustic interference can occur from offshore wind turbines above water, interrupting communication and navigation for birds and bats, as well as below water from turbine noise and strumming of anchor lines, potentially affecting communication and navigation of marine mammals and some fish species. Sea turtles may also be affected.

The mooring structure will also influence sound transmission from the turbine to the water. It seems reasonable that a moored structure of small cross section would transmit less sound energy to the water than a rigid structure of larger cross section, but resonance frequencies and intensities will also vary. Thus monitoring across the frequency ranges to which marine mammals and fishes are sensitive is prudent.

Wind turbines can generate significant noise, enough to irritate humans in the nearby area. The properties (volume and frequency) of the sound that will be transmitted by the turbines into the ocean will depend strongly on the design of the turbine blades and on the structure of the platform. However, given the important role that acoustic communication plays in the ecology and behavior of cetaceans, characterizing the acoustic "footprint" of floating wind turbines should be given high priority.

Measurements around bottom-mounted offshore wind structures suggest that, at frequencies used by baleen whales (20 Hz – 200 kHz), sound levels 100 m from a turbine near maximum power could exceed 100 decibels (dB) referenced to one micro-Pascal [1 μPa] (Betke 2006). These levels are not high enough to directly harm a whale, but they are likely to make it very difficult for whales to communicate within a few hundred meters of the turbines (Nowacek et al., 2007). Detailed measurements of the noise produced by the turbines and their anchoring system should be included in the study. They should characterize the sound produced under different operating conditions (wind speeds, wave heights) and different seasons (with different sound-speed profiles). Once the characteristics of an individual turbine and platform design are known, including its acoustic coupling to the water through the anchor lines and platform, then it should be possible to estimate the sound produced by a series of turbines.

Very little information is available on potential risks to pelagic species of turbine noise and strumming of anchor lines. At a rudimentary level, research on the reaction of fish to fishing vessels may be comparable in terms of reaction to a stimulus. Fish reaction to fishing vessels typically consists of diving or horizontal movement, although avoidance is highly variable both within and among species (Neproshin, 1979; Olsen et al., 1983; Ona and Godø, 1990; Fréon et al., 1990; Gerlotto and Fréon, 1992; Fernandes et al., 2000; Gerlotto et al., 2004). Presumably the avoidance, when it occurs, is a response to vessel noise, strumming of warp lines attached to the trawls, chemical cues from injured or stressed fish, visual cues of the net itself or behavior of other fish, or some combination. A review by Wahlberg and Westerberg (2005) on potential impacts of noise from nearshore wind farms on fish indicates that very little is known, and many of the effects will likely depend on individual site characteristics (number and arrangement of turbines, composition materials of turbines, wind speed, fish species, etc.). The authors estimate the detection range of three species of fishes (Atlantic salmon, goldfish, and cod) based on noise measurements of nearshore wind turbines in Sweden and modeling at distances of 0.4 to 25 km from the structures. However, these results have questionable relevance to the present water depths and mooring arrangements. A deep-water sound channel can be expected and would be expected to increase the propagation distance of low-frequency sound.

Acoustic effects on benthic macrofauna are poorly known. Some shallow-water benthic organisms respond to vibrational stimuli in wave swash (Ellers 1995), and pressure pulses recently have been shown to carry information on activities of neighboring infauna (Wethey and Woodin 2005), but substantial acoustic or pressure-pulse effects at water depths greater than 100 m seem unlikely.

Recommended acoustic studies include both monitoring and modeling to understand

- What sounds are produced by the turbine system (turbine, platform, anchor, cables);
- How turbine system sounds compare to ambient sounds;
- Propagation of the sound both above and below water;
- Implications for marine species, including marine mammals and fishery resources; and
- Implications for coastal residents or other activities near turbines (see Section 5.4 subsection on sound and aesthetic impacts).

Acoustic measurements can be undertaken via hydrophone systems deployed at regular intervals via ship-based surveys or via acoustic instruments mounted on oceanographic buoys or mounted on the turbine/platform/anchor system or on separate bottom tripods. Pilot studies are currently being undertaken by UMaine, led by Dr. Andrew Pershing, to document acoustic signatures of the 100 kW test turbine planned for deployment at the UMaine deepwater offshore wind testbed south of Monhegan Island. Resulting data will be analyzed from the perspective of potential impacts on marine mammals, particularly endangered large whale species through their use of sound. Additionally, the Department of Energy's (DOE's) Pacific Northwest National Laboratory (PNNL) is currently developing specialized methods for modeling noise propagation from offshore wind installations (contact: Andrea Copping, Senior Program Manager for marine and coastal waters http://marine.pnl.gov/staff/staff_info.asp?staff_num=1094).

5.3.7 Electromagnetic Field Effects

Electromagnetic Field Effect (EMF) sources from offshore wind farms include potential leakage from cables connecting individual wind turbines, as well as electrical cables between wind farms and shore. The EMFs of concern in water are the magnetic field and the induced electrical field. Magnetic and induced electric fields will travel through the water. Wind turbines produce EMF at certain operational speeds, with the electrical field carrying farther in air. Living marine resources that may be affected by EMF include marine animals that navigate and hunt prey by magnetic field, including sharks and rays, as well as invertebrate species such as lobster. Air-borne EMF from turbines may have deleterious effects on birds and bats.

Cable burial in this region has been studied at these water depths. Non-electrical cables appear to present little long-term habitat change. Sharks, skates and rays are exceptionally sensitive to EMF, however, and fishermen have expressed concerns that seasonal migrants such as lobsters might be sensitive to EMF.

Underwater and laboratory EMF studies in seawater are logistically difficult and expensive. Recognizing that difficulty, Pacific Northwest National Laboratory (PNNL) has chosen to address EMF issues directly with rigorous laboratory and field tests. PNNL plans to complete initial laboratory sensitivity studies for American lobster by the end of 2011. These tests are designed to determine what EMF levels may impair feeding and migration behaviors for comparison against field strengths surrounding submarine cables.

5.3.8 Potential Risks and Recommended Studies

Direct physical interactions

A key site-selection criterion is to reduce potential for direct interaction by avoiding aggregation sites and transit routes of whales. Although the recommendation is the same for birds and bats, data on their transit and use of offshore habitats as functions of altitude and offshore location are scarce. As noted, radar ranges of less than or equal to two kilometers (≤ 2 km) are needed to resolve individual passerines, and the need for a fixed or floating platform for radar will make pre-deployment data problematic to obtain. One adaptive management approach would be to use surveillance radar to detect and avoid flyways of large flocks, followed by studies after turbine deployment that mount radar units directly on the turbine platforms to evaluate flock and individual bird trajectories and behaviors.

Habitat modification

In terms of pelagic habitat modification, a before-after, control-impact (BACI) design is recommended to evaluate the impact of floating offshore wind platforms on pelagic fishes. Two sampling approaches should be used concurrently – one based on mobile acoustic surveys with biological verification and the other based on continuous stationary acoustic monitoring. Mobile sampling should be conducted day and night, twice per month during each of the new and full moons. Mobile acoustic units would consist of dual-frequency (38 and 120 kHz), downward-looking echosounders and a side-looking (fanned directly below boat to the surface), multi-beam sonar. The latter will enable sampling close to and under floating platforms from distances of hundreds of meters (dependent on frequency of the system). Mobile survey data will be used to quantify fish biomass and intensity of aggregation. Midwater fish trawling and MOCNESS will be used to verify pelagic acoustic targets and partition biomass and aggregation metrics into species and functional groups. Continuous stationary acoustic sampling will consist of a self-contained, seafloor-mounted, upward-looking acoustic system to sample the water column directly under and around floating platform(s) and at a control site. Data would be collected at a sampling rate of one ping per minute (for example). The unit would need to be retrieved, data downloaded, new battery installed, and then re-deployed at intervals dependent on sampling rate. Data would provide continuous diel and seasonal coverage to fill gaps between active surveys and will be highly informative for understanding development of and changes to pelagic community biomass and aggregation metrics after deployment. The system may also be able to monitor marine mammal use of the area (potentially continuously) depending on system configuration, sampling rate, frequencies, beam angles, etc.

Acoustic surveys, coupled with biological verification, are the optimal sampling strategy in deep-water habitat for pelagic species. Visual surveys (i.e., SCUBA) are not practical as in shallow-water assessments, ROVs are not effective for quantitative assessments of pelagic fishes, and reliance on trawl or gillnet sampling is limiting in spatial and temporal coverage compared to acoustics. Broadband sonar is a promising acoustic method. It would provide better spatial resolution, remote identification of species or functional groups across pelagic fish and large invertebrate (e.g., krill and northern shrimp) trophic levels, and perhaps reduce the need for biological sampling after sufficient calibration and validation compared to what is possible with standard narrowband echosounders.

Although scale of an up to 30 MW demonstration project is marginal with respect to induction of substantial upwelling (Broström 2009), it seems prudent to initiate studies at this scale to enable estimates of impacts from scaling up. A reasonable design would include an upstream buoy and a downstream buoy to achieve time resolution, with glider observations taken at the onset of stratification, at peak stratification in summer and during the fall decay of stratification. An effect during peak stratification would be a good indication of a larger effect from scaling up, whereas the greatest sensitivity of stratification to perturbation occurs during its onset and decay. This design would also reveal the magnitude and spatial extent of any resulting phytoplankton bloom (through optical sensors on the glider), informing potential concerns about increased phytodetrital fluxes to the seabed.

In terms of macrofaunal effects, recommended sampling design would employ BACI methodology on four stations, with two stations located randomly within the anchor footprint, one station 500 m upstream and the final station 500 m downstream of the nearest anchor with an approximate minimum of three cores or grabs from each of the four stations. Sampler designs that restrict bow waves are preferable, and samples should be sieved through a 0.3-mm sieve because many adult macrofauna in this depth range are small, and a 0.3-mm sieve has been widely used in East Coast environmental assessments. Expectation for macrofaunal abundance in a 0.02-m^2 sample is approximately 560 individuals (Weissberger et al., 2008), suggesting that a sample size smaller than the 0.1 m^2 traditionally used in studies of trawling impacts could be adequate. By far, the greatest expense is the time-consuming sorting of animals from sediments and identification of species. Because much community change depends on recruitment and many species recruit annually, before-after samples should be taken annually. Sampling each year in the same season will maximize power to detect control-treatment differences. Late summer or early fall is convenient both from the standpoint of avoiding both bad weather and taxonomic problems with recently settled juveniles. Experience with closure areas effectively doubles the statistical power by allowing a one-tailed alternative hypothesis against the null that structure-forming species will be unchanged or will decrease in abundance within the anchor footprint. That is, it is expected the effective closure to mobile gear to allow structure-forming species to recolonize. An enrichment effect from falling fragments and feces of fouling organisms is possible at the downstream station. Changes in composition and abundance of benthic and demersal megafauna can be assessed using a BACI design and a remotely-operated vehicle (ROV).

Acoustic Effects

Measurements of noise fields around wind turbines (levels, frequencies, ranges) are needed. Even with this information (which will not be possible prior to deployment), it will be difficult to recreate conditions in the laboratory to systematically test response(s) of fishes. A comparative field experiment using one 3 – 5 MW test turbine can be used to evaluate potential effects of noise from wind turbines on fish. Using a BACI design, continuous stationary (active and passive) acoustic monitoring can be deployed in control and experimental test sites at various distances to examine patterns in fish distributions as functions of environmental conditions (e.g., wind speed) and ambient noise levels. An iterative approach to modeling and measurement is recommended both above and below the water to maximize skill in prediction before scaling up further from the up to 30 MW farm occurs.

Electromagnetic Field Effects

We anticipate a better ability to design electromagnetic field (EMF) studies and a better articulation of the need for them after PNNL completes additional, rigorous studies on animal sensitivity across a range of species. Possibilities include field observations via ROV on American lobster behavior, when PNNL sensitivity tests reveal how far such effects might extend.

