

The resulting analysis was performed by the consensus of active participants during the public OETF subcommittee #1 meeting held on March 17, 2009, on information from the University of Maine Offshore Wind Energy Geographic Information System (OWEGIS). The outcome provides one approach to classify complex overlapping multi-faceted data in a consistent fashion and does not reflect any position within or external to the University. For another approach to the same complex overlapping multi-faceted data, please see “The Creation of a Multidisciplinary, Criteria-Oriented Review and Selection Process for Deepwater Wind Test Facilities in Maine State Waters” developed by the State Planning Office.

OWEGIS was created with the intent to collect, analyze, and display graphical information to assist in planning, permitting, and the development of offshore wind energy in the Gulf of Maine. The following pages provide a brief description of the data collected and integrated into the Gulf of Maine OWEGIS to date. Additionally, it identifies data in various stages of acquisition and integration, as well as supplemental information necessary to improve OWEGIS. ***Note that this information reflects the current state of knowledge and should not be considered the final authority on continuously evolving data, data sources, or on-going scientific studies.**

Gulf of Maine Offshore Wind Energy Development Initiative



*Topic: Updated Content of the Gulf of Maine Offshore Wind Energy Geographic Information System (OWEGIS) – DRAFT**

Date: April 22, 2009

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The Offshore Wind Energy Geographic Information System (*OWEGIS*) was created with the intent to collect, analyze, and display graphical information to assist in planning, permitting, and the development of offshore wind energy in the Gulf of Maine. This document provides a brief description of the data collected and integrated into the Gulf of Maine *OWEGIS* to date. Additionally, it identifies data in various stages of acquisition and integration, as well as supplemental information necessary to improve *OWEGIS*. ***N.B. This information reflects current state of knowledge and should not be considered the final authority on continuously evolving data, data sources, or on-going scientific studies.**

A. Rating Criteria for Offshore Wind Turbine Site Locations Minimizing Conflict – Weights by Filter Order & Geometry Type

Weights by Filter Order - Arabic Numerals: 1 – 3 respectively for first order filtering to third order filtering for siting considerations

1 – first order resource assessment filtering for siting considerations (e.g., physical criteria – winds, water depth, infrastructure, marine hazards)

2 – second order resource assessment filtering for siting considerations (e.g., additional physical criteria – land use, public planning information)

3 – third order resource assessment filtering for siting considerations (e.g., site specific conditions – local and regional feature assessment)

Weights by Geometry Type - Upper Case Letters: A – C for go/no go conditions, range conditions, site specific conditions

A – Go/No go conditions for siting (e.g., shipping channels or unexploded ordinances)

B – Range conditions (e.g., bathymetry, wind power class – technology dependent, etc.)

C – Site specific conditions (e.g., endangered/threatened/depleted species, shellfish industry, etc.)

Assessment Criteria for Offshore Wind Turbine Regions of Interest were divided into four general categories with “telescoping” as follows:

Resource Availability – Physical Characteristics (Level 1)

Human Activity Constraints – Coastal Economic & Extractive Resource Uses (Level 2)

Human Activity Constraints – Cultural & Aesthetic Features (Level 2)

Human Activity Constraints – Environmental Impacts & Wildlife (Level 2)

Industrial Needs – Infrastructure & Commercial Uses (Level 3)

Legal & Permitting Boundaries (Level 4)

Coastal economic & extractive resource uses, environmental impacts & wildlife, and cultural & aesthetic features are treated equal. *OWEGIS* layers were developed in reference to MMS’ Proposed Rule 30 CFR Parts 250, 285, & 290 & the Multipurpose Marine Cadastre OCS Mapping Initiative.

B. OWEGIS Current Content

Items in gray indicate data in acquisition/integration and/or data sources that can only be viewed for proprietary reasons and/or have limited data sharing agreements. Items marked by * indicate data are multi-dimensional and are listed under more than one category.

