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HOW LANDSCAPE CHANGE AFFECTS COMMERCIAL AND RECREATIONAL
FISHERMEN'S PERCEPTIONS AND PLACE MEANINGS

BY

TALYA S. TEN BRINK

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
IN
MARINE AFFAIRS

UNIVERSITY OF RHODE ISLAND

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DOCTOR OF PHILOSOPHY IN MARINE AFFAIRS

OF

TALYA SYVANN TEN BRINK

APPROVED:

Dissertation Committee:

Major Professor Tracey Dalton

David Bidwell

M. Conor McManus

Kate Mulvaney

Nasser H. Zawia

DEAN OF THE GRADUATE SCHOOL

UNIVERSITY OF RHODE ISLAND

2020

ABSTRACT

It is critical to plan for environmental change in order to mitigate its adverse effects on human wellbeing. This series of manuscripts examines the impacts of landscape change on commercial and recreational fishermen. Each manuscript provides a unique perspective on place meaning and place change. Using a mixed methods approach, data were collected and analyzed on fishermen's perceptions of familiar places and on the changes that these places undergo. The first manuscript investigates the impact of offshore wind farms on commercial and recreational fishermen, using the first offshore wind farm in North America – the Block Island Wind Farm (Rhode Island) – as a case study. The second and third manuscripts examine urban fishermen's emotional attachment to and perceptions of coastal places in the urban fringe of upper to mid-Narragansett Bay, RI, and the impact of predicted climate-change related weather events on their behavior.

Manuscript 1 examines the impact on commercial and recreational fishermen by the Block Island Wind Farm (Rhode Island) infrastructure and by the perceived and observed environmental changes in the area due to the turbines and cable systems. Twenty-five commercial and recreational fishermen were interviewed about their perceptions of the human/behavioral and ecological impacts of the offshore wind farm. Perceived impacts included increased areas for spearfishing, increased fishing due to the wind farm acting as an artificial reef, the wind farm as a destination or target, crowding of recreational fishing vessels around the offshore wind farm, which interfered with existing fixed fishing gear, and fear about future impacts. Although many biological studies have tested the impact of other wind farms on marine

ecosystems, this manuscript is the first published paper on how an offshore wind farm in North America will impact local marine resource users. These findings inform the planning and development of future offshore wind farms along the east coast of the United States.

Manuscript 2 focuses on identifying the place meanings for forty-three urban recreational fishermen at the urban fringe of mid-Narragansett Bay, RI. The study investigates how coastal place meanings vary by place and by fishermen's characteristics in the urban fringe using applied thematic analysis and binomial logistic regressions. Themes include issues of pollution, heritage, sustenance, and environmental justice for urban and peri-urban recreational fishermen, many of whom are Latino, Asian, low-income, recent immigrants, and/or non-English speaking. As Upper Narragansett Bay water quality improves, these findings can provide insights into the function of other urban coastal fishing areas by urban and peri-urban fishermen.

Manuscript 3 examines the impact of climate change on urban recreational fishermen and how fishermen perceive future management changes, such as the building of a dock on a public fishing access site in Rhode Island. Climate change has altered and continues to alter air and sea conditions in Narragansett Bay, and those conditions will impact the ability of urban fishers to benefit from recreational fishing. Findings demonstrate that climate change impacts, like additional rainfall and hurricanes, are perceived to reduce overall recreational fishing use of the sites due to erosion, dangerous conditions, and lack of access. A few fishermen may, however, increase their use of the site due to their motivations to fish. These findings inform the

design of desirable adaptation strategies for various coastal users and vulnerable populations under climate change. Through effective adaptation strategies, the site characteristics necessary for human well-being that were discussed in Manuscript 2 will be preserved.

Planning for environmental change can maintain aspects of human well-being derived from coastal and marine areas. Each manuscript provides a perspective on the meaning of place and place change in such areas. These manuscripts capture the relationship of coastal and marine users with their environments as these environments undergo change. Offshore wind farms, polluted urban waterways, and climate change-related events all impact coastal and marine users. By understanding past, current, and potential future impacts, managers can design places to maintain benefits for all users.

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Growing up on the Cape and lifeguarding at public beaches in Falmouth, Massachusetts showed me the diversity of coastal users, and I hope that I was able to give those people a voice. Thank you to my interviewees for sharing their experiences with me and I hope that my research honors them. Thank you to Alex and my friends from Falmouth, the Netherlands, and worldwide for their love, kindness and support. Finally, I would like to deeply thank my family for their love, support and dedication. Especially my mother and father, the first scientists I knew. Finally, I would like to thank the people who work for a happier, more ecologically sound world.

PREFACE

The dissertation is presented in three manuscripts (chapter two to four). However, a comprehensive introduction and comprehensive conclusion comprise chapters one and five. Manuscript 1 was published by Frontiers Publishing 27 November 2018 in *Frontiers in Marine Science* (<https://doi.org/10.3389/fmars.2018.00439>). Manuscript 2 and Manuscript 3 are prepared for submission to a journal.

Manuscript 1: Perceptions of Commercial and Recreational Fishers on the Potential Ecological Impacts of the Block Island Wind Farm (US)

Manuscript 2: Place Meanings of Recreational Anglers in the Urban Fringe

Manuscript 3: Perceived Impact of Climate Change on use of Urban Recreational Fishing Coastal Areas

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CHAPTER 1:

COMPREHENSIVE INTRODUCTION: UNDERSTANDING LANDSCAPE CHANGE IN THE PAST, PRESENT, AND FUTURE

Through a series of manuscripts, this dissertation examines the impacts of landscape change on commercial and recreational fishermen. This dissertation focuses on place-based benefits in the context of fishing activities. The first chapter investigates a past change, the placement of an offshore wind farm structure in the marine landscape. The second chapter examines what places presently mean to people and focuses on coastal fishing access points in the urban-suburban interface, or the urban fringe. The third chapter explores a future predicted change in the environment, and how those changes will impact the respondents and the sites in Chapter 2. Using a mixed methods approach, data on fishermen's perceptions of familiar places and how those places undergo change are explored. These findings can inform coastal change, including designing, implementing, or adapting offshore wind farms and future coastal access areas in the urban fringe.

Why study fishermen's perceptions, attitudes and behaviors related to wind farms? Offshore wind farms are a new technology that, if built at the scales currently proposed (Coren 2018), will dramatically change the marine environment in the United States. Although many biological studies test how the farms will impact marine ecosystems (Diogo et al. 2017), this manuscript (Chapter 2) is the first published paper on how an offshore wind farm in North America can impact the marine resource users. The recreational and commercial boaters and fishermen in the area are not only

impacted by the changes captured in biological catch, but they are also impacted by navigational challenges, changes in the layout and use, and of how other user groups adapt to a new structure in the water. Furthermore, by understanding the challenges and changes in the area through the eyes of the fishermen in the area, we can understand the gaps in ecosystem changes that are not necessarily captured in a variety of biological surveys that may not be comprehensive (Diogo et al. 2017). These types of findings are vital for the planning and development of future offshore wind farms in order to minimize negative environmental and social impacts (Maclean et al. 2014; Willsteed et al. 2017).

However, offshore wind farms are only a symptom of the mitigation to impacts of a much larger change in the marine and coastal environment: *climate change*. Climate change is predicted to impact human health, food security, infrastructure, tourism, recreation, water resources, and ecosystems (Climate Science Special Report, 2017). Studies have been conducted on how climate change (such as warming sea temperatures) is predicted to impact commercial fisheries (Colburn et al. 2015; Putten et al. 2017). However, recreational shore fishermen that use the urban fringe are a vulnerable population that has not yet been well studied (Pulford, Polidoro, and Nation 2017). Chapter 4 addresses: *How will climate change-related impacts such as more rainfall, more flooding and hurricanes, and warmer waters impact these vulnerable coastal users?* These findings help coastal managers prepare for the future, plan adaption strategies including alternative communication strategies, and maintain the benefits of coastal recreational fishing areas in the urban fringe under climate change.

To understand what the loss of these places signifies to recreational shore fishermen on the urban fringe, it is necessary to understand what these places currently mean to the fishermen (Chapter 3). Place meanings are responses to the question, “What does this place mean to you? Why is this place special or important to you?” The meanings of the place vary depending on site and on the fisherman (or fisher; the terms are used interchangeably to refer to fishermen of all genders). *Why is it useful to explore place meanings of recreational fishermen?* These place meanings indicate the specific benefits a place can provide to people, which may be threatened under climate change. Too often, emotional attachment to places is captured in a place attachment scale, rather than through participant’s self-defined place meanings (Wynveen and Kyle, 2014). These place meanings can illuminate cultural and mental models, demonstrate how places inform well-being, show the use and value of the urban fringe, show relative differences between places and users, and clarify how to manage areas for continued well-being under change. People want to protect desired place meanings (Stedman, 2016). Place meanings demonstrate core aspects of a site that should be considered when designing a public access site, and an understanding of how valued sites may change based on factors such as motivation, gender or cultural group, for example.

Studying future change helps us understand the environmental and social possibilities of coastal and marine landscapes (Devine-Wright and Howes 2010). In this series of manuscripts, the impacts of landscape change were examined using a qualitative approach through collecting and analyzing commercial and recreational fishermen’s perceptions of familiar places and how those places undergo change. Each

of these studies provides a unique consideration of place that informs future coastal management for human wellbeing.

CHAPTER 2

PERCEPTIONS OF COMMERCIAL AND RECREATIONAL FISHERS ON THE POTENTIAL ECOLOGICAL IMPACTS OF THE BLOCK ISLAND WIND FARM (US)

Authors:

Talya S. ten Brink

Tracey Dalton, Ph. D

Corresponding author:

Talya ten Brink

tenbrink@uri.edu

University of Rhode Island

Dept. of Marine Affairs

Kingston, RI 02881

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ABSTRACT

Offshore wind is gaining momentum in the United States as a viable source for meeting domestic energy needs. Although offshore wind farms have been developed in Europe and Asia, the Block Island Wind Farm (BIWF) is the first offshore wind farm built in North America. To improve marine resource management, it is critical to understand the impacts of the wind farm on marine resource users in context. Little is known about the impacts of offshore wind farms on marine resource users in the United States. This study investigates recreational and commercial fishers' perceptions of the impacts of the BIWF on the local marine ecosystem. Semi-structured interviews were conducted with 25 fishers, mostly based out of Block Island or Point Judith, Rhode Island (US), in the summer and fall of 2017. During the interviews, fishers were asked about their perceptions of changes in the marine ecology of the wind farm area during and after the offshore wind turbines were constructed, and how their activities in the area have changed since the wind farm was installed. Results indicate that there were perceived impacts of the BIWF on the local ecosystem and the behavior of the marine resource users. For some recreational fishers, the wind farm functioned as a destination or target and served as an artificial reef for spearfishing. For some commercial fishers, the increase in recreational fishing due to the establishment of the BIWF crowded out commercial fishers in these areas. As the offshore wind farm industry expands within US waters, findings from this study and others like it provide valuable insights on the potential impacts of these wind farms on marine resource users.

Keywords: offshore wind, commercial, recreational, perceptions, artificial reef,
marine resource user, fishing, offshore energy

INTRODUCTION

Use of offshore wind turbines are gaining momentum in the United States as a viable option for meeting domestic energy needs. Knowledge of the impacts of offshore wind turbines on other local marine uses and resources in the United States is limited. Although studies have been conducted on proposed offshore wind farms in the US (Kimmell and Stolfi Stalenhoef 2011), there is currently only one offshore wind farm operating in US waters, the Block Island Wind Farm (BIWF). BIWF consists of five 30-megawatt turbines located about 16 miles south of mainland Rhode Island.

Past research on active offshore wind farms outside of the US has found several positive and negative impacts on marine biota, habitats, and ecological function. Impacts include the creation of an ‘artificial reef,’ (Bergström et al. 2014; Langhamer 2012; Lindeboom et al. 2011; Wilhelmsson and Malm 2008), increased fish assemblages (Bergström et al. 2014; Wilhelmsson and Malm 2008); and disturbance of existing ecosystems (Bergström et al. 2014; Wilhelmsson, Malm, and Marcus 2006). Impacts on birds and mammals have also been recorded (Bergström et al. 2014).

The impact of offshore wind farms on marine resource users has not been extensively studied. Marine resource users can include recreational boaters, ferry riders, sightseers, conservationists, fishers, and beachgoers. Some studies (e.g. Firestone and Kempton, 2007; Firestone, Kempton, Lilley, and Samoteskul, 2012a; Krueger, Parsons, and Firestone, 2011; Landry, Allen, Cherry, and Whitehead, 2012) have examined impacts of wind farms on on-shore recreational activities such as beachgoing. This project focuses on recreational and commercial fishers that transit

wind farm areas by boat. Lüdeke (2017) looked at the impacts of German North Sea offshore wind turbines on marine resource users and found that the turbines had a large environmental impact, both positive and negative, through creation of benthic habitat and protected areas, as well as injury to fish during construction and birds during operation. He proposed mitigation of some construction impacts through noise mitigation systems, and compensation to fishers for loss of fishing grounds. Lüdeke (2017) determined that 60% of their surveyed experts in the offshore wind farm industry want to exclude biological hotspots from future wind farm areas. Hooper, Ashley, and Austen (2015) discussed how offshore wind farms could potentially disrupt important European fisheries through poor placement and noted that, “the lack of reported experience of potting within OWFs was not related to stock concerns but to uncertainty around safety, gear retrieval, insurance and liability” (p. 16).

The transferability of these impact study findings may be sensitive to differences in physical, cultural, and economic settings in disparate locations (Lindeboom et al. 2011; Maar et al. 2009). Although other pre-construction studies for offshore wind have been conducted, such as in the case of Cape Wind (Brownlee et al. 2015), the BIWF is the first offshore wind farm to be fully constructed and operational in North America.

This study uses a qualitative approach to examine recreational and commercial fishers’ perceptions of the impacts of the BIWF on the local marine ecosystem and human activities in and around the wind farm area. A qualitative approach is useful for revealing how fishers understand the wind farm and their relationship to it (Lüdeke 2017) and for providing rich insights about feelings, thoughts, and emotions that do

not always emerge through more quantitative research methods (Bernard 2006). In qualitative studies, participants may speak in their own terms (Bernard 2006). The local ecological knowledge derived from fishers' recreational and work practices and their place-based knowledge of biotic dynamic interactions can provide valuable insights (Garavito-bermúdez and Lundholm 2017; Richmond 2013) about changes in the area around the BIWF.

To better understand perceptions of the Block Island Wind Farm project, it is necessary to understand the process of its development. The state of Rhode Island (RI) has policies that set out goals for uses of coastal waters and for power generation. Previously, an effort in nearby Massachusetts to build an offshore wind farm, called Cape Wind, had failed due to local opposition (Firestone et al. 2012b). In 2008, a Rhode Island state renewable mandate decreed that by 2020, 15% of the state's energy should be from renewable sources. Deepwater Wind (DW) was selected as the developer for an offshore wind farm in RI state waters and promised a power cable to Block Island. DW submitted permit applications for the Block Island Wind Project, a 5-turbine project that would serve as a demonstration project for offshore wind development in the US. State officials from the Coastal Resources Management Council (CRMC) decided that, instead of siting the offshore wind farm through a leasing process based on the BOEM model and NEPA processes, they would use a planning/zoning model that would result in a special area ocean management plan (SAMP) around the optimal site for offshore wind turbines. The planning, data collection and mapping process, including wind, bathymetry, and bird activity, were

completed in two years and included many stakeholder meetings (McCann, et. al., 2013). Once the SAMP was finalized, the federal NEPA process for the offshore wind project progressed, including a federal environmental impact statement.

By 2015, the BIWF had received the required permits from the US Army Corps of Engineers, Federal Aviation Administration, US Fish and Wildlife Service, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, US Environmental Protection Agency, US Coast Guard, Rhode Island Coastal Resources Management Council, Rhode Island Department of Environmental Management, US Department of the Interior's Bureau of Ocean Energy Management (BOEM) and Rhode Island State Historic Preservation Office (Block Island Times 2014). The permits reflected that there were some limits to the data available. The developers were required to respond to complaints from boaters on navigational safety impacts caused by the construction process of the BIWF project and detail their responses in a report to the US Army Corps of Engineers (Block Island Permit, U.S. Army Corps permit, Permit Number: NAE-2009-789, September 14, 2014).

Transmission cables connect the wind farm to Block Island and to the mainland shore of Rhode Island. Before the construction of the BIWF, Block Island electricity was running on a local diesel generator. The BIWF provided an opportunity to local Island stakeholders for Block Island to be connected to the mainland electrical grid (United States Army Corps of Engineers 2012). The BIWF was designed to link Block Island to the mainland electricity grid, so that when the turbines were not running, the

electricity would flow in a stable and potentially less expensive manner from the National Grid electricity on the mainland of Rhode Island.

Rules for Mariners were issued in July 2015 to close off areas around the turbines during construction. The areas that were closed off due to construction (in 2015 and from May 15 to October 31, 2016) varied according to the construction activity (United States Coast Guard 2018). Pile driving lasted from July to October 2015 and cable laying and turbine construction lasted from October 2015 to August 2016. Wind farm construction was completed in December 2016. At the time of our study, the BIWF had been operational for about 8 months and the data were collected in the first summer season after operation.

Figure 1. Location of turbines of Block Island Wind Farm (Source: Rhode Island Geographic Information System Data).

Figure 2. Block Island Wind Farm (Photo by A. Calianos).

METHODS

Study Area

The study area includes the area in and around the BIWF as well as the area around the transmission cables connecting the wind farm to Block Island and to the mainland shore of Rhode Island. Location of the BIWF is shown in Figure 1.

The five turbines of the BIWF are located about 3 miles off of Block Island, Rhode Island in the northeastern part of the United States. The turbines themselves are located just inside Rhode Island State Waters (Fig. 1). The turbines are about 600 feet tall and rest on four-pile jacket foundations that were drilled into the bedrock. The turbines are placed about half a mile from each other in an arc and have an electrical generation capacity of 30 megawatts (MW).

The BIWF is located near Rhode Island's largest commercial fishing port, the Port of Galilee in Pt. Judith, and other smaller ports like Block Island (Tetra Tech Environmental Consultant 2012). However, only a small portion of the 189 federally-permitted commercial fishing vessels based in these ports in 2009 historically fished the area in and around the BIWF. At about 6 mi², the BIWF area has supported a limited amount of lobster fishing, gill netting, and trawling (Tetra Tech Environmental Consultant 2012). Recreational fishing has also taken place in the BIWF area. There were 73 party/charter vessels based in Pt. Judith and Block Island in 2009 and tens of thousands of individuals participating in recreational ocean fishing in and around Block Island waters (McCann et al. 2013).

The sediment type under the turbines is mainly coarse sand. Turbines 1, 3, and 5 were surveyed (Bartley et al. 2017). Turbines 1 and 3 stand on coarse sand, while

Turbine 5 stands on coarse sand and pebble, gravel, and coarse sand sediment types (Bartley et al. 2017). One section of the cable lays over a clay, fine sand, and fine silt mix (Deepwater Wind 2012). Block Island is a popular summer tourist destination, with 70% of the houses on the island categorized as vacant or seasonal/recreational (Block Island Times 2001). A ferry service links Block Island to the mainland in Point Judith in Narragansett, Rhode Island. Marine resource users can currently access the area where the wind turbines are located; there are currently no navigational restrictions around the turbines.

Data Collection

We conducted in person semi-structured interviews (summer/fall 2017) with 25 fishers, mainly based out of the towns of New Shoreham (Block Island) or Narragansett, Rhode Island. Each interview lasted 30-90 minutes. Purposive sampling was used to recruit interview respondents. Purposive sampling is a commonly used sampling technique in qualitative studies where individuals are selected based on their characteristics and the objective of the study and are studied in depth (Bernard, 2006; Guest et. al., 2006). Interview respondents had to meet the following criteria: (1) recreational or commercial fishers; (2) used the area in and around the BIWF; and (3) over 18 years old. To ensure that a wide range of perspectives was captured in the interviews, we tried to recruit fishers from across a diversity of commercial and recreational gear types and different home ports. Because there is no list of recreational and commercial fishers using the waters in and around the BIWF, we used snowball sampling techniques to identify potential study participants. In snowball

sampling, respondents and other individuals knowledgeable about a topic suggest the names of possible study participants (Bernard, 2006).

