Winds of Change - Predicting Water-Based Recreationists' Support and Opposition for Offshore Wind Energy Development in the Great Lakes

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Abstract

This study examined the factors influencing water-based recreationists' perceptions of support and opposition towards off-shore wind energy development (OWD) on Lake Erie. Much of the proposed or future Lake Erie OWD infrastructure may either be within or adjacent to public lands, waters, and protected areas, raising concerns about the potential environmental and social impacts upon recreation stakeholders. The limited body of OWD research within the United States has suggested there are numerous factors that may influence overall perceptions of support and opposition such as political orientation and beliefs in climate change. Moreover, recent research has proposed that the perceived recreation impact of OWD may be the most important predictor of support and opposition. This study confirmed this premise and found the perceived recreation impact of OWD to be the strongest predictor of support. Results of a multiple linear regression suggested that political orientation (β=.135), beliefs in the anthropogenic causation of climate change (β=.207), beliefs in the occurrence of climate change (β=.213), and the perceived recreation impact of OWD among water-based recreationists (β=.439) were significant predictors of support for OWD on Lake Erie (R^2=.46). Study findings corroborated previous research which suggested that regional climate change beliefs and political attitudes may influence support for OWD. From a policy and management standpoint, study results highlight the importance of assessing and communicating recreation experience and use impacts when planning, developing, and managing OWD and related decisions in the United States.

Keywords: Offshore Wind; Energy Development; Water-based Recreation; Outdoor Recreation

Introduction

As the demand for renewable energy production in the United States continues to increase, wind energy remains one of the most viable domestic options (Jacobson et al., 2015). While numerous land-based wind energy development sites in the United States are currently in operation, offshore wind energy development (OWD) has been slow to develop in the United States for various social, ecological, and political reasons. Due to recent capital investments, however, Lake Erie is now positioned to receive North America's first freshwater OWD project; with the Great Lakes as a whole poised for significant OWD infrastructure given substantial wind resources proximate to large population centers (Ashtine et al., 2016). Much of the OWD infrastructure in the Great Lakes or elsewhere may be within or adjacent to public lands, waters, and protected areas, raising concerns about the potential environmental and social impacts on recreation stakeholders in these areas.

Previous research has suggested, but not tested, the relationship between perceptions of recreation impacts and perceived support and opposition for OWD. This study examined the factors influencing water-based recreationists' perceptions of support and opposition towards OWD on Lake Erie. Water-based recreationists are critical and novel stakeholders who have the potential to be impacted by the development of OWD on both Lake Erie and around the world. In this study, respondents reported significantly more support ($M = 5.95$) for OWD on Lake Erie than opposition ($M = 2.71$). For this reason, this study focused on predicting support rather than opposition towards OWD. The literature has suggested that various perceptions of impact may strongly influence the support of OWD, but to date, no studies have assessed this phenomenon among a water-based recreation population. This research examined the influence of beliefs in the occurrence and anthropogenic causation of climate change, political orientation, and perceived recreation impact from OWD in predicting support for OWD.

Wind Energy Development

While non-renewable fossil fuels have often been a source of political controversy, recent literature has suggested support across the political spectrum for the expansion of renewable energy resources (Sheikh et al., 2016). Further, bi-partisan support has been particularly strong for wind energy resources (BaBinet et al., 2009; Engels et al., 2013; Sheikh et al., 2016). Due to the less frequent occurrence and implementation of wind energy within the United States, as compared to many European nations, research on public opinions has been limited in the United States. However, Rand and Hoen's (2017) comprehensive review of literature from the past three decades has suggested consistently high support for wind energy development in the United States.

Some studies have suggested that public support may be contingent upon beliefs in the intent of the proposed project as well as the transparency of the stakeholder process (Devine-Wright & Howes, 2010; Devine-Wright, 2011). Research has also found that individuals within close proximity to wind development sites often support wind energy development (Hoen et al., 2018). Multiple factors have been demonstrated to significantly influence support such as the characteristics of the individual project, sensory impacts (e.g., visual and auditory), perceptions of the planning process, and demographic characteristics (Hoen et al., 2018).

Offshore Wind Energy Development

As worldwide wind energy development has become more common, the discussion surrounding OWD has increased substantially. While many European nations have embraced

OWD, offshore wind installations have traditionally received stark opposition in the United States for various social, ecological, and political reasons (Bidwell, 2017; Engels et al., 2013; Klick & Smith, 2010). Research has demonstrated that perceptions of wind energy development (both onshore and offshore) often vary markedly between North American and European populations. In the United Kingdom for instance, OWD has received significant support as opposed to onshore wind development (Haggett, 2011); while in the United States, onshore wind installations has often received higher levels of support as opposed to OWD (Rand & Hoen, 2017). Overall, perceptions of wind energy development has been shown to vary distinctly within both continents based on numerous influencing factors such as governmental support and/or opposition, political ideology, the availability of alternative energy sources, project siting, and the scale of development (Firestone at al., 2018; Haggett, 2011; Devine-Wright, 2011, Rand & Hoen, 2017). Thus, findings from both European and United States studies has both complemented and contrasted one another.

Recently, Americans' opinions and attitudes towards OWD have begun to shift towards acceptance and support (Hoen et al., 2018). In December 2016, America's first commercial grade OWD installment went online off the coast of Rhode Island (Deepwater Wind, 2017; Firestone et al., 2018). While public perceptions of OWD in the United States have often depended upon general attitudes and opinions towards specific projects, research has suggested a more complex relationship may exist between attitudes, opinions, and support and/or opposition for OWD (Bidwell, 2015; Devine-Wright, 2011; Grott & Bailey, 2016; Firestone et al., 2018). Studies have also suggested that community stakeholders' perceived place attributes, as well as the values they assign to individual settings, may influence support and opposition for OWD depending on the perceived "fit" of the proposed project within the landscape or community (Brownlee et al., 2015; Devine-Wright, 2011; Firestone et al., 2018).