Existing resources for environmental data and monitoring:

- GoMOOS/NERACOOS regional buoy network observing system,
- ongoing regional environmental monitoring efforts,
- marine research universities, institutes, and consortia,
- state and federal resources,
- Maine Wind Industry Initiative (MWII) member organizations

5.4 ENVIRONMENTAL STAKEHOLDERS

This section is intended to identify those groups and individuals most directly affected by or potentially concerned with the assembly, installation, and operation of an up to 30 MW deepwater offshore wind project with connectivity to the State of Maine, as well as to outline their primary concerns, questions, and attitudes with respect to offshore wind energy. In particular, the section provides relevant information related to other installations or activities of significance in the regional analysis, including but not limited to shipping, fishing, recreational uses, and sites of military importance. Note that military sites have not been queried to date.

The Island Institute, in Rockland, Maine, is the primary author of Section 5.4. It is a membership-based community development organization focusing on the GoM, particularly Maine's island and remote coastal communities. The Institute is supportive of wind development that is appropriately sited with community input and balances impacts to ecological and human uses with community benefit. The organization played a key role in the development of the 4.5 MW community-owned Fox Islands Wind project on Vinalhaven Island, Maine, and supported the State of Maine's efforts to engage coastal stakeholders in the 2009 effort to designate ocean energy demonstration areas. The Institute's goal in developing this stakeholder section is to better inform the siting process and encourage community engagement in offshore wind siting and development.

5.4.1 Introduction to Environmental Stakeholders

This section represents a compilation of existing information about environmental stakeholders in the marine areas covered by the feasibility report, as well as information derived from the extensive experience of the authors working with priority environmental stakeholders, especially commercial fishermen, environmental non-governmental organizations (NGOs), and coastal residents. In addition, Island Institute staff organized a series of individual interviews with high-priority environmental stakeholders, eliciting information regarding their questions, concerns, and attitudes with respect to offshore wind development. These stakeholders include: mobile-gear fishermen, fixed-gear fishermen, tourism operators, coastal land trusts, environmental NGOs, and island electric utility representatives.

Previous Stakeholder Engagement on Offshore Wind

A wealth of valuable information about stakeholders interested in offshore wind has been gleaned from a public outreach process that was undertaken as part of the 2009 state-led effort to designate ocean energy demonstration areas in state waters. This outreach effort took place at the direction of LD 1465 and was led by the Maine State Planning Office (SPO) and the Maine Department of Conservation (MEDOC), in consultation with federal, state, and non-governmental (NGO) entities (See http://www.maine.gov/spo/specialprojects/OETF/index.htm). Its primary goals were to gauge the extent of human use and activities in each of the proposed areas and to document concerns and comments related to proposed sites. Public outreach included over 20 meetings ranging in scale from large regional public meetings to conversations with small groups or individuals representing environmental, economic, fisheries, or municipal interests.

As a result of the 2009 demonstration site outreach process, many of the individuals and groups interviewed for this section have been previously engaged in discussions pertaining to offshore wind development. It is useful to note, however, that these previous discussions were based on demonstration areas within three (3) nmi of land, for which the permitted sites, size, and activities differ significantly from current plans for an up to 30 MW commercial ocean energy project located ten (10) nmi from an inhabited area of the state. Nonetheless, many of the same questions, comments, and concerns remain relevant and are echoed in this section, including (1) the importance of siting to minimize adverse impacts to current ocean users; (2) the viability of emerging technology, and (3) access to compensation or community benefit.

Topics Addressed

This section builds on prior stakeholder engagement efforts by addressing areas that are at least ten (10) nmi offshore with a depth of at least 300 ft (90 m). To allow for the inclusion of regional detail where available, coastal waters are divided into the following areas: south of and including Casco Bay, between Casco Bay and Penobscot Bay, Penobscot Bay to Winter Harbor, and east of Winter Harbor.

Table 5-2: Stakeholder concerns, questions, and priorities as relating to deepwater offshore wind energy in Maine

Stakeholders contacted for this section raised a number of common concerns, questions, and priorities related to deepwater offshore wind energy, including:

- **Will it benefit Maine people and how?**
- **As a ratepayer, what will the costs be? Will the power be shipped to another state while we get stuck paying for it?**
- **How will ocean energy development impact current users of the ocean, both from a pilot perspective and eventual build-out?**
- **Which fisheries will be allowed amongst turbines in an array? Which will be completely excluded?**
- **How will those individuals and/or communities negatively affected by ocean energy development be compensated?**

This section provides information pertaining to the following stakeholder groups:

- Commercial fishing
- Commercial shipping
- Recreational fishing
- Other boating (recreational, tourism businesses)
- Archaeological/cultural resources
- Aesthetic and sound concerns for people on water or nearby land masses
- Environmental/conservation concerns (e.g. NGOs)
- Island electric utilities

For each topic, this section provides:

- A description of each activity or resource in areas that meet the criteria of being at least ten (10) nmi offshore with a depth of at least 90 m and any associated vessel exclusion zones
- Economic value of activities and resources (as publicly available)
- Priority concerns, questions, and attitudes related to offshore wind energy
- Maps of where/when activities/resources occur
- Identification of and contact information for key industry groups, individuals, and NGOs (as publicly available)

To the extent that interviewees agreed to public dissemination of the spatial information they offered, maps detailing current uses of coastal waters are incorporated into this section. Information deemed to sensitive by interviewees for map display is summarized in the section text.

5.4.2 Summary of Major Current Human Uses

Commercial Fishing

Commercial fishing contributes significantly to both the culture and economy of Maine's coast. Well over 200 million pounds were landed in commercial fisheries in 2009, contributing nearly $325 million to Maine's economy (Figure 5-23). In island and coastal communities, commercial fisheries can account for more than 70% of employment (Island Institute, 2008). Commercial fisheries are managed by the Maine DMR in state waters (less than three (3) nmi from shore) and by NMFS in federal waters (greater than three (3) nmi from shore).

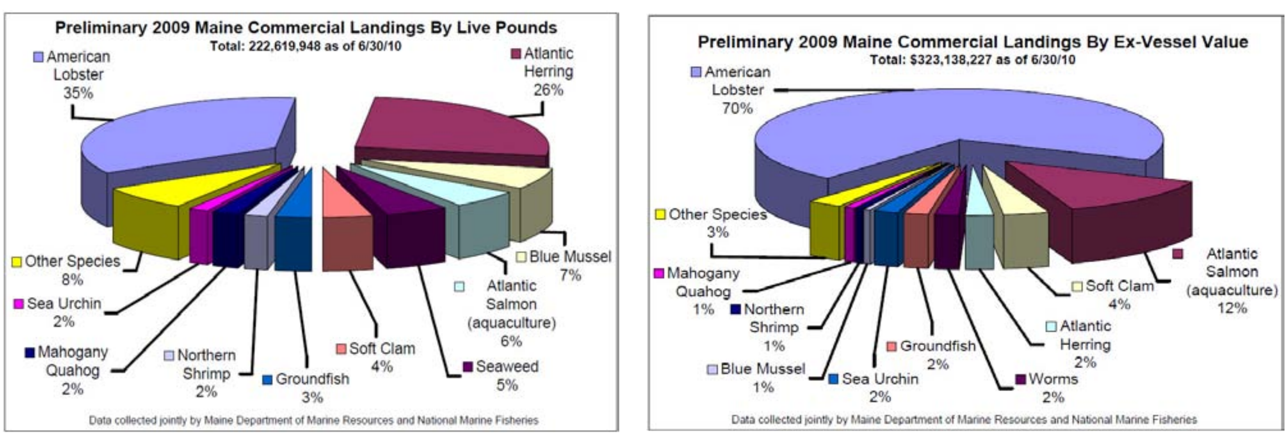


Figure 5-23: Preliminary Maine commercial fishery landings by weight (left) and by value (right). Source: Maine Department of Marine Resources, 2010.

Reliable digital information on the spatial distribution of commercial fishing occurring in state and federal waters is lacking. Data commonly used to show the extent of offshore fishing activity is that which is gathered by Vessel Monitoring Systems (VMS). However, since VMS is only required for certain fisheries, not including offshore lobster, VMS are only mounted on those boats that are also used for fisheries that require it. According to NMFS, only about 6.5% of lobstermen that hold federal permits report data via VMS.

The maps in Figure 5-24 through Figure 5-28 illustrate the extensive nature of fishing grounds off the coast of Maine as well as the complexity of fisheries and gear types across areas. It should be noted that these maps show areas fished by only those fishermen from selected harbors or regions, as they represent an incomplete 'snap-shot' from an ongoing project being undertaken by the Island Institute in partnership with commercial fishermen, entitled Mapping Working Waters (II-MWW).

This section focuses on major commercial fisheries occurring ten (10) nmi offshore and in over 300 ft water depth, including lobster, Northern shrimp and groundfish (suite of 17 species). In addition, the section also discusses other offshore fisheries, including small pelagics (herring, menhaden, sand eels), hagfish and ocean quahog. Information on major stakeholder groups for each fishery is highlighted below. In addition to these groups, a number of non-profit community organizations are actively involved in supporting commercial fisheries, including the Island Institute (Rockland), Penobscot East Resource Center (Stonington), and Cobscook Bay Resource Center (Eastport). Along with these groups, Maine Sea Grant (Orono and regional offices) and the Gulf of Maine Research Institute (Portland) provide research, education, and outreach services to the fishing industry and other marine users.

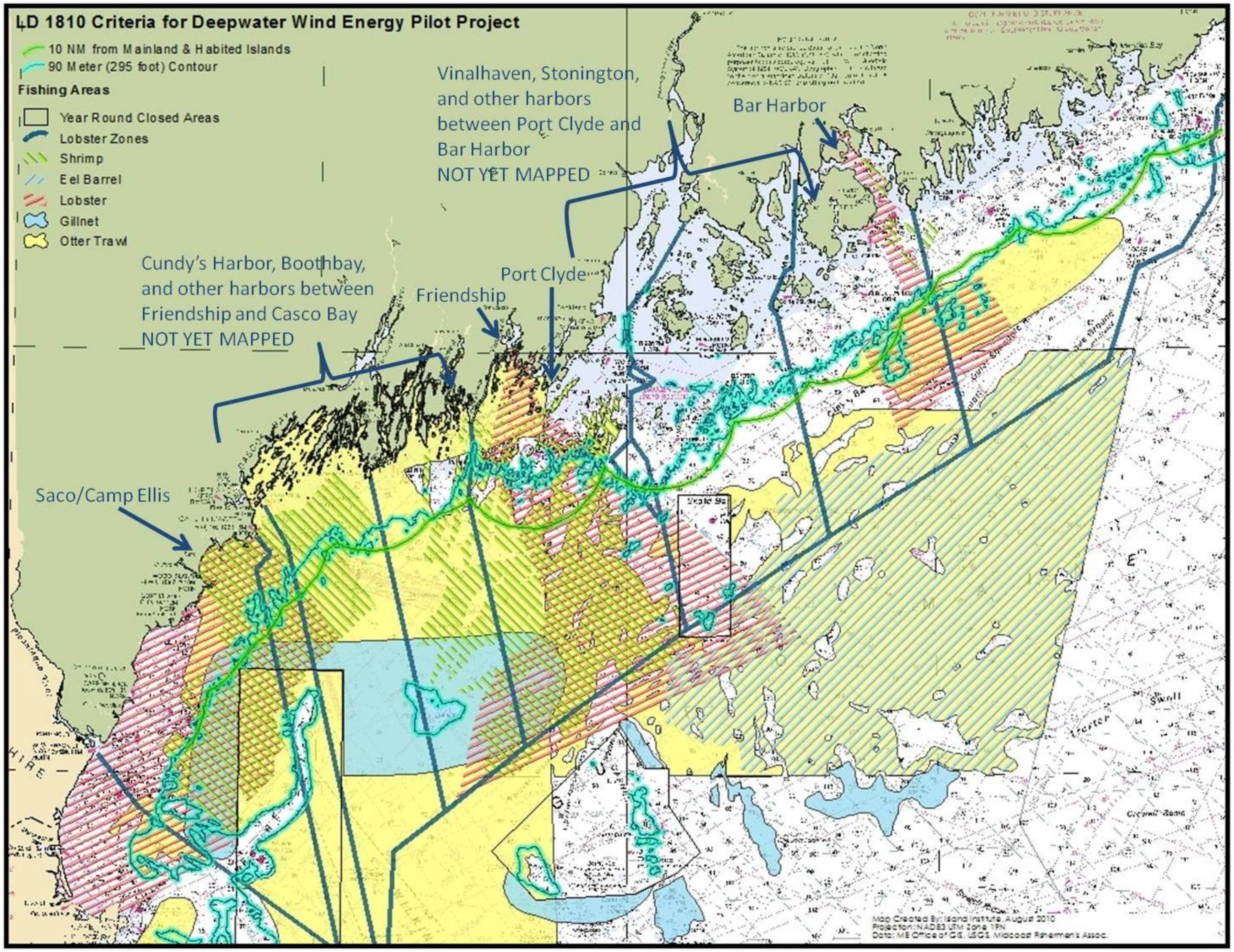


Figure 5-23: Commercial fishing areas identified through stakeholder interviews (groundfish trawl, shrimp trawl, lobster pot, hagfish barrel) from selected communities. Note major fishing harbors are currently not included on these maps. Information herein is proprietary; please request permission before duplicating or reproducing this material. (Source: Island Institute, Mapping Working Waters)