We first consulted with staff at the state coastal and fisheries management agencies in Rhode Island to identify commercial fishers who had historically fished in the BIWF area. These fishers were contacted for potential interviews, and were also asked to provide the names of others who fished in the area. We stopped recruiting commercial fishers when we had reached out to all of the commercial fishers identified through this process. To recruit recreational fishing respondents, we contacted charter boat captains in Pt. Judith and Block Island as well as spearfishing captains and other individual recreational fishers. As with commercial fishers, we used snowball sampling to identify recreational fishers who used the BIWF area. We continued recruiting recreational fishers until data saturation was achieved, which is the point at which no new information is observed in the data (Guest, et. al., 2006).

The goal of the interviews was to understand past and current uses and perceptions of change before and after the wind turbines were constructed and operational. To ensure the collection of reliable, comparable qualitative data, we developed an interview guide (Supplementary Material). Interviews asked respondents about: (1) their fishing experience and prior use of the study area before the construction of the BIWF; (2) their use of the area and any ecological changes in the area during construction of the BIWF; (3) their perceptions of any changes in the area and uses of the area after the BIWF was constructed; and (4) how their individual behaviors in the area changed as a result of the BIWF.

This study was carried out in accordance with the recommendations of Institutional Review Board. The protocol was approved by the Institutional Review Board, University of Rhode Island Office of Research Integrity, Division of Research and Development. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

The interviews were audio-recorded and transcribed. They were coded for themes using NVivo 11. Applied thematic analysis and a structural coding approach were used to segment different sections of text that correspond to themes or research questions (Guest et. al., 2012). Themes were first identified, and then coded as behavioral or ecological impacts. An impact was considered to be a human use/behavioral impact if it referred to the activity of humans, while an impact was considered to be an ecological impact if it referred to a physical or biological impact on the natural ecosystem.

RESULTS

Characteristics of respondents

All the interview respondents were male and most were year-round residents of Rhode Island. Some charter and recreational fishers were summer residents of Rhode Island. We interviewed seven commercial fishers. Four mainly used gillnets, one mainly used lobster traps, one was a scallop dredger and one was a trawler for other species. We reached out to all the commercial fishermen that used the area identified through snowball sampling and captured the majority of the commercial fishermen who used the area.

We interviewed 18 recreational fishers, seven of whom were based out of Block Island. Of the recreational fishers, 12 were charter captains. Two of the charter captains were also spearfishers. There were an additional four spearfishers. We chose to interview charter fishermen because they used the marine area around Block Island frequently as their primary source of income. The gear used by the recreational fishers who did not use spearguns was rod and reel (i.e. hook and line). All of the spearfishers interviewed also fished by rod and reel, although they were categorized as spearfishers because their main fishing activity used spearfishing gear.

It is worth commenting on the relatively small sample size of commercial fishers in this study. As noted earlier, limited commercial fishing took place within the BIWF area prior to wind farm construction. We attempted to recruit as many commercial fishers as possible who had fished in and around the BIWF. According to the interview respondents, the fishers participating in this study comprised much of the active commercial fishing going on in the BIWF area.

Perceived impacts

Numerous perceived impacts of the BIWF on the marine ecology and the behavior of fishers emerged through the interview analysis. Key impacts, grouped into human/behavioral and ecological impacts, are described below. Thirteen themes related to behavioral impacts (or non-impacts) were described by respondents, with an additional eight themes related to ecological impacts (Table 1). Of the thirteen human/behavioral themes, ten related to existing conditions, while three focused on uncertainty about future conditions. In the following sections, perceived human/behavioral and ecological impacts are described in more detail, using the language of the respondents where possible.

Figure 3. Perceived offshore wind farm impacts described during the interviews with fishers

Table 1. Perceived offshore wind farm impacts described during the interviews with fishers				
Impacts on humans and ecological system	Identified Themes	# of Respondents (out of 25 total fishers)	# Commercial (out of 7)	# Recreational (out of 18)
Human use/ Behavioral	More recreational fishing in the area	22	5	17
	New Audio-Visual-Kinetic experience of the turbines	14	3	11
	Navigational concerns of running into the turbines	10	6	4
	Loss of access to the area during construction	10	6	4
	Lost fishing ground and gear (varied reasons)	8	6	2
	Turbines as landmark or target	8	2	6
	Compensation for negative impacts of wind farm	7	6	1
	More commercial rod and reel fishers in the area	5	0	5
	Created new area for spearfishing	5	0	5
	Benefit of not using diesel generator for electrical power on the island	4	1	3
	Only 5 turbines (concerned about more)	4	3	1
	Concern about access after construction	3	2	1
	Concern about decommissioning the turbines	3	2	1
Ecological system	'Structure' or 'reef' or 'fish aggregating' as rationale for fish behavior	20	3	17
	Additional fish species noticed in the area	11	0	11
	Fewer fish during construction	11	2	9
	Little to no impact on fisheries	11	2	9
	Some turbines more ecologically beneficial than others	11	4	7
	Establishment of 'mussels' and other habitat	9	1	8
	Sound issues during construction	7	2	5
	More cod in the area (personal and indirect experience)	5	0	5

Human/Behavioral Impacts

More recreational fishing in the area than before the wind farm

Most fishers (22), including both recreational and commercial, noted that there was increased recreational fishing in the area since the turbines were constructed. This impact of the BIWF was discussed by more fishers than any other impact.

Some felt it was because the turbines functioned as a landmark. One fisherman said, “Some days, when the fluking was really good out there, you’d see 50, 60 boats out there; where years ago, you might only see 20. So, word gets out: ‘Go to the wind farm, there’s good fluking.’ And then everybody runs. And I don’t know if anybody credits the wind farm for it, or it’s just that the wind farm happens to be there.”

Others noted that the turbines provided the ability to catch targeted species of fish. A spearfisherman described catching codfish around the wind turbines, stating, “That winter [2015], for about 2 months, starting in December right through January, whenever we went out, we’d catch codfish. Nice ones too. Like 15 pounds. Right in front of the windmills. I’ve never experienced that before.”

New Audio-Visual-Kinetic Experience of the Turbines

Fourteen fishers, including recreational and commercial, noted that being around the turbines and having them in the horizon was a new experience. One charter boat captain found that the experience of being around the wind farm was negative, saying, “To me they [turbines] are an eyesore. To customers, it’s something to gawk at. You know, cause they’re very, very impressive when you get up to them. They’re massive. But to me... I’d rather not see them out there.” The change in experience was an intangible impact, but it was often mentioned.

Another fisherman had a positive visual-kinetic experience, noting that “It’s pretty neat. You know, I mean you’re looking at a man-made structure that’s six hundred feet high. That’s the height of two football fields put together stacked up.”

At least two charter fishers had taken people out on ‘wind farm tours,’ and one charter fisherman said, “Just depends on what’s going on... we stopped fishing this year because I’m doing these windmill charters. There’s a lot of call for that, so we pretty much stopped charter fishing and [started] running tours.” Another fisherman noted that the demand for wind farm tours were less than he had expected and the majority of his charters were for fishing.

Navigational Concerns that boats could run into the turbines

Many fishers (10), mostly commercial, thought that the turbines could be a navigation hazard. One charter boat fisherman said he thought that the impact of the wind farm as a navigation hazard was more important than its impact on fishing; “I don’t think they [turbines] are going to harm the fishing at all, [but] I’m waiting for the first dragger to hit ‘em.” He explained that fishers may run into the offshore wind farm because of fog or exhaustion, noting that commercial fishing boats are often understaffed. He explained “Cause those guys [commercial fishers] work hard... it’s exhausting and... you could fall asleep very easily. People don’t realize it’s easy to do. Sooner or later, somebody’s going to bang one... I think they’re a hazard to navigation.”

While some fishers felt that the idea of themselves hitting the turbines was laughable, some felt that fog, wind, or exhaustion could cause themselves or other individuals to hit the turbines. Two commercial fishers invested in additional navigational radar technology in order to navigate around the turbines and other boats in the dark.

Although many respondents were concerned about running into or being blown into the turbines, one felt that the turbines served as a navigational aid and three others were not concerned at all about navigating around the turbines.

Loss of access to the area during construction

Ten fishers discussed the access to the area that was lost during construction of the turbines. In the interviews, almost all of the commercial fishers described how DW provided some funding to fishers who could prove that they fished in the areas that would be closed for construction to compensate for their lost time fishing when those areas were closed. Some fishers noted that the construction of the cable had been delayed, resulting in additional lost fishing time for which they were not compensated. Recreational fishers were not compensated for any loss of access during construction.

Lost fishing ground and gear (varied reasons)

Several respondents (8) also discussed how the offshore wind farm resulted in displacement and crowding of fishing vessels which made them feel like they had lost productive fishing ground. This concern was discussed at length by all but one commercial fisher. As one commercial fisherman explained, “We went to a different area, tried a different spot, which was less productive, I mean, less money. Sometimes a lot of guys lost gear.” Six out of seven commercial fishers discussed lost fishing grounds or gear due to crowding. One fisherman who lost a net during construction due to a misunderstanding about the time and area of construction was compensated by the wind farm developer.

The influx of recreational fishers around the wind farm caused displacement of commercial fishers. One commercial gillnetter explained, “There are a lot of places we can’t get. If you do go there, let’s say you gillnet there, when you go to haul it, [recreational fishers] don’t really know what is going on because it [gillnet] has two ends on it. [...] They’ll go get fish hooks and weights and lures caught in the net [...] You spend half a day pulling all this fishing gear out of your twine. So, a lot of spots--if they’re fishing there--we can’t go anymore. “

Because the BIWF had become a new destination for recreational fishers, the commercial gillnetters interviewed felt that they were displaced or crowded out by the increase in recreational fishers. The physical establishment of the offshore wind farm also necessitated a change in the angle of the layout of the gillnet gear.

Turbines as landmark or target

Several respondents (8), including six recreational fishers, noted that they considered the wind farm to be a destination or target for recreational fishers. It was considered a destination for fishing; as one recreational fisherman said, “If there was nothing out there, I certainly would not have gone out there otherwise. It definitely has the bug to a lamp effect.”

While recreational fishers generally felt that the wind farm’s role as a destination or target was beneficial, the two commercial fishers who brought up this impact described it as negative because it increased the amount of activity going on in their fishing grounds.

Compensation for negative impacts of wind farm

Six commercial fishers discussed compensation in the event of negative impacts on their fishing. One fisherman did not think that it was necessary for him to get any compensation because he only transited through the area. One recreational fisherman wanted assurance that a commercial fisherman who had a historic fish trap would be reimbursed for relocating his trap to accommodate the cable.

More commercial rod and reel fishers in the area

Commercial rod and reel fishers' fish with the same technique and gear as recreational and charter boat fishers, but have a commercial license to sell the fish. Respondents noted that it is difficult to tell what license other fishers were using, but some respondents (5) felt that there were more commercial rod and reel licenses being used in the area than in the previous years.

Establishment of new spearfishing grounds

All five of the spearfishing respondents felt that the wind farm provided new grounds for spearfishing. Spearfishers described how they sometimes went to the wind farm to target rarer fish species, like tropical fish. The wind farm area also attracted spearfishers that were beginners because of the novel experience of being around the turbines. One charter spearfisherman described how he now "can take beginners to it [the BIWF], because they can just float around and look at it... I mean it's incredible looking.... And the amount of fish-life's unbelievable. [...] People want to see it [the BIWF]. Gives them something to look at besides the norm."

He continued, “Within two or three months [of construction of the BIWF] it was loaded with fish. And this year it has even more. So now it’s not only structure to hide them but there’s a food source on it. [...] I think it will keep getting better [for spearfishing]. But there’s mussels all over it, the scup [a common pelagic fish in the region] are eating the mussels... there’s bass on it eating the scup... there’s uh there’s all kinds of small marine life... minnows and shiners that are hanging around it for protection. And of course, that brings in the pelagics.”

Benefit of not using diesel generator for electrical power on the island

Several fishers (4) discussed the benefit of not using the diesel generator on the island. Some of the fishers lived on the island and felt that the benefit of not using the diesel generator for electrical power outweighed any other concerns. One recreational fisherman residing on the island noted, “The wind mills are not that offensive. They're not saving us any money at this point, but as my wife is quick to point out, we're getting a constant flow of electricity. With the generators, it was always going up and down...Nobody on Block Island, when they were running the diesel generators, could use an electric clock, because it would not keep time... That also wore heavy on your appliances.... and now it [electricity] is consistent.”

Concerns about future wind farms, access to the area after construction, and decommissioning the turbines

Three respondents were concerned about future wind farm projects, their access to those areas, and how turbines would be decommissioned. One fisherman explained,

“this particular farm isn’t the end all, be all [...]. They are going to put something like 200 turbines here and the whole ocean, you know, is going to be carved up.”

Another commercial fisherman noted, “This is just 5 wind turbines. Five in a row. If it was 15 or 20 in a block, or 50, that would be a whole different story. Now, this little demonstration project is not a big deal, and really doesn’t have a big impact so to say.”

He continued, “I mean, it [BIWF project] is minimal, but still, there they are. It’s offensive that they are there on the water. Here is the radar [shows interviewer a photo on his cell phone of his boat’s radar]. I took quick pictures of [the turbines], for the radar.... The blue dot there is [my boat], see how these sweeps, now that’s on a 6-mile range out there, see how it’s [the turbines are] just obliterating the opportunity to see any other target on there.” To this fisherman, the wind farm was a physical symbol of his concerns about the future, dislike of many different aspects of the project, and navigational issues with the turbines.

Ecological Impacts

‘Structure’ or ‘reef’ or ‘fish aggregating’ as rationale for fish behavior

Most respondents (20), including seventeen recreational fishers, noted that the wind turbines created a new structure for fish habitat and served as an artificial reef. Many fishers (9) also noticed mussel growth and fish attraction as a description of the artificial reef, as one recreational fisherman noted, “the fish were on the structure within a month of them putting it in... it was incredible. [...] These had growth, they had small mussels on ‘em within a couple months... It was unbelievable!”

Another fisherman explained that the wind farm structure created a deep vertical ecosystem: “Coming up from the bottom almost all the way up, you could almost see them from above, like a vertical ecosystem, of just like, scup. [...] So, it’s definitely acting as sort of an artificial reef. It’s definitely benefiting the fishing.”

One recreational and one commercial fisherman discussed how the turbines did not provide a new long-term habitat, noting that the artificial reef would not create a richer area for fishing, but just serve as a temporary attraction for fish.

Other fish species noticed in the area, including cod, a target species

The fish species found at the BIWF are a mix of in-shore and offshore species. Many recreational fishers (11) noticed additional fish species in the area. Some of the fish species that have been noticed around the turbine by respondents include scup (*Stenotomus chrysops*), summer flounder or fluke (*Paralichthys dentatus*), black sea bass (*Centropristis striata*), striped bass (*Morone saxatilis*), tautog (*Tautoga onitis*), bluefish (*Pomatomus saltatrix*), mako shark (*Isurus oxyrinchus*), triggerfish (*Balistidae spp.*), Almaco jack (*Seriola rivoliana*), cobia (*Rachycentron canadum*), mahi (*Coryphaena hippurus*), bonito (*Sardini spp.*), false albacore (*Euthynnus alletteratus*), banded rudderfish (*Seriola zonata*), sea robin (*Triglidae spp.*) and cod (*Gadus morhua*). Five fishers noted that the wind turbines attracted cod, a targeted fish rarely seen in waters near the wind farm, and one said that he personally caught cod there in 2016, after the turbines were installed. In fact, respondents brought up cod more than any other species when describing changes in fish populations near the turbines.

One spearfisherman noted, “I think, we’re seeing a wholesale change of the whole area. Oh yeah, because I see this whole ecosystem developing out there. This whole thing with the codfish and the herring, that just blew my mind. I mean, like, I was pulling up the codfish and they had herring like this big [uses hands to show interviewer the size of the fish] in them. And there was a reason that the herring were hanging out in that area. And like I said, that was not last year but the winter before. Winter of ’16. I mean, just the number of bluefish that I’ve seen...”

He explained that he likes to fish near the wind turbines to catch different types of fish, both in-shore and offshore, “We definitely dive [turbine numbers] 5 and 4, shoot a couple blackfish [tautog] off of it.... Shoot another semi-tropical thing. You go out and try to target a big blackfish because there are big ones there, up to ten pounds and over.”

Effects under construction

Respondents also described how turbine construction negatively impacted water quality and underwater noise. One fisherman noticed murky water quality, sound, and vibrations during the three weeks of drilling, saying, “The whole side of the [Block] island was just a big mud plume.... And then as the tide switched, it would generally dissipate. But when they were using the lancers to drive it, there was just silt everywhere. And the pounding, you could hear the pounding on Watch Hill Reef in the water... you could hear the pounding of the pilings being driven.”

Many fishers (11) felt that there were fewer fish in the area of the wind turbines during construction. Some described the fish as being “chased” into other areas that

were further away from the wind farm and noted that there seemed to be more fish in other areas around the island. Two spearfishers noted that the sound of drilling negatively impacted fish on the southeast side of the island; that there were fewer striped bass on the side of Block Island closest to the turbines during construction and more of them in other areas around the island. This short-term impact of noise pollution was the primary negative environmental impact of the turbines and discussed by seven respondents, although the fishers felt that the fish quickly recovered after the noise disturbance.

One spearfisherman explained, “I’ll tell you what used to scare the fish.... When they built them [turbines]. When they were putting them in, when they were driving those things down in the ground, we could hear it underwater on Block Island in the shallows... almost 3 miles away. I mean loud! It scared all the fish in the area, we had really bad fishing in that area in that season... once they were in... once they laid up driving the pilings, then the fish would return. So, it would just make them nervous for a short period of time.”

Ecological differences among turbines

Eleven fishers perceived slight ecological differences around each of the turbines, indicating that they preferred fishing at certain turbines. A few other respondents (3) felt that even when the turbines were located on different substrate (e.g., mud, rock), the ecosystems around each turbine were identical.

One spearfisherman explained that his favorite turbine to fish was Turbine 5 (see Figure 1), saying, “I’ve been on the other turbines, it hasn’t been quite as good in the

past on [turbine] 1. What's happening, I think the ecosystem is growing this way, and maybe it has to do with the incoming tide, but they all seem to be covered with the base layer of mussels now. And that's what they need. The base layer ecosystem that they need, which will promote other growth, which will promote growth for the other fish. I haven't spent enough time to say it's not good there. [...]. Oh yeah, definitely, [turbine] 5 has the densest mussels, 5 is definitely the leading edge of the ecosystem, that's what I think, that's my impression."

BIWF has no impact on fish

Many fishers (11) felt that the wind farm had no major ecological impacts. They felt that fish stocks had natural variability, and that the wind farm had not had a discernably large impact on fishing. One charter fisherman explained, "This year [2017] has been a crazy year, so I don't know if it's because of the wind farm, or it's just a crazy year."

His comments illustrate the variable nature of local fisheries, further noting, "I mean, we had a really lousy spring, and we haven't had much of a summer either. And we have had a lot of bait. There is more bait around this year than there ever was. And I don't know why that's happening, but I think the fish are just getting so full of the bait, that you know, unless they are hungry, they are not going to come eat our lures. That is why I think the fishing is a little off this year. The bottom fishing is fine. Bottom fishing is good. But bass fishing... and bluefishing is off. There is hardly any bluefish around. When they show up, it's like, crazy. And then the next day they are gone."