European Perceptions of OWD

Limited research has assessed the social perceptions and impacts of OWD. Due to higher levels of OWD and project siting, the majority of this research has been conducted in Europe, where studies have suggested the importance of community stakeholder perceptions within the OWD process (Devine-Wright & Howes, 2011; Haggett, 2010; Langer, Decker, Roosen, & Menrad, 2016; Rudolph, Haggett, & Aitken, 2018). The European literature has often found that factors such as aesthetic impacts, lack of tangible benefits, place attachment, and lack of "fit" between the proposed development and the community may influence the support and opposition for OWD (Devine-Wright & Howes, 2010; Haggett, 2010; Wolsink, 2005). The majority of these studies have concluded that impacts to the landscape, particularly aesthetic and visual impacts, are often of paramount concern (Devine-Wright & Howes, 2010; Haggett, 2010; Wolsink, 2005).

Many of these European studies have secondarily mentioned the impacts of OWD upon recreationists as an afterthought. For instance, Devine-Wright and Howes (2010) found that the symbolic meanings of a place, such as its reputation as a picturesque tourist destination, influenced community perceptions of OWD. Both Devine-Wright and Howes (2011) and Sorensen et al. (2003) proposed that community stakeholders may perceive OWD to negatively impact tourism. Further, Rudolph et al. (2018) and Haggett (2010) suggested potential negative impacts of OWD upon water-based recreation activities. However, none of this research has assessed the impacts of OWD specifically upon an outdoor recreation population.

Political Orientation and Beliefs about Climate Change

The debate over the use of fossil fuels has recently intensified within the United States. While non-renewable energy resources including coal, oil, and natural gas remain widely used, opinions regarding their development have become politically polarized (Sheikh et al., 2016). Research has demonstrated that individuals with conservative orientations are more likely to support the development of non-renewable resources, while individuals with liberal orientations are more likely to support renewable energy resource development (Bechberger & Reiche, 2004; Sheikh et al., 2016; West et al., 2010). Unlike other forms of renewable energy, wind energy typically receives support across the political spectrum in the United States (Rand & Hoen, 2017).

These politically charged differences in energy preferences likely stem from the relationship between political orientation and beliefs about climate change (Poortinga et al., 2011; Unsworth & Fielding, 2014; Engles et al., 2013). Research has shown that this relationship transcends nations and is not merely associated with a nation's political parties, but rather with general left- and right-wing political ideologies (Bidwell, 2015; Poortinga et al., 2011; Unsworth & Fielding, 2014). Studies have shown that the distinction of one's political beliefs, especially when aligned with more conservative attitudes, can be related to opposition to climate change policies, which often include the development of renewable energy resources (Unsworth & Fielding, 2014). Further, research has suggested that those with more prominent, conservative political identities are often more likely to question the occurrence of climate change and less likely to recognize its anthropogenic causation (Poortinga et al., 2011; Unsworth & Fielding, 2014). As Engles et al. (2013) suggested, those who are more skeptical of the occurrence of climate change or its anthropogenic causation are less likely to display strong support for renewable energy development.

As for OWD in the United States, Bidwell's (2015) study of the Block Island Wind Farm in Rhode Island suggested that liberal political beliefs were a predictor of concern for climate change, which in turn was related to support for OWD (Bidwell, 2015). Further, research in Nantucket Sound and Delaware Bay demonstrated that while concern for climate change is positively related to support for OWD, it may not be the primary driver of support (Firestone et al., 2009). In general, studies of OWD within the United States have suggested that aesthetic values, potential location of facilities, and region-specific attitudes are often strong predictors of support for OWD (Blaydes et al., 2008; Brownlee et al., 2015; DeSantis & Reid, 2004; Firestone & Kempton, 2007; Firestone et al., 2009; Kempton et al., 2005). While concern for climate change and political orientation are frequently related to OWD support, they do not appear to be the strongest influencers (Bidwell, 2015). This is consistent with findings from other United States based studies which have suggested that community stakeholders' perceptions of OWD impact may strongly influence overall support and opposition for OWD (Firestone et al., 2009; 2018). Thus, the perceived impact of OWD may be the most important predictor of support, especially among water-based recreation stakeholders (Bidwell, 2017; Brownlee et al., 2015).

Perceived Negative Impacts

Wind energy research has shown that visual and auditory impacts are often the most acute sources of opposition, particularly for those living in close proximity to wind energy development (Rand & Hoen, 2017). However, studies have suggested that broader perceived negative impacts of energy development often stem from a lack of "fit" between the proposed development and the values that people assign to both the community and the landscape

(Devine-Wright & Howes, 2010). As Devine-Wright and Howes (2010) suggested, "fit" refers to how an energy development project is interpreted within the symbolic meaning of a community or location. Individuals within a community who do not see an adequate "fit" of energy development may fall into what is referred to as a "place protector" category. A "place protector" refers to an individual who does not oppose all forms of energy development, but only those that do not align with their symbolic meaning of the place (Bell et al., 2013). Place protectionism has been shown to play an important role in areas that are perceived as places for recreation or environmental quality (Bell et al., 2013; Devine-Wright & Howes, 2010). For example, research has suggested that the industrial aspect of some OWD sites can induce opposition among community stakeholders who see OWD as disrupting the place meanings that value natural beauty and the recreation potential of the marine environment (Devine-Wright & Howes, 2010). Recreationists, in particular, have been shown to be generally opposed to industrial development, as they often view the recreation location as a "place to escape" areas that host economic production and industrialization (Devine-Wright & Howes, 2010; Stedman, 2003).