PHYSICAL CHARACTERISTICS

1 Gulf of Maine Wind Resource

- **1 B** Analysis/interpretation of comprehensive wind data collected from the Gulf of Maine buoy network by Dr. Susan A. Elston, including wind speeds and classes for elevations of 50 m and 100 m above mean sea level.
 - January 2009 analysis includes 11 data stations within 3 nautical miles and 13 stations within 6 nautical miles of the coast, with a total of 40 data stations within U.S. and International Atlantic Ocean waters.
 - An additional 16 verifiable sites will be included for subsequent analyses of the wind resource.
- **1 B** U.S. DOE National Renewable Energy Laboratory (NREL)/AWS Truewind Gulf of Maine wind resource at 50 & 100m.
- **1 B** LANDSAT satellite imagery for the Gulf of Maine from USGS Global Viewer (to be incorporated)
- **2 B/C** Scatterometer winds providing spatial fields of wind vectors over the entire Gulf of Maine (consideration by Andy Thomas)
- **3 C** Historical Atlantic hurricane tracks*

2 Bathymetry and Topography

- **1 B** Selected contour intervals – 20 fathoms (40 meters), 30 fathoms (60 meters), 50 fathoms (90 meters), 100 fathoms (180 meters), 200 fathoms (400 meters) – designating regions of bathymetric change*
- **1 C** Continental shelf survey (ICS) bottom photographs (older data – low resolution data)
- **1 C** Integrated continental shelf surveys (ICS) surveys
- **1 C** Seismic fault lines in the coastal zone and uplands*
- **2 B** Geologic depth profiles of marine soils, bedrock, and gas deposits at discrete locations from Maine Geological Society survey tracks: locations shown in *OWEGIS*, with actual profiles available from UMaine Marine Geologists Joseph Kelley and Daniel Belknap.
- **2 B** Gulf of Maine bathymetry (ocean depths)
- **2 B** Maine 20 m topography (for assistance in characterizing on-shore wind resource)
- **2 B/C** Coastal Navigation Charts (Resolution: 1:24,000 for Greater Portland; Bar Harbor; Casco Bay; 1:80,000 – 1:120,000 elsewhere in the Gulf of Maine Region)
- **2 C** Surficial soils (low resolution data)
- **3 A** Inter-continental shelf (ICS) surficial soils and methane gas locations from the Maine Geological Survey (data in acquisition)
- **3 C** Inter-continental shelf bathymetric survey tracks and bathymetry from Maine Geological Survey

INFRASTRUCTURE & COMMERCIAL USES

3 Transportation Infrastructure

- 1 C Maine airports (*Maine airports showing a 5 nautical mile radius buffer zone around them*)
- 1 C Coastal airports (*Coastal Maine airports within 10 nautical miles of the coastline showing a 5 nautical mile radius buffer zone*)
- 1 C Heliports and Med-Flight/Life-Flight landing locations (data in acquisition)
- 1 C Air tours in Coastal Maine (Trenton, MDI/Acadia region)
- 1 C Alternative Fuel Stations (data in acquisition)*
- 1 C Navigable waterways (data in acquisition)*
- 1 C Army Corps of Engineers Ports (data in acquisition)*
- 2 C National Railway Network (data in acquisition)*
- 2 C Ferry routes
- 2 C Rail lines*

4 Utility and Development Infrastructure

- 1 C Electrical infrastructure (*power plants, substations, 115 kV and 345 kV transmission lines*) – current infrastructure
- 1 C Electrical infrastructure (power plants, substations, 115 kV and 345 kV transmission lines) – current infrastructure (proprietary)
- 1 C Electrical infrastructure (power plants, substations, 115 kV and 345 kV transmission lines) – approved plans (data requested)
- 1 C Electrical infrastructure (power plants, substations, 115 kV and 345 kV transmission lines) – submitted plans (data requested)
- 1 C Pipeline and cable infrastructure (data requested from management body)
- 1 C Military Bases and Installations (data in acquisition)
- 1 C Navigable waterways (data in acquisition)*
- 1 C Army Corps of Engineers Ports (data in acquisition)*
- 2 C National Railway Network (data in acquisition)*
- 2 C Rail lines*
- 2 C Hospitals

5 Coastal Restrictions & Marine Hazards

- 1 A Dragging prohibited zones
- 1 A Dumping and spoil grounds, explosives dumping grounds, areas of unexploded ordinance(s).
- 1 A Military zones
- 1 A Right whale restrictions (critical habitat, foaling grounds, recommended avoidance routes)
- 1 A Shipping lanes (harbor approach, traffic separation)
- 1 C Seismic fault lines in the coastal zone and uplands*
- 2 C Obstructions (movable physical hazards, buoys, etc.)

