

**BUILDING COMMUNICATION BRIDGES BETWEEN SHORELINE
ANGLERS AND NATURAL RESOURCE POLICYMAKERS**

by

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ABSTRACT

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Under the Supervision of Professor Melissa Scanlan, JD

Fishing has been a vital aspect of Wisconsin’s rich cultural history, predating statehood, to the earliest indigenous communities. A deep fishing heritage continued to grow with the arrival of European settlers through the 19th and 20th centuries, and continues today where fishing provides a means of recreation, a source of sustenance, and supports a multibillion-dollar industry. Wisconsin’s fisheries offer diverse commercial, recreational, and tribal angling opportunities. This resource supports thousands of jobs and is a vital aspect to local, state, and national economies. Many large municipalities along the Great Lakes, such as Milwaukee, are built near estuaries and harbors which are highly modified aquatic habitats that provide shoreline angling opportunities. The combination of shoreline angling locations near urban areas attracts a community of shoreline anglers that represent diverse racial, socioeconomic, and educational backgrounds. However, lacking representation in policymaking forums, these communities’ angling interests and perspectives are often overlooked.

This study provides a comprehensive literature review to evaluate the current state of knowledge on the history of shoreline angling in Milwaukee County, current barriers to fishing participation, and science and policy communication techniques. We conducted a quantitative survey of shoreline anglers throughout Milwaukee County to characterize various subgroups

within the shoreline angling community, identify their preferences, motivations, and sources of information, and the preferred mechanisms to solicit input in policy processes from these stakeholders. We also conducted a policy analysis to determine if and how the diverse perspectives of shoreline anglers are incorporated into policy decisions. We surveyed Wisconsin Department of Natural Resources (hereafter: “DNR”) fisheries staff to understand their approaches to stakeholder engagement. Then we compared the published policy documents to survey results from the cohort of shoreline anglers and DNR staff.

We found shoreline anglers in Milwaukee County represent a racially, socioeconomically, and educationally diverse community, with a variety of perspectives, motivations, and primary sources of information for fishing. We hypothesized that due to the lack of organizational representation in policymaking fora, shoreline anglers’ interests and perspectives were not adequately incorporated into fisheries policy decisions. From this study, we aim to characterize shoreline angling communities, their characteristics, perspectives, and interests in fisheries management, and to recommend effective policy communication best practices that will allow for more diverse, equitable, and inclusive policymaking processes. This study provides a case study and model for natural resource management agencies to better understand and incorporate racially, socioeconomically, and educationally diverse stakeholder groups into policy decisions.

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DEDICATION

To my daughter, Amelia.

May you grow to love

all of

Nature's infinite beauty.

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I dedicate this project to my daughter, Amelia. She has given me a new purpose in life. In everything I do, I seek to make this world a better place for her.

Chapter 1: Introduction

Fishing has been a vital aspect of Wisconsin's rich cultural history, predating statehood, to the earliest indigenous communities. A deep fishing heritage continued to grow with the arrival of Europeans through the 19th and 20th centuries, and continues today where fishing provides a means of recreation, a source of sustenance, and supports a multibillion-dollar industry. Wisconsin's fisheries offer diverse commercial, recreational, and tribal angling opportunities. This resource supports thousands of jobs and is a vital aspect to local, state, and national economies. Many municipalities along the Great Lakes, such as Milwaukee, are built near estuaries and harbors which are highly modified aquatic habitats that provide shoreline angling opportunities. The combination of shoreline angling locations near urban areas attracts a community of people who fish from banks, docks, piers, or by wading in stream (hereafter, shoreline anglers) that represent diverse racial, socioeconomic, and educational backgrounds. However, lacking representation in policymaking forums, these communities' interests and perspectives are often overlooked.

Chapter 1 sets the stage by providing background information of the history of fishing and the current context of fisheries and shoreline angling in Milwaukee County. Chapter 1 also outlines the objectives, research questions, and hypothesis that guided this research. Chapter 2 provides a comprehensive literature review to evaluate the current state of knowledge on the history of shoreline angling in Milwaukee County, current barriers to fishing participation, creel survey methods, and science and policy communication techniques relevant to this study. Chapter 3 describes the methods, results, and a discussion of the quantitative survey of Milwaukee County shoreline anglers focused on demographics, motivations, satisfaction levels,

and primary sources of fishing information. Chapter 4 details the methods employed to survey DNR staff members, and presents the survey results obtained from DNR staff regarding their perspectives and experiences related to shoreline angling and fisheries management. Chapter 5 complements the DNR staff survey with an analysis of DNR fisheries management policies and communication strategies. It covers the methods used for policy analysis, current DNR policies regarding shoreline angling in fisheries management plans, approaches to stakeholder engagement, and barriers to effective communication within the DNR. Chapter 6 synthesizes the findings and engages in a discussion about science and policy communication best practices for shoreline angler engagement, explores policy options and recommendations based on the research findings, and identifies limitations of the research project and potential areas of future research. The thesis concludes with Chapter 7, which answers the research questions and offers insights into the implications of this project.

We expected the results of these investigations to find that shoreline anglers in Milwaukee County represent a racially, socioeconomically, and educationally diverse community, with a variety of perspectives, motivations, and primary sources of information for fishing. We hypothesized that due to the lack of organizational representation in policymaking fora, shoreline anglers' interests and perspectives were not adequately incorporated into fisheries policy decisions. From this study, we aimed to characterize shoreline angling communities, their characteristics, perspectives, and interests in fisheries management, and to recommend effective policy communication best practices that will allow for more diverse, equitable, and inclusive policymaking processes. The purpose of this study is to provide a case study and model for natural resource management agencies to better understand and incorporate more diverse stakeholder groups into policy decisions.

1.1 Background

Native American Communities Near Lake Michigan

The region of what is now southeast Wisconsin has been home to multiple Native American communities that fished in the region's rivers, lakes, and streams for thousands of years prior to the arrival of European missionaries in the late 17th century (Clelan, 1982). The Menominee, Potawatomi, and Ojibwe tribes were among the Native American peoples who fished these waters and called this good land home (Doxatar and Zakhar, 2011 and Lyons, 2022).

Figure 1



Note: Map of Tribal Lands circa 1800. (<https://wisconsinfirstnations.org/map/>).