Perceived Positive Impacts

Other studies have suggested that when communities perceive energy development to "fit", such that it is enhancing the location rather than disrupting it, (e.g., a town becoming a leader in renewable energy) public perceptions are often much more positive (Devine-Wright & Howes, 2010; Fergen & Jacquet, 2016). Rand et al. (2017) corroborated these findings and suggested that one's attachment to the community could be positively related to attitudes toward wind energy development, likely due to a perceived positive impact on the community (Hoen et al., 2018). Fergen and Jacquet (2016) and Slatterly et al. (2011) found residents in agriculturally intensive areas were supportive of wind energy development in part because the development "fit" with the productionist land ethic where an economic return from land use had long been supported and expected.

While energy development has typically been viewed as negatively impacting tourism and recreation, several studies have suggested that OWD in particular could actually have a positive impact on tourism and recreation (Firestone & Kempton, 2007; Firestone et al., 2009; Landry et al., 2012). For example, OWD may represent a unique tourist attraction for both nature and water-based recreationists. This form of energy development could present new opportunities for tourism such as boat tours to visit OWD sites (Firestone et al., 2009). This literature has suggested that OWD could also provide benefits to the marine habitat. For example, wind turbine foundations have been shown to act as artificial habitats and structures for marine life (Bidwell, 2015). It is possible that positive perceptions of these benefits are more prevalent among outdoor recreationists as opposed to the general population (Brownlee et al., 2015; Larson et al., 2011). Among water-based recreationists (WBR), Brownlee et al. (2015) identified high levels of support for OWD, which may have been partially attributed to the preexisting and prominent pro-environmental values that exist among most outdoor recreationists. Research has also suggested that these underlying environmental values may predispose recreationists to support environmentally friendly forms of energy development such as OWD (Brownlee et al., 2015; Larson et al., 2011).

Recreationists' Perceived Impact of Offshore Wind Energy Development

A multitude of research in both North America and Europe have examined the general public's perceptions of wind energy development. Within these studies, outdoor recreation and

recreationists' perceptions of OWD are often treated as a secondary pursuit or afterthought. None of these studies have explicitly measured recreationists' perceptions of OWD and the influence of perceived impact upon support for OWD. Yet, numerous studies have suggested the importance of understanding the perceptions of OWD impacts upon outdoor recreation populations and their associated activities (Bidwell, 2015; Brownlee, 2015). As multiple OWD studies have shown, a variety of perceived impacts may exist for communities, recreationists, and tourism (Bell et al., 2013; Bidwell, 2017; Brownlee et al., 2015; Devine-Wright, 2011; Firestone et al., 2009). Research in the United States has suggested that OWD *may* impact the overall experience for outdoor recreationists and that it *may* be the most important predictor of support and opposition towards OWD amongst outdoor recreationists (Bidwell, 2015; Brownlee, 2015; Firestone, 2018). While this concept garners intuitive appeal, it lacks empirical evidence. WBR are unique community stakeholders within the OWD process due to their potential firsthand interaction with this form of energy development. While the literature has suggested the importance of perceived impact upon recreationists and its role in influencing support for OWD, no studies have directly examined whether these relationships exist among WBR populations. A better understanding of these relationships may help to shape strategies to communicate and engage WBR in the OWD process.

Research Questions

R1: To what extent do water-based recreationists support OWD on Lake Erie?

R2: What is the relationship between political orientation and water-based recreationists' support for OWD on Lake Erie?

R3: To what extent do water-based recreationists' beliefs in the occurrence and anthropogenic causation of climate change, political orientation, and perceived recreation impact from OWD relate to support for OWD on Lake Erie?

Methods

Study Area- Lake Erie

Lake Erie is the shallowest and southernmost of the five Great Lakes, and is the fourth largest Great Lake in terms of surface area and the smallest Great Lake in terms of water volume. The state of Pennsylvania manages 76.6 miles of Lake Erie coastline. The Pennsylvania coastline of Lake Erie is home to a multitude of public parks and outdoor recreation facilities. Nearly every one of these recreation facilities serves the primary purpose of providing access to Lake Erie itself. This abundant access includes numerous boat launches, marinas, fishing piers, overlooks, and a large assortment of beaches. The combination of biological and geological diversity, in addition to the abundance of public access points, makes the Pennsylvania coastline of Lake Erie extremely attractive to a wide range of local, regional, and international recreationists (Ferguson et al., 2018). Within the present day Lake Erie region, WBR and marine tourism have become increasingly critical component of the economy, displacing the prominence of manufacturing powerhouses that once dominated the landscape from Detroit to the city of Erie, Pennsylvania itself. Demographically, the communities along the southern shore of Lake Erie have experienced significant population decline and economic stagnation over recent decades. Notably, Erie, Pennsylvania has recently experienced the lowest level of population since 1920 with regional unemployment rates tracking consistently higher than the national average (https://www.bls.gov/eag/eag.pa_erie_msa.htm, May 1, 2018).