- **2 B** Lobster and fish trap area* - general regions classified by NOAA Coast Survey – distinct data from local and regional information
- **2 B** Coastal shellfish collection regions* - general regions classified by Maine – distinct data from local and regional information
- **2 B** Worm crop harvest regions* - general regions classified suitable for harvesting – distinct data from local and regional information
- **3 C** Historical Atlantic hurricane tracks*

CULTURAL & AESTHETIC FEATURES

6 Native Lands and Cultural/Historical Features (including Landscapes & Seascapes)

- **1 A** National Park Service Data* (to be incorporated)
- **1 A** State Park Data* (verify have most up-to-date version)
- **1 C** Maine Coastal Island Registry*
- **1 C** Fishing charter vessel and operations locations
- **1 C** Maine portion of the Appalachian Trail
- **1 C** Maine special protection rivers, Maine’s Finest Lakes, Wildlands Lakes
- **1 C** Maine Wind Jammer Association estimated use range (SPO)
- **1 C** National Historic Register Sites (SPO)
- **1 C** Native lands
- **1 C** Whale watching charter vessel locations
- **2 C** Sunken vessels, ship wrecks, light houses, and sea archeology sites

ENVIRONMENTAL IMPACTS & WILDLIFE

7 Habitat and Wildlife (Terrestrial, Coastal, and Marine)

- **1 A/C** Marine sanctuaries*
- **1 B** Selected contour intervals – 20 fathoms (40 meters), 30 fathoms (60 meters), 50 fathoms (90 meters), 100 fathoms (180 meters), 200 fathoms (400 meters) – designating regions of bathymetric change*
- **1 B** Bats – some digitally available migration route and tracking survey routes
- **1 B** Breeding bird – locations/routes where surveys were conducted
- **1 B** Environmental Vulnerability Index Maps (Maine Oil Spill Hazard Mitigation Maps)*
- **1 B** Migratory marine mammals – sightings of threatened, endangered, and depleted species (dolphins: bottlenose, spinner; turtles: green, leatherback, loggerhead; whales: fin back, humpback, minke, sei, and northern right)
- **1 C** Anadromous fish year-class counts of salmon per location
- **1 C** Essential Aquatic Habitats (eelgrass, freshwater wetlands)
- **1 C** Essential avian habitats (bald eagle nests; coastal seabird nesting; piping plover, least tern, roseate tern areas; inland waterfowl and wading bird areas)
- **1 B** Maine and New Hampshire National Marine Fisheries Service Trawl Data
- **2 B** National Marine Fisheries Service Trawl Data

- **2 B** Northeast Resources
 - **2 B** Essential fish habitat – as per the Code of Federal Regulations (50CFR 648.81)
 - **2 B** New England Multispecies closures (year-round and seasonal closures for scallops and other species)
 - **2 B** Gulf of Maine Dynamic Area Management Zones (DAMS) for Right Whales (yearly, seasonal, and real time closures)
 - **2 B** Regulated mesh area (regulated fishing zones)

COASTAL ECONOMIC & EXTRACTIVE RESOURCE USES

8 Coastal Economic Regions (Marine and Terrestrial)

- **1 B** Selected contour intervals – 20 fathoms (40 meters), 30 fathoms (60 meters), 50 fathoms (90 meters), 100 fathoms (180 meters), 200 fathoms (400 meters) – designating regions of bathymetric change*
- **1 B** Environmental Vulnerability Index Maps (Maine Oil Spill Hazard Mitigation Maps)*
- **1 B** Local and regional Lobster and fish trap areas* (data in acquisition)
- **1 B** Local and regional Coastal shellfish collection regions* (data in acquisition)
- **1 B** Local and regional Worm crop harvest regions* (data in acquisition)
- **2 B** Lobster and fish trap area* - general regions classified by NOAA Coast Survey – distinct data from local and regional information
- **2 B** Coastal shellfish collection regions* - general regions classified by Maine – distinct data from local and regional information
- **2 B** Worm crop harvest regions* - general regions classified suitable for harvesting – distinct data from local and regional information