Native American Fishing Techniques

The Native American peoples in the region used a variety of fishing techniques, including traps, nets, spears, and hooks, to catch fish for food, trade, and ceremonial purposes (State Historical Society of Wisconsin, 1895). For the Menominee, fishing was an essential part of their traditional way of life. They had an intimate knowledge of the local waterways and the fish that lived in them. They used sophisticated techniques such as fish weirs, which were constructed of woven willow branches and used to trap sturgeon in shallow water (Beck, 1995). The Potawatomi and Ojibwe also relied on fishing for sustenance, and maintained a deep spiritual connection to the fish, specifically the *ogaa*, otherwise known as the walleye (Parkins, 1918). They believed each species of fish had its own spirit, and they used specific rituals and

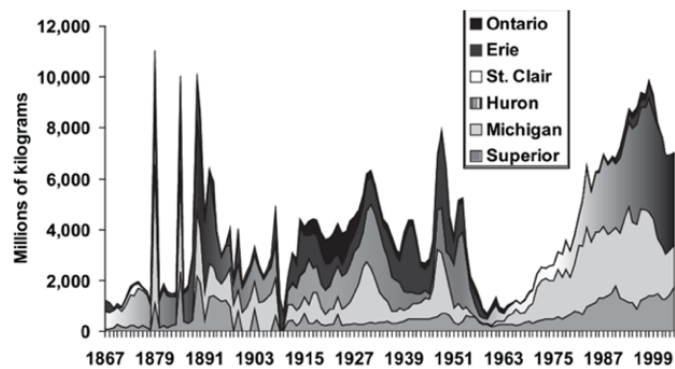
ceremonies to honor and give thanks for the fish they caught (Hultkrantz, 1983). With the arrival of European settlers and systematic removal of indigenous peoples, the traditional fishing practices of these communities were disrupted by dislocation, pollution, habitat destruction, and overfishing in the early 19th century (Bogue, 2001). Despite these challenges, many Native Americans in the region continue to fish and maintain their cultural connections to the water and the fish that live in it today.

Post-Settlement - Industrial Era Fishing and the Collapse of Yellow Perch in Lake Michigan

Following the arrival of European colonizers in the early 19th century, commercial fishing emerged as a vital industry that contributed to the rapid economic growth and development of what would later become Milwaukee (Brenden, 2013). Milwaukee’s geographic location along the shore of Lake Michigan, at the confluence of three major rivers (the Menominee, Milwaukee, and Kinnickinnic) and position within a natural harbor made it ideally situated to become a major hub of commercial fishing activities in the Great Lakes region.

By the mid-19th century, the development of new technologies such as gillnets and larger fish traps, and industrial processes allowed for greater and more efficient catch rates by commercial fishers and at a cheaper cost (Bogue, 2001). Another critical development in the industrialization of commercial fisheries was the invention of steam-powered boats (Proffitt, 2019). These ships allowed fishermen to travel greater distances, use larger nets, and haul greater quantities of harvested fish (Brown, 1999). Mechanized lifters also

Figure 2



Note: Commercial harvest yields of lake whitefish from Ebner et al. (2005)

contributed to the rapid increase of harvest yields towards the end of the 19th century (Figure 2). This growth was further aided by the expansion of railroads along the Milwaukee-Chicago corridor and increased access to markets along the East Coast.

The majority of fish caught in Milwaukee during the 19th century were lake trout and whitefish (Baldwin, 2000). These fish were in high demand due to their excellent taste and high nutritional value. Lake trout was considered a delicacy and was highly sought after by restaurants and consumers in other parts of the country. Consequently, by the end of the 19th century, Milwaukee had become one of the largest fishing ports on the Great Lakes, with hundreds of commercial fishing vessels and several processing plants near Milwaukee's harbor (Bogue, 2001).

By the early 20th century, the growth of the fishing industry in Milwaukee had both positive and negative impacts on the city and its environment. On one hand, the intensive fishing practices of the 19th century took a significant toll on fish populations (Ebner, 2008). Overfishing and habitat destruction led to declines in native fish species. Pollution from unregulated industrial and urban activities further degraded the water quality of Lake Michigan and its tributaries, leaving a legacy of contaminants in the river and harbor sediments that persist today.

Despite this, fishing provided sustenance, employment, and income for many residents, including newly arrived immigrants from Germany and Poland who settled near the Milwaukee Harbor on what is now known as Jones Island

Figure 3



Note: Fishing boats near Jones Island village. Image courtesy of the Milwaukee Historical Society.

(Figure 3, Gurda, 2018). Over time, commercial and recreational fishing played a key role in

shaping Milwaukee's cultural identity, as fishing became an increasingly important part of the city's heritage and traditions into the 20th century.

The Lake Michigan fishery underwent significant changes during the 20th century due to overexploitation, pollution, invasive species, and habitat degradation. Early in the 20th century, commercial fishing on Lake Michigan was dominated by small, family-owned operations using traditional fishing methods, such as gill netting and trap netting (Brown, 2001). The fishery was primarily focused on whitefish, lake trout, with some perch, and herring harvest as well (Baldwin, 2000). However, overfishing, pollution, and changes to the ecosystem had a significant impact on the fish populations in the lake. By the 1940s, the numbers of whitefish and lake trout had declined drastically (Figure 2). The rapid decline of lake trout and whitefish in the Great Lakes was caused by a combination of factors, but primarily due to overfishing (Wilberg, 2000). Coble et al. (2011) argues that it was a complex interaction between overfishing and the introduction of sea lamprey to the Great Lakes that weakened the populations of desirable fishes, and made them less resilient while habitat destruction, pollution, and the introduction of other non-native species accelerated their collapse.

Following the collapse of the lake trout and lake whitefish fishery by the 1940s, commercial, recreational, and subsistence anglers began to shift their effort towards yellow perch (Clapp & Dettmers, 2004). Yellow perch are a nearshore species and could often be caught from piers and other shoreline access locations, thus making them an important species for shoreline anglers (Clapp & Dettmers, 2004). Due to their abundance,

Figure 4



Note: Undated picture of shoreline anglers along Milwaukee's breakwall. Image courtesy of the Milwaukee Journal Sentinel Archives.

accessibility, and relative ease to catch, perch fishing along the shore of Lake Michigan became an affordable and accessible means of recreation, while also providing a cheap source of nutrition and protein for low-income anglers (Figure 4). Consequently, perch fishing became the predominant commercial, recreational, and subsistence fishery in Milwaukee from the 1940s until the late 1960s (Santucci, 2014).

Recreational and subsistence anglers employed a variety of strategies and techniques to catch and harvest yellow perch through the mid-20th century. Many anglers used artificial lures and live bait from boats and from shore on bridges or piers near the water. Other anglers fished through the winter by drilling holes in the ice. Similarly, the levels of expertise and commitment varied. Committed anglers often invested significant resources to establish effective techniques, learning patterns, and studying preferred habitats (Encyclopedia of Milwaukee, 2021). Historian and journalist John G. Gregory for the Milwaukee Journal described the fishing opportunities near Milwaukee, “Anglers found rare sport at these landings. Those who came with hook and line and spear rarely missed their share of lake food” (Encyclopedia of Milwaukee, 2021).