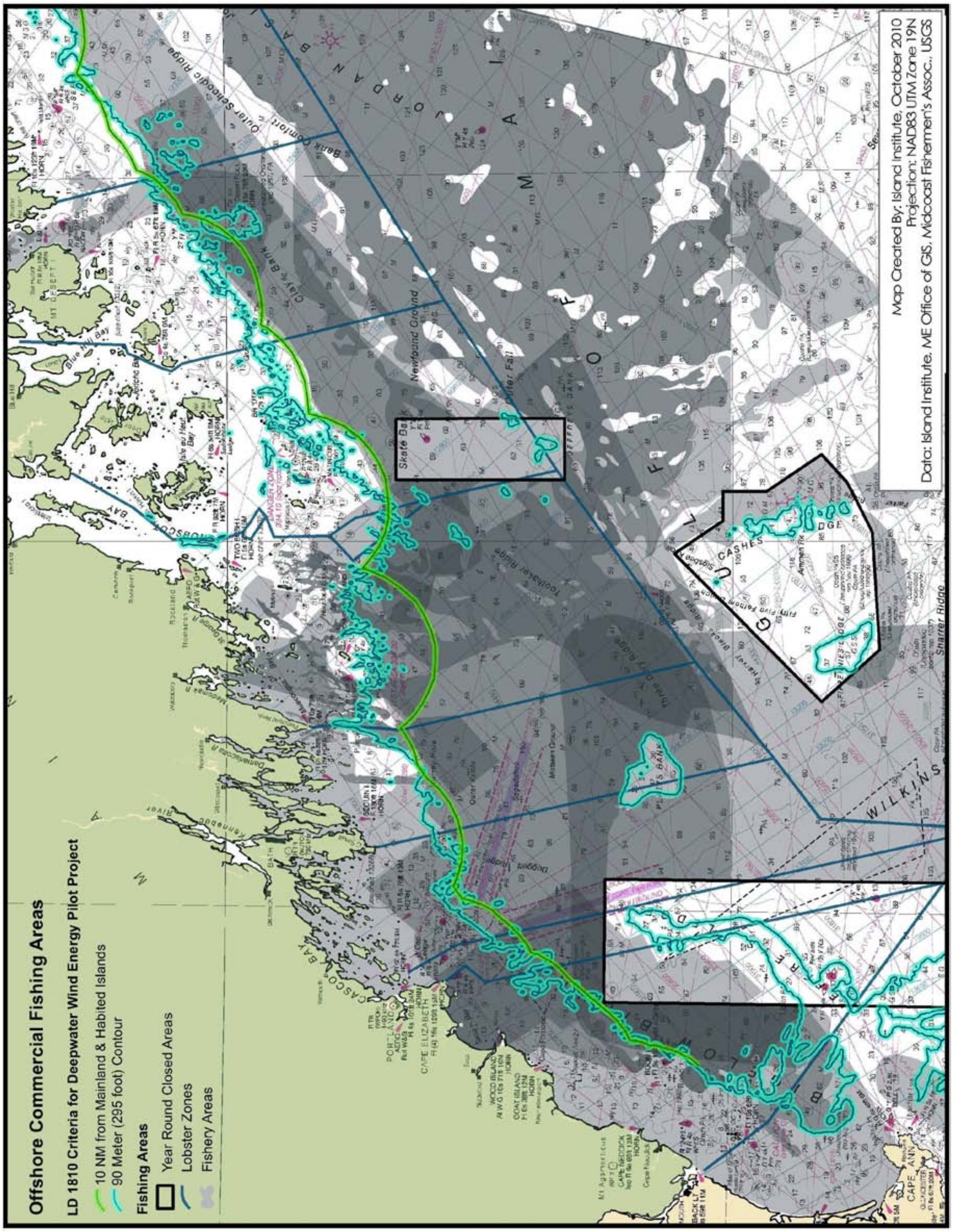


Figure 5-24: Commercial fishing areas identified through stakeholder interviews (groundfish trawl, shrimp trawl, lobster pot, hagfish barrel) from selected communities. Darker areas represent places where there are more types of active commercial fishing. Note major fishing harbors are currently not included on these maps. Information herein is proprietary; please request permission before duplicating or reproducing this material. (Source: Island Institute, Mapping Working Waters)

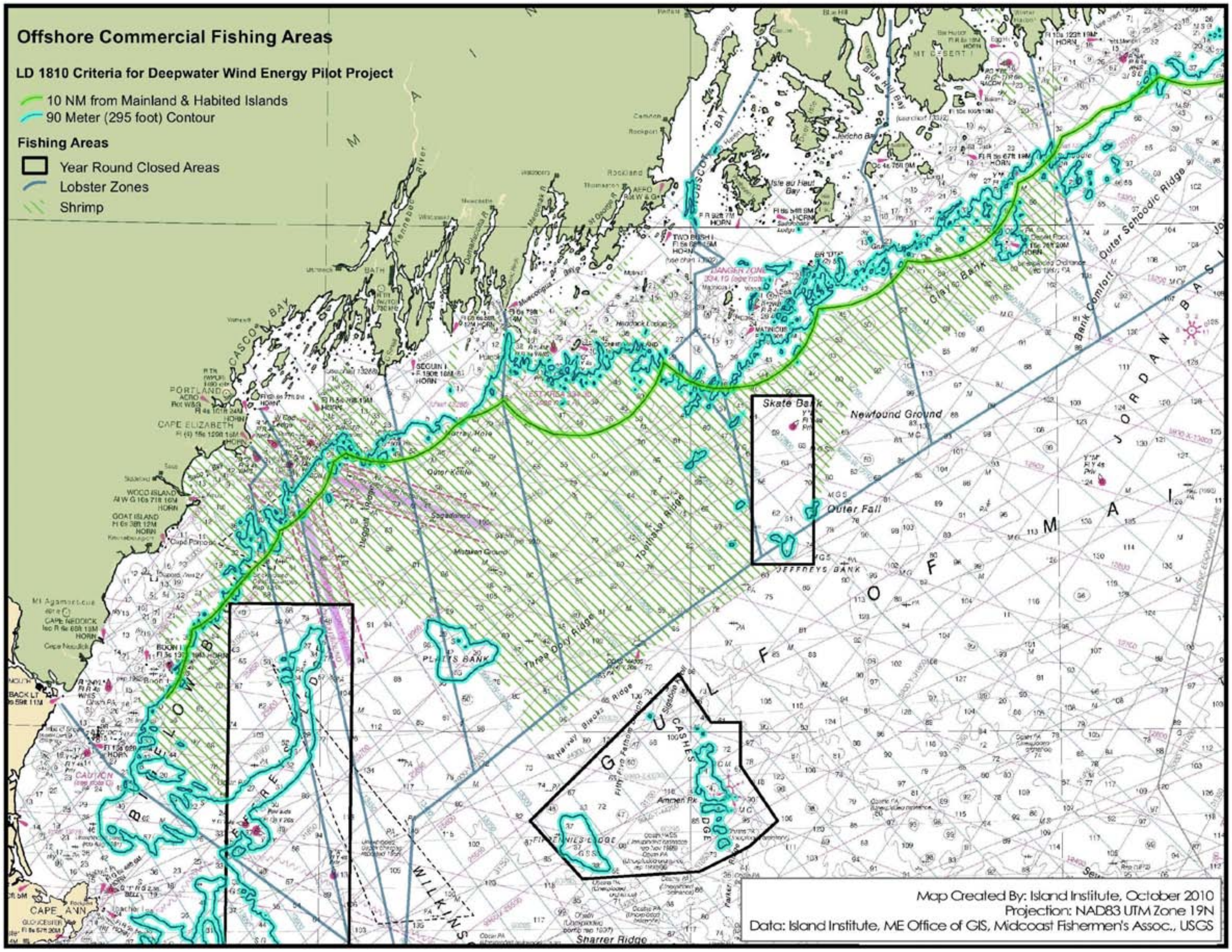


Figure 5-25: Commercial shrimp trawl areas identified through stakeholder interviews from selected communities. Note major fishing harbors are currently not included on these maps. Information herein is proprietary; please request permission before duplicating or reproducing this material. (Source: Island Institute, Mapping Working Waters)

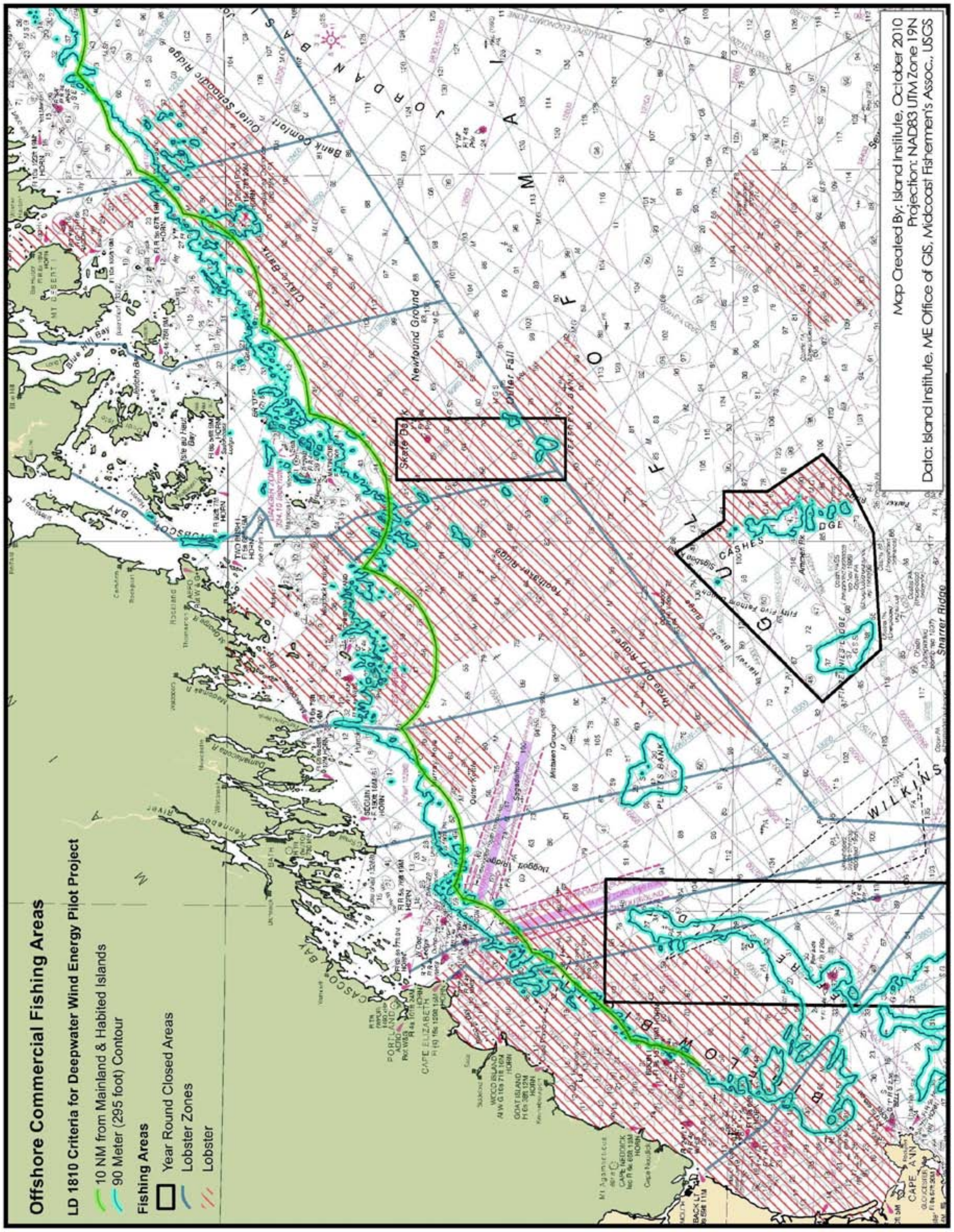


Figure 5-26: Commercial lobster pot fishing areas identified through stakeholder interviews from selected communities. Note major fishing harbors are currently not included on these maps. Information herein is proprietary; please request permission before duplicating or reproducing this material. (Source: Island Institute, Mapping Working Waters)