The focal point of this study included all of the publically accessible coastal parks and protected areas and affiliated water-based recreation activities located within the Pennsylvania coastline of Lake Erie, proximate to Erie, Pennsylvania. Through conversations with natural resource managers and local stakeholders, the researchers obtained permission to sample WBR within all 13 of the publically accessible coastal parks and protected areas within the Pennsylvania coastline of Lake Erie. A majority of these sites included overlapping recreation facilities. For example, one of the sites included a boat launch, a beach area, and a fishing area. A major data collection site in this study was Presque Isle State Park, which has been shown to attract over 4.2 million visitors annually (Mowen et al., 2013). Combined, the 13 study sites contained three marinas, seven boat launches, six fishing areas, and five beaches.

The Ice Breaker OWD Project

While this study was designed to examine WBR attitudes and perceptions toward OWD *in general* on Lake Erie, in must be noted that currently proposed for development on Lake Erie is a pilot offshore wind installation consisting of six 3.45 MW turbines constructed approximately seven to ten miles off the shores of Cleveland, Ohio. The project has been publically debated in the area since at least 2010, with construction originally slated for 2017 and currently planned for 2019. Various local recreation stakeholders (e.g., anglers, birders, conservationists) have publically opposed the project over possible conflicts with wildlife and recreation opportunities, while large scale environmental organizations (e.g., Nature Conservancy, GreenErie, Environment Ohio) have supported the development. Besides touting the innovative turbine towers designed to withstand ice buildup on the lake (hence the *Icebreaker* moniker), the developers of the proposed site have framed the OWD primarily in terms of economic development, via an emerging manufacturing industry of offshore wind turbines in the region, as well as a way to promote the area as a technological leader in alternative energy. Proponents hope the Icebreaker project will create momentum for a new regional hub for OWD, with anticipated construction of additional OWD sites in the Great Lakes in the next 15 years based on successful implementation (NorTech, 2010).

Data Collection

On-site face-to-face survey interviews were used to gather data from WBR throughout the study sites from May to September of 2015. To gather a diverse and representative sample, a systematic sampling plan was developed in consultation with natural resource managers and local stakeholders to coincide data collection with peak WBR use periods (Vaske, 2008). The survey was administered via tablet computers using a commercially available off-line data collection application. Two trained research assistants approached potential respondents, described the purpose of the study, and solicited respondents to participate in the survey, which was read aloud and took between 10 and 15 minutes to complete. If potential respondents indicated they did not partake in any WBR activity that day, they were thanked for their time and excluded from the study. For systematic sampling purposes, interviewers contacted every third person or party observed and requested their participation (Vaske, 2008). Only consenting adults (18 years of age or older) were eligible to participate.

The topics within the first portion of the survey included trip visitation patterns and sociodemographic characteristics. Once this portion of the survey was completed, respondents were given a laminated informational flashcard. This flashcard provided respondents with a brief informational narrative informing them of OWD on Lake Erie. The narrative read, “A small

number of wind turbines (6) are being considered for placement in the waters of Lake Erie. Each turbine would potentially extend 300 feet above the water's surface. Although the exact placement of these turbines has not yet been determined, the turbines would potentially be located approximately 7-10 miles from shore." While the flashcard description was similar in scope to the Lake Erie Icebreaker project, it did not identify the Icebreaker project by name, nor did it explain any benefits or drawbacks of OWD. The purpose of this flashcard was to orient the respondent to a generalized OWD proposal in an unbiased manner. This flashcard technique has been employed in numerous OWD studies (Brownlee et al., 2015; Firestone & Kempton, 2007; Firestone et al., 2009). After reviewing the flashcard, respondents were asked a series of questions pertaining to climate change and OWD. These items referred to beliefs in the occurrence of climate change, beliefs in the anthropogenic causation of climate change, the perceived recreation impact of OWD, and support and opposition for OWD. Finally, respondents were asked an open-ended follow up question assessing any additional perceived recreational impacts of OWD. Upon completion of the survey, respondents were thanked for their time and asked if they had any other questions. In total, 275 respondents were approached, yielding 242 completed surveys and an 88% response rate.

Theory

While research has suggested the importance of including the perceived impact of OWD when predicting support and opposition, this concept has not been empirically tested and validated. This study sought to add to the growing body of OWD research by specifically considering WBR perceptions' of impact. WBR have been identified as key stakeholders in the development process, as the OWD infrastructure may either be within or adjacent to public lands, waters, and protected areas within the Pennsylvania coastal section of Lake Erie. Several studies have advanced theory that respondents may base support or opposition on how the development symbolically "fits" within exiting uses of the landscape or community (Devine-Wright & Howes, 2010; Fergen & Jacquet 2016; Rudolph, Haggett, & Aitken, 2018; Slatterly et al., 2011; Van Veelan & Haggett, 2017). Further, recreationists may hold specific landscape or community meanings that could favor preservation over industrial or economic development. Relatedly, the theoretical framework of social-psychological disruption has suggested that energy development can be viewed as a measure of continuity or disruption to a community (Jacquet & Stedman, 2014). Jacquet and Stedman (2014) further surmise that among impacted individuals, the perceived level of continuity or disruption could be a driver of support or opposition to energy projects. In this study context, industrial energy development within Lake Erie may or may not align or "fit" the meanings that WBR have developed for the landscape or community. This exploratory research sought to investigate these phenomena among a WBR population to explore the potential impact that OWD might have upon recreationists at Lake Erie. Therefore, the overall purpose of this study was to examine the factors that influenced the support for OWD on Lake Erie.

Results

All data were analyzed using Statistical Package for the Social Sciences (SPSS) version 24.0. To address research question R1 frequencies, measures of central tendencies, valid percentages, and supplemental open-ended comments were used. To address research question R2 analysis of variance (ANOVA) procedures were used to analyze difference among group means, followed by Scheffe's post-hoc analysis. Finally, to address research question R3 a series

of multiple linear regressions were used to create a path model. Multiple regression path modeling was selected as it establishes a designated path or direction of relationships and provides estimates of the magnitude and significance of causal relationships between variables (Vaske, 2008).