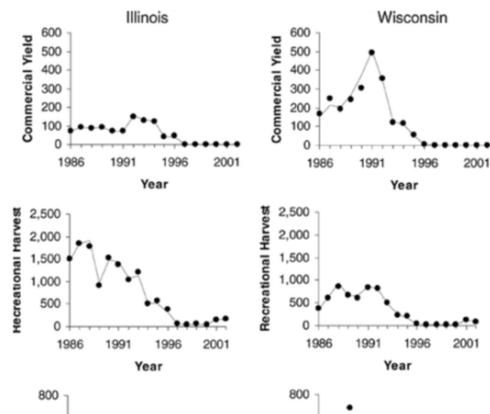
Similar to the collapse of the lake trout stock, the decline of perch fishing in Milwaukee, beginning in the second half of the 20th century, was caused by a combination of factors. One of the primary factors was also overfishing, which occurred due to the high demand for perch and the use of increasingly efficient fishing methods. Another factor was the establishment of invasive species, including the round goby and zebra mussel, which disrupted the natural food web and degraded the preferred habitat of yellow perch (Clapp & Dettmers, 2004). These invasive species outcompeted many native species for food and habitat, reducing the availability of prey for perch and making it more difficult for them to survive and reproduce. Pollution was also a significant factor in the decline of perch abundance in Lake Michigan near Milwaukee

(Bacheler, 2011). Additionally, the unregulated discharge of untreated sewage and industrial waste from point-sources into Lake Michigan prior to the Clean Water Act of 1972, as well as the use of pesticides and fertilizers in surrounding agricultural areas, contributed to water pollution and habitat degradation, making it more difficult for perch to reproduce and the survival young-of-year fish (Santucci et al., 2014). These factors combined and enhanced the rapid decline of yellow perch throughout the 1980s and 1990s, reaching a near-total collapse and extirpation approaching the new millennium (Figure 5).

Few freshwater systems have faced such extreme changes over the last 100 years as have been observed in Lake Michigan (Collingsworth, 2017). The history of commercial fishing, overexploitation, and nonnative invasions in the

Great Lakes have fundamentally altered aquatic habitats and ecosystems (Egerton, 2018). Prior to the turn of the 20th century, the Great Lakes commercial fishers produced more than 100 million pounds of wild-caught fish annually, declining more than 80% over the 20th century to merely 18.7 million in 2012 (Great Lakes Environmental Assessment and Mapping Project). However, despite the decline of the native species observed during the 20th century, many anglers continued to operate in Milwaukee's waters. To supplement fishing opportunities, Great Lakes natural resource agencies have implemented stocking programs to support fish populations in the lake by stocking non-native fishes, including chinook salmon, coho salmon, steelhead, and

Figure 5



Note: Commercial harvest (in 1,000 kg) recreational harvest, and catch per effort of Yellow Perch in Wisconsin and Illinois waters of Lake Michigan from 1966-2002 (Wilberg et al. (2005).

brown trout. The DNR manages Wisconsin's stocking program in collaboration with several partner organizations.

Shoreline Angling in Milwaukee Today

Today, anglers in Milwaukee have adapted to the changing ecological and environmental conditions by targeting introduced nonnative species such as chinook and coho salmon, and brown and rainbow trout, and by using new fishing technologies such as trolling and the use of fish finders. Additionally, habitat improvements, dam removals and fish passage structures, and improving water quality have led to a perceived improvement of fishing opportunities in the Milwaukee area (Lower et al., 2015). The Milwaukee River Area of Concern Remedial Action Plan will be a critical aspect to enhanced fishing opportunities and overall environmental remediation of nearshore and riverine habitats in and around Milwaukee into the future (Dow, 2022). The Milwaukee River and Estuary Area of Concern Remedial Action Plan, established in 1987, targets 11 beneficial use impairments, particularly focusing on contaminated sediment and historical pollution from industries. Expanded boundaries now include upstream areas to comprehensively address pollution sources and restore water quality, fish and wildlife habitat, and recreation opportunities (Wisconsin DNR, US EPA).

Milwaukee offers a variety of fishing opportunities for recreational angling. The city has several fishing piers and public access points along Lake Michigan, the Milwaukee, Menominee, and Kinnickinnic Rivers, and other small inland ponds. Anglers can target a variety of species, including salmon, trout, walleye, perch, and bass, with many licensed guides and charter companies offering fishing trips on Lake Michigan and the surrounding tributaries. The Milwaukee River is another popular spot for shoreline fishing, with access points located throughout the city. In addition to the Milwaukee River, the Menominee River also offers

multiple opportunities for shore fishing, particularly near American Family Field where, if you're lucky, you can catch a rainbow trout and a home run ball in the same day. Anglers can try their luck at the Summerfest Lagoon, a small cove of Lake Michigan near the heart of the city, where they can catch a northern pike and a great concert at the same time. Lakefront locations provide popular shoreline fishing opportunities, with several piers and jetties offering access to Lake Michigan. The McKinley Pier, located in McKinley Marina, is another popular fishing spot, with anglers targeting panfish, pike, bass, salmon, and trout. Other popular lakefront fishing spots include Lakeshore State Park, South Shore Park, and the numerous inland ponds and lagoons in Milwaukee County parks.

Barriers to Shoreline Fishing Access

While shoreline angling is more accessible than fishing from boats on Lake Michigan, shoreline anglers still face barriers to entry, including geographic and socioeconomic factors. Geographically, the location of the city on Lake Michigan's residential, commercial, and industrial lakefront may limit fishing opportunities due to limited public shoreline access in competition with those other uses. Limited public access locations and private property ownership can further restrict access. Socioeconomic barriers, such as poverty and lack of transportation, can limit access to fishing equipment and prevent some individuals from enjoying the benefits of shoreline angling.

Shoreline anglers were found to come from a diverse range of demographic backgrounds and have different levels of investment, skill, and equipment in Key West, Florida (Furman et al., 2023). Many are recreational anglers looking for an affordable way to fish without a boat, while others may be more experienced anglers seeking a specific catch (Beardmore, 2011). Some may be local residents while others may travel from surrounding areas to fish. Shoreline anglers may

also vary in age, gender, and ethnicity (Arlinghaus, 2005). Many anglers may prefer to fish in areas close to public access points, such as parks or piers, while others may prefer more secluded areas along the shoreline (Furman, 2023). Additionally, shoreline anglers may have different levels of knowledge and sources of information about the local fishery, fishing regulations, and fishing techniques (Valentine, 2003).

Four prior studies have characterized anglers in Wisconsin and the Great Lakes region; however, they did not specifically characterize shoreline angling communities in and around Milwaukee, Wisconsin (Bradshaw & Legler, 2021, Golebie et al., 2019, Tingley III, 2019, Lauber et al., 2017). Researchers have also begun to explore the social inequities in shoreline fishing in Key West, Florida and Minneapolis/St. Paul, Minnesota, however these inequities have also not been studied in Milwaukee, where social factors may differ (Furman et al. 2023, Schroeder et al., 2008).

These aforementioned studies of shoreline anglers vary in terms of geographic and temporal scales. These existing studies provide a background foundation for this research. However, we found that Wisconsin's most populated area, Milwaukee County, lacked research on shoreline angler characterizations, preferences, and sources of information on fishing locations, opportunities, regulations, policy decisions, or management actions (hereafter, fishing information). We also found no studies of Wisconsin DNR communication strategies with shoreline anglers.