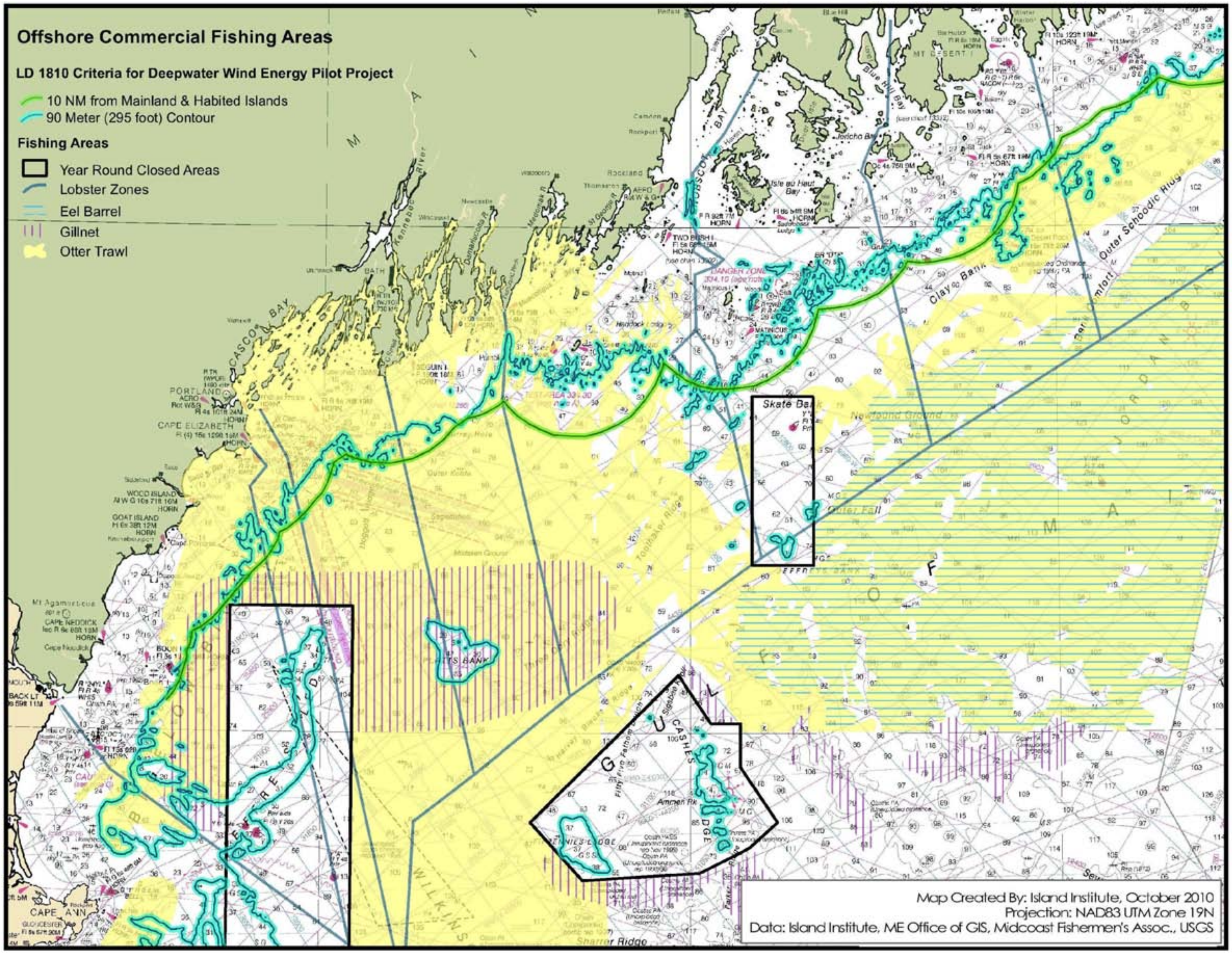


Figure 5-27: Commercial groundfish trawl and hagfish barrel fishing areas identified through stakeholder interviews from selected communities. Note major fishing harbors are currently not included on these maps. Information herein is proprietary; please request permission before duplicating or reproducing this material. (Source: Island Institute, Mapping Working Waters)

Lobster

In 2009, the lobster fishery was Maine's largest fishery, in terms of both pounds landed and revenue generated (Figure 5-23). Over the last five years, an average of 71.2 million pounds of lobster was landed each year, valuing on average $276.7 million per year (Maine DMR, 2010). In 2008, licenses in the Maine Lobster Fishery were used as follows (Deirdre Gilbert, Maine DMR, pers. comm.):

- 6,492 commercial licenses eligible for tags (distributed uses of total available)
    - 2,053 (32%) have no reported activity
    - 4,439 (68%) have at least one pound (1 lb) of landings
    - 2,703 (42%) landed less that 1,000 pounds (lbs)
    - 1,309 (20%) landed greater than 20,000 pounds (lbs)
    - 217 (3%) landed greater than 50,000 pounds (lbs)

Of the commercial lobster license holders in the state of Maine, about 2,000 actively fish in state waters and 1,300 hold federal lobster licenses (Patrice McCarron, MLA, pers. comm.).

Inside Maine state waters, lobster fishing is a trap fishery. In federal waters, lobsters can be caught in both traps and trawls, but only those caught in traps can be landed in Maine. Lobsters caught in trawls are landed in either New Hampshire (NH) or Massachusetts. Traps are set either singly or in strings of up to ten (10) or 20 traps. These longer strings of traps are used primarily offshore, and represent areas where there is gear coverage on more bottom area than is immediately apparent from the density of buoys on the surface. Both Maine-based and out-of-state vessels fish for lobster in the federal waters ten (10) nmi off Maine's coast.

While fishing effort and gear follow the lobsters' seasonal migration patterns, moving closer to shore in the summer and farther offshore in the winter, virtually all waters off the coast of Maine are spoken for in the sense that they are fished by individuals from a particular harbor, or in the case of overlapping areas, more. As such, any exclusion areas related to offshore wind development can be expected to displace some number of fishermen from their traditional fishing grounds. The intensity of lobster fishing is highest closest to shore in state waters, and decreases with distance from the coast. However, there is substantial offshore lobster fishing in federal waters, and a greater degree of mixing across communities as those who fish far offshore are more mobile and cover larger areas.

Maine's coastal waters are divided into lobster zone territories, which are managed by Zone Councils, composed of industry representatives, in conjunction with Maine's DMR. Lobster zone boundaries are shown in Figure 5-29, below as given by the Maine DMR Regulations Chapter 25.94 (Image available at http://www.maine.gov/dmr/council/lobsterzonecouncils/Lobster%20Zones%20All%20Zones.jpg . In federal waters, the fishery is managed by the Atlantic States Marine Fisheries Commission (ASMFC), an inter-state management body. The major industry organization for the lobster fishery is the Maine Lobstermen's Association (MLA), see stakeholder contacts section. In addition to participation in the MLA, many lobster fishermen are actively involved with fisheries management, through participation in their regional Lobster Zone Councils, the Maine State Lobster Advisory Council (MSLAC), the Maine State Marine Resources Advisory Council (MSMRAC), and as advisors to the ASMFC.

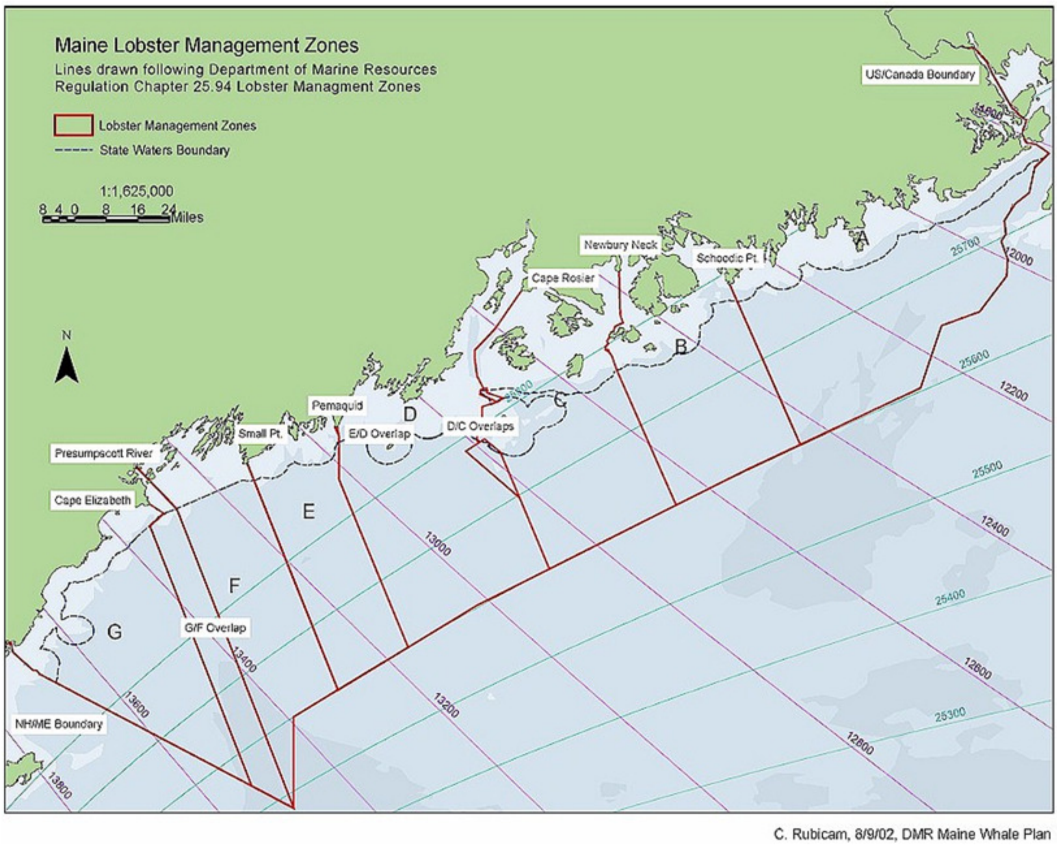


Figure 5-29: Maine's Lobster Management Zones

Northern Shrimp

Northern shrimp are caught in both trawls and traps in Maine state and federal waters, primarily during the winter months. Preliminary data for 2009 show nearly 4.8 million pounds of shrimp, valued at $1.92 million, were landed in Maine. The start date and length of the fishing season varies year to year, but in recent years has started in either November or December and ended in May. Maps of shrimp tows by region as well as names of draggers and operators can be found on the DMR website: http://www.maine.gov/dmr/rm/shrimp/shrimptow.htm. Shrimp tow areas offshore of ten (10) nmi are also shown in the overall fishery area map, in Figure 5-26, above.

