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An approach for analyzing the spatial welfare and distributional effects of ocean wind power siting: The Rhode Island/Massachusetts area of mutual interest

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ABSTRACT

Coastal and marine spatial planning (CMSP) involves characterizing the potential socioeconomic consequences of locating one or more human uses in place of others in the coastal ocean. Most commonly, the focus of CMSP is on the siting of alternative uses across ocean space. This article examines the broader economic and distributional effects of the potential siting of a renewable energy facility (wind power) in a southern New England offshore area that also is used intensively for commercial fishing. For a leading siting alternative, a counterfactual involving the complete displacement of commercial fishing would result in estimated direct output impacts to the regional economy of $5 million, leading to $11 million in direct, indirect, and induced impacts and a corresponding loss of about 150 jobs. Total economic welfare losses were estimated at $14 million, reflecting not only output reductions but also the effects of price increases in the relevant markets. The welfare losses would be progressively distributed, such that households in mid- to high-income categories would likely bear the most significant impacts. Adjusting these welfare losses for society's aversion to income inequality, inequality-adjusted impacts would be more pronounced in areas that are not necessarily located in close proximity to the coastline. Individual low-income households located in five non-coastal census tracts would bear estimated median impacts (≥ $140/year), which would be an order of magnitude larger than those borne by the next group of impacted households. When implementing CMSP, it is critically important to characterize not only the distribution of effects over the coastal ocean but also the distribution of impacts on coupled human communities onshore, including those communities that may not be considered strictly coastal.

1. Introduction

Coastal and marine spatial planning (CMSP) is concerned with characterizing the potential socio-economic consequences of locating one or more human uses (or non-uses) in place of others in the coastal ocean [1,2]. Several approaches to assessing such tradeoffs have been proposed in the literature [3–6], and they have been implemented to varying degrees in the field [7,8]. These approaches focus almost exclusively on evaluating the impacts to specific coastal zone or ocean users or stakeholders. Often, sophisticated mapping technologies are employed to depict alternative spatial distributions of human activities in the coastal ocean [9–12]. Notwithstanding the implementation of these partial equilibrium approaches, rarely are the linkages between the broader human communities and ocean ecosystems identified and made clear.

Ecosystem-based management (EBM) requires a closer examination of these broader linkages [13]. As a tool for exploring the implications for EBM of alternative spatial arrangements of human activities in the coastal ocean, CMSP should incorporate the full extent of effects on human communities [14,15]. Thus, it is important to depict not only the spatial effects of alternative plans for human uses of the ocean but also those in the coupled onshore human communities.

This article develops a framework to examine the broader potential economic and distributional effects of the siting of a renewable energy facility (ocean wind) in a southern New England area that has been used intensively for commercial fishing (Fig. 1). It is shown how the potential displacement of commercial fishing could affect the fishing industry directly, and the consequent regional multiplier effects on economic impacts, value added, local tax revenues, and employment are estimated. Further, the article

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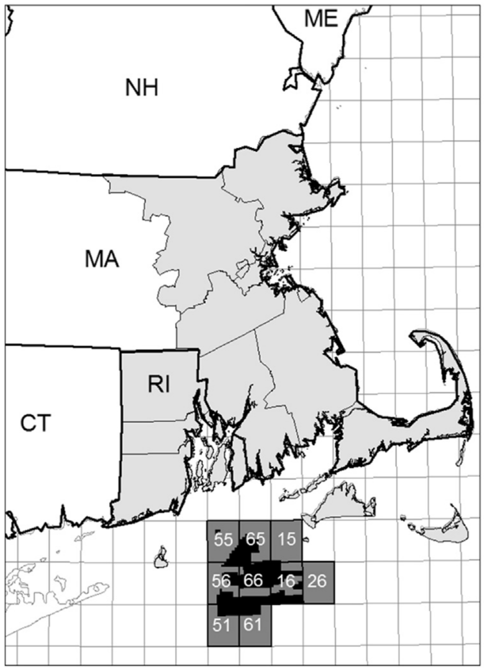

Fig. 1. Coastal New England states showing coastal counties in RI and MA (light gray), Area of Mutual Interest (AMI) (black), and 10′ squares containing the AMI (dark gray).

focuses on understanding changes at a high resolution (at the level of US census tracts) of a measure of lost economic welfare from the displaced fisheries. Finally, it examines the potential effects of aversion to inequality, as reflected in a non-constant marginal utility of income, over the spatial distribution of welfare effects across census tracts in coastal Rhode Island and Massachusetts.