Descriptive Statistics

Of the 242 survey respondents, approximately 59% identified as male and 41% as female (Table 1). The average age for survey respondents was 47 years. The sample was fairly homogenous by race, with nearly 95% of survey participants identifying as white. Income levels of respondents were relatively evenly distributed with the highest percentage of respondents (35.8%) identifying their income within the range of $50,000-$74,999. Over 40% of the sample had earned a high school diploma or less and nearly half (48.3%) of the respondents noted they had attended some college, a two-year college, or a four-year college; 7% of the sample had earned a graduate or professional degree. These sociodemographic statistics closely resembled other similar research in the study area (Mowen et al., 2013).

[INSERT TABLE 1 HERE]

Respondents were asked to indicate which WBR activity was their primary activity on the day they were sampled (Table 2). Of the entire sample, boaters represented nearly one-half (48.3%), with the remainders primarily beach users (28%) and anglers (23.5%). In terms of trip visitation patterns, respondents were largely repeat (91%) day trip visitors (71%) recreating for an average of 4.4 hours. These experienced and largely localized visitors noted they spent an average of seven days per month, 35 days per year, and 18 total years engaged in their primary WBR activity and traveled a median distance of 15 miles from their homes to the survey site. These trip visitation statistics also closely resembled other similar research in the study area (Mowen et al., 2013).

[INSERT TABLE 2 HERE]

To assess visitors' attitudes towards OWD, respondents were asked to indicate the extent they agreed with seven support statements and seven opposition statements related to OWD using a seven-point Likert scale (1= completely disagree, 7= completely agree) (Table 3). Both the support and opposition constructs had been previously validated to assess visitors' attitudes towards OWD (Brownlee et al., 2014; DeVellis, 2003; Noar, 2003). Overall, visitors indicated high levels of support (M=5.97) and low levels of opposition (M=2.73) towards OWD on Lake Erie. Due to the low level of opposition toward OWD in this study, the duration of the analyses focused only on the prediction of OWD support.

Respondents were asked to indicate their political orientation using a single-item seven-point Likert scale (1= extreme conservative, 4= moderate, 7= extreme liberal) which was developed based on previous literature (BaBinet et al., 2009; Engels et al., 2013; Sheikh et al., 2016) (Table 1). The political orientation distribution was fairly even with approximately 28% of respondents identifying as conservative, approximately 33% of respondents identifying as moderate, and approximately 38% of respondents identifying as liberal. The mean for political orientation was 4.20, suggesting the sample was fairly moderate, although leaning toward the liberal side of moderate.

To measure beliefs in the occurrence of climate change, visitors assessed the extent they believed eight physical impacts from climate change were happening around the earth using a seven-point Likert scale (1= completely disagree, 7= completely agree) (Table 3). In general, visitors indicated high levels of agreement (M=5.63) that climate change was indeed occurring around the world. To measure beliefs in the anthropogenic causation of climate change, visitors assessed the extent they believed seven human behaviors were contributing to climate change around the earth on a seven-point Likert scale (1= completely disagree, 7= completely agree). Overall, visitors noted even higher levels of agreement (M= 5.83) that anthropogenic causation was influencing climate change around the world. Both the occurrence and anthropogenic causation constructs had been previously validated as comprehensive measures of climate change perceptions (Brownlee et al., 2014).

Finally, to measure visitors' perceived impact of OWD on recreation, respondents evaluated the extent OWD would impact their overall WBR experience (Table 3). This was performed through the use of a single-item seven-point Likert scale (1= negatively impacted, 7= positively impacted). Overall, visitors noted their primary WBR activity would be positively impacted (M=5.20) by the presence of OWD on Lake Erie. This item was created based on previous OWD and recreation impact literature and conversations with natural resource managers and other relevant Lake Erie stakeholders (Jacquet & Stedman, 2014; White et al., 2008).

[INSERT TABLE 3 HERE]

Bivariate Analysis by Political Orientation

A series of one-way analyses of variance (ANOVA) were performed to further explore the influence of political orientation amongst the sample (Table 4). For data segmentation purposes, the single single-item political orientation scale was recoded within these bivariate analyses to reflect the three most commonly referenced political ideologies in the United States: 1) conservatives, 2) moderates, and 3) liberals (Adams et al., 2010; Hamilton, 2015; Twenge, et al., 2016). Within this recode, a response of 1-3 represented a *conservative* political ideology, a response of 4 represented a *moderate* political ideology, and responses of 5-7 represented a *liberal* political ideology. ANOVA results found significant differences by political orientation in support for OWD. Those identifying as liberal and moderate averaged significantly higher mean scores for support than those identifying as conservative ($M_{liberal}$=6.20; $M_{moderate}$=6.20; $M_{conservative}$=5.33). Study results also suggested significant differences by political orientation regarding beliefs in the occurrence of climate change ($M_{liberal}$=5.91; $M_{moderate}$=5.92; $M_{conservative}$=4.98), beliefs in the anthropogenic causation of climate change ($M_{liberal}$ = 5.77; $M_{moderate}$ = 6.20; $M_{conservative}$=5.48), and the perceived recreation impact of OWD ($M_{liberal}$=5.51; $M_{moderate}$=5.35; $M_{conservative}$=4.67) (Table 4).