The number of fishermen landing shrimp has varied widely over the past decade as the stock size has fluctuated dramatically. It was estimated that just over 200 boats from Maine participated in the fishery in the 2007 – 2008 season. It should also be noted that in the 2008 – 2009 season a number of boats from the lobster fishery rigged over to fish for shrimp in the winter months when the market for lobster was poor. Similarly, many lobstermen also participate in the spring halibut fishery in state waters, particularly in the Downeast region.

The GoM fishery for northern shrimp is managed across Maine, New Hampshire, and Massachusetts by the Interstate Fisheries Management Program (ISFMP) of the Atlantic States Marine Fisheries Commission (ASMFC). Maine members of the ASMFC Northern Shrimp Advisory Panel are listed in the contacts table at the end of this chapter. There is currently not an industry organization solely focused on the northern shrimp fishery, however the Midcoast Fishermen's Association includes many active shrimp fishermen and serves as a voice for the fishery. Glen Libby, President of the Midcoast Fishermen's Association, and other members of the association expressed a number of questions, priorities, and concerns related to shrimp fishing, which are highlighted below.

Groundfish

The groundfish fishery or the "Northeast multispecies fishery" is managed by the Northeast Fishery Management Council (NEFMC) and the federal NMFS. The groundfish fishery includes American Plaice, Atlantic Cod, Atlantic Halibut, Atlantic Wolffish, Haddock, Ocean Pout, Offshore Hake, Pollock, Red Hake, Redfish, Silver Hake, White Hake, Windowpane Flounder, Winter Flounder, Witch Flounder, and Yellowtail Flounder. Groundfish are caught in trawls, gillnets, and, to a lesser extent off the Maine coast, using long lines. Maine members of the NEFMC are listed in the stakeholder contacts at the end of this section.

While groundfish fishing decreased substantially after stocks plummeted following overfishing in the 1970's and 1980's, substantial efforts have been made to bring these fish back and there is currently a complex management plan in place to allow groundfish species to return to their once abundant levels on federally mandated rebuilding timetables. In Maine, fishermen belong to one of two groundfish sectors: the Port Clyde Community Groundfish Sector or the Sustainable Harvest Sector. Through sectors, a group is granted a total allowable catch (TAC) for each groundfish species that can be caught over the year at the sector's discretion with the understanding that once the TAC for one species in the allocation has been reached, sector members are no longer permitted to fish for any species. Those who do not belong to a sector fish under the Days At Sea allocation scheme and comprise what has come to be referred to as the "common pool". The Island Institute, The Nature Conservancy, and members of the Port Clyde Community Groundfish Sector are partnering on a series of fisheries capacity and sustainability projects. An additional sector, the Community Groundfish Sector, supported by the Penobscot East Resource Center, has been formed as a vehicle for re-building an active groundfishery east of Penobscot Bay.

Since 2007, all federally-permitted groundfish vessels have been required to operate a Vessel Monitoring System (VMS). State and federal agencies with access to VMS data are therefore able to produce maps showing groundfish fishing spatial distribution in recent years. Nonetheless, determining areas critical to the groundfish industry is more difficult than for some other fisheries, as there is an expectation that the industry will rebound over the next decade. While currently groundfishing is primarily an offshore industry, the expectation is that areas closer to shore will once again become productive and valuable to the fishery, as has occurred in recent years in the western GoM off the coast of New Hampshire and northern Massachusetts. In speaking with members of the fishery, this was among their primary concerns – that VMS data do not accurately depict the high historical value of areas that are currently sparsely fished due to limited groundfish resource, and that future access to fishing grounds not be limited to only those offshore areas currently used.

The Midcoast Fishermen's Association (Glen Libby, President) and Associated Fisheries of Maine (Maggie Raymond) are two key industry organizations representing groundfish fishermen in the State.

Small Pelagic

Small pelagics are caught using both mid-water trawls and weirs and include such species as herring, menhaden, and sand eels. Of these, Atlantic herring is the state's most important pelagic fishery, with nearly 58 million pounds landed in 2009 (Figure 5-23). Historically this catch fueled a large sardine canning industry in the State. While the last of these canneries closed in April 2010, herring is still a huge driver in the state's coastal economy as it is the primary bait used by the lobster fishery. The small pelagic fishery, generally termed the 'herring fishery' as a catch-all, is highly mobile and inter-annually variable in location. The herring fleet exploits different areas along Maine's coast during different years. The East Coast Pelagic Association (Mary Beth Tooley) is an important industry organization for this fishery. Figure 5-24 and Figure 5-28 includes a map showing areas of commercial pelagic fishing effort.

Hagfish

The fishery for hagfish has expanded across the northern GoM over the last decade, and is now undertaken across large areas, as shown in Figure 5-28. The fishery is known as the 'eel barrel' fishery and is managed by the NEFMC. Landings, total commercial value, and number of participants are not well known for this fishery; however, the fishery has expanded territory eastward over the last five years (Figure 5-28). There is not a currently active industry organization for hagfish in Maine. For an overview of the fishery, please see the following website article:
http://www.workingwaterfront.com/articles/Unregulated-hagfish-industry-creates-conflict-and-opportunity/13890/.

Quahog

In eastern Maine, there is an ocean quahog fishery, which according to preliminary data for 2009, was valued at $1.82 million. Locally these small ocean quahogs are known as "mahogany quahogs" and are generally sold for the half-shell market. The fishery is managed by the NEFMC. There is not currently an active industry organization for the ocean quahogs fishery in Maine.

Commercial fisheries concerns, priorities, and questions:

- How could turbines be placed anywhere in waters off Maine's coast while the shore line to twenty miles off shore is where all major fishing efforts are conducted?
- At what distance will fishermen be allowed to fish around and between the turbines?
- Loss of access to fishing areas and concern about being cut-out from the fishery permanently as competing uses increase
- Concern about gear loss from increased traffic as well as entanglement with structures
- Interest in knowing about new employment opportunities for those who may be displaced
- If individuals are forced to give up fishing grounds, there isn't really room for them to relocate since nearly all coastal waters are already spoken for
- What opportunities exist to compensate for, or mitigate harm to, fishing communities?
- With respect to staging areas, there is the example of the Stella Firth ship repair during the summer of 2010 between Rockland and Vinalhaven. The vessel was there ten (10) days or so, not much of a problem for lobster fishery. However, no-fishing zones associated with turbine staging in Penobscot or Casco Bay for a longer period of time (one to three months) could cause major disruptions to the lobster fishery, especially in summer or autumn months when the majority of catch is landed.
- Concern about limiting future flexibility; even though an area might not be heavily used right now, if the resource shifts, they are potentially cut out if that becomes a site.

Table 5-3: Environmental Stakeholders – Commercial Fishing Contacts

COMMERCIAL FISHING CONTACTS		
Maine Lobstermen's Association	Patrice McCarron, Executive Director	(207) 967-4555 patrice@mainelobstermen.org
Port Clyde Community Groundfish Sector	Glen Libby, Sector President	(207) 701-7032
Offshore lobster	Jon Munsey	(207) 373-0701
ASMFC Northern Shrimp Advisory Panel	Terry Alexander, Chair	(207) 729-2538
East Coast Pelagic Association; Small Pelagic Group	Mary Beth Tooley	(207) 230-7088 mbtooley@roadrunner.com
Associated Fisheries of Maine	Maggie Raymond, Director	(207) 384-4854 maggieraymond@comcast.net

Commercial Shipping

In 2007, Maine ports collectively handled over 1.5 million tons of dry cargo, 41% of which was handled in Portland; 33% in the Penobscot River ports of Bangor, Bucksport, Rockland, and Searsport; and 26% in Eastport. Additionally, Portland and Searsport handle close to 125 million barrels of petroleum products. (Source: Maine DOT, Office of Freight Transportation web site: http://www.maine.gov/mdot/freight)

Pilots are often the best source of information regarding inshore commercial shipping lanes and approach routes, as they are employed to guide cargo ships through state waters to port. For state pilot information, contact the Maine Pilotage Commission web site: http://marinepilotage.com/.

In addition to large-scale commercial shipping, many of Maine's harbors also have some short-distance freight activity. Employed by local municipalities, harbormasters manage the multitude of activities that happen along waterfronts and, as such, are familiar with the barges that come and go from their particular harbor, their schedules and routes. A directory of a number of the State's harbormasters is maintained by the State of Maine Harbormasters' Association (http://www.maineharbormasters.org/). Contact information for harbormasters not listed on this site can be found through local municipal offices.

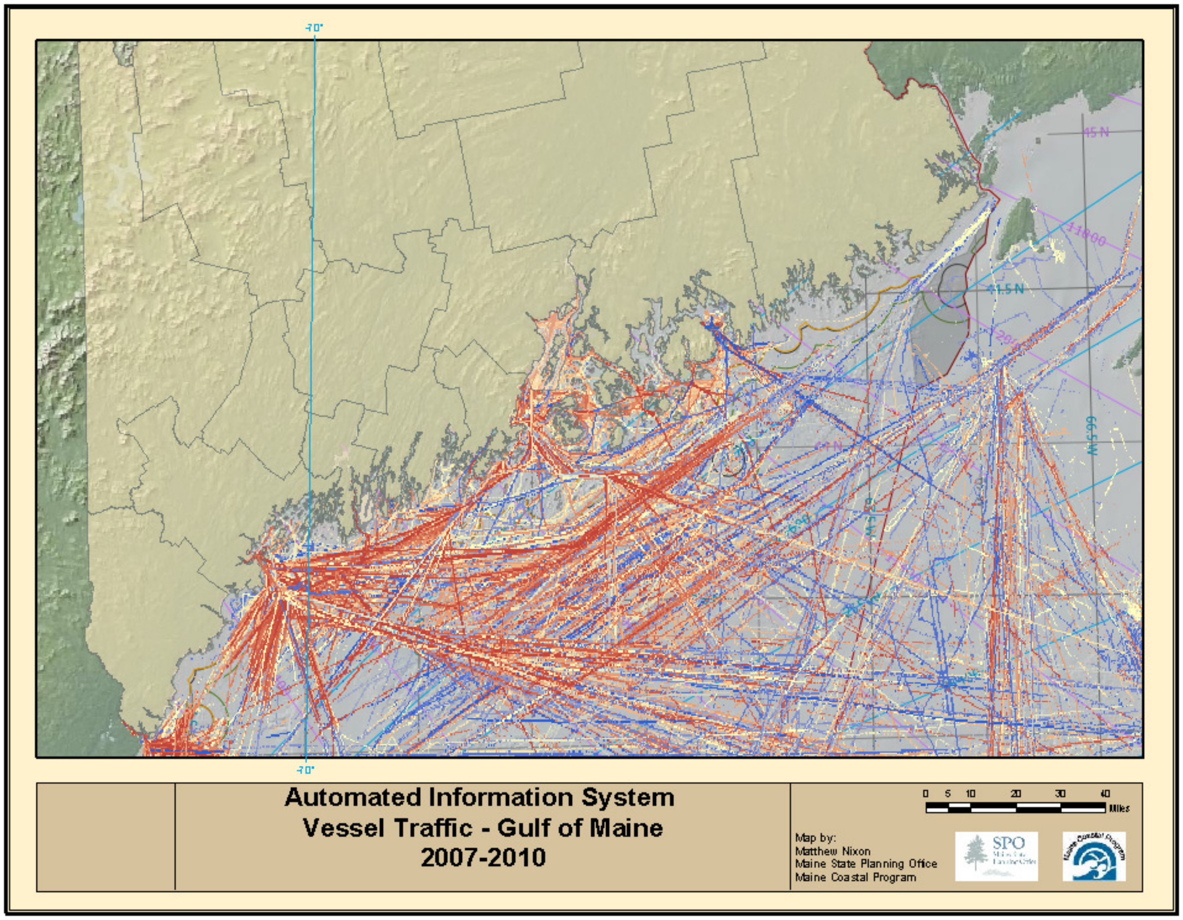


Figure 5-30: Gulf of Maine Automated Identifications System (AIS) Vessel Traffic. Vessel traffic data in GoM as reported by AIS; red lines depict routes of high-volume routes and blue lines depict low-volume traffic routes.

