

Peri-urban Shore Recreational Fishing in New England and Climate Change

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ABSTRACT

The mental and physical benefits of accessible coastlines for urban residents will be impacted by climate change. Using place attachment, identity, adaptation, climate, and recreational fishing literature, this study investigates how urban and peri-urban shore recreational fishers will likely respond to impacts from climate change, specifically those associated with rainfall, hurricanes and fish species. Findings from anglers interviewed at peri-urban public access sites in Rhode Island indicate that increased rainfall and hurricanes are perceived to reduce recreational fishing use through lack of access, dangerous conditions, and erosion. Climate change impacts were conceptualized as short or long term with many anglers highly adaptive to short term impacts. Anglers with health issues or children were less motivated to use substitution gear or strategies for weather changes. Increased immediate fish abundance may increase shore recreational fishing. These findings allow assessment and interpretation of how recreational fishers will use coastal sites in the future.

KEYWORDS

Climate change; Recreational; Fishing; Coastal; Urban

Introduction:

Climate change impacts include increased frequency of storms, flooding, water temperature increases, sea level rise, increased storm surge, loss of salt marshes, increased erosion, and marine species changes [1]. The implementation of effective adaptation strategies can reduce the vulnerability of individual coastal users and communities to these impacts of climate change [2,3]. One potential adaptation strategy includes site substitution, where users choose to go to a different site to conduct the same activity. This strategy is limited, however, because some sites are unique; there are no similar substitutions. Other limitations to site substitution include income constraints and users' preferences for certain sites [4] as well as the conditions of a potential substitute site (e.g., physical accessibility). Other adaptation strategies include activity substitution, temporal substitution, strategic substitution, such as using different gear, and information coping, such as checking the weather [5]. Across all of these strategies is a common thread: fishers hold what social scientists term place attachment [6,7], and how they navigate that attachment in view of how climate change reshapes those places is the core goal of this article.

This study explores how coastal users in Rhode Island think they will adapt to climate change impacts, such as sea level rise, more intense storms, and warming ocean waters. The study focuses on one particular set of users that will be directly affected by these impacts: recreational fishers. These urban users are important because they have historically been excluded [8,9,10]; and they face a high level of sea level rise, with Rhode Island experiencing a rate of sea level rise (SLR) that is three to four times faster

than the average sea level rise for the globe. These findings can help managers planning recreational fishing areas in the future and how to allocate resources to the areas.

Recreational fishers

Recreational fishermen depend on a biological resource that is affected by climate change [11]. In 2014, saltwater recreational fishing generated \$61 billion in the United States [12]. Recreational fishermen have diverse motivations, cultures, and gear types [13], 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 [14, 15]. The variety of different structures, motivations, and cultures of fishermen mean that their perceptions of use, impacts and strategies for adapting to climate change will vary.

Some studies have examined how the motivations of fishermen relate to changes in the built or natural environment. For example, Hunt and Ditton [14] found that anglers that were less skilled and active were likely to stop fishing when access to a reservoir was removed, but highly active anglers were more likely to find a site substitute because of their interest in fishing. Several studies have examined how fishermen may respond to climate change in terms of declining fish abundance [16,17]. Only a couple of studies, however, have examined how fishermen respond to changes in rainfall and hurricanes [18] and other weather impacts [19]. More research is needed to understand how recreational fishermen respond to changes in fish species and weather conditions [20,21]. This study directly addresses that research gap.

Climate change and recreational fishing in Rhode Island

Rhode Island serves as a useful case for studying issues of climate change and recreational fishing since it has experienced sea level rise, increasing storms, and climate-change induced fish species change, and includes both rocky and sandy shorelines. Over the years, Rhode Island has been impacted by several major weather-related events, including a hurricane in 1938 that killed 600 people and a hurricane in 1954 that killed 65 people [22]. 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, so it can serve as a 'canary in the coal mine' to demonstrate the impacts of climate change for other areas in the United States. 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 [23].