Establishment of 'mussels' or habitat

When describing the turbines as an artificial reef, many (9) also mentioned mussel growth and fish attraction, as one recreational fisherman noted, "So that's what I've seen diving there... the explosion of the mussel population, the mussels up near the top are smaller... as you descend down past 15-20 feet, the mussels get to be, I'd say they're in the range of 2.5-3 inches right now. And they are densely packed onto it [the turbine]... there's mussels growing on mussels now. So, I don't know how they're going to address that ... I'm sure there's an industrial way of removing these mussels. They must do it all over the world. But I mean, the biomass of mussels on these things has got to be in the hundreds of tons... it's got to be. It's unbelievable."

DISCUSSION

Twenty-one different impacts associated with the Block Island Wind Farm were identified by individuals who fish the area in and around the BIWF. Most of the impacts were discussed by both recreational and commercial fishers. A few impacts were described by only recreational fishers. For instance, only recreational fishers said they had seen changes in cod abundance or noticed other fish species in and around the BIWF. In contrast, many commercial fishers said that the BIWF was having little to no impact on fisheries. While commercial fishers discussed some ecological impacts during the interviews, they focused more attention on human impacts. Human impacts garnering the most attention from commercial fishers included compensation, lost ground and gear, lost access during construction, and navigational concerns. Several commercial fishers (3) also expressed concerns about future impacts (i.e. decommissioning, access after construction, larger projects in the future), while these impacts got little attention from recreational fishers during the interviews.

Ecological impacts highlighted by respondents included short-term impacts on fish during construction to potentially longer-term impacts on mussel growth and new habitat around the turbines. The noise of pile driving during construction was perceived as a negative impact on the ecology of the area. Some respondents noted that there were fewer striped bass on the side of Block Island closest to the turbines during construction and more of them in other areas around the island. Other studies have also highlighted that animals have left a wind farm area during construction (Bergström et al. 2014; Vallejo et al. 2017). For instance, Vallejo et al., (2017) reported that harbor porpoise abundance decreased in the area of a wind farm during

construction but that there was no change in porpoise abundance in the area pre-construction and post construction (i.e. during operation of the wind farm).

Lindeboom et al., (2011) found that seals stayed away from an offshore wind farm during pile driving. Two studies (Lindeboom et al. 2011; Wilber, Carey, and Griffin 2018) determined that although drilling for offshore wind farm turbines was audible in reference areas, it did not seem to have a major impact on fish abundance.

Findings from this study are consistent with prior research indicating that offshore wind farms have positive impacts by serving as ‘artificial reefs,’ enhancing habitat and attracting fish after they are constructed (e.g., Bergström et al., 2014; Lindeboom et al., 2011; Wilhelmsson and Malm, 2008). According to individuals who fish around the BIWF, the primary change (to date) at the BIWF has been at a lower trophic level (i.e. mussels), which aligns with existing studies. Petersen and Malm (2006) suggested that the ‘reef effect’ through the addition of hard substratum through turbine foundations and pilings would have the largest impact on the ecology of the area. In a study of offshore turbines in the Baltic Sea, Wilhelmsson et al. (2006) found that there was a greater abundance of fish around the turbines, and the community structure of the fish on the monopoles was different than it was before the wind farm was constructed. They also identified that mussels and barnacles were covering the turbines, noting that offshore wind farms serve as artificial reefs and potentially fish aggregating devices. In a study of the first offshore wind farm off the Dutch coast, Lindeboom et al. (2011) reported that the new hard substrate of the turbines enhanced biodiversity by acting as new type of habitat. Bergström et al. (2014) also found that there was habitat gain from offshore turbines that often increased local species

abundance in an artificial reef effect, potentially resulting in changes to higher trophic levels.

Observations from individuals fishing around the BIWF suggest that there are already some changes in higher trophic levels occurring near the turbines, such as increases in certain species abundance (i.e. cod and black sea bass). These changes are consistent with findings by Raoux et al. (2017), whose model predicted that total ecosystem activity increased after construction of an offshore wind farm and that higher trophic levels such as marine mammals, birds, and piscivorous fish would increase, and Lindeboom et al. (2011), which showed that cod stayed around an offshore wind farm and seemed to find food and shelter at their bases for at least nine months continuously. However, there is some evidence that black sea bass along the northeast US coast are migrating due to changes in climate (NOAA Fisheries Service NEFSC 2018). More study is needed to better understand if observed changes in species abundance near the turbines are due to the wind farm or to broader environmental changes.

While fishers noticed some ecological changes in the area, the most significant changes were associated with human use of the BIWF. The perceived function of the wind farm turbines as artificial reefs or fish aggregating devices greatly affected recreational use of the area. Perceptions of greater fish abundance around the turbines will likely have future positive impacts on the recreational, commercial rod and reel, and spearfishing sectors in southern New England. These findings are not surprising, as a similar study of recreational fishers in the United Kingdom found that they had positive perceptions of the artificial reef effects of wind farms and 73% of anglers

surveyed said they would be willing to fish around the perimeter or within a wind farm (Hooper et al., 2017). Although increased abundance of fish can aid fisheries and tourism sectors (Bergstrom et al. 2014), the increased activity could negatively affect resources and lead to overfishing (Giglio et al., 2018). For instance, Coleman, Figueira, Ueland, and Crowder (2004) found that recreational fisheries landings comprised 23% of the total landings in the United States in 2002, and for some valued overfished species, recreational landings were greater than commercial landings. It will be important to monitor changes in fishing pressure, particularly recreational fishing pressure, around the turbines in the coming years.

As some fishers suggested in the interviews, changes in fishing around the turbines could also affect the fishing experience. Commercial fishers are already observing conflicts in use around the turbines. There could be crowding issues among recreational fishers as well, as the wind farm attracts more users over time. The growing popularity of wind farm tours seems to have increased the overall number of boats in the area, yet this increase in use might only be a short-term impact resulting from the novel experience of viewing offshore wind farms. Levels of use around the wind farm could eventually exceed social carrying capacity, or levels deemed acceptable to commercial fishers, recreational fishers, tour operators, and other users, affecting user experience and possible future use of the area (e.g., Dalton et al., 2017). More research on the effects of offshore wind farms on user crowding and social carrying capacity is needed to better understand longer-term impacts of offshore wind farms.

As an artificial reef, the turbines provided a new site for spearfishers, a subcategory of recreational fishers who use spearfishing gear underwater to target fish, often trophy fish (Young, Foale, and Bellwood 2015). Spearfishing is historically popular in Rhode Island, especially on Block Island (Korden 2013), where spearfishers fish along rocky shorelines or other shallow reef areas. The BIWF gives spearfishers a novel experience in deeper waters and can potentially have positive impacts on the recreational spearfishing industry in Rhode Island. Alternatively, an increase in spearfishing might have some positive impacts on wind farm activities. Because they are able to make close observations about underwater ecology, spearfishers can provide early warnings of change in fish and habitat (e.g., Young et al. 2015). Videos captured by spearfishers in the Mediterranean provided a valuable tool for assessing the structure of fish assemblages on rocky reefs (Bulleri and Benedetti-Cecchi, 2014). It is possible that spearfishers around the BIWF could serve as citizen scientists, helping to monitor ecosystem changes over time (e.g., Bonney et al., 2014). Spearfishing has not yet been discussed in the literature as an impact of offshore wind farms in the North Sea; this may be due to the siting of the wind farms further offshore or in colder waters. More research on the potential impact of offshore wind farms on the recreational spearfishing industry, and the opportunity for spearfishers to provide information about the ecology of the area, is recommended.

Fishers around the BIWF have observed a variety of offshore wind farm impacts, yet these impacts seem to be unevenly distributed among different fishing sectors. Commercial fishers who historically used the area in which the BIWF was constructed tended to describe its impacts in a negative way. For instance, increased recreational

fishing in the area resulted in gear loss, crowding, and reduced access to their fishing ground. They also highlighted navigational concerns about transiting the area.

Recreational fishers, on the other hand, described more positive impacts of the wind farm related to increases in fish habitat and abundance, leading to an improved fishing experience. As noted earlier, it is possible that changes in ecology and use will negatively affect the experience of recreational fishers around the BIWF, but for now, negative impacts of the BIWF are most strongly felt by commercial fishers who had historically used the area. Our findings support the suggestion by Hooper, Hattam, and Austen (2017) to consider co-locating recreational fisheries with offshore wind farms, and providing compensation to commercial fishers who have historically fished there.

CONCLUSION

Through interviews with commercial and recreational fishers, this study demonstrates how local or traditional ecological knowledge can highlight perspectives of people who are closely connected to a resource (e.g., Berkes, Colding, and Folke, 2007). There have been numerous ecological, physical, and engineering studies of wind farms, but only a few social science studies focusing on human impacts at sea. Improved understanding of the perceptions, values, and experiences of local stakeholders in the marine environment sheds light on how resources will be impacted and can provide additional context for biological studies (Diogo, Pereira, and Schmiing 2017). Local knowledge of BIWF fishers that was gathered through this study can supplement the findings from ecological studies of the BIWF and contribute to a more holistic understanding of the impacts of offshore wind farms.

Several larger wind farms are being proposed along the Atlantic coast of New England. Rhode Island selected DW to plan a 50 turbine project with 400 MW capacity, Massachusetts awarded a contract to a 100 turbine project with 800 MW capacity, and New Jersey passed a law requiring 3500 MW of energy be generated from offshore wind power (Coren 2018). The findings of studies like this one can be used to inform how decisions on where, how, and if offshore wind farms can be placed to aid fishers (e.g., Rigano and Delle Fave, 2017). High quality environmental impact assessments of offshore renewable energy projects are needed, yet lacking (Maclean et al. 2014; Willstead, Gill, Birchenough, and Jude, 2017). Findings from this study will inform on-going environmental impact assessments of offshore wind farm projects in

the US and elsewhere. It is important to note that the BIWF was developed in state waters, less than three miles from shore, and has only five turbines, so there is still some uncertainty associated with the impacts of larger-scale wind farm projects further offshore in the US. More research on this is needed.

Energy production from offshore wind farms will contribute to broader efforts to integrate renewable energy sources into climate change mitigation and sustainable livelihoods. The Intergovernmental Panel on Climate Change (IPCC) found that renewable energy sources could reduce CO₂ emissions by more than half the estimated amount between 2011 to 2050, since the majority of greenhouse gas emissions were due to consumption of fossil fuels (Edenhofer et al. 2011). The IPCC Report and other studies note that these estimates depend on the technologies, system behaviors, site-specific conditions and types of energy sources being replaced, but potential benefits of renewable energy include social and economic development, access to energy, more secure energy supply, reduced air pollution, and lower fatality rates (Bruckner et al. 2014; Edenhofer et al. 2011; Esteban et al. 2011; Leung and Yang 2012; Saidur et al. 2011). While offshore wind has the potential to meet energy needs more sustainably than fossil fuel consumption, the impacts of renewable energy projects must be better understood. Local knowledge of the fishers in this study have provided valuable insights on the impacts of offshore wind farms on recreational and commercial fishers. Policymakers, developers and users can use these insights to more effectively plan and develop offshore wind projects.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Author Contributions Statement

TT: Contribution to the Paper through data collection, analysis, and interpretation; manuscript writing; and serving as corresponding author.

TD: Contribution to the Paper through development of the project; oversight on data collection, analysis, and interpretation; and manuscript writing.

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Written transcripts are available on request.

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CHAPTER 3: PLACE MEANINGS OF RECREATIONAL ANGLERS IN THE URBAN FRINGE

Authors:

Talya S. ten Brink

Corresponding author:

Talya ten Brink

tenbrink@uri.edu

University of Rhode Island

Dept. of Marine Affairs

Kingston, RI 02881

ABSTRACT

Manuscript 2 focuses on how coastal place meanings differ due to location and angler characteristics in the urban fringe. By understanding how anglers conceptualize coastal and marine place meanings, we can understand the landscape-related benefits for the anglers. This study examines how, where, and why recreational anglers along the mid-Narragansett Bay value their coast. Place meanings are important because they demonstrate the emotionally salient aspects of a place, and these aspects can be used for consensus-building, conflict management, and continuation of positive emotional experiences of landscape over time. In summer 2018, we conducted in person interviews with 43 anglers who use public access sites in the urban fringe. Major place meanings related to fishing, access/convenience of the site location, relaxation, and beautiful/pretty, clean/water quality, and calm/quiet. Some of these short answer place meaning responses were also explored in binomial regression statistical analyses to look for differentiations due to location or angler characteristic. From the rest of the interview text, five groupings of themes emerged that provided a deeper understanding of why anglers visited the site. These groupings were Access, Safety, Pollution, Sustenance, and Health. Findings from this study explore how place meanings and place attachment in the urban fringe are related and can inform the ways in which more urban coastal fishing areas can function for anglers. *Keywords:* place meaning, pollution, heritage, under-represented, sustenance, environmental justice, urban, anglers, immigrant, place attachment, Hispanic, Latino, fishers, Asian

INTRODUCTION

Much research has been conducted on the benefits or motivations of recreational fishing in suburban areas; however, research on recreational fishing in ethnically diverse, low income, and urban communities, is lacking (Pulford, Polidoro, and Nation 2017), especially in the urban fringe, where characteristics of urban fishing and suburban fishing can mix. This study demonstrates why public coastal fishing areas are valuable in the urban fringe for urban and peri-urban communities.

The Urban Fringe

The urban fringe, which consists of the area between urban and suburban areas, is an important space used by urban residents (Jindrich 2010). Urban fringe areas are essential for personal well-being of urban resident users (Eriksson, Nordlund, Olsson, & Westin 2012), making it important to provide access to and to preserve these areas for these users. Parks in the urban fringe provide much needed personal space for adolescents (Robertson, Montuoro, & Burston 2018) and restoration for individuals who work nearby (Colley, Brown, & Montarzino 2016). Yet the urban fringe has also been found to have some less desirable characteristics, such as marginalized community access (Hughes et al., 2015), hazardous social living conditions (Sharma-wallace 2016), greater pollution than suburban areas (Moore, Schindler, Scheuerell, Smith, & Frodge 2019), and less accessibility to fishing areas with fish that are safe to eat (Burger et al. 1999). These studies demonstrate the importance of recreational space in the urban fringe, and the importance of researching the needs of its users.

Recreational Fishing: Benefits and Motivations

Fishing has long been a way to connect with nature and culture and to provide food. Recreational fishing has been shown to provide many benefits, such as food, spirituality, recreation, relaxation, continuation of identity, and social bonds (Hunt, Stutton, and Arlinghaus 2013), and therefore has a positive contribution to community and individual well-being (Fenichel, Gentner, & Arlinghaus, 2013). More generally, access to nature is important for mental health and well-being (Eriksson, Nordlund, Olsson, & Westin 2012).

Studies show a wide variety in motivations of anglers (Dabrowska et al. 2017; Magee et al. 2018), including ‘escape’ and ‘affiliation’ (Kuehn, Luzadis, and Brincka 2017). Anglers (recreational fishers) provide an advantageous sample to study socio-ecological issues because they influence and are influenced by the environment (Arlinghaus et al. 2017; Ziegler et al. 2017). For instance, a network analysis of an angler community found that the anglers that were less skilled and less active were highly vulnerable to stop fishing when access to a reservoir was removed, while highly active anglers were more likely to find a resource substitute (i.e. fish at another site) (Martin et al. 2017).

Water Quality Pollution and Recreational Fishing

Access sites with clean water can provide important benefits for recreational fishermen. However, recreational fishing areas are not regularly checked for harmful pollutants (Pulford et al. 2017). Pulford, Polidoro, and Nation (2017) found that most recreational anglers surveyed in Phoenix, Arizona ate their harvested fish, even if the waters were polluted; and in this case, shown to be polluted with pesticides, polychlorinated biphenyls, polycyclic aromatic hydrocarbons, and phthalates. Eating

fish from polluted waters is attributed to lack of knowledge, adherence to traditional knowledge practices, and limited access to fish advisory information (Burger et al. 1999). Past research has found that many anglers would eat recreationally caught fishes even if they perceived the water to be polluted (Pulford, Polidoro, and Nation 2017). Burger et al. (1999) found that ethnicity affected how people interacted with information sources, compliance and perception in recreational fishing. All ethnicities had a willingness to comply with advisories once informed of the risks of eating polluted fish. Due to the study location in the urban fringe, water quality in relation to recreational fishing was explored in this study.

Environmental Justice in regards to Recreational Fishing and the Urban Fringe

The benefits of recreational fishing at high quality recreational areas are not evenly distributed among racial and ethnic groups; the water can be a place of segregation (García and Baltodano 2005). For example, people of color have been excluded from high quality beaches via parking fees; opening beaches that were polluted, remote or hazardous; or using beatings, assault, and harassment with the implied approval of police (Kahrl 2018). Furthermore, issues of environmental injustice (Environmental Protection Agency 2019) are more likely to occur in urban areas, which have a low income and high minority population compared to other areas in Rhode Island and other areas. Urban areas and the urban fringe often include larger proportions of minorities (Jindrich 2010), and urban anglers are often from underrepresented user groups (Pulford et al. 2017; Adams et al. 2006).

Preferences for leisure activities also vary among groups. Literature on the Hispanic community demonstrates that commitments to family and friends drive

leisure activity decision making and income level does not drastically affect participation or activity interest (Adams et al. 2006). Other studies show that Hispanic recreationists prefer recreation areas that can hold large groups (i.e. immediate and extended family) (Kyle 2008). Many factors can influence fishing behavior (Schroeder et al. 2006). Women were more likely to be ‘social’ anglers in that they fished less frequently and were more likely to fish for social motivation (i.e. to spend time with other people) (Magee et al. 2018). Women were found to more often have catch-related or social motivations for fishing (Schroeder et al. 2006).

Individual preferences for recreational areas demonstrate the importance of focusing on place-based benefits in fishing, not just the activity of fishing itself. To capture place-based benefits of fishing areas in the urban fringe, this study focuses on one aspect of sense of place, i.e. place meanings.

Sense of Place and Place Meanings

This study examines place meanings associated with the urban fringe held by coastal recreational anglers. Sense of place research attempts to capture how attached people are to places, how people relate to places, and how that relationship affects people’s behavior (Stedman 2002). Sense of place can be either positivistic or phenomenological (Stedman 2002). Wynveen et. al. (2012) defines place attachment as the intensity of the human-place bond of valuing or identifying with a place using positivist and quantitative measures, while place meanings differ from positivistic place attachment dimensions in that they describe the place directly and convey cognitions and images of the place (Brehm, Eisenhauer, & Stedman, 2013; Masterson et al., 2017).

Place meanings are important because they demonstrate the ways that geographic areas are important to people (Smaldone 2006; Smaldone, Harris, and Sanyal 2008). They demonstrate nuanced views on a place that are not captured in the trifecta of place identity, place dependence, and place attachment that comprise the existing sense of place literature (Stedman et al. 2006). One way of capturing place meanings is to directly ask people what specific places mean to them (Smith et al. 2012). Meanings are captured in different ways, varying from a series of adjectives that describe a place setting, such as cozy, friendly, or unsafe to the more symbolic and interpretive, or meanings take the form of functional nouns, such as ‘adventure’ or ‘home.’ Other place meanings reflect the place character or a characterization of the place setting, such as ‘a tourist place,’ ‘wilderness,’ or ‘the river’ (Lyon 2014; Masterson et al. 2017).

Places often have different meanings for different users and stakeholder groups. As a place is composed of a combination of social and natural features, each individual has different memories about being in a place with family, friends, others, or alone (Kyle and Chick 2007). Factors that influence place meanings include uses of the site, personal characteristics (e.g. life stages of the individual), social groups, habits, distance from the site, interpersonal relationships on the sites, weather, and environmental and man-made features of the site (Kyle and Chick 2007). Place meanings can be used to record benefits of a place or to plan for future change. Smith et al., (2011) found that common place meanings generated a collective identity for anglers and a basis for place attachment.

This study investigates how recreational anglers conceptualize place meanings in the coastal urban fringe and how location and personal characteristics influence these place meanings.