South of and including Casco Bay

Portland (http://portofportlandmaine.org/) is New England's largest tonnage seaport, the second largest oil port on the east coast, and the largest foreign inbound transit tonnage port in the United States. (Source: http://www.portlandmaine.com/ index.php?sec=2)

Portland is also home to Portland Fish Exchange, a non-profit organization owned by the City of Portland where seafood is offloaded and auctioned. (http://pfex.org)

Between Casco Bay and Penobscot Bay

There are no ports located in this portion of the coast. The bathymetry in much of this area makes navigation very difficult.

Penobscot Bay to Winter Harbor

The Penobscot River is home to a series of ports – in Searsport, Bucksport, and Bangor/Brewer. Searsport is the primary port along the Penobscot River, and home to Mack Point Marine Intermodal Cargo Terminal. Mack Point has liquid and dry cargo piers as well as an intermodal rail yard operated by Montreal, Maine and Atlantic Railway. Both Sprague Energy and Irving Oil Corporation have processing facilities on site. Primary contacts and a map of the port's facilities can be found at http://www.mackpoint.com .

Other commercial shipping of note along the Penobscot River includes bulk liquid shipments at Webber Dock in Bucksport and barge shipments leaving the Cianbro Corporation site in Brewer (Source: http://penbaypilots.com/ports.html). Rockland sits along the western approach to Penobscot Bay and has regular marine and cement barge traffic. Tug service in Penobscot Bay is provided by Penobscot Bay Tractor Tug Company, which operates out of Belfast. For pilot contacts and information contact the Penobscot Bay and River Pilots Association: http://penbaypilots.com/.

East of Winter Harbor

Maine's third major port, and the easternmost port in the United States, is the Port of Eastport (http://www.portofeastport.org/), home to the Breakwater Terminal and Estes Head Cargo Terminal. The Port of Eastport works closely with DOMTAR Pulp & Paper, Grieg Star Shipping, ORPC, First Wind and GE Energy (Source: http://www.portofeastport.org/index.php). Pilotage services for the port are offered by Eastport Pilots USA (Captain Gerald Morrison) and Quoddy Pilots USA (Captain Robert Peacock).

Table 5-4: Environmental Stakeholders – Commercial Shipping Contacts

COMMERCIAL SHIPPING CONTACTS		
Penobscot Bay & Rivers Pilots Association		(207) 548-1077 pilots@penbaypilots.com
Maine Port Authority	John Henshaw, Executive Director	(207) 624-3564

Recreational Fishing

While recreational salt water fishing takes place along the entire coast of Maine, the majority of boats operate from Boothbay Harbor to the southern Maine border, with increasing prevalence the farther south one travels along the coast. Saltwater angling is primarily done through for-hire charter and head boats, charter boats being those that carry up to six passengers while head boats carry seven or more. A listing of charter and head boats by county is maintained by Maine DMR. Of the 117 vessels listed, 108 are charter boats of which 69 operate from either Cumberland or York counties. The nine head boats are distributed relatively evenly along the coast. The DMR list of charter and head boats can be

found at the following website:
http://www.maine.gov/dmr/recreational/forhirefleet/index.html.

Saltwater sport fishing tournaments occur in summer months, with the bulk of activity again located in Boothbay and south. A list of tournaments is maintained by DMR and can be found at the following web address:
http://www.maine.gov/dmr/recreational/tournaments/index.html.

Recreational fishing concerns, priorities, and questions:

- Fisheries stakeholders note that the Western GoM Multispecies (Groundfish) Habitat Closure area (see) is used by many recreational fishing vessels.
- Concerns from recreational fishermen would depend on whether they have access to the areas around the turbines, and whether it happens in western Maine.
- Recreational fishing contact information and licensed charterboat captains can be found through the Maine Association of Charterboat Captains (MACC). See http://mainechartercaptains.org for details.

Table 5-5: Environmental Stakeholders – Recreational Fishing Contacts

RECREATIONAL FISHING CONTACTS		
Recreational Fisheries Alliance	Barry Gibson, New England Regional Director	(207) 633-5929
Maine Association of Charterboat Captains	David Pecci, President	(207) 841-1444

Source: http://mainechartercaptains.org/

Other Boating (Recreational, Tourism Businesses)

Inshore Recreational Boating and Tourism Businesses

The majority of Maine's recreational boating occurs within a few miles of shore or in the bays between islands and the coast. While this makes these activities less of a concern for the siting of offshore wind platforms themselves, they still represent relevant stakeholders when potential staging areas and transportation routes are considered.

Figure 5-31 below shows typical cruising routes used by Maine Windjammer Cruises between May and October, and demonstrates the types of routes and areas most often utilized by other recreational vessels on the coast of Maine (Image available at http://www.mainewindjammercruises.com/cruisinggrounds.cfm.)

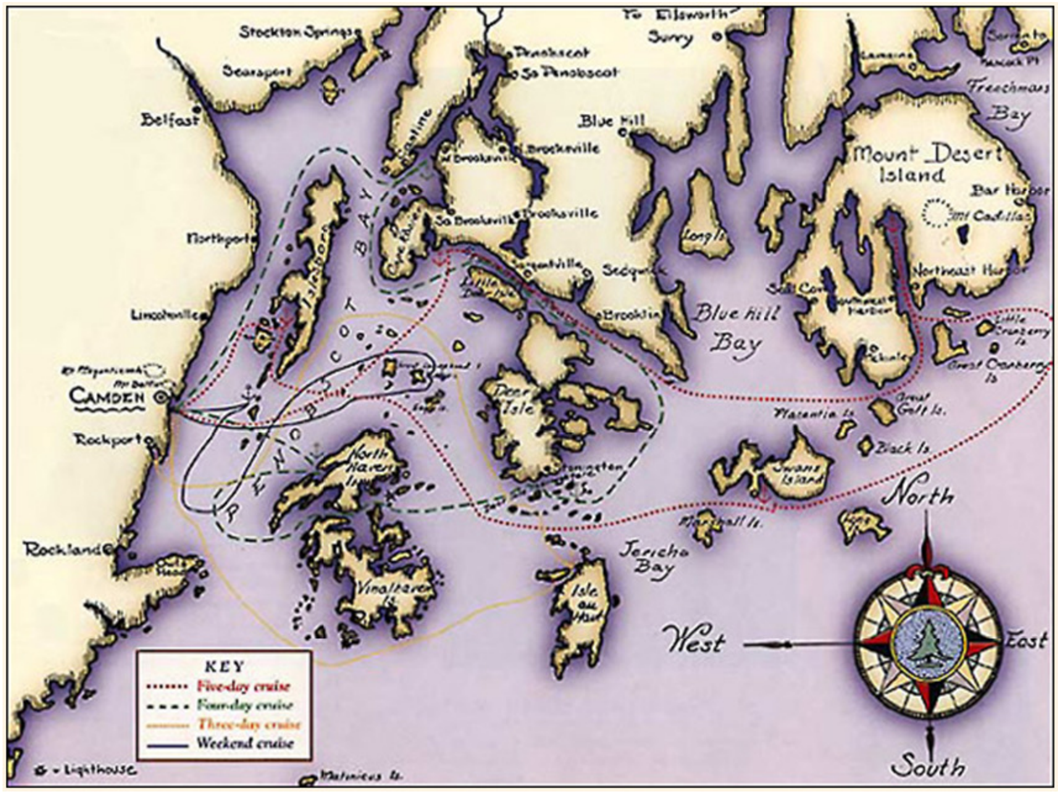


Figure 5-31: Maine Windjammer Cruises – Typical Cruising Routes

Primary types of inshore recreational boating include

- Kayaking – In addition to the numerous rental and guide companies along the coast, for an overall sense of kayaking routes and destinations, the Maine Island Trail Association (http://www.mita.org/), is a Portland-based organization that created and maintains a 375-mile water trail comprised of a chain of over 180 coastal islands and sites along the coast of Maine.
- Sailing – Charter sailboats operate either singly or as part of a local fleet. The largest fleet in the State is the Maine Windjammer Association (http://sailmainecoast.com/fleet.php; 800.807.9463) with 12 boats operating out of Camden and Rockland in Midcoast Maine.
- Lobster boat racing – A schedule listing race sites is on the following web site: http://lobsterboatracing.com/

A more detailed listing of recreational boating stakeholders by region can be found through the searchable list of marinas and boating activities maintained by the Maine Port Authority (MPA): http://maineports.com/pleasure-boating/marinas.

Offshore Cruising and Tourism Businesses

Yachts, cruise ships, whale-watching boats, and seabird tours represent the recreational boats most likely to be encountered in Maine's offshore waters.

Cruise Ships

The vast majority of cruise ship activity happens in Bar Harbor and, to a lesser extent, Portland. Other destinations include Rockland, Eastport, Freeport, Kennebunkport, Portland, Rockland, Bath, Boothbay Harbor, Camden, Belfast, Searsport, Bucksport, and Bangor. A list of cruise lines that visit Maine as well as the 2009 ship schedule by port can be found at http://www.cruisemaineusa.com .

Yachts

Local yacht clubs (http://www.yachtclub.com/usycs/maineyc.html) and cruising guides are the best resource for understanding which offshore routes are most heavily used. There are multiple annual yacht races along the Maine coast, including the Monhegan Island Race from Portland east around Monhegan and then returning. Another example is the Eggemoggin Reach Regatta (http://www.erregatta.com/), which includes a series of races within Penobscot Bay during August every year. The New York Yacht Club undertakes flotilla cruises along the Maine coast each summer, involving tens of yachts.

Whale-watching boats

The majority of Maine's whale-watching boats operate out of Casco Bay, Boothbay, and Bar Harbor. Tours are busiest through the summer tourist season. For example, Bar Harbor Whale Watch operates "four ships, two of which are for whale-watching and combined hold over 700 people per trip and they run three (3) trips a day from May – September". In addition to contributing to Maine's coastal tourism, whale-watching tour businesses are also are rich resources for whale data.

Seabird tours

Particularly due to efforts to restore Atlantic Puffins to Midcoast islands and the existing prevalence of seabirds on Downeast islands, these two regions are where most seabird tours operate. (Hardy Boat, Monhegan Boat Lines, Downeast: http://www.robertsonseatours.com/bird-watching.html)

Other boating concerns, priorities, and questions

- Would not want turbines located in summer feeding grounds where whales congregate
- Concern about potential increases in boat traffic running back and forth through whale feeding grounds
- See section on aesthetic and sound concerns, below

Archaeological and Cultural Resources

Submerged cultural resources will be in the form of historic shipwrecks and prehistoric archaeological sites. Shipwrecks will exist as features exposed, partially exposed, or buried on the ocean floor, and may be widely and randomly distributed. It is anticipated that most wrecks will have some surface expression on the ocean floor, but sediment-covered wrecks with a muted or absent surface appearance must also be anticipated. Prehistoric sites will be in the form of upland and coastal occupation, travel, and resource exploitation sites in areas that were subaerially exposed during the Late Pleistocene lowstand of sea level. These areas extend from the current coast to approximately 120 m of water depth (Kelley et al., 2010). This area will include development sites, as well as cable crossings, and staging areas.

Human occupation of these areas is established by the recovery of artifacts from Maine's nearshore region (Kelley et al., 2009; Price and Spiess, 2007; Crock et al., 2007). Because the size of these sites are anticipated to be of limited extent, and artifacts are too small to be resolved by any remote sensing techniques, recognition of these sites will be based on identification of landforms with high archaeological potential based on terrestrial site location models (Speiss et al., 1998, Kellogg, 1987), a newly developed marine site location model (Kelley et al., 2010), and detailed survey of areas of proposed bottom disturbance.