This study focuses on shore recreational fishing, an important activity in Rhode Island, which is worth \$412 million [24]. The area of interest in this study provides some of the closest public access sites to the urban centre of Providence where swimming and shellfish harvesting are prohibited because of poor water quality [25]. The two public access sites in this study are Conimicut Point Park and Rocky Point Park. Conimicut Point Park, a large sandy public beach in the shape of a point into the bay, is situated 6.1 miles south of the city of Providence border, and Rocky Point Park is a state park located 7.7 miles south of the Providence border (Fig. 1). These upper to mid-Bay sites were selected because they are popular public access fishing areas that have adequate water quality for swimming and shellfishing, are close to an urban residential area (Providence, Rhode Island), and have different types of fishing infrastructure (rocky shoreline and sandy beach).

Coastal access points along Narragansett Bay are heavily used by recreational fishermen, yet the impact of flooding and other climate change-related impacts on

recreational fishing is not clear. 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.

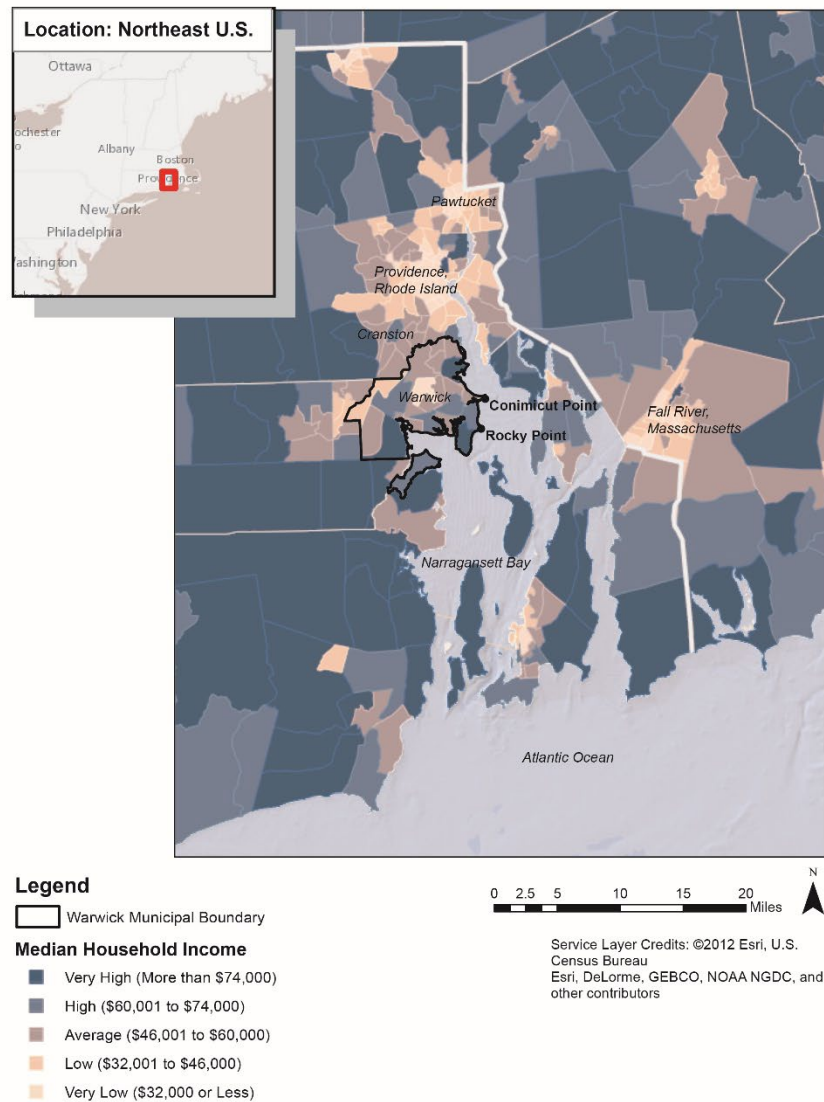


Figure 1. Study Sites and Median Household Income in Rhode Island (2011).

Methods

Interviews

During Summer 2018 (June through August), forty-three fishermen were interviewed using a semi-structured interview protocol to capture the breadth of understanding of a topic [26]. 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. The research team 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 [27], and the translations had separate transcriptions and translations which were reviewed by more than one researcher. The intercept interview method allowed researchers to capture diverse perspectives and uncover patterns of thought [28].

Participants were shown a map of the site as a scenario for its future under the worst-case hurricane storm surge inundation scenarios and asked about their perception of how climate change would impact the site (Images from SLOSH Model, U.S. Army Corps of Engineers and NOAA).