LEGAL & PERMITTING BOUNDARIES

9 Boundaries/Municipalities/Population

- **1 A** National Park Service Data*
- **1 A** State Park Data*
- **1 C** Maine Coastal Island Registry*
- **1 A/C** Marine sanctuaries*
- **1 B** Selected contour intervals – 20 fathoms (40 meters), 30 fathoms (60 meters), 50 fathoms (90 meters), 100 fathoms (180 meters), 200 fathoms (400 meters) – designating regions of bathymetric change*
- **1 C** Coastal state and federal marine boundaries
(*private, state, federal “8(g)” revenue-sharing, territorial sea, contiguous zone, economic exclusive zone*)
- **1 C** Outer Continental Shelf (OCS) Lease Blocks (data acquired, to be incorporated)
- **1 C** State easements and right of way access (roads, transmission lines, pipelines, rail)
- **1 C** State, New England States, and International boundaries
- **2 C** Tax parcels (i.e., LURC vs. non-LURC divisions)
- **3 C** 2000 Maine State Census Data
- **3 C** Maine towns

C. Areas of *OWEGIS* Needing Further Development or Data Integration

- Supplemental migration routes and tracking survey data (digital GIS, tabulated, or proxy) for the following:
 - **ECON 1 B** Ground fish and fisheries resource zone information
 - **ENVR 1 B** Protected mammals (right whales, etc.) and/or delisted species
 - **ENVR 1 B** Updates to salmon essential habitat, newly designated closure areas for Atlantic Salmon fishing rights
 - **ENVR 1 B** Birds and Bats (tracking methods: radar, satellite, or radio-tagged)
- **CLTR 1 C** Additional Native population information regarding cultural/historical resources and wind power development
- **CLTR 2 C** Onshore historical or archeological sites (for permitting), recreational trails, additional recreational resources
- **ENVR 1 C** Areas of Special Significance
- **ENVR 1 B** Maine Seaweed and Kelp Harvesting Areas
- **ENVR 2 B** Land use change information – changes in land use with time over the last 20 and 50 years for development purposes
- **INFR 1 C** Additional power infrastructure information
- **INFR 1 C** Med-flight information and coastal hospitals with helicopter landing facilities
- **LEGL 1 A** Comprehensive Maine State permitting agencies and requirements for offshore energy development
- **LEGL 2 C** All relevant public and marine policy, management, and planning information
- Potential Additional Sources of New Information
 - **CLTR 2 C** Maine Island Trails Association
 - **ECON 1 C** Cobscook Bay Resource Center
 - **ECON 1 C** Penobscot East Resource Center
 - **ECON 1 B** Island Institute
 - **ENVR 1 C** University of Southern Maine Census on Marine Life
 - **ENVR 2 B** Northwest Atlantic Marine Alliance

D. Bibliography of digital information collected and integrated into *OWEGIS*

- Automated Wreck and Obstruction Information System (AWOIS)
- Bangor Hydro (BHE)
- Maine Department of Environmental Protection (ME-DEP)
- Environment Canada (envCanada)
- Federal Emergency Management Agency (FEMA)
- Federal Geographic Data Committee (FGDC)
- Island Institute
- Maine Department of Conservation (DoC)
- Maine Department of Marine Resources (DMR)
- Maine Office of GIS (MEgis)

- Maine Geological Survey (MEGS)
- Maine Land Use Regulation Commission (LURC)
- Massachusetts Office of GIS (MAgis)
- Minerals Management Service (MMS)
- National Atlas
- National Data Buoy Center (NDBC)
- National Geophysical Data Center (NGDC)
- National Oceanographic and Atmospheric Administration (NOAA)
- National Renewable Energy Laboratory (NREL)/AWS Truewind
- National Weather Service (NWS)
- National Marine Fisheries Service (NMFS)
- Northeast Multi-Species Information Sheet: Closed Area Regulations (<http://www.nero.noaa.gov/whaletrp>)
- Northeast Protected Resources (Division of NOAA)
- Office of Coast Survey (OCS) (Division of NOAA)
- Coastal Service Center (CSC) (Division of NOAA)
- Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP)
A clearinghouse of proprietary “spatially, temporally interactive online archives for marine mammals, sea turtles and seabirds” comprised of data collected from worldwide resources and hosted by Duke University (<http://seamap.env.duke.edu/>)
- Patuxent Wildlife Research Center (<http://www.mbr-pwrc.usgs.gov/bbs/>)
- Maine State Planning Office (ME-SPO)
- The Nature Conservancy (TNC)
- United States Code of Federal Regulations (CFR)
- United States Geological Survey (USGS)
- United States Minerals Management Service (MMS)
- University of Maine Department of Marine Sciences
 - Physical Oceanography Group (PhOG) - Gulf of Maine Oceanographic Observation System (GoMOOS) Buoy Program
 - Marine Geology Work Group – Drs. Joseph Kelley and Daniel Belknap