2. Methods

2.1. Study region

On 26 July 2010, a memorandum of understanding (MOU) was signed between the governors of Rhode Island and Massachusetts, proposing an area of mutual interest (AMI) for offshore renewable energy development located about 35 km south of the Rhode Island coastline. The AMI would concentrate offshore renewable energy development in federal waters off the coasts of both states. The MOU occurred because of the momentum generated by ocean planning efforts in both states, namely both the Rhode Island Ocean Special Area Management Plan (Ocean SAMP) and the Massachusetts Ocean Management Plan [9,12]. The MOU ensured that renewable energy development in the AMI would receive prior approval by each state's governor, and that any economic benefits (if they materialized) would be shared fairly and equitably between the two states.

In February 2012, an area within the AMI was designated by the Bureau of Ocean and Energy Management (BOEM), an agency of the US Department of the Interior, as an official “wind energy area” (WEA) that would be subject to leasing for renewable energy development. The geographic area of the WEA is 667 km^2, divided into two subareas, known as the North Lease Area (395 km^2) and the South Lease Area (272 km^2). The WEA is smaller in spatial extent than the AMI as originally proposed, because it excluded some waters that had been deemed by BOEM (through its public comment process) as areas that were especially important for commercial fishing. By 3 July 2012, BOEM had made available for public comment a draft Environmental Assessment (Draft EA), providing six alternatives involving the leasing of outer Continental Shelf (OCS) lands to private firms for the development of offshore wind energy facilities. The alternatives comprised:

(A) Lease the entire WEA;
(B) Exclude areas comprising migration routes for the North Atlantic right whale (*Eubalaena glacialis*), an endangered marine mammal;
(C) Exclude all areas ≤ 28 km from the coast;
(D) Exclude all areas ≤ 39 km from the coast;
(E) Exclude an area for the present and future laying of telecommunication cables; and
(F) No action and, therefore, no leasing.

The following year, on 4 June 2013, BOEM announced that an auction for renewable energy leases in the WEA was planned, and the agency released a list of eligible bidders, including Deepwater Wind New England LLC, EDF Renewable Development Inc, Energy Management Inc., Fishermen's Energy LLC, Iberdrola Renewables Inc., Neptune Wind LLC, Sea Breeze Energy LLC, US Mainstream Renewable Power (Offshore) Inc., and US Wind Inc. As the first competitive lease sale for a renewable energy project on the OCS, the auction took place in two phases on 29 and 31 July, and, on 30 August, after an antitrust review by the US Department of Justice, BOEM announced that Deepwater Wind New England LLC had won the leases for both the North and South Lease Areas.

2.2. Direct impacts to commercial fisheries.

In order to implement an approach for characterizing the tradeoffs involved in the siting of an offshore wind facility in the WEA, a counterfactual is assessed involving the loss of commercial fish harvests and landings. Specifically, potential changes in (reductions of) revenues to commercial fishing using historical fisheries data from the study area are estimated. The spatial resolution of the data was at the 10-minute-square (TMS) level. Specifically, the average annual revenues of fish landings were calculated for TMS statistical areas located off the coasts of Rhode Island and Massachusetts using US National Marine Fisheries Service (NMFS) data from 1999 to 2008. Fishing revenues were assumed to be uniformly distributed over each TMS. While data do exist to describe the non-uniform distribution of commercial fishing within a TMS, such data are not widely available, due to confidentiality considerations, and they are unlikely to lead to qualitatively different results [11].

The study area is proximate in location to two major fishing ports in New England: Point Judith in Rhode Island and New Bedford in Massachusetts. Vessels fishing in the AMI lease areas typically are taking day trips from these two ports and other smaller local ports in Rhode Island and Massachusetts. Primary species caught include lobster (*Homarus americanus*), monkfish (*Lophius americanus*), sea scallop (*Placopecten magellanicus*), various skates (*Leucoraja spp*., *Raja eglanteria*), blackback (*Pseudopleuronectes americanus*), fluke (*Paralichthys dentatus*), yellowtail (*Pleuronectes ferruginea*), whiting (*Merluccius bilinearis*), herring (*Clupea harengus*), and scup (*Stenotomus chrysops*) (Table 1). Both mobile (*e.g.*, trawl and dredge) and fixed (*e.g.*, pots and gillnet) gears are used in fishing operations (Table 1). The fixed gears are fished using trawls (a series of lobster pots attached to one line) with typical string lengths of 0.4–0.8 km or gillnets with typical string lengths of 0.2–3.0 km. The deployment of both mobile and fixed gears arguably could be affected by the construction of permanent structures for an offshore renewable energy facility, and the BOEM has begun to focus on characterizing best management practices for handling these possible conflicting uses, including identifying feasible technical mitigation and assessing means of financial compensation to fishermen who may be forced to modify their gears or fishing practices [16].