Respondents were also asked about how other climate change related weather impacts, like rain and fish species change in the future, would affect their behaviour. The predicted values for the frequency of rain increase and the storm intensity were obtained from the IPCC Report [29,30]. 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 [31].

Results

Characteristics of Respondents

The study captured a diverse sample of interviewees. Thirty-five interviews were conducted in English, and eight were conducted in Spanish. The race/ethnicity of the interviewees included White (40% of interviewees), Hispanic or Latino (28%), Asian (21%), African American or Black (7%) and Native American (2%). The incomes per household were under \$50,000 a year pre-tax for 49% of participants and over \$50,000 for 9% of participants. Forty-two percent of participants chose not to give an income. Each interview took between eight minutes and 61 minutes. The interviewees ranged between 20 and 79 years old with an average age of 47. 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. Of the 43 interviews, 30 were with fishermen located at Conimicut Point and 13 were at Rocky Point. Some (6) interviewees came from a household that included five or more family members. This sample cannot be compared to the population of anglers in Rhode Island because there is no information available on the demographic characteristics of anglers in the state of Rhode Island or at the study sites.

Perceived Impacts on Fishing Behaviour 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. 2). 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. 3).

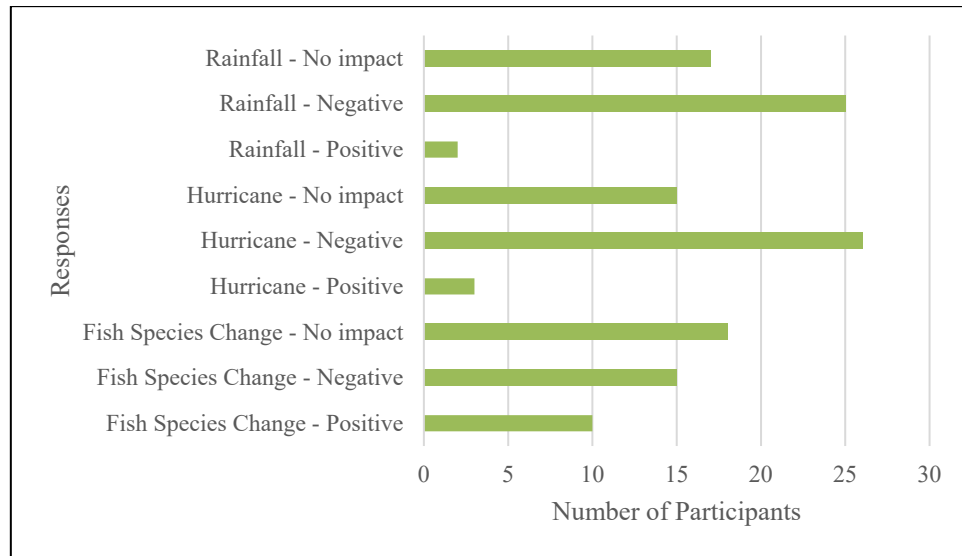


Figure 2. Number of fishermen who discussed negative, positive, or no impact of rainfall, hurricane, and fish species change on fishing behaviour (43 interviewees total).