1.2 Objectives and Hypotheses

This research aims to characterize the demographics of the shoreline angling community in Milwaukee County, quantify their preferences, identify their sources of fishing information,

analyze how shoreline angler preferences are reflected in fishery management plans, and develop communication best practices for policymakers to make information that is already available more accessible to these groups.

This study builds a framework of communication techniques and best practices for decision- and policymakers to better engage with shoreline anglers in Milwaukee County. While the results of this investigation provide useful information and tools to federal and state fisheries managers, the setting, methodology, results, and conclusions will also provide a model for other natural resource managers to identify and incorporate more diverse stakeholder groups into policy decisions.

To achieve the goals and purposes of this research, the objectives are to a) characterize the shoreline angling community in Milwaukee County, b) quantify shoreline anglers' satisfaction with fishing opportunities and motivations for fishing, c) compare shoreline angler communication preferences with current DNR policies and utilization of communication strategies, and d) develop policy recommendations to build communication bridges between shoreline and policymakers. The specific research questions of interest and hypotheses are as follows:

1. Question: *What are the preferences, motivations, sources of information, and demographics within the shoreline angling community?*

Hypothesis: Shoreline anglers represent a racially and socioeconomically diverse stakeholder group. They will prefer action and harvest-oriented fishing opportunities. Primary sources will be social media and conversations with other anglers.

Methodology: Shoreline Angler Survey

2. Question: *Are shoreline angler preferences reflected in current management plans?*

Hypothesis: Current regulations and management plans do reflect the interests of many shoreline anglers.

Methodology: Policy Analysis of DNR Fisheries Management Plans

3. Question: *How are the perspectives of shoreline anglers received by DNR fisheries managers and then incorporated into management plans?*

Hypothesis: DNR primarily relies on public meetings, and creel surveys as a mechanism for soliciting stakeholder input.

Methodology: DNR Staff Survey and Policy Analysis of DNR Fisheries Management Plans

4. Question: *How are policy and regulation changes communicated to shoreline anglers by the Department of Natural Resources? What are the most effective communication strategies for delivering policy decisions to shoreline anglers?*

Hypothesis: The DNR primarily relies on traditional communication platforms such as print, digital, and social media to share information.

Effective communications strategies include easy-to-access online resources posted at common shoreline angling locations, targeted marketing at local bait shops, translation of regulations into Spanish, Hmong.

Method: Shoreline Angler Survey and DNR Staff Survey

Chapter 2: Literature Review

A literature review on a variety of topics relevant to shoreline angling and policy communications was conducted to build a knowledge base by synthesizing existing research, find knowledge gaps related to shoreline angling in Milwaukee County, and construct study methodologies to evaluate questions and hypothesis related to the research objectives of this project. This chapter first outlines the methods employed in conducting the literature review in section 2.1, then dives into the key findings relevant to shoreline angling in the 2020 DNR Great Lakes Salmon and Trout Survey in section 2.2, identifies barriers to fishing in other study domains that may also be experienced by shoreline anglers in Milwaukee County in section 2.3, and explores novel methods of conducting creel and angler preference surveys in marine and other complex fisheries that can be implemented by fisheries managers in Milwaukee and Wisconsin in section 2.4. This literature review provided context for this research project and identified critical knowledge gaps that this study aimed to fill.

2.1 Literature Review Methods

The literature review on each of the above themes followed a similar methodology. For example, the literature review of indigenous fishing techniques in southeastern Wisconsin involved several steps. First, a search of peer-reviewed articles on search engines such as Google Scholar, JSTOR, Web of Science, and other databases by using search terms such as “Native American fishing techniques,” “tribal fishing in southeast Wisconsin”, and others was conducted. From this foundation of peer-reviewed publications, the references and citations within those articles were reviewed to identify additional relevant literature on those topics. Additionally, several books, encyclopedia entries, archived reports, and primary sources from museums and

libraries to obtain insights into indigenous practices in the region prior to and post European disruption and settlement were obtained. After gathering a robust body of literature on the pertinent themes, sources were analyzed and documented in an annotated bibliography with to build a comprehensive and detailed reference list to incorporate into the various aspects of this research project.

2.2 DNR 2020 Great Lakes Salmon and Trout Survey

Prior to 2020, the DNR had not conducted a large-scale study of Lake Michigan anglers with the express purpose of evaluating angler behavior, satisfaction, and perceptions of various fisheries management objectives (DNR Staff email, author files, March 3rd, 2023). Thus, the

Figure 6

SAMPLE	POPULATION %	SAMPLE (N)	RESPONSES (N)
Resident: Stamp	97.5%	3,900	961
Resident: 2-day license	2.5%	100	13
Non-resident: Stamp	70.8%	1,062	294
Non-resident: 2-day license	29.2%	438	106
Total	—	5,500	1,347

Note: Wisconsin Fishing License holders surveyed for the 2020 Lake Michigan Salmon and Trout Angler Survey (Bradshaw & Legler, 2021).

findings in the 2020 Great Lakes Salmon and Trout Angler Survey are the first quantified assessments of Lake Michigan angler perspectives in

Wisconsin. The questionnaire survey was administered online to a random, albeit proportional sample of resident and non-resident Great Lakes Salmon/Trout Stamp and 1-Day License holders (n= 5,500, Figure 6). The final response rate was 38% (n = 1,347) (Bradshaw & Legler, 2021). The Wisconsin DNR offers various authorizations to legally engage in fishing activities. These include resident and non-resident annual, 1-Day, Spousal, Junior, and Senior Citizen licenses. The Great Lakes Salmon/Trout Stamp is an additional authorization to a fishing license which enables anglers to fish for salmon and trout species in the Great Lakes and their tributaries (Wisconsin DNR).

Demographic data from survey respondents were compared with license holder demographic data. Female respondents were reasonably proportionate to the known percentage

of female stamp/license holders; however, the age of respondents was biased towards older anglers relative to the general license/stamp holder population. To account for this bias towards older anglers, the researchers applied a weighted correction factor to the survey results.

The geographic scope of the survey was Lake Michigan, its tributaries, and the Bay of Green Bay. Ecologically, these waterbodies are the primary habitats of salmon and trout species

Figure 7

TYPICAL ACCESS	% BY PRIMARY RESIDENCE		
	>1 county away from Lake Michigan	Lake Michigan shoreline county	Non-residents
Shoreline, tributaries	26	39	16
Shoreline, open water	16	28	11
Docks or piers, open water	21	31	16
My boat	32	39	34
Friend/family members boat	30	37	34
Charter boat	38	27	38

Note: Percentage of fishing access users by access-type surveyed by Bradshaw & Legler, 2021).