Results of a Scheffe's post-hoc analysis determined further significant differences between both liberals and conservatives and between moderates and conservatives. Within each of these analyses, a similar statistical trend prevailed. Those identifying themselves as liberal and moderate were significantly more likely than their conservative counterparts to support OWD, believe in the occurrence of climate change, and perceive positive impacts towards OWD on Lake Erie. Beliefs in the anthropogenic causation of climate change was the single exception to this trend, where conservatives differed only from moderates. The literature notes that individuals identifying with moderate political ideologies often share similar attitudes and

perceptions towards various forms of energy development as those identifying with conservative political ideologies (Alessi, 2017; Clarke et al., 2016; Edwards, 2018). However, given that wind energy development in the United States has been shown to receive support across the political spectrum, it is not surprising that individuals identifying with either liberal or moderate political ideologies displayed strong support for OWD in this study (Rand & Hoen, 2017).

[INSERT TABLE 4 HERE]

Multiple Linear Regression for Support for OWD

Results from the multiple linear regression indicated that political orientation, beliefs in the occurrence of climate change, beliefs in the anthropogenic causation of climate change, and perceived recreation impact of OWD explained a significant amount of the variance in support for OWD on Lake Erie (Table 5; Figure 1). Those variables accounted for 46% of the model variance. Perceived recreation impact had the strongest positive relationship with support for OWD development (β=.439). The more WBR felt that OWD would have a positive effect on their recreation experience, the more likely they were to support OWD. Further, the more visitors agreed that climate change was occurring (β=.213) and that it was anthropogenically caused (β=.207), the more likely they were to support OWD. No instances of multicollinearity were found within any of the study variables or analyses.

Political orientation was also found to be positively related to beliefs in the occurrence of climate change, beliefs in the anthropogenic causation of climate change, perceived recreation impact of OWD, and support for OWD (Table 5). The more visitors' political orientation leaned towards liberal, the more likely they were to agree that climate change and anthropogenic causation were occurring, perceive a positive recreation impact from OWD, and support OWD. While political orientation was directly related to support for OWD, this relationship was also partially mediated through other variables in the model (Figure 1). Further, the perceived recreation impact of OWD and beliefs in the occurrence and anthropogenic causation of climate change partially mediated the relationship between political orientation and support for OWD.

[INSERT FIGURE 1 HERE]

[INSERT TABLE 5 HERE]

Open-Ended Perceived Impacts of OWD

The quantitative analyses in this study demonstrated that visitors' perceived impact of OWD on recreation was an important and influential factor when predicting support and opposition towards OWD. In an effort to further understand this phenomena, visitors were also asked a follow-up open-ended question to supplement quantitative findings. After responding to the single-item question assessing the perceived impact of OWD on recreation, visitors were asked to further elaborate as to how OWD would impact their overall WBR experience. The open-ended responses (n=100) were analyzed using the constant comparison method (Corbin & Strauss, 2007) (Table 6). The authors discussed the codes, generated a codebook, and independently coded each of the statements three separate times to obtain an acceptable inter-rater reliability statistic (87% agreement) (Miles & Huberman, 1994). Overall, visitors seemed to identify and incorporate both recreation impacts as well as the broader implication of OWD. The most frequently cited codes related to economic impacts (28%), alternative energy impacts

(15%), general environmental impacts (12%), and aesthetic impacts (10%) (Table 6). The majority of the open-ended comments were positive and/or supportive of OWD. These comments and their interpretation are discussed in further detail in the ensuing sections.

[INSERT TABLE 6 HERE]

Discussion

OWD has been slow to develop in the United States for various social, ecological, and political reasons. Due to its vast wind potential combined with recent capital investments, however, Lake Erie is now positioned to receive North America's first freshwater OWD project. This OWD infrastructure may either be within or adjacent to public lands, waters, and protected areas, raising concerns about the impacts on recreation stakeholders. In this study, the predominantly older, experienced, localized, and politically moderate sample exhibited high levels of support for OWD, as well as high levels of belief in both the occurrence and anthropogenic causation of climate change. Moreover, respondents noted that the presence of OWD would positively impact their WBR experience. For example, OWD may represent a unique recreation and tourism attraction that could present new opportunities for WBR such as informational and interpretive boat tours to visit OWD sites. Further, anglers often target structures in lakes, as fish may congregate around the cover they provide. OWD infrastructure could supplement this fish cover and subsequently boost angler effort and success in areas that lack natural structure. These findings have intuitive appeal as research suggests recreationists may be predisposed to support renewable forms of energy development such as OWD (Brownlee et al., 2015; Larson et al., 2011).

Based on the literature, it is evident that support for traditional renewable energy resources (e.g., solar) can be politically polarizing. On the contrary, recent literature has suggested large-scale support for wind energy development across the political spectrum (Rand & Hoen, 2017). Within this study sample, similar trends prevailed. While conservatives were less likely than moderates and liberals to support OWD, the level of support found among conservatives was still favorable, further supporting the notion of broad political support towards OWD (Rand & Hoen, 2017). Overall, perceptions of OWD were largely supportive and positive among the sample which was not surprising given the moderate political nature of the sample as well as the previously stated relationship between wind energy development and political orientation.

Previous research has also suggested strong, but complex relationships between political orientation and both climate change beliefs and support for energy development. Within this study, the perceived recreation impact of OWD and beliefs in the occurrence and anthropogenic causation of climate change partially mediated the relationship between political orientation and support for OWD. This study also found that political orientation did not have as strong of a direct influence on support for OWD as previous research has suggested. When viewing the literature broadly, political orientation variables often appear to be far more influential and robust in basic models, but the influence of political orientation variables often declines once other nuanced and mediating variables are included. The results in this study suggested that while political orientation did indeed directly influence support for OWD, political orientation had a stronger influence upon climate change beliefs and recreation impacts. For instance, political orientation accounted for over 16% of the variance in beliefs in the occurrence of climate change, making this the strongest partial mediation relationship in the model. These

findings further contributed to the literature emphasizing both the individual and combined importance of including political orientation in energy development research.