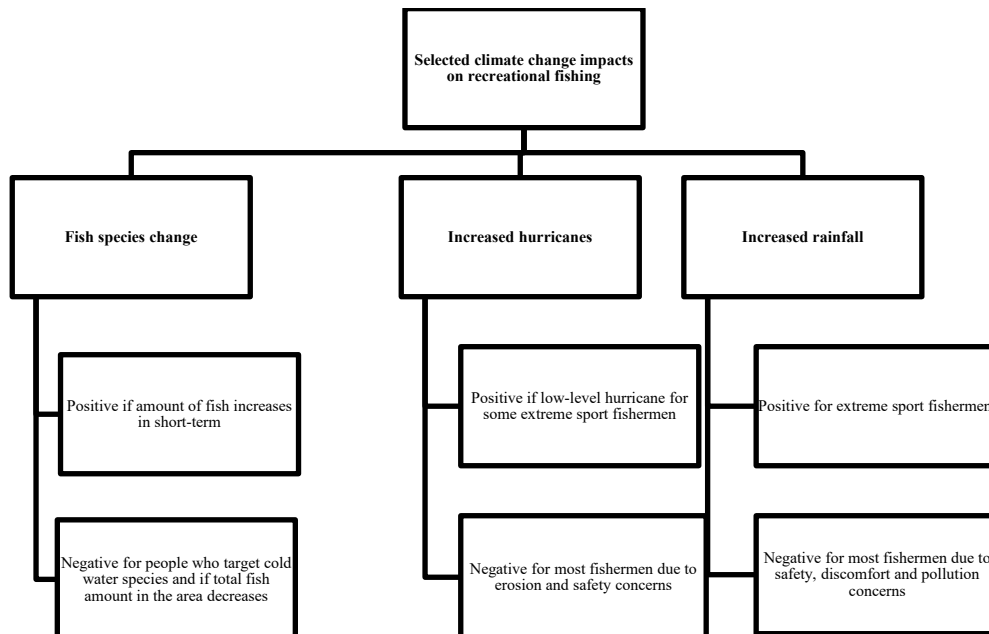


Figure 3. Conceptual scheme of findings for positive and negative perceived potential impacts of climate change on recreational fishing. The response, ‘No impact on fishing behaviour’ was not included in the conceptual scheme for simplicity.

Theme	Illustrative Quote
Unconcerned about fish species change	“[It will] not really [have an impact]. Cod - I can’t really catch because I don’t have a boat.”
Highly adaptive to fish species change	“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.”
Positive impact of fish species changes	“It’ll bring all the bait. Bait for the fishes, so it’d be a lot better.”
Negative impact of hurricanes	“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.”
Temporary impact of hurricanes	“I think it’ll have more an effect on the vegetation rather than the actual structure

	[...] this [site] has withstood hurricanes in the past.”
Temporary impact of hurricanes	“Floods don’t stay long.”
Positive impact of hurricanes	“If the fish are biting, you’re going to find me out here.”
Positive impact of hurricanes	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.”
Negative impact of increased rainfall	“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.”
Unconcerned about increased rainfall	“I’ve fished in the rain, it doesn’t bother me,”

Table 1. Illustrative views of perceived positive, negative, and no impact on fishing behavior

Fish Species Change

Some fishermen (15, 34%) thought that the change in fish species would have a negative impact on their fishing behaviour at the site. One reason was that the amount of their target fish would decrease. Some fishermen (9, 20%) felt that they would fish less at the site since they target fish other than scup for food or for recreational purposes. A few fishermen (5, 11%) 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, 42%) felt that the change in fish species would have no impact on their fishing behaviour. Based on these responses, some fishermen (10, 23%) felt that the fish species change would have a positive impact. They felt that they would be able to catch more fish. These responses indicate that increase in warm-water fish may be seen as beneficial for some fishermen, at least in the short-term. For this population, although changes in fish species owing to climate change may decrease their use of the site for some individuals, it would increase the use of the site for others. This demonstrates that motivations of some fishermen, such as catching large quantities of fish, may result in increased coastal recreational fishing, site use, and benefits of recreational fishing to individuals.

Increased Hurricanes

Over half the fishermen (26, 60%) felt that increased hurricanes would have a negative effect on their experience of the site. Some (6, 14%) felt that it would decrease their ability to use the site owing to erosion and change in the landscape. 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, 35%) felt that increased hurricanes had no impact or mixed impact on their use. A few (4, 9%) fishermen felt that their use of the site would depend on the strength or category of a hurricane. For example, one felt that a Category 1 hurricane would not impact use, but 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, 7%) felt that increased hurricanes could have a positive effect on their fishing behaviour in the area. They felt that hurricanes led to a greater catch.

Fishermen felt that hurricanes would have short-term or long-term impacts. Some fishermen (10 out of 26, 38%) who felt negatively about increased hurricanes felt that they would have long-term impacts. A few fishermen (2 out of 15, 13%) who were neutral about hurricanes felt that they would have long-term impacts. These findings demonstrate that increased hurricanes caused by climate change are predicted by participants to have negative effects on coastal use and coastal fishing areas in New England. This could result in decreased site use and decreased access to the benefits of recreational coastal fishing.