Study Area: Coastal Warwick

The study area for this project is Warwick, Rhode Island (RI) on the east coast of the United States. As a coastal community on the estuary of Narragansett Bay, Warwick is located between the city of Providence where it is unsafe to swim or shellfish, and suburban communities further south in Narragansett Bay (GB SAMP), where it is safe to do those activities. Safe areas for swimming mean better water quality than areas that are not safe for swimming. The two study sites selected on Warwick's coastline are the furthest places north on the western side of Narragansett Bay where urban anglers can access safe swimming, and shellfishing. At the urban fringe along Narragansett Bay, Warwick provides an ideal setting for examining place meanings in urban fringe areas.

Upper to mid- Narragansett Bay is characterized by industrial activities and reduced environmental quality (Figure 4). Upper Narragansett Bay hosts a major port near Providence and a multiple use area with high recreational use, commercial fishing vessels, recreational motor boats, and service vessels. Areas were converted from industrial zones to residential marinas as wastewater treatment improved water quality (Dalton, Thompson, and Jin 2010). Most of the permanent beach closures in Narragansett Bay are at the same latitude as or north of Warwick (upper estuary) (Narragansett Bay Estuary Program 2017). The water quality in the upper estuary is

impacted by excess nutrients, causing eutrophication and low oxygen which restricts fish habitat and most recreational use. The water quality in the lower bay is not pristine; however, it is of higher water quality than in the upper bay. In the upper bay, the coastline is surrounded by urban lands whereas in the lower bay, it is surrounded by greater forest and wetlands. There are strong north south gradients; industrial contaminants (due to human population, industrial activity, and wastewater treatment plants) are greatest in the northern part of the bay and are lower in the lower bay. Both legacy contaminants and new contaminants from personal care products, pharmaceuticals, and industrial chemicals, are more concentrated in the upper bay (Narragansett Bay Estuary Program 2017, Rhode Island 303d Impaired Waters List).

The area is also characterized by gradients in population. The poverty rate (based on the U.S. population) in Providence is 26.9% and Warwick is 6.7%. See Figure 4 for the Median Household Income throughout Rhode Island. See Figure 4b for the population density per mile in Rhode Island; Warwick (black border) is on the southern edge of urban Providence.

Figure 4. Study Sites and Median Household Income in Rhode Island (2011)

Figure 5. Population Density in Rhode Island (2011)

Two sites within coastal Warwick were identified as study sites to represent the urban fringe. The two study sites, Conimicut Point and Rocky Point, (Figure 4) are popular fishing areas in the upper to mid-Bay region that have similar water quality and distance from an urban residential area (Providence, Rhode Island), but have

different amounts and types of fishing infrastructure. Both sites have parking onsite and no entrance fee.

Conimicut Point Park (Figure 6) is a public beach that wraps around a sandbar, and has a walking trail, playground, parking and a field in the middle. The beach is sandy, with shallow topography, and south of the point of the sandbar is conditionally open for shellfishing in most weather. Conimicut Point Park is an official RI CRMC public access right of way and is located 6.1 miles south of the Providence border.

Figure 6. Google Earth Image of Conimicut Point Park

Rocky Point Park (Figure 7) is a state park (open since 2014) that includes a few (3-4) small beaches. The majority of the fishing takes place from a rocky shoreline composed of a concrete wall and rip rap. The park is located 7.7 miles south of the Providence border. The park was both an amusement park, which closed in 1995, and a Native American settlement site. Remnants of the amusement park are visible on the site, including an old pier dock, which was rebuilt the year after data collection for this study. The park includes hiking trails, biking paths, and wide lawns.

Figure 7. Google Earth Image of Rocky Point Park

METHODS

Semi-structured interviews were used to collect data on place meanings of coastal recreational anglers because they capture nuances of emotion better than structured survey instruments (Masterson et al., 2017). In person interviews are a useful method for studying sensitive issues or conflicts (Bernard 2006), and semi-structured interviews are particularly useful for capturing information when only meeting the participants once (Bernard 2006).

Forty-three (43) anglers were interviewed during summer 2018 (June through August). The research team visited each site at least once a week following different time patterns to gather a diverse sample of interviewees. We interviewed at different times of day, days of the week, and alternated between sites. The interviews were audio-recorded on site. The study was restricted to participants that 1) were over the age of 18, and 2) currently or recently fished (they fished that summer or the previous summer) at either Conimicut Point or Rocky Point parks. Participants were selected through purposive sampling because there is no random sampling frame from which to select. During crowded days, every third person in a group was interviewed. This selection strategy is a standard way of reducing the amount of people to interview on a site during a site visit (Bernard 2002) and to prevent potential oversampling of similar experiences among individuals within groups. Interviews were conducted in Spanish and English. Spanish was selected as an alternative interview language because when scoping out the sites Spanish was heard on the site as a predominant language. The research assistants were fluent in Spanish (i.e., native Spanish speakers) and translated as needed. The interview protocol was back translated (Bernard 2006) and translations

were discussed until agreement was achieved between the two bilingual research assistants and the author.

Place meanings were captured in two prompts. In the first prompt, respondents were asked “What is important to you about this place?” Academic vocabulary such as ‘place meaning,’ ‘identity,’ ‘dependence,’ and ‘attachment,’ were not used, and instead words such as ‘special,’ ‘important,’ and ‘time to get there,’ were used so that respondents were more likely to self-define place meanings (e.g. Smaldone et al. 2017). In a second prompt, participants were asked, “If you had to say what this site means to you in two to three words what would they be?” In response, some respondents said more than 2-3 words and those were used since the respondents were directly describing what was most important or special about the site. See appendix B for the full semi-structured interview protocol.

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- I. Place: When did you start coming to this site? How long have you been coming here? How often? How far do you live from this place?*
 - II. Place meaning: What is important to you about this place?*
 - III. Site areas: [Google Earth Birds-eye image]. This is an image of the site; which areas exactly are you talking about?*
 - IV. Fishing: How long have you been fishing? What type of fishing do you do? What types of fish do you catch? What fish do you target and why? Do you like to keep them?*
 - V. Company: With whom do you generally come to the site? Why? How many people?*
 - VI. Motivations: Why do you come here? What types of things do you do here? Do you have any family traditions associated with the place? Does this place remind you of your heritage or culture? Do you feel welcome there? What makes you feel welcome or not welcome?*
 - VII. History: I want to ask you about changes at the site, both changes you might have seen, and changes you have heard of. You said you've been coming since [...]. Have you noticed any changes since coming here?*
 - VIII. Place Meaning Wrap up: If you had to say what this site means to you in two to three words what would they be?*
-

Figure 8. Selection of questions from the semi-structured interview instrument

Data analysis

All interviews were transcribed. The Spanish interviews were also translated, with separate transcription and translation documents that were reviewed to ensure translation reliability. Terms and descriptions provided in response to both prompts were used to create a list of place meanings which were then grouped into major theme areas.

To explore factors (site and personal characteristics) influencing how people are thinking about these places, we regressed place meanings (relax, fish, friends) onto selected predictors (race, gender, site of interview) while controlling for age in a series

of logistic regression models. These specific place meaning responses were selected for two reasons. First, the fishing motivation literature has repeatedly identified the importance of relaxation, catch-related, and social motives (e.g., Magee et al. 2018, Hunt et al 2013, Schroeder 2006). Second, we decided to limit our qualitative analyses to only those places meanings that had greater numbers of endorsements (i.e., four or more participants) to ensure increased variability in our outcome variable for a binomial analysis. Estimates were exponentiated to compute odds ratios. Separate models were conducted for each place meaning. Goodness of model fit was evaluated using the Aldrich-Nelson pseudo R^2 value (T. J. Smith and McKenna 2013).

RESULTS

Demographics of Respondents

Of the 43 interviews, 30 were conducted at Conimicut Point and 13 interviews were conducted at Rocky Point (Table 2). Most of the interviews (35) were conducted in English; however, eight of the interviews were conducted in Spanish. Seventeen interviewees identified as White, two identified as African American, one identified as Native American, and one did not report any race or ethnicity. None of the interviewees chose more than one ethnicity. The interviewee ages ranged between 20 and 79 and had an average age of 47. The majority of the respondents lived in Warwick, Cranston (the town between Warwick and Providence), or Providence; most respondents (at least 38) came from the greater Providence area. Most respondents came to the study site between five times a week to twice a year, and only in the summer. Five of the anglers also identified as shellfishers. Household sizes varied with 23 interviewees living in a household with three or more family members, and six living in a household that included five or more family members. According to their responses, seven interviewees had household incomes below the federal poverty level. However, many interviewees (19) did not reveal their household income. The interview length was between eight and 61 minutes.

Table 2. Demographic description of interviewees (N=43)		
Category	Interviewees	Percent of Interviewees
Gender		
Female	8	19%
Male	35	81%
Study Site		
Conimicut	30	70%
Rocky Point	13	30%
Language Spoken at Home		
Spanish spoken at home	11	26%
Asian Language Spoken at home	9	21%
Shellfishing as well as Fishing	5	12%
Language of Interview		
Spanish Interviews	8	19%
English Interviews	35	81%
Race/Ethnicity		
White	17	40%
Asian	9	21%
Hispanic or Latino	12	28%
African American or Black	3	7%
Native American	1	2%
Income		
Income under \$50,000/household	21	49%
Income over \$50,000/household	4	9%
Income under \$50,000/household for a household of 2 or more	17	40%

The short answer responses (Figure 9) were grouped into five main themes (Figure 10) based on how interview respondents elaborated on the place meanings in the full interviews. A nuanced portrait of the use of the site emerged in the interviews

that was not necessarily captured in the short place meaning responses, highlighting the value of qualitative research to capture place-based benefits as part of place meaning literature.

The most common short place meanings were related to fish or fishing (20 respondents). Other place meanings related to easy or convenient access (14 respondents), water quality (8), beautiful or pretty landscapes (8), and relaxation (8) (Fig 9). Other place meanings included availability of parking, being with kids or family, charming or quaint, memories/tradition, multiuse activities, and areas for rest, like benches. Respondents discussed how the sites were not too big or crowded and had areas for walking, children to play, clamming, and, most importantly, fishing. See appendix C for all the place meanings.

Figure 9. Coastal Place Meanings: What does the site mean to you?

-
- **Access:** Accessibility, and Convenience
 - **Pollution:** in Water and on Beach
 - **Safety:** Physical and Social
 - **Sustenance:** Extractive Resources of the Site and Using Extractive Resources of the Site to Connect with Community
 - **Health:** Physical and Mental
-

Figure 10. Major themes derived from the place meanings for recreational anglers in the urban fringe

Five major themes comprising the short place meanings were derived from the broader interviews and included access, pollution, safety, sustenance, and health.

Access: Accessibility and Convenience

Easy access to the water with plentiful parking was a major reason people preferred the sites. Conimicut Point had 100 parking spaces and Rocky Point Park had more than 100. One angler highlighted the easy beach access from his house and from the parking lot at Conimicut Point. He explained, “it's close by and it's beautiful. You don't [have to] walk [...], the parking lot is right there.” Distance from home was an important consideration for some anglers. Anglers recognize that their fishing access areas are limited, relative, and restricted by available funds for travel and parking. People with lower household incomes may not have access to resources (i.e. cars and boats) or access to sites further away or on the water. Other anglers highlighted the importance of having free access to resources. One angler expressed his limitations to resources, “Make more access to people, especially poor people like this. We have

only one pole. Not boats like other people.” For them, particularly easy access will factor into locations they choose to fish. Another angler explained that he fished there because, “gotta pay to be on a boat.” The site was important to people because it had easy access from the parking lot, had fish and clamming availability, was close to urban areas, there were not many accessible alternatives, and use was free.

Another angler explained that he was very happy to be able to do something outdoors even if he had a disability, but that parking near to the beach was highly important to his ability to fish. He said, “The best thing they ever did was open this back [up] and give us back the parking, you know? There’s not a lot of people that just can walk. I take advantage of this because my disability with my feet it gives me a little bit action, you know?” Fishing was a great way for people with a disability to increase not only their physical health, but also their mental health. As one said, “I’m bouncing back from a disability so I’m just trying to relax a little bit [out here].” They were able to overcome mobility challenges to get exercise and fresh air.

Pollution: Polluted Water

Access to recreational sites with good water quality to catch edible fish was also discussed. The majority of the anglers came from urban areas. One angler explained that he went to the site because, “It’s close enough. And the water’s [...] clean enough, it ain’t got all trash everywhere.” Another angler said that the area was important because it was clean of diesel fuel, unlike other public fishing areas. Some anglers were afraid that the urban areas of Providence, which include a port and areas

that are zoned for industry, may add pollutants to the water. Anglers felt that the water quality in the study sites was good. One angler went to the site because of the “water quality. I have this feeling [that] fish I catch are just clean compared to like downtown [Providence] water.” Waste water was perceived to be polluted in the urban areas, which demonstrates environmental justice issues. One angler came from Woonsocket to fish. Woonsocket is 28 miles north of Conanicut, and it is within the Providence River and Narragansett Bay Watershed. One angler said, “I’ve seen a difference between Narragansett’s waste water to Woonsocket and it was huge. Going out that way [in Narragansett] they say you can drink it, and it’s clear, it’s clean, crystal clear. Woonsocket goes looking like ice coffee.” The town of Narragansett is 28 miles south of Conanicut. Anglers described a gradient of water quality with the poorest quality in the northern section near Providence and the best water quality south near the open ocean. However, saltwater fishing in general was sometimes perceived to be safer than freshwater fishing. Anglers were concerned about the water quality in urban areas, and valued the two sampled sites because they felt that they could eat fish from the sites.

Pollution: Trash on the beach

Trash in the parks was also a problem. For example, one Spanish-speaking angler felt that trash on beaches detracted from his enjoyment of the park, saying (translated as), “When people are fishing somewhere and they leave everything behind, like their garbage, that’s uncomfortable and a bad sign of the place and also of the people who come to visit.” Other anglers preferred this site to fishing areas in Providence that they described as having trash on land or in the water.

Safety

Physical Safety

Physical safety at the sites was not always a positive place meaning. Broken glass was mentioned at both study sites. One angler said, “You know, people just wanna come down and party and, and they leave their beer bottles, and you know, my brother, eight years ago, he caught pieces, somebody broke a bottle. He got 62 stitches on his foot. Almost lost his foot coming out of the water. On that side. On the beach side.” Anglers also talked about how safety is ensured by lifeguards for swimming. Lifeguards were posted at one side of Conimicut Point, but did not have oversight on the sand spit, which has dangerous currents. Other issues are due to the fishing infrastructure of the site. For example, climbing on rocks can be dangerous. Anglers described being hurt on the rocks, and difficulty taking their children onto rocky shorelines because of the rough terrain. Physical safety on the sites was referred to in relation to broken glass, rocky coastline, undercurrents from the sand spit, and lifeguards. However, the sand spit and rocky shoreline were also seen by some as positive fishing amenities.

Social Safety

Safety and mobility were important aspects of why people liked the study areas. One Latino angler explained that it was more difficult to fish in Providence because of crowding and fear for his safety. He said, “I went to a place last time it was in East Bay Bike Path [in Providence] and there was like eight [anglers] just perched onto like

one spot. Like I knew this spot and I knew I was gonna fish it too. But you can just see, you can just feel like [they are thinking] oh you know, ‘don’t f*** with me, don’t mix with my lines,’ and you can just see them like having like illegal fish, there you know.” The angler felt safe and welcomed by the diversity at the study site. A female angler said, “And one of the things I like about it the most is, particularly during the summer, but a little bit off season, is that it’s often like the U.N., you get Guatemalans, you get Dominicans, you get another guy from Lebanon, a guy from Indonesia, a lot of Asians.” Others felt that people on the site were friendly and kind.

Another angler also said he liked the site because he felt welcomed by the people. One respondent’s comment illustrated this well, “It’s a close-knit community so it just comes down to basic human respect. You introduce yourself first because there is such a local neighborhood. I might live close, like a mile and a half away, but these people are each other’s neighbors and they walk here together, so, it’s kinda like you’re in someone else’s backyard. But they understand it’s open to everyone at the same time, but it comes with that common courtesy.” The combination of care by the local community and community groups (Save the Bay, a local environmental group, was conducting trash cleanups), as well as a diverse user group from Providence, allowed the sites to be calm, safe, and family friendly. Furthermore, the fact that Conimicut Point was not a large open beach, but rather had beach behind pockets of hills, may have helped with the feeling of the beach being small and manageable. One female angler explained that she liked Conimicut Point because it was smaller than other beaches, friendly, and more family oriented. However, one angler felt that the local landowners felt too much ownership over the area and was concerned with public

access. He said, “I have a problem with people thinking they own this place just because they live close by.” Although one angler felt that the oversight by the local landowners was negative, other anglers felt that the site was safer because people cared to talk to the people who were using the site.

Sustenance

Extractive resources of the site

The extractive resources of the site, such as fish and shellfish, were highly important to people. Anglers often want to provide for their families or for their own health by taking fish home. These anglers highly value the extractive resources in the ocean. A commercial shellfisher who also went recreational fishing at the site said, “There’s more gold in the ocean than there is on land [...] since June I’ve been here every single day.” One female angler found her community through women at Conimicut Point, and explained how the extractive multiuse aspect was important to spending time and experiences together, “Basically we go all day. We’ll do one [i.e. fishing] if it’s high tide and then at low tide we’ll go quahogging [shellfishing].”

However, anglers liked to catch specific species, either because of their personal taste, it was a personal challenge, or they felt a connection to their heritage. Personal taste may constrain some of the fish species that people can catch. For example, one respondent explained, “I just can’t [eat bluefish]. They are very oily and very bloody, and I just can’t stomach the taste of them.” The fish also may serve different uses in

the household, for example, one respondent said that scup do not freeze well, unlike tautog, so they had to be eaten quickly. As species move due to climate change, some anglers may not have the access to pursue their preferred species. Target species included sea robin (*Triglidae spp.*), porgy/scup (*Stenotomus chrysops*), striped bass (*Morone saxatilis*), summer flounder or fluke (*Paralichthys dentatus*), and bluefish (*Pomatomus saltatrix*). Rationale for target species included fish that were exciting, challenging or fun for anglers to use their techniques and skills, fish that tasted good (potentially due to how they prepared it), or fish that were familiar species.

Sustenance used to connect with community

Anglers felt that gathering food from the site was a way to connect with family and friends. One female angler explained that she used the many extractive resources on the site to spend time with friends; she said, "If we're not fishing, [my friends are] helping me [collect] seagrass, [or] we're clamming, if we're not clamming we're cooking." She then shared the food by grilling it with her friends, and meeting new people and making new friends through the experience of collecting and preparing food. Similarly, another angler greeted an angler on the beach who brought dinner to share composed of sea robins (fish species) he had caught, and in that way, they became closer friends.

Heritage played a role in how anglers used their extracted resources from the site; for example, how anglers prepared or cooked their catch for consumption. Heritage has a direct link to culture and family history that is often expressed through food. Anglers described how they prepared the fish they caught using recipes from their

families or home countries. When asked why one angler liked scup, he said, “Just been eating [it] since I was little.” When asked if any recipes were made with the fish from his home country of Guatemala, one young angler said, “Oh yeah, sometimes [my mother] will steam them in a banana leaf and she’ll put a whole bunch of spices in there. [That’s] for scup, but with stripers, she’ll usually just make a traditional stew”. A female angler explained that with the clams she harvested, “We made clams casino, I make a Portuguese sauce. I learned it from my mom, from the Azores.”

The idea of providing sustenance was a way to connect families. As one angler said, “If I could, I would let [the fish] go, but I know my mother’s going to want to eat it.” Forty-two out of forty-three respondents mentioned family in their interviews, demonstrating the importance of creating connections with family and family members in this place to the interviewees. One angler explained, “The last time I came last year, I took nineteen *mojarras* [scup] home with me. It was excellent, the family was here playing, some fishing. And we brought sandwiches.” Other anglers went fishing and grilling weekly with people from their church, friends, or family. They often grilled the fish that they caught and ate them immediately, which created a satisfying experience of shared fresh meals. These findings demonstrate that time spent with family, friends, and community, or providing for family and friends through extractive edible resources from the site was a very important aspect of the site meanings.