Consistent with previous research, this study found that political orientation, beliefs in the occurrence of climate change, and beliefs in the anthropogenic causation of climate change had a significant positive influence on support for OWD. More importantly, this study determined that the perceived recreation impact of OWD had the strongest positive relationship with support for OWD development. While this premise has been *suggested* in the literature, to our knowledge, no research has attempted to empirically validate the influence of recreation impact within an OWD context. This study demonstrated the importance of including recreationists' perceptions of OWD impact as this variable was found to explain more variance in support for OWD than political orientation and climate change beliefs. Said another way, while political orientation and beliefs about climate change and its causation were important, they were not as robust as the perception of personal OWD impact upon recreation.

While the perceived recreation impacts of OWD did have a direct and strong influence on support for OWD, the deeper discussion revolves around the nuanced interpretation of this relationship. The more positively a recreationist perceived they would be impacted by the OWD, the more likely they were to support OWD on Lake Erie. When integrating the supplemental open-ended comments, WBR stakeholders seemed to identify and incorporate both recreation impacts as well as the broader implication of OWD. For instance, the majority of comments were related to the topics of *economic impacts, alternative energy impacts*, and *positive changes* in addition to *recreation and tourism impacts.* Respondents noted recreation benefits such as, "alternative energy development would bring positive tourism to the area", but more importantly general economic and community benefits such as, "helping the local economy", acting as "a step in the right direction" and "aid in the natural progression and integration of alternative energies".

These findings corroborated the literature and suggest recreation stakeholders in this study positively perceived the "fit" of OWD amongst their community and landscape (Devine-Wright & Howes, 2010; Fergen & Jacquet, 2016). The WBR in this study expressed an understanding of not only the recreation impacts of OWD, but also the holistic and economic importance of OWD to their community and region. Moreover, economic development was identified by respondents as a positive value of OWD, echoing previous research of wind energy development in economically struggling regions (Fergen & Jacquet, 2016; Slatterly et al., 2011). It is possible respondents may have been reacting to ongoing economic-themed public discourse over the proposed Icebreaker project; however, this study did not test for sources of information or levels of familiarity with the Icebreaker project in particular. Regardless, it was clear that a focus on economic production and portraying the region as an alternative energy leader was a message that likely resonated with many respondents. When assessing support and opposition for OWD, it appeared that the WBR in this study perceived an enhancement of their community rather than a disruption. WBR are a legitimate and vocal stakeholder in the OWD realm. Thus, each development phase of OWD (e.g., proposal, construction, operation) warrants particular input and policy from these important recreation stakeholders.

Implications for future research include examining recreation impact across multi-item constructs, segmenting recreationists by activity type, investigating the influence of demographic variables, employing multi-phase assessments of both controversial and non-controversial OWD sites, and examining both cross-sectional populations as well as general populations. This study employed a single-item indicator to measure visitors' perceived impact of OWD on recreation.

This single-item indicator was successful in assessing recreation impacts, but future research should consider including other multi-item recreation impact measures with various unidirectional scaling in addition to this variable in an effort to corroborate study findings. While the focus of the study was to assess WBR as a whole, there is merit in examining differential effects for specific forms of WBR. Future studies should consider segmenting and analyzing recreationists by well-defined activity types and consider the direct and indirect effects of demographic variables (e.g., gender, income, education). These segmentations and analyses could aid in further understanding support and opposition for OWD among individual user segments. It should be noted that initial analyses of this data tested for these interactions (e.g., activity type and demographics) but found no significant relationships. Future research should also consider assessing OWD projects throughout the various stages of development (e.g., proposal, construction, operation). Moreover, because of the limited number of OWD sites in the United States, OWD locations are often swirled in controversy. Future studies should identify both controversial and non-controversial OWD sites to explore the premise of OWD support and opposition further. Finally, researchers must also recognize that recreationists are not the only relevant stakeholders within the OWD domain. Future research should assess not only cross-sectional recreation populations within an area, but also general population samples within the surrounding area for comparative purposes.

Conclusion

The results of this study suggested large-scale support for OWD among water-based outdoor recreationists at Lake Erie across the political spectrum. OWD appeared to be in line with and "fit" the attitudes of the population of this study. Because the perceived recreation impact of OWD was the strongest predictor of support for OWD, it is important to understand how OWD affects a variety of recreationists and to involve this constituency in the OWD planning and policy process. This is especially true as OWD companies attempt to gain public support. This need for engagement and communication with recreation stakeholders will be critical to the continued success of OWD in the United States. When understanding support and opposition for OWD, this study demonstrated that it may be more important to understand stakeholders' various perceptions of local impacts along with political ideology and climate change beliefs. Previous research has suggested that perceived impact is the most important predictor of support, but had not tested this concept specifically. This study corroborated previous energy research and highlighted the importance of considering and assessing recreation stakeholder impacts when planning, developing, and managing OWD and related policy in the United States.