Initial survey for submerged cultural resources will require a number of geophysical techniques that will allow for the remote identification of high potential areas. These include multi-beam bathymetry and backscatter intensity data, side-scan sonar, and seismic reflection profiling, all combined with precise position data. Because offshore development requires some of the same information used in submerged cultural resource evaluation, advance planning can allow information for cultural resource assessment and development to be collected simultaneously.

If culturally sensitive areas are identified on the basis of the above techniques, more detailed surveys will be required if the resources are in areas of sea floor disturbance. For shipwrecks, this will entail more detailed mapping of the site, involving high-resolution geophysical techniques (side-scan sonar or multi-beam survey), investigation by remotely operated vehicle (ROV), or evaluation by submersible. Potential prehistoric cultural resources can be investigated in more detail through focused seismic reflection profiling studies, coring, and ROV or direct submersible investigation, if materials are exposed at the sea floor. Intensive studies of submerged cultural resources will be expensive, and developers may choose to avoid areas of potential, rather than carry out costly investigations.

Aesthetic and Sound Concerns

Millions of dollars pour into the state's coastal regions each year as tourists flock to the area to enjoy scenic vistas and natural landscapes. This subsection will briefly discuss how offshore wind development may affect both residents and visitor experiences along the coast in terms of aesthetic and sound impacts.

Aesthetic

While visual impact has played a significant role in some efforts to develop offshore wind in the United States (e.g., Cape Wind), the issue did not emerge as a critical concern during the 2009 efforts to site ocean energy demonstration sites (J. Atkinson, pers. comm.). Atkinson helped the State of Maine to facilitate public outreach during this siting process (see Introduction, above) and noted that reactions of stakeholders on visual impacts included:

- Concerns about "industrialization of a viewshed," particularly in the region around Acadia National Park;
- Questions and concerns about visibility of turbines in terms of marine safety purposes (e.g. commercial shipping and fishing); and
- Comments about turbines being visually pleasing

[N.B., these observations are from the oral comments given at various meetings and during public events that Atkinson planned for the State. Moreover, they do not reflect the content of any written comments the State received or phone conversations that may have taken place between stakeholders and agency personnel prior to or after these meetings.]

Atkinson noted that these reactions were in response to presentations on plans to site and test deepwater, floating wind turbines in state waters, the specifics of which vary significantly from the focus this section places on areas more than ten (10) nmi from shore. In addition, these reactions were based on plans for a limited number of turbines installed for a limited amount of time. Atkinson therefore stressed that the responses to larger, commercial projects sited farther from shore for longer periods of time may vary from those received during the outreach process for the demonstration areas.

While formal public opinion studies on the aesthetic impact of offshore wind in Maine have yet to be completed, the topic was brought up in some stakeholder interviews for this section. A statewide perspective was offered by Vaughn Stinson, Executive Director of the Maine Tourism Association. Stinson's comments do not represent the official stance of the organization, but are some initial thoughts in response to information about the up to 30 MW RFP released by the Maine PUC. He noted that the visibility of an offshore wind farm would not necessarily have an adverse impact on coastal tourism. Rather, public emphasis on the environmental benefits and carbon footprint reductions of a project may help the site become a tourism attraction. Stinson suggested that there are both costs and benefits to renewable energy development and that depending on where an offshore wind farm is sited, the benefits have the potential to outweigh the costs. Stinson had not previously been aware that turbines will be located at least ten (10) nmi from the nearest inhabited land, but gave his comments based on this information.

An example of a local perspective was given by Glenn Burdick, president of Monhegan Associates, a land trust that holds approximately two-thirds of Monhegan Island in conservation. The mission of the Associates is two-fold: (1) to protect the wildlands of Monhegan and its scenic vistas, and (2) to support the island's community. While the organization currently does not have an official stance on offshore wind, it is supportive of responsibly-sited renewable energy. However, Burdick did note that due to the organization's focus on the natural environment of the island and its surroundings, there would be great interest in the proper siting and development process of a large-scale, commercial offshore wind farm. Changes to the viewshed near some of Monhegan's most visited sites, such as the renowned cliffs on the eastern side of the island, may be of particular concern.

In regards to the second part of the organization's mission to support the island community, Burdick suggested that efforts to balance visual impacts by providing tangible benefits to the island community may help some of the organization's membership to accept an offshore wind project sited reasonably nearby. Burdick offered an example of how some form of transfer payments by a wind farm developer might help the municipal power company to finance a small-scale community-owned wind project as a way to lower the extremely high cost of energy on the island (see Island Electric Utilities, below).

Finally, reactions to the visual impact of terrestrial-sited wind power in Maine may help to inform those seeking to understand the potential response to offshore wind development. Reactions to onshore wind for the most part have been mixed, with a small but vocal group of activists contesting the development of wind in more rural, mountainous parts of the State. Information on these views can be found at http://www.windtaskforce.org and http://www.penbay.org. Ron Huber, of Penobscot Bay Watch (http://www.penbay.org), is currently suing the State of Maine relating to the designation of the ocean energy demonstration areas in state waters.

Sound

A minimal amount of concern about the sound impacts of temporary test turbines was raised during the 2009 demonstration area siting process (J. Atkinson, pers. comm.). However, concerns over the sound impacts of land-based wind power have been featured prominently by both Maine-based and national media outlets in recent months. These concerns have ranged from general annoyance to concerns about human health effects to property value impacts. The concerns have been raised in response to large commercial-scale wind projects (e.g., First Wind's project in Mars Hill, Maine) as well as smaller, community-owned projects (e.g. Fox Islands Wind in Vinalhaven, Maine). Due to the relatively high visibility of these issues, the efforts of small but vocal group of anti-wind activists (again, see: http://www.windtaskforce.org and http://www.penbay.org), and the larger scale of commercial offshore wind projects, it is likely that some concerns about sound impacts will be raised in the development of offshore wind in Maine.

As suggested by Section 5.3.6 of this report, developers interested in siting wind farms in the GoM should be prepared to discuss the potential for sound propagation over water to impact residents on land. The results of sound modeling studies will likely be of interest to some stakeholders, but more experiential information such as sound recordings may prove to be more useful in helping them to understand the nature of the potential impact. Stakeholders interested in the well-being of various marine species will also be concerned with the potential for underwater impacts as also discussed in Section 5.3.6 and electromagnetic field effects discussed in Section 5.3.7. Developers should therefore be prepared to detail relevant ecological research and monitoring.

Aesthetic and sound concerns, priorities, and questions

- How far away will the offshore turbines be heard?
- Will sounds reach islands or mainland locations?
- How far away will turbines be visible?
- Will they be visible from island or mainland locations?

Environmental and Conservation Areas of Concern

National and regional environmental NGOs engaged in coastal and marine issues in Maine include National Audubon, The Nature Conservancy (TNC), Conservation Law Foundation (CLF), Environmental Defense Fund (EDF), and the Pew Environment Group. TNC and CLF are actively engaged in Maine fisheries issues and other marine issues. In addition, The Ocean Conservancy, the National Wildlife Federation (NWF), and Oceana are concerned with coastal and marine issues nationally and are engaged in discussions about offshore wind energy along the Atlantic seaboard.

These national environmental organizations tend to be supportive of renewable energy, in general, and of offshore wind development, in particular. Staff members interviewed for this section noted that their organizational support for particular deepwater offshore wind developments would hinge on site selection that avoids, minimizes, and mitigates local environmental impacts and impacts on current users to the greatest extent possible. Marine Spatial Planning (MSP) is an activity of particular interest to some environmental NGOs at this time, including TNC and CLF, which are active participants in the Northeast Regional Ocean Council (NROC), which will be implementing the National Oceans Policy for the GoM region. NROC has stated that siting of renewable energy projects will be one of its primary immediate objectives (http://collaborate.csc.noaa.gov/nroc/default.aspx .)

Environmental and conservation organizations with particular interest in issues of coastal and marine significance in Maine include the Maine Chapter of Audubon, National Resources Council of Maine, Environment Maine, Maine Coast Heritage Trust (MCHT), Friends of Maine Seabird Islands, and The Lobster Conservancy.

At regional and municipal levels, environmental interests are often represented by local land trusts, conservation commissions, soil and water conservation districts, and environmental education organizations. Though many of these groups are more traditionally focused on land issues rather than marine concerns, in coastal communities some are active in both areas. In addition to environmental and conservation organizations, Maine is also home to a number of non-profit organizations and networks with a statewide focus on renewable energy generation. They include the Ocean Energy Institute (OEI), the Maine Wind Industry Initiative (MWII), Maine Renewable Energy Association (MREA), and the Environmental and Energy Technology Council of Maine (E2Tech).

For those groups that work in the field of land conservation – primarily MCHT and local land trusts – the primary concerns will be the ways in which offshore wind intersects with the land and the public. There is an interest in knowing more about transmission lines and grid connections as well as shoreline staging areas. In addition, there is a strong interest in maintaining a very open public process around offshore wind development. There is preference for local efforts over large-scale industry and a sense that development should be structured to provide maximum benefit to "the many," rather than a small few. Environmental concerns voiced by land trusts included apprehension about storing excess energy as ammonia as well as possible interference with whale and bird migrations.

Also of particular relevance for offshore wind conservation considerations, are those species federally- or state-listed as endangered, threatened, or protected that utilize Maine's coastal waters, particularly whales and seabirds. See Section 5.3 for more detail on listed species considerations.

In the case of the North Atlantic right whale, efforts are being made to reduce entanglements including new federal regulations prohibiting lobstermen from using floating rope. These regulations, enacted in April 2009, required wholesale changes in gear for lobstermen and have raised awareness of right whale protection amongst coastal residents and fishermen. See Section 5.3 for more detail on marine mammal considerations.

Of the 4,600 coastal islands in Maine, 294 have been designated by the United States Fish and Wildlife Service (USFWS) as nationally significant seabird nesting islands. (Source: http://www.fws.gov/northeast/gulfofmaine/downloads/fact_sheets/nesting_islands_data.pdf). The Maine Coastal Islands National Wildlife Refuge contains more than 50 of these offshore islands and four coastal parcels, totaling more than 8,100 acres, spanning more than 250 miles of Maine coastline and including five national wildlife refuges – Petit Manan, Cross Island, Franklin Island, Seal Island, and Pond Island. (http://www.fws.gov/northeast/mainecoastal/). See Section 5.3 for more detail on bird and bat considerations.

Mount Desert Island is also of particular concern since it is home to most of Acadia National Park. The park also includes part of Isle au Haut and the Schoodic Peninsula. Acadia is the second most visited national park in the country, and therefore represents an important scenic, cultural and economic resource.

South of and including Casco Bay

Active marine environmental and research groups include Friends of Casco Bay and Gulf of Maine Research Institute (GMRI).

Between Casco Bay and Penobscot Bay

Located in Muscongus Bay, Eastern Egg Rock is designated as the Allan D. Cruickshank Wildlife Sanctuary and is the site of the National Audubon Seabird Restoration Program's Project Puffin, providing important habitat to Atlantic puffins and nearly 4,000 pairs of nesting terns, laughing gulls and eiders. (Source: http://www.projectpuffin.org/EasternEggRock.html)

Of the islands that make up the Maine Coastal Islands National Wildlife Refuge, two (e.g., Franklin Island and Pond Island) are located in the Midcoast. There are also a number of environmental education facilities located in the Midcoast, including Hurricane Island Outward Bound School, Kieve-Wavus, Inc., and the Hog Island Audubon Center. Active marine environmental groups include the Quebec-Labrador Foundation's Marine Program (http://muscongusbay.org/) and the Island Institute (http://www.islandinstitute.org).

Penobscot Bay to Winter Harbor

Of the islands that make up the Maine Coastal Islands National Wildlife Refuge, Seal Island is located in Penobscot Bay. Also of particular significance to seabird nesting is Matinicus Rock. Sears Island, which was purchased by the state in 1997, falls in this area of the coast and is of note for the recent debate around its use between those interested in preserving the island and those who would like to build a cargo port on it. Ron Huber, of Penobscot Bay Watch, who is currently suing the state of Maine over the designation of the offshore wind demonstration sites, has been an active participant in this Sears Island controversy. For more information, see the following websites:
http://www.maine.gov/doc/initiatives/SearsIsland/press/OwnershipDebate.shtml
http://www.maine.gov/doc/initiatives/SearsIsland/DraftConcensusAgreement02012007.pdf

Active marine environmental and research groups in this region of the coast include the Island Institute, Marine Environmental Research Institute and Penobscot East Resource Center.