Gaining Individual Physical and Mental Health from the Study Area

Physical & Mental Health

People gained energy through sustenance from the fish they ate, but they also felt that the sites themselves gave them health, both physical and mental. As one angler said, fishing was an activity he could practice for physical health that was possible even with physical limitations. He said, “[Fishing] is one thing I can do that doesn’t destroy me. I came out here like two days after my second knee surgery. I was wobbling out here with a knee brace on.” For five anglers, walking was as an important place meaning of the study areas. One angler said that he takes a walk around Rocky Point to get exercise before fishing and that he felt that the park was most important for improving people’s health through walking paths.

These sites in the urban fringe provided an important space for respondents to achieve mental health improvements and increase aspects of wellbeing.

Connection with others

One respondent came with his ten-year-old son with autism, to spend time with him, or before or after school to calm him down. He said, “He’s having a tough time in school with just even teachers. I take him fishing every morning. Before school, it helps him in school. Helps him just relax a little bit. He knows a lot about fishing.”

Connection with family members was an important part of the way the site improved mental health. Many anglers said they fished with their fathers or children, and enjoyed memories of being on the site as a child. One unemployed female angler felt that it helped her connect with her partner. These connections with others were referred to in terms of individual mental health.

Alternative to bad habits and coping with stressors

Other anglers explained that the opportunity to go fishing at the site was a good alternative to more health-damaging vices such as alcohol and drugs. One older man who was going through cancer treatment described how fishing at the site had been an alternative to him as a way to spend his time instead of drinking and drugs. He said, “[My friends when I was young] went down a different road lifestyle-wise; that didn’t seem healthy to me. So I got out of that, [and took up fishing].” He explained that fishing helped him cope with stress, “If you were having a bad day at work, or you were depressed, or you had a traumatic incident happen in your life, where would you rather go? Would you rather sit in a bar and drink alcohol all day or come down here?” He described the role of fishing in his life as “a religion,” a common phrase in the fishing community (Miller 2019) that demonstrated how fishing provided meaning in his life. The site provided this meaningful aspect to his life, which increased his use of and benefits from the site.

Fishing at the site also helped people cope with trauma or life events. One veteran explained that fishing was good for, “the elder[ly] and for the veteran and for the retire[d] people. They come here, relax.” Another angler came to the site to remember his son, who he had fished with, who had passed away. Several anglers were physically disabled or suffering from mental health issues and could not work, but fishing at the site made them feel good. Free parking and wheelchair accessible beachfront allowed anglers to access the site.

Fishing as meditation, as a space to relax or as a technique to combat anxiety

Fishing was often used as a way to combat anxiety. One angler who suffered from anxiety explained, “Once you feel that peace you just want to come back and feel it again. [...] Instead of arguing you’re having fun together and just changes your whole attitude and your whole perspective for, even if it’s just for the time we’re here.” She was able to use fishing to connect with the site and to connect with others. She would not usually leave the house, but fishing and clamming were activities that she looked forward to for leaving the house and allowed her to clear her head. Many anglers used the site as therapy or mental health medication; as one angler explained, “It’s not just about coming to catch fish or anything like that, simply that it serves as a way to relax, you relax the stress away from work, the stress of all things. This is like therapy for some.” The act of fishing allowed him to connect with himself and the site in the present moment. Another angler said that for him, fishing was an alternative to medication. Fishing was used also as a way to help insomnia. One angler said that he visited the site to fish at four AM when he could not sleep. He explained that he loves fishing at the site for “peace of mind, and it helps my anxiety and [to] just clear my head from racing and forget about what [my] problems [are] and just try to stay in the moment and hear the water crashing. Peaceful.” Although many anglers came to be with a community, others came to be alone, relax, and recharge. Meditative qualities of fishing and a way to slow down racing thoughts were important for mental health, and especially the sound of the waves and the horizon were used as relaxation points. One angler highlighted the improved mental health feeling of connection to themselves, the ocean or the wider world. He explained, “I just feel connected to the ocean. Like it’s not necessarily that it brings me back to reflecting of where I might

have come from or who I am but it's more subjective, very personal, like I don't know. We're talking about fin fishing but going out shellfishing, when you're there at sunrise and you're the only person out in the water, chest deep in the water, and the fish are jumping, it's basically meditation and you just feel whole. You are you for a moment." The site itself, not only the act of fishing, provided mental health benefits to anglers.

Quantitative Analysis: exploring factors shaping place meanings

We also wanted to understand what factors (site or personal characteristics) are influencing how people are thinking about these places or driving how they feel. To further explore place meanings and how they relate to personal characteristics of anglers, we conducted binomial logistic regression and correlation analysis in R-studio for the short place meaning responses. To begin to explore this topic we explored three short answer place meanings that have gotten attention in the literature: catch-related, social and relaxation motivations (Magee et al. 2018, Hunt et al 2013, Schroeder 2006).

We looked specifically at responses to these questions (see supplementary material for all the place meanings) because they captured what respondents described as the most important aspects of the site. We regressed place (Conimicut Point vs. Rocky Point), race (White vs. People of Color (PoC)), and gender (Male vs. Female) onto the binary endorsement or non-endorsement of place meaning (relax, friends, fish) to measure the likelihood that these characteristics may influence the endorsement of the given place meanings.

Results from the model investigating the place meaning of ‘fish’ are presented in Table 3. Respondents endorsed the place meaning of ‘fish’ significantly more strongly at Conimicut Point than Rocky Point (OR = .10; 95% confidence interval [CI] = .01-.51, $p = .012$) such that angler interviewed at Rocky Point were 10% as likely as those interviewed at Conimicut to endorse ‘fish’ as a place meaning. The logistic model explained about 22% (Aldrich-Nelson pseudo R^2) of the variance in place meaning response and correctly classified 61% of cases.

Table 3. Parameter estimates for logistic regression model of ‘fish’ place meaning

Variable	Estimate	SE	p	Low	OR	High
Intercept	-0.32	1.19	.79	.07	.72	7.8
Gender ref: Male	-0.93	0.99	.35	.04	.39	2.58
Site (ref: Conimicut)	-2.30	0.92	.01	.01	.10	.51
Race (ref: PoC)	-0.90	0.92	.33	.06	.41	2.37
Age	0.03	0.03	.35	.97	1.03	1.09

We did not find any significant results for the place meaning, ‘relax’ (see Table 4). The logistic model only explained 4% (Aldrich-Nelson pseudo R^2) of the variance in this place meaning.

Table 4. Parameter estimates for logistic regression model of ‘relax’ place meaning

Variable	Estimate	SE	p	Low	OR	High
Intercept	-2.31	1.41	.10	.01	.10	1.31
Gender ref: Male	0.20	0.97	.83	.14	1.23	7.73
Site (ref: Conimicut)	0.74	0.80	.36	.41	2.09	10.35
Race (ref: PoC)	0.01	1.01	.99	.13	1.01	7.65
Age	0.01	0.03	.64	.95	1.01	1.08

The model regressing the place meaning ‘friends’ onto focal predictors revealed a significant effect for gender (OR = 27.1; 95% CI = 2.20-1012.59, $p = .023$) such that women were considerably more likely to endorse ‘friends’ as a place meaning across

sites. However, given the small sample size, particularly of women ($N = 8$) and wide confidence interval, future investigations should seek to elucidate this effect (Table 5).

Table 5. Parameter estimates for logistic regression model of ‘friends’ place meaning

Variable	Estimate	SE	<i>p</i>	Low	OR	High
Intercept	-2.57	2.27	.26	.00	.08	4.39
Gender (ref: Male)	3.30	1.45	.02	2.20	27.09	1012.59
Site (ref: Conimicut)	-0.98	1.53	.52	.01	.37	5.64
Race (ref: PoC)	-0.40	1.82	.82	.01	.67	25.31
Age	-0.01	0.05	.80	.88	.99	1.10

The logistic model explained about 15% (Aldrich-Nelson pseudo R^2) of the variance in place meaning response and correctly classified 87% of cases.

DISCUSSION

Although many themes that emerged from the interviews related to the activity of fishing, the benefits of the activity of fishing on the site would not be possible without the characteristics of the site itself. Even the place meaning ‘fishing’ itself reflected the site’s unique characteristic as a promontory with “good fishing.” Findings from this study demonstrate that anglers value recreational fishing areas in the urban fringe for different reasons, including access, mental health, community, and sustenance. The findings demonstrate that anglers in the urban fringe have some of the same concerns as in urban fishing areas (e.g. water quality (Pulford, et al. 2017)), and suburban/rural fishing areas (e.g. site characteristics that align with recreational skill or specialization (Martin et al. 2017)). Discussions around access demonstrated that urban anglers are limited in reaching clean fishing areas with what they perceive to be good water quality. Physical and social safety were important in order to stay healthy, and harvesting food and sharing it with community was very important to people. Many of the place meanings related to personal health and connections to place, oneself, and others, which were all enriched at the site. They were also related to activities on the site and uses of the site. Clear connections were formed between physicality and activity, such as grilling with friends or being able to push a wheelchair from a parking lot onto the beach.

Quantitative Findings

Many of the place meanings described by the anglers seemed to derive from physical characteristics of the site and its recent historical use. The results that the

place meaning ‘fish’ was more significantly endorsed at Conimicut Point than Rocky Point, may be a sign that when a place has multilayered place meanings, such as Rocky Point occupying a larger physical space, some place meanings may recede. For example, although most place meanings were shared between the two sites, respondents from Conimicut Point were more likely than respondents at Rocky Point to refer to fishing as a place meaning, which is likely due to different site characteristics. Rocky Point is a larger site with hills, wide lawns, hiking trails, and a history as an amusement park which many people recalled during the interviews. Conimicut Point has a uniquely shaped sand spit, which respondents said was good for fishing. The sand spit also created an undertow that was dangerous for wading into the water, but good for catching fish. So, for some anglers, Conimicut Point was valuable as a unique fishing area, in addition to being considered a clean, easily accessible public site in the urban fringe. It drew anglers that were motivated for challenge or adventure from the sand spit, as well as anglers with a disability due to a parking lot on the beach. These rich fishing areas due to physical site characteristics are not common; managers should look for unique fishing promontories to designate as public fishing areas in the urban fringe.

Socializing was another fishing motivation. The model regressing the place meaning ‘friends’ onto focal predictors revealed a significant effect for gender, and this finding aligned with the finding by Magee et al. (2018) that “Social fishers and generalists had lower levels of centrality to lifestyle, fished less frequently, [and] were more likely to be female,” (p.112) unlike Trophy Fishers and Escapism fishers. Women may also have been concerned for their safety due to the people around them

and so more likely to prefer ‘friendly’ fishing areas. However, given the small sample size, particularly of women ($N = 8$) and wide confidence interval, future investigations should seek to elucidate this effect.

Cultural and mental models

Respondents had different conceptualizations of place meanings, such as cleanliness and fishing. For example, cleanliness was thought of by some as related to water quality, while others saw it in terms of the trash on the beach. Fishing had different meanings for different respondents. For some, fishing was a way to connect with family or friends, while for others, it was a way to enjoy being alone. For many respondents, place meanings (such as ‘fish’ and ‘friends’) were interrelated. For example, an angler who would fish alone would find meaning through giving his fish to a friend to prepare and eat together, or an angler who would enjoy fishing on the rocks while his children were playing could also be concerned that the children did not get injured on the rocks. Although we expected anglers to describe many of these place meanings (e.g., relax), some of the ways that people conceptualized the place meanings were unexpected; for example, the importance of site- and activity-specific relaxation in their habits and mental models of the world. Research on conceptual models (e.g. Paolisso, Weeks, and Packard 2013) demonstrates the importance of understanding how people perceive how the world works. These models demonstrate how respondents see the conditions that drive their behavior. These shared mental models then become implicit cultural models. Aspects of these cultural models, such as understandings of clean water or how to use fishing to maintain social ties, can help

managers and environmental communities integrate strategies for achieving benefits to coastal users. For example, respondents described how the site allowed them to relax by providing a place for relief from their psychological struggles and space for peace or coping.

Place Meanings and Well-being

The findings demonstrate that the study area, and specifically the two sites in the study area, contributed positively to well-being. Place meanings described by respondents were directly related to aspects of human well-being, which encompass a variety of dimensions (e.g., health, material well-being, freedom) (Alkire 2002; Nussbaum 2003; Sen 1983). For example, many place meanings included dimensions of health, such as walking or spending time outdoors (physical health) or relaxing (mental health) (Alkire 2002). Meditative absorption has been proven to be good for well-being (Kashdan et al. 2010). Meaning-making is an important aspect of mental health; deciding on what makes one's life meaningful allows for identity, pride, connection, morality, and other important aspects of well-being (Alkire 2002; Manzo 2005). Some of the place meanings that related to well-being were 'relax' (Mental health), 'friends' (Social), and family. Other place meanings such as 'beauty' or 'welcoming' are indirectly related to well-being by increasing positive emotions (Dalton and Thompson 2013). Fishing on the site allowed respondents to connect with their senses, play, and have a sense of control over their environment, all aspects of well-being (Nussbaum 2003). Finally, the study area provided psychological, social,

and physical resources of the site that helped respondents meet challenges in terms of food, low self-esteem from not working, outdoor activity despite disability, loneliness, and others. In this study, place meanings have been shown to directly correspond with aspects of well-being.

Use of the urban fringe

Interviews with recreational anglers in the urban fringe highlight why it is an important place to them. The urban fringe supports a confluence of users, from transient urban residents, to contemporary residential users, to historical or traditional users such as Native tribal members. Since memories of childhood spent in nature can encourage pro-environmental behaviors in adulthood, creating more accessible natural areas for urban children is important (Chawla 1999).

Managing for Coastal Users

The urban fringe provides space for diverse urban populations to access clean, aesthetically pleasing, fishing areas. Findings from this study highlight the importance of the urban fringe for the anglers who use this space. Features of the coastal urban fringe that were important to respondents included access for families, non-residents and users with disabilities, maintaining extraction rights, and ensuring clean water and park land.

We suggest managing these places for a welcoming atmosphere, and planning for multigenerational use, including longer term place meanings, and neighborhood oversight. Areas for children to play, green grass, benches, and wheelchair

accessibility were also appreciated. Many anglers remembered the sites as children or brought children with them to play in an area. A welcoming, safe, and calm area will draw vulnerable communities, whether it is children, sick, elderly, or disabled users. To maintain these areas for non-residents, such as urban anglers, resident stickers should be avoided. To manage the areas for physically disabled anglers, they should be accessible with parking or drop-offs close to the water. To maintain extraction rights, which are one of the most important place meanings to our study participants ('fishing'), the fishery should be managed over time to be sustainable and accessible for all users, and have clear warnings about resources at the site that are unsafe to eat (Teo et al. 2019). Urban users come because, based on our findings, the amenities, place meanings, and attachment to the place. They should also be flexible to incorporating the history of the site, seeing the number of ways it has been used over the years, and reflecting the narrative of the users.

Place Meanings can inform Place Attachment Literature

Although these findings could be connected to the person-place-process understanding of defining place attachment (Leila Scannell and Gifford 2010) (i.e. personal identity – place use history – fishing or shellfishing), they were more related to well-being measures. The scales that are traditionally used to denote agreement or disagreement with sentences to measure place identity or place dependence (L. Scannell and Gifford 2013) would have missed many of the nuances that people feel during place attachment and place meaning formation. The scales would have missed the use of the site to heal from or cope with life difficulties, such as impoverished

nutritional options, lack of exercise, anxiety, trauma, loneliness and others. The place meanings (See Appendix C) were directly related to valued aspects of people's lives, such as their children, rather than reflexive understandings of their emotional valence that had not been previously or comparatively measured on other sites or with other cultural groups. Instruments that measure agreement with phrases such as "I am attached to this place" or "This is a special place for me" not only ask the respondent to try to understand the intention of the researcher in regards to the question, but also robs the respondent of the ability to renew their positive place meanings through value choices and reaffirming meaning-making in their lives.

The theory that developed through this work and the interrogation of the gaps in the place attachment literature resulted in an interesting relationship between the theoretical aspects of well-being and the theoretical aspects of place meaning. As Manzo (2005), Kusel (2009) and Davenport et al. (2010) found, multiple aspects of a place contribute to well-being. We recommend that this relationship be explored further; rather than only using place attachment to measure well-being (Quinn, Bousquet, and Guerbois 2019); and understand how the levels of well-being, before and after place attachment to a site, relate to post-site experience levels of well-being.

Place Meanings in this Study as Compared to Other Studies

All three types of place meanings -- adjectives, nouns, and characterizations, were expressed by respondents. Types of place meanings in the literature that developed from existing literature and other qualitative data included: "individual identity, family identity, self-efficacy, self-expression, community identity, economic meaning, and

ecological meaning,” which was then related to management outcomes (J. W. Smith et al. 2011). However, the place meanings from the Smith et. al. study (2011) did not seem directly related to the place meanings found in this study, perhaps because the topic was lakeshore management by residents, not a recreational fishing area by users. Wynveen and Kyle (2014) identified the place meaning themes: “esthetic beauty, lack of built infrastructure/pristine environment, abundance and diversity of coral and other wildlife, unique natural resource, facilitation of desired recreation activity, safety and accessibility, curiosity and exploration, connection to the natural world, escape from the everyday, and family and friends.” These themes were similar to the place meanings found at in this study, perhaps because of similar site recreational use as visitors rather than property owners to this study. Their place meanings had many similarities with those found in this study. However, the groupings they found are broad and they do not highlight issues like safety and health, and specific sites may have more or less place meanings in each category based on the site. We found that the values on the site are intrinsically connected to the use of the site. Our themes – pollution, access, sustenance, community, mental and physical health, and safety, have many similarities with the themes from the literature. So do the top place meanings themselves: fish/fishing, access, cleanliness, relaxation, and beautiful scenery. However, they do not entirely overlap with those found by Wynveen and Kyle (2014) and Smith et al. (2011), who additionally discussed economic meaning, solitude, and contrast to everyday settings.

This study was limited by small geographic areas. Further research should explore these initial findings in other geographic areas. Study participants may have

preferred other languages; only Spanish and English were offered. Another limitation is that we conflated ethnicity and race to give interviewees the opportunity to self-identify as broadly as possible. People who expressly self-identified as Latino and/or Hispanic were also coded as People of Color although these could be considered orthogonal constructs. Future studies could explore different users, such as place meanings in the urban fringe for indigenous users, in more detail.

Our findings encourage researchers to connect their place meanings to the well-being literature, since it is more straightforward for respondents to understand, site and person -specific, and values-based.

CONCLUSION

The unique approach used in this study addresses the importance of place context through the lens of place meanings in the urban fringe for recreational fishing. The results indicate that community, pollution, access, sustenance, and health are important for urban anglers at the urban fringe. Food is a part of creating community, both on the site and off the site. Fishing access points and waterfront parks at the urban fringe provide much-needed mental and physical health, and a healthy activity for people who do not work. The water quality discussions demonstrate that spatial policies, such as cleaning the water and opening the beach for swimming and conditional shell fishing, attracts urban anglers to the site. The most common place meanings, relating to fish, access, water quality, beauty, and relaxation, demonstrate the importance of the site to urban anglers. Other aspects such as kid-friendly, multi-use, welcoming and benches and parking, demonstrate that these issues should be considered when designing access points. The five themes, access, pollution, safety, sustenance, and health, demonstrate core aspects that should be considered when designing a public access site, or when adapting it to threats such as climate change. Fish consumption advisories are also necessary, and in languages and disseminated to immigrant and non-English speaking communities.