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Tables

Table 1. Water-Based Outdoor Recreationists' Sociodemographics

Variable	*N*	% or *M (SD)*
Age	242	47 years (11.9)
Gender		
Male	143	59.1%
Female	99	40.9%
Race/Ethnic Background		
White	228	94.6%
Non-white	13	5.4%
Income		
Under $25,000	10	5.0%
$25,000-$49,999	45	22.4%
$50,000-$74,999	72	35.8%
$75,000-$99,999	58	28.9%
$100,000-$149,999	12	6.0%
$150,000 or more	4	2.0%
Education		
Less than High school	57	23.6%
High School Graduate	51	21.1%
Some College	33	13.6%
Two-year College	16	6.6%
Four-year College	68	28.1%
Graduate or Professional Degree	17	7.0%
Political Orientation[a]		4.20 (1.2)
Conservative	64	28.3%
Moderate	75	32.2%
Liberal	87	38.5%

Note. Percentages may not equal 100 because of rounding.

[a]Note. Political Orientation (1= extreme conservative, 4= moderate, 7= extreme liberal)

748 **Table 2.** Water-Based Recreationists' Trip Visitation Patterns

Variable	***N***	**% or *M (SD)***
Primary Activity Participation		
Fishing	57	23.5%
Boating	117	48.3%
Beach Use	68	28.0%
First Time versus Repeat		
First time visitor	21	8.7%
Repeat visitor	221	91.3%
Trip Type		
Day trip	171	70.7%
Average hours spent on a day trip	171	4.38 hours (1.7)
Overnight trip	71	29.3%
Average hours spent on an overnight trip	71	2.40 nights (1.1)
Experience Use History		
Average days per month recreating	220	7.3 days (4.8)
Average days per year recreating	220	34.7 days (36.6)
Average total years recreating	221	17.7 years (13.9)
Distance Traveled from Home		
Median total distance traveled	233	15.0 miles (43.9)
Visitors traveling 15 miles or less	134	57.5%

Note. Percentages may not equal 100 because of rounding.

749

750 **Table 3.** Water-Based Recreationists' Beliefs, Attitudes, and Perceptions' Towards Climate
751 Change and OWD

Variable	α	*N*	*M (SD)*
Beliefs in Climate Change			
Occurrence of climate change[a]	.941	226	5.63 (1.28)
Anthropogenic causation of climate change[b]	.885	226	5.83 (1.18)
Attitudes Towards OWD			
Support towards OWD[c]	.835	226	5.97 (1.03)
Opposition towards OWD[d]	.759	226	2.73 (1.10)
Perceived Impact of OWD on Recreation			
Overall perceived recreation impact of OWD[e]	---	226	5.20 (1.29)

Note. Percentages may not equal 100 because of rounding
[a]Note. Beliefs in the Occurrence of Climate Change (1= completely disagree, 7= completely agree)
[b]Note. Beliefs in the Anthropogenic Causation of Climate Change (1= completely disagree, 7= completely agree)
[c]Note. Support for OWD (1= completely disagree, 7= completely agree)
[d]Note. Opposition towards OWD (1= completely disagree, 7= completely agree)
[e]Note. Perceived Recreation Impact of OWD (1= negatively impacted, 7= positively impacted)
752

753 **Table 4.** One-Way Analysis of Variance Comparing Political Orientation to Beliefs, Attitudes,
754 and Perceptions' Towards Climate Change and OWD

Variable	Liberal Mean (*SD*)	Moderate Mean (*SD*)	Conservative Mean (*SD*)	*F* Value
Support towards OWD[a]	6.20[1] (0.72)	6.20[1] (0.61)	5.33[2] (1.48)	18.76***
Occurrence of climate change[b]	5.91[1] (0.98)	5.92[1] (1.04)	4.98[2] (1.60)	13.94***
Anthro causation of climate change[c]	5.77[1,2] (1.15)	6.20[1] (0.75)	5.48[2] (1.43)	7.13**
Perceived recreation impact of OWD[d]	5.51[1] (1.13)	5.35[1] (1.21)	4.67[2] (1.36)	9.17***

*Significant at .05 level, **significant at .01 level, ***significant at .001 level

Note. For Conservative respondents: n = 64, For Moderate respondents: n = 75, For Liberal respondents: n = 87

[a]Note. Support for OWD (1= completely disagree, 7= completely agree)

[b]Note. Beliefs in the Occurrence of Climate Change (1= completely disagree, 7= completely agree)

[c]Note. Beliefs in the Anthropogenic Causation of Climate Change (1= completely disagree, 7= completely agree)

[d]Note. Perceived Recreation Impact of OWD (1= negatively impacted, 7= positively impacted)

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756

757 **Table 5.** Results of Multiple Linear Regression for Support of OWD

Dependent Variable	R^2	Independent Variables	β	Sig
Support towards OWD	.460***	Perceived Rec Impact of OWD	.439	.000
		Occurrence of Climate Change	.213	.002
		Anthropogenic Climate Change	.207	.001
		Political Orientation	.135	.019
Occurrence of climate change	.163***	Political Orientation	.403	.000
Perceived recreation impact of OWD	.08***	Political Orientation	.283	.000
Anthro causation of climate change	.037**	Political Orientation	.192	.004

*Significant at .05 level, **significant at .01 level, ***significant at .001 level
Note. Only significant variables were used in this model

758

759 **Table 6. Open-Ended Perceived Impact of OWD**

Impact Code	Frequency	Valid %
Economic Impacts	28	28%
Alternative Energy Impacts	15	15%
General Environmental Impacts	12	12%
Aesthetic Impacts	10	10%
Positive Changes	9	9%
Recreational Impacts	6	6%
Tourism Impacts	4	4%
Positive Reputation	3	3%
Management Actions	2	2%
Other	11	11%
Total	100	100%

760

Figure Captions

Figure 1. Final Regression Model for Support for OWD on Lake Erie