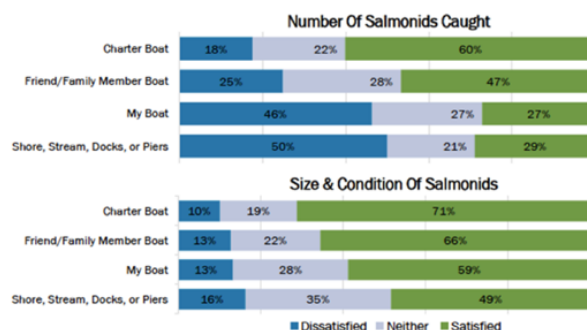
and locations of salmon and trout angling, which is the primary focus of the study. The results of this survey shed light on many interesting social dynamics

involved in these fisheries. The percentage of anglers in a Lake Michigan shoreline county who reported accessing shoreline fishing locations was reported at 39% tributary shoreline access, 28% open-water shoreline access, and 31% open water dock or pier access (Figure 7). These data suggest these types of shoreline locations are a heavily utilized means of fishing access.

Furthermore, 19% of all survey respondents indicated Milwaukee County as the primary location of shoreline access, which was the most of all Lake Michigan shoreline counties (Bradshaw & Legler, 2021).

The 2020 Great Lakes Salmon and Trout Angler Survey also provides interesting signals of shoreline angler preferences. For instance, 50% of anglers who reported fishing from shore, streams, docks, or piers were dissatisfied

Figure 8



Note: Satisfaction with number, size, and condition of salmonids caught among 2020 Lake Michigan Salmon and Trout Survey respondents (Bradshaw & Legler, 2021).

with the quantity of salmon and trout caught, however only 16% were dissatisfied with the size and condition of the fish caught (Figure 8). Thus, the greater dissatisfaction with number of salmonids than dissatisfaction with size and condition suggests that shoreline anglers may either prefer an “action” fishery where quantity of fish caught is more important than the quality of fish caught or general shoreline angler satisfaction. Also included in this survey are questions related to science and policy communications.

The data collected by researchers at the DNR during the 2020 Lake Michigan Angler Survey provide useful insights into areas of potential research to evaluate the behaviors, preferences, perceptions, and characteristics of the shoreline angling community that focuses on trout and salmon across a wider geography. We designed our study to build on this foundation and more fully understand the shoreline angling community in Milwaukee County.

2.3 Barriers to Accessing Fishing Opportunities

A variety of barriers to fishing can limit shoreline angling opportunities. Key factors contributing to barriers include that residential, commercial, and industrial development has drastically reduced shoreline access (Furman 2023). Many riparian areas near the Milwaukee Harbor were developed during the 19th and 20th centuries as the Port of Milwaukee became a hub for the burgeoning shipping, fishing, and manufacturing industries in the city (Gould, 1914). In the latter half of the 20th century, Milwaukee’s primary economic drivers shifted away from industry and manufacturing towards financial and technological services (Kenny, 1995). Despite these changes, Milwaukee’s shorelines have remained the key locations for development (Walzer, 2011).

Residential and commercial development has grown along the shorelines due to their aesthetic value. Recently, the City of Milwaukee has emphasized continuing this economic

growth, with additional recreational, environmental and sustainability considerations (Milwaukee ECO, n.d.). While the shorelines along Lake Michigan and its tributaries in the greater Milwaukee area remain dedicated to residential and commercial development, shipping, and industry, many locations have been redeveloped with an eye towards expanding public access to the waterfront (Harbor District, 2019).

Studies of social barriers to fishing in other parts of the U.S. informed and guided this study. One such study of shore-based anglers in Key West, Florida found social barriers that may prevent economically, racially, and ethnically diverse anglers from accessing fishing opportunities (Furman et al., 2023). These barriers disproportionately impact people of color and include an absence of proximate recreational areas, time limitations, safety concerns, financial restrictions, language gaps, and lack of transportation to fishing access sites (Scott & Kim, 1998). In addition to the barriers to fishing opportunities described by Scott & Kim in Texas (1998), Schroeder et al. (2008) found that while plentiful information on fishing is available, it was insufficiently accessible to communities of color Minneapolis/St. Paul Minnesota, which can limit participation in the activity. They further suggested the need for simplified information and recommended future studies to evaluate the effectiveness of simplified communications strategies.

Several economic barriers may preclude many people from fishing as well. These barriers often arise from income inequality, cost of equipment, and availability of resources, and they can have significant impacts on the ability of people to fish and enjoy the benefits of fishing such as a cheap source of protein (Bennett et al., 2021). Fishing requires specific equipment, such as fishing poles, bait, and tackle, which can vary in cost (Furman, 2023). Furthermore, targeting species such as salmon or trout requires specialized gear, further increasing the cost to entry.

Additionally, individuals who wish to fish in local rivers or lakes must purchase a fishing license, which can be an additional financial burden for low-income anglers. The cost of equipment and licenses can be a significant barrier for low-income families or individuals, who may not have the financial resources to purchase the equipment required to fish (Schroeder, 2008).

2.4 Innovations in Cost-Cutting Creel Survey Methods

Surveying recreational anglers is essential for obtaining data on fishing effort, catch rates, and angler preferences. Creel surveys are evaluations of anglers to gather biological, fishing effort, and angler preference data. Creels are typically conducted in-person at fishing location, but can also be administered through a variety of off-site or digital means (Nieman et al. 2021). Traditional methods, such as intercept surveys, can be labor-intensive and costly to implement, especially in large or remote areas, or complex systems where anglers might access fishing opportunities through diffuse locations (Carruthers et al., 2019). Technological advancements have provided novel approaches to collecting fishing data such as angler effort, catch, behaviors, and preferences. As discussed by Cooke et al. (2021), these advancements have had a profound impact on both recreational fishing practices and the broader field of fisheries management. From the widespread adoption of social media platforms to the development of mobile phone applications and remote monitoring technologies, the way anglers interact with their environment, and share and receive information has undergone significant transformation. However, with these advancements come new challenges and complexities that require careful consideration. This review aims to identify innovative methods of conducting creel surveys and exploring novel approaches and their implications for enhancing fisheries management practices.

The emergence of social media platforms and the widespread use of smartphones among anglers have revolutionized the way fishing-related information is shared and accessed (Venturelli et al., 2016). These technological advancements have enabled anglers to connect with each other, share experiences, and access real-time information about fishing opportunities (Martin et al., 2014). Correspondingly, these tools have been implemented to gather fishing information and input on fisheries management decisions (Venturelli et al., 2016).

Angler apps have emerged as another digital tool for collecting fisheries data in real-time. These apps offer opportunities to efficiently gather data related to fishery resources and angler behavior. Unlike traditional survey methods, which often rely on periodic sampling and manual data entry, angler apps allow for continuous data collection, enabling researchers and managers to capture fluctuations in angling activity and harvest in near real-time (Venturelli et al., 2016). Additionally, angler apps facilitate the engagement of citizen scientists in data collection efforts, empowering anglers to contribute to the management of fishery resources (Venturelli et al., 2016). By leveraging the widespread use of smartphones among anglers, these apps have the potential to reach a broad audience and collect data across large spatial scales. However, challenges such as recruitment and data quality need to be addressed to maximize the utility of angler apps in fisheries management (Venturelli et al., 2016). Recruitment strategies may include incentivizing app usage, ensuring user-friendly interfaces, and transparent communication about data use and privacy policies. Despite these challenges, angler apps represent a promising innovation in cost-cutting creel survey methods, offering an efficient means of data collection from diverse users.