Urban residents travel to use coastal access points for sustenance, community, and mental and physical health. We also found that recreational fishing areas in the urban fringe are heavily used and valued for these aspects of well-being; pollution extent and policy lines (e.g. shellfish openings) impact landscape use. Place meanings and qualitatively and quantitatively investigating those meanings allows for more

information than place attachment scales. The place meanings found in this study overlap with those found in the literature but do not duplicate them. This may be because although several meanings of a site are valuable, some are more important than others and therefore captured in the few words of place meanings. These findings help clarify the extent urbanization, pollution, and change have on place meanings of shore anglers, including historically underrepresented urban, minority, and immigrant anglers. When managing these areas under change, aiding or preserving positive place meanings will allow urban residents to preserve connections that impact their well-being. This study provides a unique perspective on how context matters and explores the connection between activity, people, and place.

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Ethics Statement:

This study was carried out in accordance with the recommendations of Institutional Review Board. The protocol was approved by the Institutional Review Board, University of Rhode Island Office of Research Integrity, Division of Research, and Development. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

Conflict of Interest Statement:

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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CHAPTER 4:
PERCEIVED IMPACT OF CLIMATE CHANGE ON USE OF URBAN
RECREATIONAL FISHING COASTAL AREAS IN RHODE ISLAND

Authors:

Talya S. ten Brink

Tracey Dalton, Ph. D

Corresponding author:

Talya ten Brink

tenbrink@uri.edu

University of Rhode Island

Dept. of Marine Affairs

Kingston, RI 02881

ABSTRACT

This manuscript investigates how urban and peri-urban fishermen view potential future climate change-related weather events and infrastructure change. Although researchers have studied how fishermen will react to the change in fish species, this study looks at that change in the context of other weather-related changes. Additional rainfall and hurricanes are perceived to reduce recreational fishing use of the site due to lack of access, dangerous conditions, and erosion. Change in fish species is perceived by some to have a positive impact on recreational fishing as the major fish species caught in the area is a warm-water fish (scup, *Stenotomus chrysops*) that is predicted to increase in abundance. Most fishermen would decrease their use of the site with additional rainfall and hurricanes. Differences in responses may be due to different gear types and motivations of fishermen. Fishermen were also asked about a future infrastructure change – if a dock was built on the site. The dock was perceived to ‘fit’ at one site more than another site. These findings inform how we can design desirable adaptation strategies for various coastal users and vulnerable populations under climate change. This study will also help predict place disruption or decrease of positive place attachment due to disasters like hurricanes, or perceived negative changes on the site.

Keywords: climate change, adaptation, recreational fishing, recreation management, coastal, vulnerable populations, urban, landscape planning,

INTRODUCTION

Climate change is a major driver of environmental change, and people respond to environmental changes differently. Improved understanding of these responses can inform the design of more desirable adaptation strategies for coastal users and populations to plan for climate change (Adger et al. 2009; Larter et al. 2019).

Land use of the coastline is changing due to environmental effects of climate change (Clay, Colburn, and Seara 2016). Human-induced climate change affects coastal areas with increased storms, flooding, water temperature increases, and other impacts (Fresque-baxter and Armitage 2012). According to the Rhode Island Beach Special Area Management Plan (2018), coastal climate change impacts in the state include warmer temperatures, more frequent hurricanes and storms, sea level rise and increased storm surge. Other climate change-related impacts include loss of salt marshes, increased erosion, hurricane wind damage to residential, commercial, and public service infrastructure, and marsh and marine species change.

These impacts can be reduced through adaptation measures. Adaption reduces the vulnerability of communities to the impacts of climate change (O'Neill and Graham 2016). Place-based approaches for understanding how individuals associated with coastal areas adapt to change can highlight the limits and opportunities of adaptation (Adger et al. 2011). Understanding how weather and landscape changes due to climate change will impact the experiences of shore recreational fishermen will allow adaptation planning for the future.

One coping mechanism for landscape change is site substitution. It is the expectation that recreationalists will replace lost fishing sites with locations that provide equivalent benefits (Freitas et al. 2013). However, the ability of coastal users to engage in adaptation strategies to environmental change has been linked to sociodemographic traits. Income has been found to influence ability to substitute sites (i.e. when recreationalists replace their visit at one site with another recreational site) for coastal recreational areas. Habitual patterns of use may also constrain flexibility for change; for example, some recreationalists may be more inflexible than others to site substitution due to habitual patterns of use (Oh and Hammitt 2011). Age may also constrain which substitution activities are able to be conducted (i.e. age may determine which sites are physically accessible).

In addition to site substitution, other popular coping behaviors or adaptation strategies to climate change-related site impacts include activity substitution, temporal substitution, strategic substitution (using different gear) and information coping (checking the weather) (McCreary et al. 2019). These types of substitutions replace a habitual activity, time of day for recreational experience, or gear, with alternative activities, times of day, or gear. For example, younger recreational users (under age 35) of Lake Superior (MN) were more likely to report strategic coping than visitors age 55 and older, and visitors with a long history at the site were more likely to practice both information coping and strategic substitution (McCreary et al. 2019). Understanding the situations and contexts that may facilitate adaptations to landscape change can help coastal managers prepare for the future.

To prepare for climate change, coastal managers must understand community-based perceptions of risk in coastal areas (Ensor et al. 2017). For example, people often perceive risks at the individual property scale and not at the town scale, which can impact preferences of flood management strategies (Quinn et al. 2019). Climate change impacts can also alter people's perceptions of previously beloved places. In a study by Devine-Wright and Howes (2010), a proposed offshore wind farm was seen to threaten the natural identity of a place. Adaptation can be seen as a result of social psychological dependencies on the local environment, which includes relationships and group ties, trust, and social capital to obtain information about local issues (Smith et al. 2012). This study examines how climate change affects the perceptions, attitudes and behaviors associated with place of one particular group of coastal users: recreational fishermen.

Recreational fishermen depend on a biological resource that is affected by climate change (Collie, Wood, and Jeffries 2008). In 2014, saltwater recreational fishing generated \$61 billion in the United States (U.S. Department of Commerce 2016). Recreational fishermen have diverse motivations, cultures, and gear types (Derbyshire 2006), which influence different substitution strategies and coping mechanisms to climate change. Fishermen may also be ethnically and culturally diverse, with their motivations for fishing related to their culture (Hunt and Ditton 2001; Schroeder et al. 2006). The variety of different structures, motivations, and cultures of fishermen mean that they will have different perceptions about their use and ideas of adaptation in response to climate change.

Motivations, whether they are to catch fish or enjoy fishing on a site, may influence how fishermen react to change on the site. Studies have looked at different values of recreational fishermen, including expectations of others, nurture (i.e. passing on fishing traditions), escape, and affiliation (Kuehn et al. 2017). Magee et al. (2018) found that there were three major reasons for the general activity of fishing: mastery, social factors and relationships, and escapism. Hunt and Ditton (2010) found that Anglo recreational fishermen placed importance on being in nature and the sentiment ‘escape,’ while Hispanic recreational fishermen placed greater importance on competence in fishing. Fishing can also provide subsistence for low-income households (Hughes 2015).

Fishermen’s motivations are related to their responses to landscape change. Hunt and Ditton (2001) found that the anglers that were less skilled and active were very likely to stop fishing when access to a reservoir was removed, while highly active anglers were more likely to find a resource substitute because of their interest in fishing. Dabrowksa et al. (2017) found that very specialized fishermen were less deterred by travel issues than less specialized recreational fishermen and were instead more influenced by bag limits and fish size. They found that in general the recreational fishing community was resilient; a large percentage of regional fishing sites would have to be inaccessible in order to cause recreational fishermen to reduce their fishing activities. However, fishermen are motivated not only by fishing-specific aspects of their experience (amount of fish caught), but also by the place in which the recreational fishermen fish.

Studies have examined how fishermen may respond to climate change in terms of declining fish abundance (Colburn et al. 2015; Putten et al., 2017). However, the relationship of recreational fishing motivations and adaptive behaviors has not been extensively studied. Putten et al. (2017) found that greater perception of ocean changes did not correlate with greater willingness to adapt new behaviors, yet they note their study was limited by not having a comparison study in an area with less quickly warming sea temperatures.

Separately from fishermen's responses to climate change, coastal resource managers responding to climate change-related flooding may need to implement infrastructure changes. Fishermen rely on different structures for fishing, such as breakwaters, piers, beaches, dock/port infrastructure, and shallow waters for wading (fly-casting) (Derbyshire 2006). Fishing piers are one potential management response to flooding and sea level rise. Understanding how people perceive a change in infrastructure on the site can help inform effectively planning for climate change.

This study focuses on shore recreational fishermen in southern New England, in an area that provides urban fishermen access to a safe fishing area (e.g., Burger et al. (1999)). Areas in Providence, the urban center of the region, do not allow swimming and shellfish harvesting due to poor water quality (Narragansett Bay Estuary Program 2017). Coastal areas focused on in this study are some of the closest public access sites to the urban center where it is usually safe to swim and shellfish, and provide recreational activities.

Rhode Island has been impacted by several major weather-related events, including a hurricane in 1938 that killed 600 people in southern New England, and one in 1954 that killed 65 people in New England (Perry 2019). Climate change in the US is predicted to negatively impact people's health, food security, infrastructure, water supply, ecosystems, and tourism and recreation (USGCRP: Fourth National Climate Assessment, 2017). Rhode Island is also experiencing a rate of sea level rise (SLR) that is three to four times faster than the average sea level rise for the globe. Rhode Island had a six-inch sea level rise between 1970 and 2012 and SLR is expected to increase by three to five feet above the levels in 1990 by 2100 (University of Rhode Island Climate Change Collaborative 2013).

Recreational fishermen in Rhode Island heavily use coastal access points in Narragansett Bay, yet the impact of flooding and other climate change-related impacts on their recreational use is unclear. This study investigates how climate change impacts associated with rainfall, hurricanes and fish species will affect recreational fishing activity in urban-rural coastal sites along the Narragansett Bay in Rhode Island, USA.

Study area

The study area includes the upper to mid-Narragansett Bay region. This region is characterized by sandy soils, developed residential areas, and coastlines with estuarine areas. Rhode Island's Constitution ensures four shoreline rights, namely: passage through the sea, fishing, gathering seaweed, and access to swimming areas (Rhode Island Const. art. XVII). The area below the mean high-water mark is public land (RI

General Laws § 46-23.6). Formal public access points are managed by the R.I. Coastal Resources Management Council (CRMC) and the R.I. Department of Environmental Management (RIDEM).

The two public access sites in this study include the following:

Conimicut Point Park: This site is a large sandy public beach that contains the tip of Conimicut Point and is situated 6.1 miles south of the city of Providence border. South of the point or the center of the beach is conditionally open for wild harvest shellfishing. North of the Point is closed for shellfishing.

Rocky Point Park: This site is a state park that is located 7.7 miles south of the Providence border. It includes limited parking and areas for saltwater fishing from a concrete wall and rip rap, walking, biking, and kayaking. Rocky Point Park has a rich cultural heritage of being both a Native American settlement site and an amusement park that was closed in 1995. About a year after the study was conducted a fishing pier was built on the site. Although this park has been open to public access since 2014 and does not have an entrance fee, it is not yet on the CRMC list of public shoreline access points.

These upper to mid-Bay sites were selected (Figure 4) because they are popular public access fishing areas that have adequate water quality for swimming and shellfishing, are a close distance from an urban residential area (Providence, Rhode Island), and have different types of fishing infrastructure (rocky shoreline and sandy beach).

Both sites are in Warwick, which is part of the Providence metropolitan area. Median income in Warwick is \$71,191 and per capita income is \$37,461. 6.4% of the

people in Warwick are in poverty. Median income in Warwick is higher than for the general population of Rhode Island (\$61,043); however, the city of Providence, where many users of Warwick's coastal zone live, has a lower median income (\$24,052) than both Warwick and the general population of Rhode Island. Of the total population of the city of Providence, 26.9% live in poverty. The population of Rhode Island is 15.9% Hispanic or Latino, 5.3% of Warwick is Hispanic or Latino, and 42.0% of the city of Providence is Hispanic or Latino.

Figure 4. Study Sites and Median Household Income in Rhode Island (2011).

METHODS

Interviews

During Summer 2018 (June through August), forty-three fishermen were interviewed using a semi-structured interview protocol. Interviews are a useful research method because they capture the breadth of understanding of a topic (Becker 1996) and allow deeper understanding of what topics mean to people. They also can capture diverse perspectives and uncover patterns of thought (Patton 2015). Interviews were conducted in Spanish and English (based on preference of the respondent) and interviewees were invited to participate via an intercept method, which involved asking every fisherman (or every third fishermen if the site was crowded) to participate. We visited each site at least once a week following different time patterns (i.e. tides, morning work shifts, post-work shifts). The Spanish interview protocol was back translated with two bilingual researchers in order to ensure translation accuracy (Bernard 2006), and the translations had separate transcriptions and translations which were reviewed by more than one researcher.

To help participants understand the impact of flooding on their sites, they were shown a map of the site as a scenario for the future of the site under the worst-case hurricane storm surge inundation scenarios. The map was created using data from Rhode Island GIS, specifically Hurricane Surge Inundation Areas (Worst Case) for Rhode Island using values developed by the National Hurricane Center using the SLOSH (Sea Lake and Overland Surge from Hurricanes) Model that was developed by the U.S. Army Corps of Engineers, New England District (USACE) and the National Oceanic and Atmospheric Administration (NOAA) (See Figure 11). The

values were calculated by subtracting bare earth elevation data from the worst-case hurricane surge values (Rhode Island Geographic Information System (RIGIS) 2019). However, the model does not take into account sea level rise. More recent models, such as STORMTOOLS, which combines the SLOSH model and another model by USACE, show a 100-year return period storm with two feet of sea level rise. Although the maps shown in the protocol did not note the estimated water depth, as STORMTOOLS does, they have similar areas for category 4 hurricanes (see Appendix D).

Respondents were also asked about how other climate change related weather impacts in the future would affect their behavior. The predicted values for the frequency of rain increase and the storm intensity were obtained from the IPCC Report (Intergovernmental Panel on Climate Change 2014; Rhode Island Coastal Resources Management Council 2018). The predicted species of fish that would increase are warm water fish such as scup, butterfish and squid, and predicted fish species that would decrease are cold water fish such as cod, winter flounder, and hake (Collie, Wood, and Jeffries 2008).

Other interview questions asked:

“More intense storms and higher floods: The frequency of Category 4 intense storms is likely to increase and possibly double by 2100. How do you think that will impact your use or change your thoughts about the site?”

More frequent rainstorms or heavier rain: Summer precipitation is expected to increase by 7-8% between 2008 to 2050; and winter and spring precipitation is

expected to increase by 9% to 14%. How do you think that will impact your use of the site or change your thoughts about the site?

Types of fish changing: Warm-water fish such as scup, butterfish and squid are expected to increase and cold-water fish such as cod, winter flounder, hake are expected to decrease. How do you think that will impact your use?"

To capture how respondents perceived climate adaptation infrastructure additions, the following question was asked:

"Platform or Fishing Pier: If RI DEM was to build a fishing pier or a platform in the site? How do you think that will impact your use or change your thoughts about the site? Why?"

Figure 11. Flooded portions of study sites under hurricane categories 1-4: Conimicut Point (Left) and Rocky Point (Right)

RESULTS

Characteristics of Respondents

Of the 43 interviews, 30 were with fishermen located at Conimicut Point and 13 were at Rocky Point (Table 2). Eight of the interviews were conducted in Spanish, and the rest were conducted in English. Some (12) interviewees identified as Latino or Hispanic, and nine identified as Asian. Seventeen interviewees identified as White, two identified as African American, one identified as Native American, and one did not report any race or ethnicity. None of the interviewees identified as more than one race or ethnicity, although it was an option. Over half (22) of the interviewees spoke a language other than English at home. The interviewees ranged between 20 and 79 years old with an average age of 47. Most respondents came from Warwick, Cranston, or Providence. At least 38 out of the 43 respondents (88%) came from the urban metropolis (greater Providence-Fall River urban area). Most respondents visited the study site only in the summer, and came between twice a year to five times a week. A few (5) of the hook and line fishermen were also shellfishers. Some (6) interviewees came from a household that included five or more family members. Seven interviewees reported household incomes below the federal poverty rate. Nineteen interviewees did not disclose their household income. It is unclear if the sample is representative of anglers in the area because no studies have shown demographic characteristics of anglers in Rhode Island or by fishing site in Rhode Island. Each interview took between eight minutes and 61 minutes.

Table 2. Demographic description of interviewees (N=43)

Category	Interviewees	Percent of Interviewees
Gender		
Female	8	19%
Male	35	81%
Study Site		
Conimicut	30	70%
Rocky Point	13	30%
Language Spoken at Home		
Spanish spoken at home	11	26%
Asian Language Spoken at home	9	21%
Shellfishing as well as fishing	5	12%
Language of Interview		
Spanish Interviews	8	19%
English Interviews	35	81%
Race/Ethnicity		
White	17	40%
Asian	9	21%
Hispanic or Latino	12	28%
African American or Black	3	7%
Native American	1	2%
Income		
Income under \$50,000/household	21	49%
Income over \$50,000/household	4	9%
Income under \$50,000/household for a household of 2 or more	17	40%

Figure 12. Number of fishermen who discussed negative, positive, or no impact of rainfall, hurricane, and fish species change on fishing behavior (43 interviewees total).

Perceived Impacts on Fishing Behavior at the Study Sites

Interview respondents were asked about a variety of impacts of climate change in terms of rainfall, hurricane and fish species change (Fig 12). Multiple reasons for perceiving each climate change impact as negative, no impact, or positive were discussed, including perceptions of climate change in general, target gear types or fish, safety, temporary impact and permanent land change. The following sections will describe perceived impacts associated with each change and the factors influencing these perceptions (Fig. 13).

Figure 13. Conceptual diagram of reasons for positive and negative perceived potential impacts of climate change on recreational fishing. The response, ‘No impact on fishing behavior’ was not included in the conceptual diagram for simplicity.

Fish Species Change

Some fishermen (15) thought that the change in fish species would have a negative impact on their fishing behavior on the site. One reason was that the amount of their target fish would decrease. Some fishermen (9) felt that they would fish less on the site since they target fish other than scup for food or for recreational purposes.

A few fishermen (5) felt that the expected change in fish species would indicate that the ecosystem was becoming degraded. They discussed impacts on the entire ecosystem, not just their target fish.

Many fishermen (18) felt that the change in fish species would have no impact on their fishing behavior. For example, one said, “Not really [have an impact]. Cod--I can’t really catch because I don’t have a boat.” One fisherman said, “It wouldn’t have an effect on me in that sense, but simply that you have to adapt to what there is, when another is not available. There would be no other way but to adapt to what is there and learn to fish what is available at the moment.” Based on these responses, many fishermen are unconcerned about the change in fish species.

Some fishermen (10) felt that the fish species change would have a positive impact. They felt that they would be able to catch more fish. One fisherman felt that climate change would bring in more bait fish, saying, “It’ll bring all the bait. Bait for the fishes, so it’d be a lot better.” These responses indicate that increase in warm-water fish may be seen as beneficial for some fishermen, at least in the short-term.

Increased Hurricanes

Over half the fishermen (26) felt that increased hurricanes would have a negative effect on their experience of the site. Some (6) felt that it would decrease their ability to use the site due to erosion and change in the landscape. One woman explained possible changes to the landscape, “It would affect a lot, I’d say, because there you can see that it is beautiful. With that [hurricanes], all the rocks would move, everything would move up, I would not use it well anymore.” Another felt that because a hurricane would cause the landscape to become unsafe or slippery, he would not come to fish during or immediately after a hurricane. Others mentioned that a hurricane would impede access to the site. These fishermen demonstrated that the

hurricanes would negatively impact their fishing, because of erosion, safety, and impeded access.

Many fishermen (15) felt that increased hurricanes had no impact or mixed impact on their use. They mentioned the temporary impact, with one explaining, “floods don’t stay long.” Another fisherman said that he did not think it would change the structure of the site: “I think it’ll have more an effect on the vegetation rather than the actual structure [...] this [site] has withstood hurricanes in the past.” A few (4) fishermen felt that the strength or category of a hurricane affected how it would impact their use. For example, one felt that a Category 1 hurricane would not impact use, while other categories would cause erosion of the site. These interviewees perceived that the impacts of hurricanes are circumstantial; the impacts vary for each hurricane and many may have a temporary effect.