Increased Rainfall

More than half the fishermen (25, 58%) felt that increased rainfall would have a negative impact on their use of the site for fishing. Several fishermen (6, 14%) felt that climate change would increase flooding, especially at Conimicut Point, which was a low-lying site with a parking lot that would flood in the scenario presented. Two fishermen noted that erosion of the site would also increase. A few (3, 7%) said that the

additional rainfall was a safety issue and slippery for fishermen fishing from the rocks. Another issue for a few fishermen (4, 9%) was the perception that rain could increase the chance of getting sick. Another major reason that two fishermen (2, 5%) disliked the increased rainfall was that 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. Increased rainfall was perceived to threaten health, safety, and comfort, and cause an increase in pollution. Many fishermen (17, 40%) felt that an increase in rainfall would have no impact or mixed impact on their use of the site 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 (32% of the 25) who felt negatively about rainfall thought that there would be long-term impacts on the site. Decreased safety caused by weather events and erosion of the landscape are predicted by the respondents to reduce their use of the site greatly.

Discussion

Results illustrate how recreational fishermen in the study areas may respond to impacts from climate change. It is clear that climate change will not have a uniform effect on individuals. There are a range of responses, and although many impacts will have a negative effect on recreational fishing, some impacts may enhance the recreational fishing experience for some respondents. Findings from the interviews inform the development of a theoretical model for how climate change can impact recreational fishing (Fig. 4).

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 [32]. 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 as target species change, other fishermen will increase their fishing or adapt to the new species in order to continue catching fish. Many fishermen will not change their behaviour because they do not target a species specifically nor fish more or less depending on availability of fish, but rather fish for fun, relaxation, or other reasons. This finding is not surprising as recreational fishing behaviour is influenced by multiple factors, including the catch of target species [33].

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. [5] that although winter activities along Lake Superior would decline because of climate change, popular summer activities would

benefit from warming. This finding can be explored as a substitution / adaptation strategy for cold-weather-dependent activities so that people can gain well-being from warm-weather activities. But, 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 fishermen (18) felt that they were not sure of the impact of fish species change on their fishing behaviour or did not see any impact of this on fishing behaviour. These fishermen may have been cautious to assume that total fish abundance would increase or they did not care which fish species they caught. Fishermen using boats may have a different response.

Motivations to fish in hurricanes or rainfall

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 for not fishing in the rain. Yet, 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 [35] 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 behaviour. The complex rationale for why increased hurricanes may or may not be helpful for recreational shore fishing can inform predictions of coastal use in the future.

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. But, many respondents felt that hurricanes and rainfall would only have short-term impacts on the site and would not impact their fishing behaviour.

Some respondents were concerned about short-term impacts of increased rainfall—especially reduced water quality in the urban fringe because of 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) [36] found that ‘ethnicity’ and ‘English Language skills’ account for variations in disaster preparedness. Managers should avoid the risk of disaster by ensuring that informal community networks have clear, pointed advice in Spanish and English available for distribution [36].

Understanding the views of shore recreational fishermen in terms of climate change impacts as short-term or long-term impacts can help understand choices made in terms

of fishing behaviour. With long term site impacts, such as erosion, fishermen may end up substituting sites with varied characteristics, such as sandbars for rocky shorelines. On the other hand, with short term impacts, such as increased rainy days, fishermen may end up including different gear, such as increased foul weather gear.

One of the limitations of this study was that it captured perceptions of future behaviour; respondents were predicting their future behaviour but may not act as they predict. This study is limited because users who were already displaced because of fish species change or increased rainfall were not sampled. No differences in responses related to race or ethnicity were apparent during analysis.

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; future research on this topic is recommended 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. by an amount up to \$312 million annually [19]. 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 using a case study of two coastal access areas in Rhode Island. Based on the findings of the study, the quality of recreational fishing in the urban fringe is perceived by respondents to decrease generally with more hurricanes and with more rainfall, which cannot always be ameliorated by site substitution and foul weather gear. Increased hurricanes can have negative impacts on the use of a site for

recreational fishing owing to erosion, lack of safety, and lack of access. Increased hurricanes can also have mixed impacts on the use of a site because of temporary impact or category of hurricane. Finally, increased hurricanes can have positive impacts on the use of a site owing to the perception of more fish in the area. Increased rainfall can have negative impacts: 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 from better fishing. Many respondents do not believe that increased 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, for example, whether to advocate for restoring or preserving an area, or for surrendering an area to climate change impacts such as sea level rise.