Off-site angler surveys offer a cost-effective alternative to on-site surveys for evaluating recreational fishing. McCormick et al. (2015) examined the biases associated with off-site

surveys and proposed a multi-method approach to assess reporting accuracy. Their study brings to light the complexity of capturing accurate data in recreational fisheries, where anglers may not always provide fully transparent or precise information about their catches. The inherent challenge lies in the reliance on anglers' memory and willingness to report their fishing activities truthfully, which can introduce various biases into the data collected through off-site surveys (McCormick et al., 2015). By employing a multi-method approach that combines on-site surveys with off-site questionnaires, the researchers aimed to gain a comprehensive understanding of reporting biases and their implications for fisheries management. Their findings underscore the importance of understanding and mitigating reporting bias in survey methodologies to ensure accurate fisheries management (McCormick et al., 2015).

To address these challenges, researchers have explored one such off-site survey method known as Time-Location Sampling (TLS), to survey specialized recreational fishers at centralized, off-site locations (Griffiths et al., 2012). Specifically, Griffiths et al. present a comprehensive, innovative, and cost-effective approach focused on the utilization of TLS as a key method to intercept individuals at bait shops where anglers of diverse backgrounds and avidities congregate. While TLS surveys successfully intercepted diverse anglers, the authors recognize potential recall bias in estimating catch and effort. To address these issues, they propose modifications to TLS surveys, including shorter recall periods or the integration of diary surveys, which offer higher-quality trip-specific data though at a higher cost. Despite the promise of TLS for accessing hard-to-reach anglers, the authors emphasize the importance of addressing methodological considerations to ensure data quality and representativeness in survey efforts (Griffiths et al., 2012).

Remote camera monitoring represents another cutting-edge approach to conducting creel surveys, particularly in challenging environments such as estuarine ecosystems. Nieman et al. (2021) employed remote cameras to monitor recreational fishing activity in the Peel-Harvey Estuary, situated in south-west Western Australia. By strategically deploying remote cameras at key fishing locations, researchers overcame longstanding obstacles, including safety concerns and limited visibility during nighttime sampling efforts (Nieman et al., 2021). Remote cameras provide a unique opportunity to capture 24-hour fishing activity, including crepuscular and nocturnal patterns, which are often overlooked in traditional survey methods (Nieman et al., 2021). However, the information gained from cameras are limited in terms of type of data gathered, both spatially and temporally (McCluskey & Lewison, 2008). This temporal photographic coverage allows for a more complete understanding of recreational fishing and its corresponding ecological implications. Despite its promise, the implementation of remote camera monitoring is not without challenges, including logistical hurdles associated with equipment maintenance, privacy concerns, and data processing. However, by leveraging advances in technology and data analytics, researchers can streamline these processes and maximize the efficiency and effectiveness of remote camera monitoring programs.

Similarly, Hartill et al. (2016) described a cost-effective creel survey method of monitoring angling activity using web cameras paired with concurrent low-intensity angler creels to validate data collection. The integration of web cameras at boat ramps enables the counting of boats entering and exiting each location, providing a reliable, though limited indicator of angling activity (Hartill et al., 2016). Although manual interpretation of images can be laborious, advancements in technology, such as interactive database software, have made data processing more efficient (Hartill et al., 2016). By subsampling these images, informed annual estimates can

be made, allowing for the assessment of long-term trends in recreational fishing. Additionally, creel-intercept surveys conducted concurrently with web camera monitoring helped validate the accuracy of the data collected, ensuring the reliability of the information gathered (Hartill et al., 2016). Combining on- and off-site creel surveys can capture angler behavior and estimates of fishing effort. This is because through off-site monitoring by using technology such as cameras, you can identify when an angler arrives at a location, and then departs. Thus, giving an estimate of angler-hours. A metric frequently used to determine effort. With that information, and combining that with a subset of on-site catch or harvest rates can allow managers to also estimate catch per effort or exploitation. This combined approach offers a cost-effective, yet comprehensive solution for monitoring recreational fisheries.

These technology-reliant creel survey methods are not mutually exclusive from in-person or on-site methods. They can be complementary and provide avenues for developing comprehensive angler assessments. By integrating complementary survey methods, fisheries managers can enhance the accuracy and reliability of recreational catch estimates in complex fisheries management contexts. Ferter et al. (2022) explored integrating various creel survey designs to estimate recreational catches in diverse and multifaceted fisheries settings. Through their study, they found the potential benefits of merging on-site creel surveys with off-site surveys, offering a nuanced understanding of angler dynamics (Fertter et al., 2022).

The integration of multiple survey methods also enables researchers and fisheries managers to capitalize on the strengths of each approach while mitigating their respective limitations and biases, thereby yielding more robust and comprehensive survey results. By combining the detailed trip-specific data obtained through on-site roaming creel surveys with the broader spatial coverage afforded by off-site surveys, it is feasible to capture a broader spectrum

of angler behavior and fishing effort estimates. Integrating complementary survey data from multiple approaches also facilitates the detection and mitigation of potential biases inherent in individual survey approaches, thereby enhancing the overall reliability and validity of survey response data. In this research, we employed this integrated approach to creel survey methods to gather data from shoreline anglers. We utilized in person on-site roaming creel surveys and social media to distribute off-site surveys. The combination of approaches provided valuable insights into the dynamics of shoreline angling in Milwaukee County. This can be employed by fisheries managers for more targeted and effective management strategies, and we explain this further in our recommendations in Chapter 6.

2.5 Science and Policy Communications

“Policy communications” refers to the process of developing and sharing information about policies and issues to stakeholders with the goal of informing, educating, and influencing these groups to participate in specific projects, proposals, and propositions (Ahn, 2016). These communications are important for governmental, academic, and private entities to ensure effective and consistent messaging (Bielak, 2008). In a natural resource and fisheries management context, this involves sharing information related to statutory or administrative rule changes, stocking initiatives, habitat improvement projects, permitting decisions, or other actions that impact fisheries-related activities. Often, these projects involve, and impact interested individuals or groups. Therefore, it is imperative for decisionmakers to communicate the directions, scientific rationales, interpretations, and actions in a manner that is effective and preferred by the intended target audience.


To successfully do so, policy and science communicators must first identify who the intended audience is, specify the goals and purposes of the communication, and evaluate the

audience’s interests in the topic (Besley, 2020). To understand who the audience is involves considering factors such as education level, cultural background, age, occupation, or other demographic information. From this information, communicators can identify the level of technical expertise of the audience. Additionally, characterizing the audience can determine the preferred method of delivering and receiving information. For example, a younger audience may more aptly receive policy information by visual aids, whereas older audiences may prefer written or verbal formats (Willoughby, 2016). This information can also help communicators identify the audience’s influence and key interest(s) on various topics. Doing so can help communicators frame the key messages of a communication in a way that will be memorable and influential (Lewenstein, 2003). By understanding the target audience, communicators can tailor their message in a way that is most effective and engaging for the intended audience. This can help increase the impact of a communication and build a more informed and engaged public.