A few fishermen (3) felt that increased hurricanes could have a positive effect on their fishing behavior in the area. They felt that hurricanes led to a greater catch. One fisherman said, “If the fish are biting, you’re going to find me out here.” Another fisherman explained his rationale of why storms were good for fishing: “I would probably come here [in a hurricane] more because the flooding and the storms stir up the shellfish, which stir up the other fish that eat them, which stir up the fish.” These three respondents varied on multiple demographic characteristics including age, race/ethnicity, and how frequently they fished, and where they were interviewed (Conimicut or Rocky Point), yet all three agreed that hurricanes might positively impact their fishing activities due to increased fish catch.

Different fishermen felt that hurricanes would have short-term or long-term impacts. Some fishermen (10 out of 26) who felt negatively about increased hurricanes felt that they would have long-term impacts. A few fishermen (2 out of 15) who were neutral about hurricanes felt that they would have long-term impacts.

Increased Rainfall

More than half the fishermen (25) felt that increased rainfall would have a negative impact on their use of the site for fishing. Several fishermen (6) felt that climate change would increase flooding, especially at Conimicut Point, which was a low-lying site that had a parking lot that would flood in the scenario presented. Two fishermen noted that erosion of the site would also increase. A few (3) said that the additional rainfall was a safety issue and slippery for fishermen fishing from the rocks. Another issue for a few fishermen (4) was the perception that rain could increase the chance of getting sick. As one fisherman said, “With the kids and all that, you see that sometimes they get sick. I almost never come when it rains. If it rains, I’d stop coming all the time.” Another major reason that two fishermen (2) disliked the increased rainfall was because they felt it would lead to worse water quality. Other fishermen thought that the increased rainfall would decrease their use of the site because they only fish on sunny days for comfort. For people that fish together, heavy rain may also reduce the amount of time they go fishing together. For example, one fisherman stated, “[My partner] wanted to go out the other day in the rain but I’d rather go out when it’s nice and sunny.” Increased rainfall was perceived to threaten health, safety, and comfort, and cause an increase in pollution.

Many fishermen (17) felt that an increase in rainfall would have no impact or mixed impact on their use of the site. One fisherman mentioned, “I’ve fished in the rain, it doesn’t bother me,” and another said he would buy rain gear if necessary. These fishermen felt that the rain did not influence their choice to go fishing, or that fishing was more important than the weather. Some fishermen were willing to fish during heavy rain and thunderstorms if fish were biting, while others who would fish in the rain felt that if there were thunderstorms or very heavy rain, they would not fish. A mixed impact related to the intensity of the rainstorm; some individuals were willing to fish during light rain but not heavier thunderstorms.

One fisherman felt that an increase in precipitation would have a positive impact on his use of the site because it would provide better fishing. This respondent also felt that increased hurricanes were positive for fishing.

Some fishermen felt the flooding and rainfall would be a short-term impact, while others felt that the erosion would drastically change the site. Eight fishermen out of the 25 who felt negatively about rainfall thought that there would be long-term impacts on the site. Decreased safety due to weather events and erosion of the landscape are predicted by the respondents to greatly reduce their use of the site.

Potential Management Action

Since flooding and erosion can require that areas of the coast be built up for recreational fishing, the interviews also assessed participants’ desire for a built fishing structure, a dock, to be installed. A dock or pier can be a climate-adaptive hardscape solution to flooding and sea level rise. For example, Whitehead et al. (2009) found that

“reductions in beach width negatively affect the quality and number of fishing trips even as anglers adapt by using piers and bridges” (777).

Figure 14: Percentage of negative and positive perceptions of a dock being built on the study areas by site (N=43)

Many respondents (18 respondents, 60% of respondents at Conimicut) were in favor of a built fishing structure (dock) at Conimicut Point, which has shallow topography and a sandy shore (Figure 11). They felt that the dock was better for fishing, because it was solid and would allow fishing in deeper water. One fisherman felt it was helpful because the dock would extend far into the water and potentially slow boat traffic. Another fisherman thought walking out on a dock would be a good experience. However, two fishermen (2) expressed some concerns about crowding on

the dock. Overall, these fishermen felt that the dock would generally improve their fishing experience.

Some respondents (12 respondents, 40% of respondents at Conimicut) were not in favor or did not care about a built fishing structure at Conimicut Point. They were concerned about crowding, safety, and/or wanted to keep a natural setting. Several fishermen (4) felt that the site was too pretty or naturally beautiful for a dock. As one fisherman illustrated, “I would probably come less because look at this [view]. Imagine them wrecking something like that here, it would make no sense.” Other fishermen not in favor of a dock (3) felt that the dock would draw people who were not family-oriented or cause crowding on the site. One fisherman emphasized, “A fishing dock, I feel as if it’s gonna attract the wrong type of crowd [...] it’s gonna become more of a landmark place to go see then to actually use and keep clean. It’ll [draw] people [that] go and [take] selfies and pictures and throw water bottles and cigarette butts off of the side of the [...] dock.” The fisherman felt that the dock would not fit with the current use of the site. One fisherman felt that the dock would be unsafe and slippery, and another felt that there was no need for it because of the sand spit. One fisherman, who was also a shellfisher, argued that it would damage sea floor, which is shallow in that area. One fisherman felt that the fish would cluster under the dock and reduce fish abundance in other areas of the park. Another fisherman explained that he used the natural topography of the site to practice challenging sport fishing and that he would not come to the site if it used man-made infrastructure. The

responses of these fishermen demonstrated that they did not think that Conimicut Point was suitable for building a dock.

On the other hand, at Rocky Point, which had a rocky shoreline and steeper topography than at Conimicut Point, all respondents were in favor of a dock. There are currently remnants of a dock there but the dock was damaged beyond use at the time of the interviews. Several (n= 6) felt that the dock would be a good idea because it was historically there (i.e. the dock will be a reconstruction and not new, or the dock could be repaired). As one fisherman said, “Everything that is reconstructed [would] give more beauty to the place.” Another felt that the dock would be good for fishing, allowing people to fish in deeper water. Other fishermen explained that a dock would give people more access, such as the elderly or those without access to a boat, that it would be good for walking, and that it would enhance the fishing experience. Unlike many respondents at Conimicut, they felt a dock would positively add to their experience and would improve enjoyment of the scenery. Participants had strong views in favor of the dock, with one stating that construction of a dock was his biggest priority for taking part in the interview. The reasons that all Rocky Point respondents were in favor of a dock at Rocky Point ranged from historic reconstruction, access for the elderly and deep-water access for people who did not have boats, new areas for walking, and enhancement of the fishing experience.

DISCUSSION

Results illustrate how recreational fishermen in the study areas may likely respond to impacts from climate change. There could be various responses, and although many impacts will have a negative effect on recreational fishing, some impacts may enhance the recreational fishing experience for some respondents. The conceptual framework developed from the interviews (Fig. 13) starts to build a theoretical model for how climate change can impact recreational fishing.

Fish species change has variable impacts

Findings demonstrate that fishermen have different preferences for catching different fish species. Scup, a common warm water fish in the area, does not have a high market value and their fillets have many bones (Rowley 2015). Scup is a lower value fish than the cold water species in the area but fishermen still find value in fishing it and may benefit from more scup. Although some fishermen will reduce their use of the site due to changing target species, other fishermen will increase their fishing or adapt to the new species in order to continue catching fish. Many fishermen will not change their behavior because they do not target a species specifically nor fish more or less depending on availability of fish, but rather they fish for fun, relaxation, or other attributes of the fishing experience. This finding is not surprising as recreational fishing behavior is influenced by multiple factors, including target species (e.g. Arlinghaus et al. 2017).

Some fishermen felt that an increase of scup in the area would cause them to fish more. They assumed the total fish abundance in the area would increase. This finding

is similar to the findings of McCreary et al. (2019) that while winter activities along Lake Superior would decline due to climate change, popular summer activities would benefit from warming. This finding can be explored as a substitution strategy for cold-weather-dependent activities to adapt so that people can gain well-being from warm-weather activities. However, these activities may also eventually decline as ecosystems collapse or warm-water fish also move out of the area as waters continue to warm. Although many interviewees couched their perceptions within a larger understanding of climate change, connecting information about climate change to specific impacts on recreational activities can help the public conceptualize and prepare for climate change.

Many (n = 18) fishermen felt that they were not sure of the impact of fish species change on their fishing behavior or did not see any impact of this on fishing behavior. These fishermen may have been cautious to assume that total fish abundance would increase or they did not care which fish species they caught.

Risk aversion of fishermen in bad weather

The responses in relation to increased rainfall and flooding demonstrate that perceptions of increasing the risk of illness, potential harm to physical safety, increased pollution in the water, and discomfort were major reasons to not fish in the rain. However, surprisingly, some fishermen said that they would be more likely to fish in bad weather. Differences in hurricane predictions (for example, less frequent hurricanes Category 3 or higher and more Category 1 and 2 hurricanes) will impact the use of the site differently. Fishermen were more likely to say they would fish in

Category 1 and 2 hurricanes than in categories 3 or higher. Therefore, some fishermen were not risk averse to bad weather. Their interest in fishing during hurricanes demonstrate the power of informal information networks such as fishing derbies mentioned by Kuehn, Luzadis, and Brincka (2013), with their perception that fishing is better after a hurricane. Fishing during the hurricane, and not just before and after, may be more related to risk-taking behavior.

Long-term and short-term impacts of increased hurricanes and rainfall

Impacts were conceptualized as long-term or short-term impacts by many respondents. A long-term impact of increased hurricanes and rainfall that concerned respondents at Conimicut Point was erosion of the landscape. Planning adaptation strategies to address erosion, such as the building of docks and access roads, can reduce this threat and maintain recreational fishing use. These adaptation strategies should include anti-slip materials in order to reduce safety issues for fishermen during rain events. However, many respondents felt that hurricanes and rainfall would only have short-term impacts on the site and would not impact their fishing behavior.

Some respondents were concerned about short-term impacts of increased rainfall—especially reduced water quality in the urban fringe due to rainfall. In the urban fringe, where the study sites are located, fishermen are sensitive to poor water quality, because of the pollution in the area from stormwater runoff. Eating polluted shellfish or fish can result in negative health impacts. Erosion and poor water quality are two ways that urban communities are vulnerable to climate-related disasters. Teo et al. (2019) finds that ‘ethnicity’ and ‘English Language skills’ account for variations

in disaster preparedness. Managers should account for disaster vulnerability due to sources of disaster information, potentially through informal community networks (Teo et al. 2019).

Importance of place in 'fit' of fishing docks

The responses demonstrated that additional infrastructure in an area will only be successful if it is seen as suitable for the site. Even though docks are able to be used as a climate change adaptation strategy (Whitehead et al. 2009), fishermen may not want them on some sites. These responses demonstrate that it is important to consider the aspects of place attachment or place meaning (see previous manuscript) of a site to people before choosing a climate-related adaptation response; since in Conimicut Point, the site was seen as more beautiful and natural without the dock by some fishermen. The place meaning at Rocky Point, which included historical use, was seen as enhanced by a dock. Change when seen as appropriate or fitting increases attachment to the site, while change that is not seen as appropriate or fitting can cause mental anguish and indicate threats or fear (Devine-Wright and Howes 2010). Reasons such as the natural coastline, beauty, strong place attachment, and shellfishing had a large impact on whether respondents approved of the adaptation strategy. An historical dock at Rocky Point and the steep topography increased support of the new dock. Shallow topography and no historical dock at Conimicut increased opposition to the new dock. Some respondents approved of docks at both sites and may indicate that those people are more willing to accept site change or adaptation to climate change.

However, the response of some fishermen who did not want a dock at Conimicut may change if they cannot access the site otherwise. One of the limitations of this study was that it captured perceptions of future behavior; respondents were predicting their future behavior and may act differently in the future than they think now.

The project had several other limitations. This study is limited because users who were already displaced due to fish species change or increased rainfall were not sampled. Another limitation is that we conflated ethnicity and race in order to give respondents the opportunity to self-identify as broadly as possible. People who expressly self-identified as Latino and/or Hispanic were coded as Latino/Hispanic. Replication of this study in other coastal urban public fishing areas will contribute to the theoretical understanding of how climate related impacts affect recreational fishing. An additional impact of climate change will be the increased prevalence of heat wave issues in the summer; we recommend future research on this topic in relation to recreational fishing.

CONCLUSION

Climate change is predicted to decrease the welfare of people in marine coastal recreational fisheries of the U.S. up to \$312 million annually (Dundas and von Haefen, 2020). Planning for climate change impacts on coastal recreation is important in order to maintain the wellbeing of the coastal users. This study indicates how climate change may impact coastal recreation. Based on the findings of the study, the quality of recreational fishing in the urban fringe is perceived by respondents to generally decrease with more hurricanes and with more rainfall. Increased hurricanes can have negative impacts on the use of a site for recreational fishing due to erosion, lack of safety, and lack of access. Increased hurricanes can also have mixed impacts on the use of a site due to temporary impact or category of hurricane. Finally, increased hurricanes can have positive impacts on the use of a site due to the perception of more fish in the area. Increased rainfall can have negative impacts due to flooding, safety, slipperiness, stress on immune systems resulting in potential illness, and degraded water quality; mixed or no impacts, sometimes depending on thunderstorms; and positive impacts due to better fishing. Many people do not believe that hurricanes will have a large impact on fishing. Some fishermen may even be more likely to fish during hurricanes and during rain. Managers can use this information to understand how people will use sites in the future under climate change or management decisions. When managing these areas under climate change, aiding or preserving these sites will allow urban residents to preserve connections to nature.

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Ethics Statement

This study was carried out in accordance with the recommendations of Institutional Review Board. The protocol was approved by the Institutional Review Board, University of Rhode Island Office of Research Integrity, Division of Research, and Development. All subjects gave written informed consent in accordance with the Declaration of Helsinki.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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CHAPTER 5: COMPREHENSIVE CONCLUSION

This study provides a unique perspective on why context matters and how place-based benefits are valued in the context of urban fringe, recreational, or commercial fishing. In this study, the impacts of landscape change were examined by analyzing commercial and recreational fishermen's perceptions of familiar places. The first part of the study interrogated how offshore wind farms may impact commercial and recreational fishermen, using the Block Island Wind Farm (BIWF) as a case study. It allowed a deeper understanding of how these marine resource users are impacted not only by the BI Wind Farm itself but also by the perceived and observed environmental changes in the area due to the turbines or cable systems. Findings from this study include how local ecological knowledge can be used for the co-production of knowledge. Commercial fishers tended to describe the aspects of the offshore wind farm in a negative way, because of crowding and navigational concerns, while recreational fishers described more positive impacts of the Block Island wind farm, such as improved fish abundance and fishing experience. These understandings can inform the planning and development of other future offshore wind farms. The second part of the study examined fishermen's emotional attachment to coastal places in mid-Narragansett Bay. This part of the study focused on the place meanings of coastal recreational fishers at a range of public access areas in mid-Narragansett Bay. In particular, it investigated how coastal place meanings differ by place and by fisher characteristics. The findings inform the understanding of how diverse urban fishermen are using the urban fringe, the importance of fishing in their lives, and why they

choose to fish where they fish. Issues like access, pollution, mental health, safety, food, and community were strong decision-making factors. The third part of the study examined how future climate and management conditions would change the perceived use of those coastal recreational fishermen. Findings such as the ‘fit’ of a dock, and the predicted use of the study area under hurricane or increased rainfall conditions, or with fish species change, allow a prediction of how use of the site will change in the future. This study in the urban fringe in Narragansett Bay had a rich discussion of how coastal users will be affected by climate change impacts and signals how the place-based benefits from the second part of the study, which aid human wellbeing in the urban fringe, may be lost under climate change.

Below is a brief discussion of several key themes associated with human activities in a changing coastal and marine landscape that emerged from the three chapters. The themes include social construction of landscapes within place meanings, repairing positive place meanings, landscape ‘fit’, subjective memories, theory as it relates to phenomenology, change, and interventions, and management actions.

Social construction of landscapes

The first chapter demonstrates that patterns of use and behavior quickly adapt to incorporate an intervention in the landscape. The image of the offshore wind farm as a landmark or target to meet friends or catch fish by one user group (recreational fishermen), a hazard by another user group (commercial fishermen), and as a playground (spearfishermen) demonstrates the diverse ways that place meaning is created by different user groups in marine space. However, these place meanings may

change or layer for individuals as the places change or as the users change their activities and experiences; place meanings are additive with length of association to a place (Smaldone et al. 2017). Yet negative place meanings, such as ‘hazard,’ can indicate trauma or ‘place disruption’ (Devine-Wright and Howes 2010). The variety of ways that people can understand the same thing demonstrates the social construction of landscape; i.e. how humans interpret symbols in the landscape through their cultural context (Greider and Garkovich 1994). Differences in terms of impacts, for example, between commercial and recreational fishers, may be therefore attributed to both motivations and cultural contexts of the fishers.

Repairing positive place meanings

Manuscript 2 highlights positive place meanings for coastal users in the urban fringe. Manuscript 3 looks at how use of the site may change due to climate change. If those place meanings are lost due to climate change, Manuscript 3 provides a path to prepare for the loss by showing how behavior on the site may adapt to climate change. The phenomenon of a disaster on a place may result in a degraded sense of attachment to a place (lost positive place meanings); yet Larter et al. (2019) found that after a hurricane, long-term users were more likely to strive to repair place attachment than short term users, and their place attachments were even stronger than previously. This indicates that there is hope for repair of these positive place meanings through adaptation strategies, and that management efforts should be directed at repairing place attachment to all user groups after a place change. More research is needed to understand how place meanings change (Brooks, Wallace, and Williams, 2006;

Manzo, 2006; Smaldone et al., 2017). These papers form an analysis of how coastal and marine areas are conceptualized and perceived, and provide many avenues for future research on repairing positive place meanings in terms of testing further perceptions and/or adaptation strategies.

Landscape ‘Fit’

In Chapter 3, change is perceived as either distinct from or part of a wider framework, where some fishermen attribute fish species change to climate change and predict future ecosystem decline, and others see it as an independent phenomenon. Change can either be considered to ‘fit’ with the landscape, as in the case of proposed dock at Rocky Point (study site C), or it cannot, such as the view of some users towards the offshore wind farm or the dock at Conimicut Point (Study site B). For the Block Island Wind Farm (Study site A), place attachment increased for recreational users of the area and decreased for commercial users of the area. ‘Fit’ with the landscape was shown to have both a connection to unwillingness for change (for example, the dock at Rocky point was previously there and had remnants in the landscape), and conflict with existing coastal and marine uses. For example, the BIWF conflicted with transit areas for commercial fishermen, and the proposed dock at Conimicut Point was perceived to increase crowding on the beach. Managers should think about fit when proposing interventions in the landscape.

Subjective and broad scale memories

Time and scale were major discussion points throughout this research. For example, the memories of fishermen are subjective snapshots in time, with a non-random selection of space in which to visit (ten Brink et al. (in review)). Lessons learned for integrating social and ecological impact research around the first offshore wind farm in North America, Block Island Wind Farm). Benefits of the landscape may reflect stronger place attachment when associated with a memory with strong valence (i.e. a vivid memory may be the cause of an important place meaning and cause stronger place attachment than otherwise). Moving through the scales was necessary for participants as they conceptualized on both broad and specific scales what issues like more frequent hurricanes would mean for their use of the site. This theme needs further research to address methodological principles for comparing spaces in various times and scales.

Developing theory: the nature of change, phenomenology and interventions

Future spatio-temporal studies can be designed to analyze areas for good fishing or place attachment in terms of intervention, such as promontory, rocky bluff, sandbar, or artificial reef. These sites must be contextualized in their social, economic, and physical surroundings. However, there is no reason to not compare these issues. As Lewicka (2011) states, phenomenology researchers are able to compare places by building off of instances of a phenomenon. These instances form general characteristics that describe the experience of a place. Future avenues of research from the place meaning literature include studying the impact of climate related effects on recreational fishing, including increased prevalence of heat waves, the extent

urbanization and pollution have on place meanings of shore fishermen, and the impact of offshore wind farms. These phenomena can be compared in how society reacts to them.