East of Winter Harbor

Active marine environmental and research groups include the Cobscook Bay Resource Center.

Environmental and conservation concerns, priorities, and questions

- How will offshore deepwater wind siting intersect with ongoing Marine Spatial Planning (MSP) efforts?
- How will we ensure that multiple spatial data collection efforts ongoing in the region inform each other?
- What environmental research is currently being undertaken to understand the impacts of offshore wind energy?
- How will turbine heights intersect with bird migration heights? Do the specific heights used by birds to migrate over land apply over water?
- How exactly will adaptive management work? In the past, for example in LD 1465, the feedback loops have not been specific enough on how new environmental impacts information would be looped back into decision-making; this is a disadvantage for developers and those with environmental concerns?

Table 5-6: Environmental Stakeholders – Environmental/Conservation Contacts

ENVIRONMENTAL / CONSERVATION CONTACTS		
Conservation Law Foundation	Sean Mahoney, VP and Director of CLF Maine	(207) 210-6439 x12 smahoney@clf.org
The Nature Conservancy	Barbara Vickery, Director of Conservation Program of TNC Maine	(207) 729-5181 x210 bvickery@tnc.org

Island Electric Utilities

The GoM is populated with 15 year-round island communities, the electricity needs of which are met in one of three ways: (1) via a submarine cable and island grid owned by one of Maine's investor-owned utilities (either Central Maine Power or Bangor Hydro Electric); (2) via a submarine cable and island grid publicly owned by an island electric cooperative or company; or (3) via on-island generation (primarily diesel) and an island grid publicly owned by a quasi-municipal power district or company. As the financial burden of the latter two options is distributed amongst a very small number of ratepayers (1,020 – 1,800), the islands that fall into these categories currently pay between 24 cents/kWh and 70 cents/kWh for their power, roughly two and one-half to seven times the United States national average.

Island communities in other States (e.g., Block Island, Rhode Island and Nantucket, Massachusetts) have been closely involved in the offshore wind development process through discussions on siting and cable interconnects, as well as scenic and human use impacts. Therefore, several Maine island stakeholders were interviewed in order to identify relevant questions, concerns and interests related to the potential for offshore wind development in their state. Although this section focuses on island leaders working on energy issues, discussion with a broader set of island residents is strongly suggested should there be an interest in a site proximate to a year-round island community.

In general, comments and questions from these island energy leaders focused on the potential to tap into any power produced by offshore projects in the GoM as a strategy to lower the high cost of electricity on islands. Questions reflected the high level of uncertainty as to whether such an option might even exist, and the types of infrastructure or agreements that would need to be put in place for such a concept to become reality. Also of potential interest to developers, these leaders offered first-hand knowledge on owning and maintaining submarine cables in the GoM.

Fox Islands Electric Cooperative, Vinalhaven and North Haven Islands, Maine

Key issues raised: operating and financing submarine cables in Penobscot Bay, available capacity in existing cable

Chip Farrington, General Manager of the Fox Islands Electric Cooperative (FIEC), was one of the island leaders interviewed for this section. FIEC is Maine's largest island electric cooperative, serving 1,800 members on the islands of Vinalhaven and North Haven in Penobscot Bay. Until late 2009, FIEC provided power to its members exclusively via an 11-mile submarine cable that connects to the ISO-NE grid in Rockport, Maine's Glen Cove.

In December 2009, the 4.5-MW Fox Islands Wind project (http://www.foxislandswind.com) entered into commercial operation, generating roughly the same amount of power used by the islands over the course of the year. However, due to intermittency of wind, the submarine cable continues to be used extensively in order to buy or sell power at any given moment. Fox Islands Wind, developed and owned by FIEC with assistance from the non-profit Island Institute, is the largest community-owned wind project on the East Coast of the United States. It has been met with considerable local support, particularly in light of its ability to lower and stabilize electric rates on the Fox Islands. It is considered by many to be Maine's first foray into offshore wind, in spite of its terrestrial location.

While the vast majority of the island communities continue to support the wind project, concerns from a few neighbors over turbine noise have been broadly covered by local and regional media. As a result, and as detailed in the preceding Aesthetics and Sound Concerns section, some coastal residents may express concerns about noise impacts from proposed offshore project in spite of their sizable distance from shore.

Based on FIEC's experience, Farrington expressed concerns about the cost of financing, owning and maintaining submarine cables in the GoM. Prior to 2005, four single-phase cables powered the Fox Islands. According to Farrington, those cables began to wear away as sizeable tidal shifts dragged them over the rocky ocean bottom, causing the lines to fault ten years earlier than their anticipated end of life. Farrington recalled how FIEC struggled to secure funds to replace the cables and bury them in order to reduce the number of future faults. With the help of United States Senator Olympia Snowe's office, the Cooperative secured a multi-million dollar grant in 2005 to help cover the cost of the project that, at the time, was in excess of $6 million. Recognizing how the price of copper and other metals has since increased, Farrington estimated that the per-mile cost of new, buried cables would now be significantly higher.

Due to these costs, Farrington initially expressed doubt that a developer would consider a diversion from its straight path to a mainland interconnect in order to lay a cable "through" a Maine island. However, he suspected (the issue has not been formally discussed by FIEC's board) that the Cooperative would be "very interested" in the prospect of helping to site an on-island substation or leasing unused capacity in its existing submarine cable (10 – 14 MW of capacity are available, according to unofficial estimates). Farrington explained that the FIEC board has previously shown interest in finding advantageous uses for that unused capacity, most recently as they approved a deal with Time Warner Cable (TWC) to lease fiber for that company's high-speed internet service.

Matinicus Plantation Electric Company, Matinicus Island, Maine

Key issues raised: potential impact to fishing community, potential for power off-take to lower local energy costs

The Matinicus Plantation Electric Company (MPE) is a municipal utility that serves approximately 100 ratepayers on Maine's most remote inhabited island. At a distance of 22 miles from the mainland, Matinicus relies on diesel power at a cost of roughly 50 cents/kWh rather than a submarine cable connecting them to the ISO New England grid. MPE sells approximately 300,000 kWh to its customers each year.

Paul Murray, MPE's long-time plant manager, was interviewed for this section. Murray stated that while MPE's Board of Directors does not have an official stance on the potential for offshore wind development, he stressed that the first issue of concern for the Matinicus community would be the potential impact to commercial fishing, particularly in federal waters. The Matinicus economy is almost solely dependent upon the lobster industry, so exclusions and setbacks would likely be the issues of greatest concern to the community, even more so than energy issues. Murray therefore sees the potential development of offshore wind as a community issue and one that developers should discuss directly with island leaders should they have an interest in waters in the area.

In regards to power, Murray felt that there would likely be some interest in the potential for power off-take from an offshore wind project but that the current state of the island grid would likely challenge the ability of the community to do so for the time being. Murray was aware of a designated cable right of way between Matinicus and the mainland but questioned how development of that right of way might impact fishing, as well as, if cabling in the area could be economic due to the rough ocean bottom. Finally, Murray questioned whether a nearby offshore wind project would create any electrical interference with power, microwave phone or internet service on the island.

Monhegan Plantation Power District, Monhegan Island, Maine

Key issue raised: Potential for power off-take to lower local energy costs

The quasi-municipal Monhegan Plantation Power District (MPPD) serves approximately 120 ratepayers on Monhegan Island, located 11 miles from the tip of the St. George Peninsula in Midcoast Maine. Due to the island's distance from the mainland and its relatively small number of customers, the 11-year old centralized utility has, to date, been unable to finance a submarine cable that can provide power from the mainland. Island residents are aware of the fact that a cable right of way had been permitted to provide telephone service to the United States Coast Guard station on nearby Manana Island, but that the Coast Guard's permit has since expired.

Lacking a connection to the mainland grid, Monhegan instead depends on 70 cents/kWh diesel-generated power to meet its load. Feasibility work on a small (100 kW) community-owned wind project began in September 2008 as MPPD and the Island Institute worked to explore options that would lower the high economic and environmental costs of island power. With the December 2009 designation of a demonstration area just a few miles to the southwest of the island, Monhegan residents are now watching the development of offshore wind with great interest, many with hopes that a nearby commercial project might somehow help to lower the high cost of local electricity.

Mathew Thomson, President of the MPPD Board of Trustees, and Chris Smith, Manager of the Monhegan Power Station, were interviewed for this section. Thomson expressed a strong interest in the potential for power off-take from an offshore project if a submarine cable were to be permitted in nearby waters and a power purchase agreement could result in lower electric rates on Monhegan. However, both Thomson and Smith raised several questions about the on-island infrastructure that would be needed to facilitate such a connection. The two expressed doubts that the current Monhegan grid is "shovel ready" in terms of connecting to a cable, but stated an interest in learning how future island grid upgrades might be done in a manner that made a cable interconnect a viable option.

Based on past efforts to site transformers and other electric infrastructure on the island, Smith noted that any discussion of siting new infrastructure to facilitate a cable interconnect (e.g., an electrical substation) might be met with concerns about aesthetics, fire, noise and ability to obtain necessary easements. Thomson and Smith both wondered if the established cable right of way that runs from Monhegan to the St. George Peninsula would be of interest to potential developers, with Smith questioning if the grid in that area would be able to support the output of a 25 MW offshore wind project.

Island electric utility concerns, priorities, and questions

- Is there potential to tap into any power produced by offshore projects in the GoM as a strategy to lower the high cost of electricity on islands?
- What types of infrastructure or agreements would need to be put in place for such a concept to become reality?

5.4.3 Common Priority Questions, Concerns and Attitudes across Key Stakeholder Groups

Turbine sites

- How large an area and where?
- When would build-out to larger number of turbines occur?
- How large would the exclusion areas be for all vessels?
- How large will the exclusion areas be for mobile (trawl) gear?
- Would fixed gear be allowed within the exclusion area for mobile gear?
- What will be the effects of mooring cables, electrical cables, platforms and turbines on fishery resources?
- Concern that the scope of the project not be expanded too much, so that 25 MW turns to 100 to 500 MW, etc at the expense of stakeholders
- Concerns about how species habitat will be affected
- Concern that turbines cannot be built to withstand winter weather and extreme storms.
- Concern with how operations and maintenance will access turbines when the conditions are very rough? How?
- How will turbines be anchored?
- Comments that the turbines should be placed on Jeffreys Ledge Multispecies Habitat Closure where it is closed to fishing already (western GoM).
- Comments that the turbines should be placed on Jeffreys Bank Multispecies Habitat Closure where it is closed to fishing already (north-central GoM, south of Matinicus Island).

Staging areas in rivers or bays and tow routes between staging areas and turbine site

- Questions about where they will be staging from on the main land
- How large an area will be closed to fishing during staging and towing? Where?
- How long will the areas be used?
- During which seasons?
- Number of vessels involved in staging and towing? (concern that lobster fishing gear will be caught and destroyed by large vessels inshore)
- Comments that there should be one common route back and forth to the turbines for operations and maintenance to minimize disturbance to fishing gear.

Cables

- Questions about how habitat will respond to electricity being emitted from cables
- Concern with respect to cables and EMF emissions. High priority on requiring the highest level of shielding in the cables and burial of cables to make sure to minimize any impacts of EMF on living resources.
- What kind of magnetic field is emitted from the cables that are carrying the electricity and what kind of effect does it have on habitat on the bottom?

Cost to the public

- Why should the public pay for the development of this technology? And will we see benefits in Maine or are we giving up our territory for wind projects that send power to Massachusetts?
- Will this make electricity less expensive in the short term or even in the long term?
- What efforts will be made to mitigate financial harm borne by communities near development sites?
- How open and publically accessible will the development process be?