Elliot et al. (2017) synthesized this relationship between audience and communication objectives. They describe a “dissemination diamond” which identifies different audiences based on education level and occupation encountered in science communication, and the most effective quantity of information in a science communication

Figure 9

Who?	Main usual source of information	Amount of information usually produced and used
General public	News bulletins (TV, radio); newspaper headlines, social media, tweets, soundbites, 'pub talk'	2 minutes attention span, 140 character tweets
Undergraduate and graduate MSc/MA students	Text books, lecture notes, web sites, Wikipedia	Synoptic syntheses
PhD students and early career scientists	Books, reviews, web sites, abstracts, compendia, Wikipedia, journal articles	Detailed syntheses
Experienced natural scientists	International journal, peer-reviewed articles, some monographs	10-300 pp
Experienced social scientists	International journal, peer-reviewed articles, monographs, books	10-300 pp
Consultants	Consultant reports, government documents, unpublished reports	200 pp
Policy implementers	Government & agency reports, commissioned consultant reports	<50 pp
Policy makers	Government briefings, commissioned briefings, policy briefs	<2 pp
World leaders (e.g. POTUS)	Tweets, soundbites!	140 characters, sentences



Note: The “Dissemination Diamond” science and policy communication model from Elliot et al. (2017).

for each corresponding audience (Figure 9). Science and policy need to effectively inform

society, but it is the job of science and policy communicators to understand how different audiences consume information (Elliot et al., 2017).

Similarly, socioeconomic status impacts how scientific information is received and accepted, and it is important to understand the interests, preferences, and limitations within various socioeconomic groups. Scheufele and Krause (2019) contend that low-income audiences will be most interested in science communications through community events, hands-on activities, and interactive learning experiences. Middle income audiences will have more latitude to participate in public events such as lectures, workshops, and open-forums, and will also likely have better access to online resources. High income audiences will prefer exclusive and personalized communications that foster an environment of ownership and involvement. These strategies are broad overviews, and communications should always be tailored to the characteristics of individual audiences, as their demographics, needs, and interests in scientific communications are diverse.

In addition to understanding the characteristics of the audience and methods of delivery, the rhetoric used in a communication must also be considered (Druschke and McGreavy, 2016). The term “rhetoric” often has a focus on persuasion, however Druschke and McGreavy offer a broader interpretation which is “the ways humans communicate with one another and how communication can shape human understanding of and decision making about ecosystems.” Therefore, rhetoric can be a tool that is used by science and policy communicators to accomplish communication objectives and effectively relay scientific or policy information to stakeholder groups. Furthermore, effectively and intentionally integrating rhetoric into the development of policy communications can improve understanding of complex issues and increase the relevancy for stakeholders.

Using plain language and avoiding technical jargon are useful rhetorical techniques when delivering regulatory or policy related information to angling groups (Hartley, 2008). Doing so can ensure these groups understand the regulations and policies and in turn can engage in more productive conversations. The diverse demographics within the shoreline angling community will also require science and policy communicators to utilize a variety of communication channels and media including visual, written, verbal, in-person, and virtual methods. Employing a multi-faceted communication strategy can maximize the potential that key messages are received by target audiences. By using these techniques, fishery managers can communicate policies effectively and engage stakeholders in meaningful discussions about sustainable fisheries management.

Understanding science and policy communication best practices is crucial as it relates to building communication bridges between shoreline anglers and natural resource managers. Without proper communication, even the best science or policy can be misinterpreted or overlooked. By understanding how to effectively communicate science and policy to different audiences, specifically shoreline anglers, researchers and natural resource managers can ensure that important and relevant information is being received by all intended audiences. Additionally, understanding these best practices helps inform recommendations to natural resource management agencies. Ultimately, the ability to effectively communicate natural resource policy is just as important as the policy itself, and synthesizing communications best practices will be a useful resource for achieving that goal. Informed by these reviews of the literature, we embarked on the Milwaukee County shoreline angler survey to gather data relevant to characterizing the audience and their communication preferences.

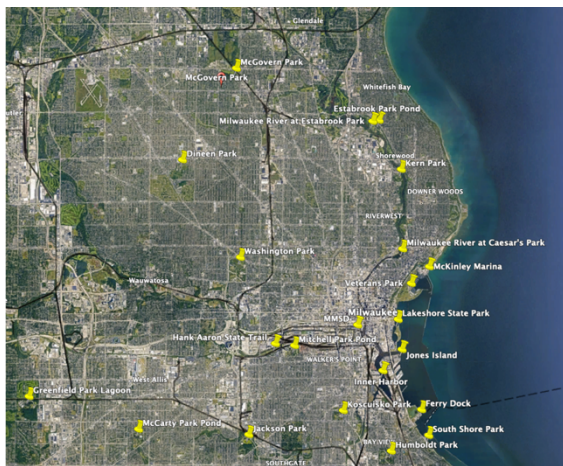
Chapter 3: Shoreline Angler Survey

3.1 Shoreline Angler Survey Methods

Data for this study were collected from survey responses from shoreline anglers across Milwaukee County during the Summer 2023 Shoreline Angler Survey (Addendum 1). The quantitative survey instrument and methods involved in the Shoreline Angler Survey combined the research approaches from Furman et al. (2023), Golebie et al. (2020), and Bradshaw and Legler (2021), and applied those approaches to a novel study domain – shoreline anglers in Milwaukee County, Wisconsin. Milwaukee provided an excellent and unstudied area for evaluating social and ecological dynamics among shoreline anglers due to the diversity of shoreline angling locations, variety of target species, and a large cohort of racially, ethnically, and socioeconomically diverse anglers provided a rich environment to investigate a multitude of novel research questions related to shoreline anglers, their preferences, perspectives, and motivations.

The 2023 Shoreline Angler Survey included 24 publicly accessible shoreline fishing

Figure 10



Note: 2023 Shoreline Angler Survey locations.

locations across Milwaukee County that represent a variety of public access types including lakefront, riverside, and inland urban ponds. Specifically, these locations included fishing access points along Lake Michigan, the Milwaukee, Menominee, and Kinnickinnic Rivers, as well as 11 inland ponds participating in the Wisconsin DNR Urban Pond Stocking Program (Figure 10). The Urban Pond

Stocking Program is a cooperative arrangement between Milwaukee County Parks and WDNR where the state provides “catchable size” (~8-10”) rainbow trout in exchange for maintenance and access at shoreline fishing locations within county parks. This program is designed to make fishing opportunities more accessible for the purpose of creating a harvest-oriented fishery in urban locations (Wisconsin DNR).