Management actions to enhance recreational use under climate change

In order to enhance recreational use of coastal and urban areas under climate change, there are some management actions that organizations can take. Management actions, such as adding toilets or trash barrels to reduce broken glass, or providing informational communication, like notifying people of water quality or risks of eating polluted seafood or times when construction would be happening on the BIWF, were important for reducing hazards and counteracting the development of negative place meanings. Similarly, checking the weather, calling the shellfish advisory hotline, or other informational coping mechanisms were used and were predicted to be used by participants. Clarifying safety information, especially in other languages used in the area, and offering alternatives in terms of site substitution, gear substitution, or activity substitution are all ways that organizations can maintain and enhance coastal use by the public during times of change. Education programs can also clarify climate change impacts.

As discussed previously, the urban fringe is an important area in which to invest for public access, since it is used by many urban fishermen. Offshore wind farms are a major source of renewable energy that can mitigate for current climate change; however, not enough is known about the impact of turbines offshore. This dissertation found that coastal and marine development can be improved by incorporating

engagement in offshore wind farm planning, revamping impact assessments, preparing for climate change by incorporating anticipated actions by coastal users, and preserving the use of coastal areas for mental health, community, and sustenance of urban fishermen.

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APPENDIX A.

I. Interview Guide:

Understanding marine resource user response to ecological impacts of offshore wind energy: a case study of the Block Island Wind Farm

We are students at the University of Rhode Island in the Marine affairs department. I'm a student working on a project to learn more about how people are impacted by the wind farm. This project is a collaboration between URI and RI department of Environmental Management, and funded by Sea Grant. We're looking to hear about the impacts of the offshore wind farm, and the interview will take about an hour. Everything you say to us is confidential, which means it will not identify you. The risks of the study are possible discomfort talking about past experiences and associated feelings and the benefits are the opportunity to help researchers and practitioners improve ocean resource use. Only the researchers will have access to this data, and the only people who will see your comments are the research team. You do not have to answer any questions you don't want to, and you can ask me any questions at any time. Also, our contact information is on the form and on this card, feel free to contact me at any time. This interview will take about an hour and I was wondering if it is possible if we could record you, so that we can go back to your comments later? Also, do you have any questions for me?

Main interview

I would like to talk to you first about your overall fishing experience and then talk about your use of the area of the BI Wind Farm area before and after the turbines were put in place.

General Background Fishing Experience Information

1. **Tell us a little bit about your fishing experience in general.** For instance, how long have you been fishing? When was the last time you went fishing?
2. **Fish: What types of fish do you typically target?** What type of fishing equipment do you use? Where do you typically go fishing? Why do you go to those places? (to understand who this fisherman is, don't need map).
3. **Boat: Do you fish from a boat?** Do you own it? For how long have you owned it? How big is the boat? Where do you keep the boat?

Experiences before construction of Block Island Wind Farm

I'm going to ask you a few questions about how you have used the area off the southern coast of Block Island (see map (Figure 12.)) I am going to ask you about your boating experiences before the wind turbines/structures were in place, during the construction phase, and after the wind farm was completed. Show respondent map of the area off Block Island coast

4. Tell us a little bit about your experience with the area off the southern coast of Block Island (show area on map). (Did you go to that area before any structures were in place (before 2015)? **Approximately how many times have you been to that area? How many times per year did you go to that site before the structures were built?**)

5. **Did you go fishing in that area before any structures were built? In which part of that area did you typically fish?** (respondent should indicate on map)
What type of fish did you target before the structures were in place? Why did you target those species? (probe for: to eat/subsistence, to sell, for fun/challenge)
Different fish have assembled at different turbines at different times. What are they?

6. I'd like you to think about the first time you heard about the wind farm. Can you remember when you first heard about it? Where did you hear about it? What were your thoughts about the wind farm at that time? Experience with the process? How are is impacted? Do you think that fish run through that area? How much time do you spend avoiding the area? How many days fishing the area before?

Experiences during construction

Foundations of the BIWF were installed in late summer of 2015. The cable was installed in the summer of 2016. In late summer 2016 the turbine towers were

installed. It was fully constructed in late summer of 2016, and started operating in December 2016.

7. Did you go to this area while the turbines/structures were being constructed?

How did the turbines look when you were there? (*Show visuals of one stage (Figure B) and ask the respondent if they visited during that time—or saw from the land. Or which stage they saw.*) Why did you go there if you didn't fish? Have you been there since?

8. Did you go fishing in the area during construction? Where did you fish [at those times]? What types of changes did you notice during construction? (probe for habitat, types of fish, mammals or birds, boats/users, recreational or commercial fishermen--types of gear they are using, sizes of fish, sounds/vibrations, as a fish aggregating device, etc.) Did you fish on the perimeter of the Safety zone? In what seasons?

Experiences after construction of Block Island Wind Farm

Now I am going to ask you some questions about your experience in that area since the turbines were fully built (since the fall 2016). Show respondent map of the area off Block Island coast (nautical chart with structures).

9. **Have you fished near the turbines/wind farm?** How close have you gotten to the wind turbines when fishing? When was that? (How often?) Why do you fish near the structures/turbines? Did you catch more that day? How did you know there were more? (probe)
10. **What types of changes have you noticed near the wind turbines/structures?**
(probe for habitat, types of fish, mammals or birds, boats/users, recreational or commercial fishermen—types of gear they are using, sizes of fish, sounds/vibrations, as a fish aggregating device, EMF, etc.)
11. **What do you think is causing those changes** (in fish, birds, habitat, boats)?
12. **What are your thoughts about those changes? How have they affected your own use** of the area? (probe for changes in fishing sites, changes in fishing gear, changes in times going to site; show map so respondent can indicate changes in spatial use if needed)
13. Have you heard of anyone else seeing changes? What changes have other people noticed?

14. **Do you know where the cable is that brings the wind energy to shore?** Do you fish near the cable? What types of changes have you noticed near the cable? (probe for habitat, types of fish, mammals or birds, boats/users, recreational or commercial fishermen—types of gear they are using, sizes of fish, sounds/vibrations, EMF, etc.) What do you think is causing those changes? How have those changes affected your use of the area?
15. Now that the wind turbines are operational, what do you think of the wind farm now? Have your thoughts about the wind farm changed over the past few years? In what ways?

Interview Protocol Images:

Figure 15. Stages of the BIWF.

APPENDIX B.

Main interview

I would like to talk to you first about your feelings about the place and then talk about your overall fishing experience.

1. Place: When did you start coming to this site? What time of day and months do you go fishing? How often? How far do you live from this place?

2. Place meaning: What is important to you about this place? Can you explain why this place is special? What else is important to you about this place? What is special? Why is that place special? How does it make you feel? Do you have any special memories at this site?

3. [Show Birds-eye image]. This is an image of the site; which areas exactly are you talking about?

Now I'd like to ask you some questions about your fishing in general.

4. Fishing: How long have you been fishing? What type of fishing do you do? What types of fish do you catch? What fish do you target and why? Do you like to keep them? Why? How does it make you feel? Any recipes you make with your catch?

5. Company: With whom do you generally come to the site? Why? How many people? Can you describe a typical day or the last time you came to the site?

6. Motivations: Why do you come here? What types of things do you do here? Do you have any family traditions associated with the place? Does this place remind you of your heritage or culture? Do you feel welcome there? What makes you feel welcome or not welcome?

7. History: I want to ask you about changes at the site, both changes you might have seen, and changes you have heard of. You said you've been coming since [...]. Have you noticed any changes since coming here? Or heard about changes in the past? In what ways? When did you notice some of those changes? What do you think about that change? How do you feel about that change?

8. Change: Now I want to ask you about how your feelings about the site could change in the future: Here's a potential future change – how do you think that will impact your use of the site? [Show image]

1. Potential future conditions due to climate change: a. More intense storms with more flooding

b. Heavier Rain

c. Change in Fish

2. If the participant does not immediately begin talking about what they think of the potential changes, explain each one: a. More intense storms and higher floods: See this image of worst-case hurricane flooding areas. Access to the site during the storm might be a problem. This map is not taking into account sea level rise. The frequency

of Category 4 intense storms is likely to increase and possible double by 2100. How do you think that will impact your use or change your thoughts about the site?

b. More frequent rainstorms or heavier rain: Summer precipitation is expected to increase by 7-8% between 2008 to 2050; and winter and spring precipitation is expected to increase by 9% to 14%. This could mean either more rainy days or heavier rainstorms. How do you think that will impact your use of the site or change your thoughts about the site?

c. Types of fish changing: Warm-water fish such as scup, butterfish and squid are expected to increase and cold-water fish such as cod, winter flounder, hake are expected to decrease. How do you think that will impact your use?

3. Platform or Fishing Pier: If RI DEM was to build a fishing pier or a platform in the site? How do you think that will impact your use or change your thoughts about the site? Why?

9. I have some quick final questions that will help me group the interviews. You can fill out this page, or I can read you the questions and fill out the page.

a. Gender:

i. Male ____

ii. Female ____

iii. Other ____

b. Age: What is your age? _____

- c. Ethnicity: Which categories describe you? Circle the category. i. Mexican,
Mexican American, Chicano
- ii. Puerto Rican
- iii. Cuban
- iv. Portuguese
- v. Azorean
- vi. Brazilian
- vii. Other Hispanic, Latino, or Spanish origin – What is this origin? _____
- viii. Black or African American or African
- ix. American Indian or Alaskan Native
- x. Middle Eastern or North African
- xi. Native Hawaiian or other Pacific Islander
- xii. Japanese
- xiii. Chinese
- xiv. Korean
- xv. Samoan
- xvi. Guamanian or Chamorro
- xvii. Vietnamese
- xviii. Hmong
- xix. Laotian
- xx. Thai
- xxi. Pakistani
- xxii. Cambodian

xxiii. Asian – Other origin – What is this origin? _____

xxiv. White

xxv. Other – ____

d. Household Income bracket in the past 12 months. Circle one.

i. Less than \$10,000

ii. \$10,000 to \$14,999

iii. \$15,000 to \$24,999

iv. \$25,000 to \$49,999

v. \$50,000 to \$99,999

vi. \$100,000 to \$149,999

vii. \$150,000 to \$199,999

viii. \$200,000 or more

e. How Many People in Household? Circle one. i. 1

ii. 2

iii. 3

iv. 4

v. More than 4

f. How Many People over age 18 in Household? Circle one. i. 1

ii. 2

iii. 3

iv. 4

v. More than 4

g. Do you speak a language other than English at home? ____ What is this language? ____

Potential future conditions:

1. More intense storms with more flooding
2. Heavier Rain
3. Change in Fish

Potential future conditions:

1. More intense storms with more flooding
2. Heavier Rain
3. Change in Fish

Spanish version:

Protocolo de Entrevista

Entrevista Principal

Primero me gustaría hablar sobre sus sentimientos hacia el lugar, y después hablar sobre su

experiencia como pescador en general.

1. **Lugar:** ¿Cuándo comenzó a venir a este lugar? ¿En qué meses, y horas del día usted

visita este lugar ? ¿Qué tan frecuentemente? ¿Qué tan lejos vive de este lugar? ¿A qué distancia vive usted de este lugar?

2. **Significado del Lugar :** ¿Qué es importante para usted sobre este lugar? ¿Puede explicar

usted por qué esta lugar es especial? ¿Qué más es importante para usted de este lugar? ¿Qué es especial? ¿Por Qué cree usted que este lugar es especial? ¿Cómo lo hace sentir a

usted? ¿Tiene alguna memoria especial en este lugar?

3. *[Show Birds-eye image]* Esta es una imagen del sitio. ¿De cuáles áreas habla exactamente?

Ahora quisiera hacerle algunas preguntas sobre la pesca en general.

4. **Pesca:** ¿Por cuánto tiempo ha pescado? ¿Qué clase de pesca hace usted? ¿Qué clase de

peces reda usted? ¿Qué tipo de pescado busca y por que? ¿Le gusta quedarse con ellos? ¿Por

qué? ¿Cómo le hace sentir? ¿Hay algún platillo/receta que hace con su pesca?

5. **Compañía:** Generalmente, ¿con quienes visite usted este sitio? ¿Por qué? ¿Cuántas personas? ¿Puede usted describir un día típico aquí, o la última vez que visito este sitio?

6. **Motivaciones:** ¿Por qué razón llega usted aquí? ¿Que clase de actividades hace usted aquí?

¿Tiene usted algunas tradiciones familiares asociadas con este lugar? ¿Le hace recordar de su herencia o cultura este lugar? ¿Se siente bienvenido? ¿Que le hace sentir bienvenido o rechazado?

7. **Historia:** Quiero preguntarle acerca de los cambios en el sitio, ambos, cambios que haya visto

y de cambios que haya escuchado. Usted mencionó que ha venido aquí desde [...].

¿Ha notado

algún cambio desde que comenzó a venir aquí? O, ¿escuchó de algún cambio en el pasado? ¿De

qué maneras? ¿Cuándo se dio cuenta de algunos de estos cambios? ¿Qué piensa de este cambio?

¿Cómo lo hace sentir este cambio?

8. **Cambio:** Ahora quisiera preguntarle como sus sentimientos del sitio podrían cambiar en el futuro:

Este es un potencial cambio en el futuro --- ¿cómo cree usted que impactara su uso del sitio?

[Enseñar imagen]

1. Futuras condiciones potenciales por cambios climáticos:

a. Tempestades más graves con más inundaciones

b. Más fuerte lluvias

c. Cambios de pescado

2. Si el participante no da la respuesta inmediatamente, explique cada uno del siguiente:

a. Tormentas más intensas e inundaciones: Vea la imagen de las áreas de los peores casos de inundaciones por huracanes. El acceso al sitio durante una tormenta pudiera ser un problema. Este mapa no toma en cuenta el aumento del nivel del mar. La frecuencia de las tormenta de intensidad Categoría 4 probablemente aumentará el doble para el año 2100. ¿Cómo piensa que esto impactará su uso o su manera de pensar sobre este sitio?

b. Torrenciales más frecuentes o fuertes lluvias: La precipitación en verano esta esperada a aumentar... incrementar por 7-8% entre el 2008 al 2050; y la lluvia en primavera e invierno esta esperada a incrementar de 9% a 14%. Esto puede significar más días lluviosos o mas fuertes lluvias. ¿Cómo cree que esto impactará su uso del sitio o sus opiniones acerca de el?

c. Cambio en el tipo de peces: Peces de agua cálida como el pez scup, el pez palometa (butterfish) y el calamar están esperados a aumentar mientras los peces de agua fría como el (cod) bacalao, el pez platija

(winter flounder) , y merluza (hake) están esperados a disminuir.

¿Cómo cree que esto afectará su uso?

3.) **Plataforma o muelle de pesca:** Si el RI DEM fuera a construir un muelle de pesca o

plataforma aquí, ¿cómo cree que esto afectaría o cambiaría su uso u opinión sobre este sitio?

¿Por qué?

9.) Finalmente tengo algunas preguntas que me ayudará a agrupar la entrevista. Usted puede

llenar este pagina, o yo lo puedo leer y llenarlo por usted.

Características

a. Genero:

i. Masculino ____

ii. Femenino ____

iii. Otro ____

b. Edad: ¿Cuál es su edad? _____

c. Etnicidad: ¿Cuál categoría lo describe? Circule la categoría.

i. Mexicano, Mexicano Americano, Chicano

ii. Puertorriqueño o Boricua

iii. Cubano

iv. Portugues

v. Azoreano

vi. Brasileiro

vii. Otro Hispano, Latino, o de Origen Español – Cúal Origen? _____

viii. Negro, Afro-Americano o Africano

ix. Indio Americano o Nativo de Alaska

x. Arabe/medio oriental o Africano del Norte

xi. Nativo Hawaiano u otro Pacific Islander

xii. Japones

xiii. Chino

xiv. Koreano

xv. Samoano

xvi. Guamaniano o Chamorro

xvii. Vietnamita

xviii. Hmong

xix. Laotiano

xx. Tai

xxi. Pakistani

xxii. Cambodiano

xxiii. Asiático – Otro origin – Cúal Origin? _____

xxiv. Blanco

xxv. Otro – ____

d. Ingreso familiar en los últimos 12 meses. Circule uno.

i. Menos de \$10,000

ii. \$10,000 a \$14,999

iii. \$15,000 a \$24,999

iv. \$25,000 a \$49,999

v. \$50,000 a \$99,999

vi. \$100,000 a \$149,999

vii. \$150,000 a \$199,999

viii. \$200,000 o más

e. ¿Cuántas personas viven en su casa? Circule una.

i. 1

ii. 2

iii. 3

iv. 4

v. Mas de 4

f. ¿Cuántas personas de más de 18 años viven en su hogar? Circule one.

i. 1

ii. 2

iii. 3

iv. 4

v. Mas de 4

g. ¿Habla algún otro idioma aparte de inglés en casa? ____ ¿Que otro idioma? ____

Potential future conditions:

1. Tormentas más intensas, más inundaciones

2. Fuertes lluvias

3. Cambios en los peces

APPENDIX C

All place meanings:

- Valued person with limited mobility who likes it
- Landscape, convenient, fishing rich
- Bacteria Level down
- Access, availability
- Charming, safe
- Welcoming, relaxing, family
- Relax, walking (health)
- Good fishing, calm
- Sandbar and good parking
- Clean beach, good fishing, quiet
- "the space"
- Warwick, good times (memories)
- Warwick, beautiful, good fishing, good parking
- clean water quality compared to providence
- good place to fish, enjoy, fresh air (quality compared to providence)
- peaceful, natural, pretty, comfortable, not bothered
- accessibility, preserved, access, clamming/fishing multiple use,
- fishing, parking, Warwick
- accessible, not crowded, peaceful, walking

- quaint, relaxing, not too big, intimate, cozy
- relaxing, walking, fishing, enjoy the weather
- beautiful, relaxing
- quiet, calm, nobody bothers you, trees, beautiful, swim, fish
- clean, fish, nice people
- just come for the fish
- something to do, to pass the time. Great place, great place to fish
- peaceful and calming; friendly, fishing, clamming, cooking, sunset, boats, windsurfers, camping, so much to do; "peace of mind"
- nice, simple, place, not crowded, good fishing
- Warwick, walking, chill, talk with my friends
- "the differences between the sides and being a point. You get one set of, one on one side and then one on the other. Calm on one side and rough on the other." "don't have to go far offshore on a pier" "calm family-oriented place to come and hang out. Catch some sun and some fish"
- Warwick, the shape (sandbar), quiet, comfortable, convenient
- easy access, atmosphere, nice people, beautiful place
- accessible, family-oriented, clean; escape, relax and just break away for a little while from society and reality, wind down, beauty, nature

- favorite places, relax, pier entrance is a good place to fish, relax, therapy, be in the moment
- comfortable, good parking, good for children, enough space (not crowded), peace of mind
- Close to home, convenient, relaxation, for fishing and enjoyment
- Nearby, nice daily get away place, you know, to enjoy nature, fish quahog (clam), sit on the bench
- beautiful; crazy sandbar; wonderful; diverse, friendly people 'UN kind of thing', close, proximity, natural; beauty, nature, bay
- kayaking, fishing, clamming, day activity
- productivity "amount of life,"(i.e. fish) you can find on the sandbar, sandbar, clear water (can see feet), beautiful, unique demographics, clean, secluded
- fish, easy for kids to play
- beautiful, quiet, relaxed, tradition
- clean (don't have too many boats with oil)

APPENDIX D.

Figure 16. Water level in feet for a hurricane level 3 or higher, plus two feet of sea level rise. Image from <https://www.arcgis.com/home/webmap/viewer.html?webmap=2d691387bbaa49518be77add554d4b40>.