References

- [1] Fresque-Baxter, J.A. and Armitage, D., 2012, 'Place Identity and Climate Change Adaptation: a Synthesis and Framework for Understanding', *WIREs Climate Change*, **3**, 251–266, doi: 10.1002/wcc.164.
- [2] Adger, W.N. et al., 2009, Are There Social Limits to Adaptation to Climate Change?, *Climatic Change*, **93**, 335-354.
- [3] Larter, P., Martin, J. G., Silver, A. and Park, P. 2019, Does time heal all wounds? Restoring Place Attachment in Halifax's Point Pleasant Park after Hurricane Juan, *Canadian Geographer / Le Géographe canadien*, 1–13, doi: 10.1111/cag.12542.
- [4] Oh, C.O. and Hammitt, W.E., 2011, Impact of Increasing Gasoline Prices on Tourism Travel Patterns to a State Park, *Tourism Economics*, **17**(6), 1311–1324, doi: 10.5367/te.2011.0093.
- [5] McCreary, A., Seekamp, E., Larson, L.L., Smith, J.W., and Davenport, M.A. 2019, Predictors of Visitors' Climate-related Coping Behaviors in a Nature-based Tourism Destination, *Journal of Outdoor Recreation and Tourism*, **26**, 23–33, doi: 10.1016/j.jort.2019.03.005.
- [6] Gieryn, T.F., 2000, A Space for Place in Sociology, *Annual Review of Sociology*, **26**, 463–496.
- [7] Paulsen, K.E., 2004, Making Character Concrete: Empirical Strategies for Studying Place Distinction, *City Community*, **3**(3), 243–262.
- [8] Burger, J., Pflugh, K.K, Lurig, L., von Hagen, L.A. and von Hagen, S., 1999, Fishing in Urban New Jersey: Ethnicity Affects Information Sources, Perception, and Compliance, *Risk Analysis*, **19**(2), 217–229, doi: 10.1023/A:1006921610468.

- [9] Westphal, L.M., Longoni, M., LeBlanc, C.L., and Wali, A., 2008, Anglers' Appraisals of the Risks of Eating Sport-Caught Fish from Industrial Areas: Lessons from Chicago's Calumet Region, *Human Ecology Review*, **15**, 46–62.
- [10] Besek, J.F., 2015, Neoliberal Niagara? Examining the Political History of Fish Consumption Advisories in New York State, *Society and Space*, **33**(2), 281–295.
- [11] Collie, J.S., Wood, A.D., and Jeffries, H.P., 2008, Long-term Shifts in the Species Composition of a Coastal Fish Community, *Canadian Journal of Fisheries and Aquatic Sciences*, **65**(7), 1352–1365, doi: 10.1139/F08-048.
- [12] U.S. Department of Commerce, 2016, *Fisheries Economics of the United States 2014: Economics and Sociocultural Status and Trends Series*, (Washington, D.C.: Department of Commerce). 1-55.
- [13] Derbyshire, K., 2006, Fisheries Guidelines for Fish-Friendly Structures Fish-Friendly Structures, *Fish Habitat Guideline FHG 006*, 1-55.
- [14] Hunt, K.M. and Ditton, R.B., 2001, Perceived Benefits of Recreational Fishing to Hispanic-American and Anglo Anglers, *Human Dimensions of Wildlife*, **6**(3), 153–172, doi: 10.1080/108712001753461266.
- [15] Schroeder, S. A. et al., 2006, He Said, She Said: Gender and Angling Specialization, Motivations, Ethics, and Behaviors, *Human Dimensions of Wildlife*, **11**(5), 301–315, doi: 10.1080/10871200600894928.
- [16] Colburn, L., Clay, P.M., Seara, T., Weng, C. and Silva A., 2015, Social and Economic Impacts of Hurricane/Post Tropical Cyclone Sandy on the Commercial and Recreational Fishing Industries: New York and New Jersey One Year Later, *NOAA Technical Memorandum NMFS-F/SPO-157*, 1-68.
- [17] van Putten, I. E. et al., 2016, Recreational Fishing in a Time of Rapid Ocean Change, *Marine Policy*, **76**, 169–177. doi: 10.1016/j.marpol.2016.11.034.

- [18] Townhill, B.L., Radford, Z., Pecl, G., van Putten, I., Pinnegar, J.K., and Hyder, K. 2019 Marine Recreational Fishing and the Implications of Climate Change, *Fish and Fisheries*, **20**(5), 977–992. doi: 10.1111/faf.12392.
- [19] Dundas, S.J. and von Haefen, R.H., 2020, The Effects of Weather on Recreational Fishing Demand and Adaptation: Implications for a Changing Climate, *Journal of the Association of Environmental Environ Resource Economists*, **7**(2), 209–242.
- [20] Hughes, R.M., 2015, Recreational Fisheries in the USA: Economics, Management Strategies, and Ecological Threats, *Fisheries Science*, **81**(1), 1–9. doi: 10.1007/s12562-014-0815-x.
- [21] Seara, T., Pollnac, R. and Jakubowski, K. 2020, Impacts of Natural Disasters on Subjective Vulnerability to Climate Change: A Study of Puerto Rican Fishers’ Perceptions after Hurricanes Irma & Maria, *Coastal Management*, **48**(5), 418–435.
- [22] Perry, J. 2019, Rhode Islanders Told to Prepare for Hurricane Season, *Providence Journal*, 09 May.
- [23] University of Rhode Island Climate Change Collaborative, 2013, *Sea Level Rise in Rhode Island: Trends and Impacts*, (Kingston, R.I: University of Rhode Island Climate Change Collaborative).
- [24] National Marine Fisheries Service, 2014, Fisheries Economics of the United States, *NOAA Technical Memorandum*, October, 175. Available online at: <https://www.st.nmfs.noaa.gov/st5/publication/index.html> (Accessed March 3, 2021).

- [25] Narragansett Bay Estuary Program, 2017, *State of Narragansett Bay and Its Watershed Summary Report*. (Narragansett, RI: Narragansett Bay Estuary Program).
- [26] Becker, H.S., 1996, The Epistemology of Qualitative Research, *Ethnography and Human Development: Context and Meaning in Social Inquiry*, **27**, 53–71, doi: 10.1080/19398440903192357.
- [27] Bernard, H.R. 2011, *Research Methods in Anthropology - Qualitative and Quantitative approaches*. (Lanham, MD: Rowman & Littlefield), pp. 728.
- [28] Patton, M.Q., 2015, *Qualitative Research and Evaluation Methods*, Fourth. (Los Angeles: SAGE Publications, Inc), pp. 832.
- [29] Intergovernmental Panel on Climate Change, 2014, Climate Change 2014 Synthesis Report, *IPPC Reports*. Available online at: <https://www.ipcc.ch/report/ar5/syr/> (accessed Dec. 13, 2019).
- [30] Rhode Island Coastal Resources Management Council, 2018, Chapter 2 Trends and Status: Current and Future Impacts of Coastal Hazards in Rhode Island, *Shoreline Change SAMP, Volume I*, pp. 25.
- [31] Collie, J.S., Wood, A.D., and Jeffries, H.P., 2008, Long-term Shifts in the Species Composition of a Coastal Fish Community, *Canadian Journal of Fisheries and Aquatic Sciences*, **65**(7), 1352–1365, doi: 10.1139/F08-048.
- [32] Rowley, J. 2015, What's Scup?, *EcoRI News*, 27 April.
- [33] Arlinghaus, R. et al., Understanding and Managing Freshwater Recreational Fisheries as Complex Adaptive Social-Ecological Systems, *Reviews in Fisheries Science and Aquaculture*, **25**(1), 1–41, 2017, doi: 10.1080/23308249.2016.1209160.

- [34] Kuehn, D., Luzadis, V. and Brincka, M., 2013, An Analysis of the Factors Influencing Fishing Participation by Resident Anglers, *Human Dimensions of Wildlife*, **18**(5), 322–339, doi: 10.1080/10871209.2013.820370.
- [35] D. Kuehn, D., Luzadis, V., and Brincka, M. 2017, “I Catch Whatever’s Biting!”: Motivations, Constraints, and Facilitators of No-preference Anglers Residing along New York’s Lake Ontario Coast, *Fish Research*, **194**, June, 188–196, doi: 10.1016/j.fishres.2017.06.003.
- [36] Teo, M., Goonetilleke, A., Deilami, K., Ahankoob, A. and Lawie, M, 2019, Engaging Residents from Different Ethnic and Language Backgrounds in Disaster Preparedness, *International Journal of Disaster Risk Reduction*, **39**, July, 101-245, doi: 10.1016/j.ijdr.2019.101245.

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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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.