The Shoreline Angler Survey consisted of 30 questions covering a range of topics including: fishing experience, skill, commitment, angling preferences, perceptions of fishing opportunities, sources of information, public participation, and demographics (Addendum 1). The questionnaire was imported into Qualtrics Survey Management software and published online for ease-of-access. Other non-survey data such as, date, time, location, weather, and number of anglers contacted were also recorded at each survey station and recorded in Excel. The number of surveys completed divided by the total number of anglers contacted during the survey administration period was used calculate the survey response rate.

The 2023 Shoreline Angler Survey was administered by UW-Milwaukee Graduate Research Fellow Joseph Bevington from June 15th, 2023, through September 5th, 2023. The survey was primarily administered in person verbally to English and Spanish speaking anglers with data inputted into an iPad, but printed and online questionnaires linked to Qualtrics with a QR code were available in English with Spanish and Hmong to provide multiple options for anglers to participate in the survey. The survey was translated using Google Translate and verified through the UW-Milwaukee Translation and Interpreting Studies program.

Prior to the on-site survey administration period, a schedule was developed using a randomized stratified sampling approach. The locations of on-site surveys were selected from the established list of popular shoreline angling locations. The time of survey administration was

also selected by randomizing three 4-hour shifts during daylight hours (7am-11am, 11am-3pm, and 3pm-7pm). The randomized survey schedule was stratified by access location type (Pond, River, Lakeshore), which ensured that survey stations are proportional to shoreline angling access types and accounted for differences in the composition of angler types. Data collected during the survey administration were entered into a Microsoft Excel csv file, which was stored securely on Microsoft OneDrive using dual-authentication access.

The Shoreline Angler Survey quantified the importance of various aspects of fishing: spending time with family/friends, enjoying natural scenic beauty, the challenge of fishing, catching fish to eat, the thrill of the catch, experiencing something new, catching a big fish, and catching a lot of fish. To do so, each respondent was asked to rate each on a scale of 1-5, with 1 described as being “not important at all” and 5 “being very important”. The purpose of these questions was to garner interest in participating in the survey, but most importantly, to identify if shoreline anglers tended to be “Trophy-oriented” (catching a big fish), “Action-oriented” (catching a lot of fish), or “Harvest-oriented” (catching fish to eat) to test Hypothesis 1. This question was essential to test the hypothesis that shoreline anglers tended to be action- and harvest-oriented.

To enhance the sample size of shoreline anglers, following the in-person survey administration, a secondary online survey was administered. This methodology to survey hard-to-reach shoreline anglers included a targeted sampling approach using social media (Dusek, 2015). An online survey was to six targeted and specialized Facebook groups: Lake Michigan Harbor Reports, Great Lakes Pier & Shore Fishing, Milwaukee River Trout and Salmon, Southeast Wisconsin Fishing, Fishing Milwaukee, and Shore Fishing Wisconsin. This electronic survey administration period was open to responses for two-weeks from September 5th, 2023,

through September 19th, 2023. Additional filter questions including “*Which counties in southeast Wisconsin do you primarily fish in?*” and “*How often do you fish from shore?*” were added to the survey instrument to filter responses that did not include people who fish from shore and people who do not fish in Milwaukee County. Respondents that did not indicate fishing in Milwaukee County or reported “Never” fishing from shore were removed from the data set.

Upon completion of the quantitative survey during Summer 2023, data were downloaded from Qualtrics into a .CSV file, cleaned and prepared for analysis. This involved checking the collected data for errors, missing values, and statistical outliers. The purpose of data cleaning is to ensure that the data used for analysis is accurate, complete, valid, and reliable (Ruel, 2016). Errors in data collection can lead to incorrect conclusions, and therefore, it was important to check for inconsistencies and attempt to rectify them (Ruel, 2016). Once the data were cleaned and errors rectified, data were prepared for analysis.

The analysis of data collected during the Summer 2023 Shoreline Angler Survey followed a rigorous process, drawing upon established methodologies outlined in previous studies by Bradshaw & Legler (2021) and Golebie et al. (2020). Initially, descriptive statistics such as mean, median, standard deviation, and standard error were computed using statistical software, specifically RStudio. These statistics were pivotal in quantifying various aspects of shoreline angler demographics, including their preferences, levels of satisfaction, and primary sources of fishing information. After completing the descriptive statistical analysis, the next phase involved data visualization and interpretation. This step was crucial for translating complex statistical results into visually accessible formats, enhancing understanding and facilitating insights into the dataset. Utilizing the "ggplot2" package within RStudio, graphs and charts were generated. The code used in data analysis and visualization is available on GitHub,

linked in Addenda A and B to allow transparency and reproducibility of the data analysis and visualization processes. These visualizations provided an overview of the survey data, and allowed trends, patterns, and relationships within the data to be interpreted.

Data cleaning, analyzing, visualizing, and interpreting was an iterative process. Data interpretation allowed for inferences to be made, and identify limitations, potential errors, or biases within the data. From these interpretations, inferential conclusions were made and further knowledge gaps within the research identified.

3.2 Shoreline Angler Survey Results

From June 15th, 2023, through September 5th, 2023, a total of 52 creel-intercept survey sessions, spanning 175 survey hours were conducted at 24 survey locations across Milwaukee County. A total of 104 in-person questionnaires were administered out of 138 anglers contacted, yielding a 75% response rate. Of the 104 surveys administered, four were administered using the Spanish translation, while zero were administered using the Hmong translation largely due to the surveyor's inability to distinguish Hmong-speaking shoreline anglers. An additional 30 responses were collected via the online survey administration; however, the response rate is unknown for this leg of the survey administration period. In total, $n = 134$ individuals were surveyed over the survey period.

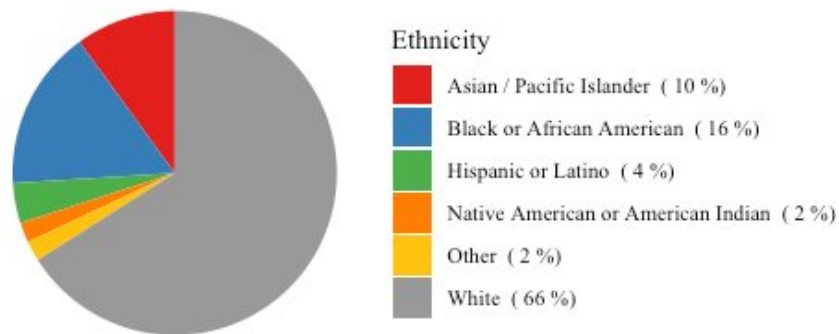
This section will first look at the motivations, preferences, and primary sources of information for collective response group, then parse out these metrics by race/ethnicity, education, and income.

Shoreline Angler Demographics

To begin to characterize the shoreline angling community of Milwaukee County, we surveyed about a variety of demographic attributes. Survey respondents were asked questions about their race/ethnicity, approximate annual household income, and highest degree of education (Questions 23-28, Addendum 1).

From this study, 66% (n = 88) identified as white, 16% (n = 22) identified as Black/African American, 10% (n = 13) identified as Asian/Pacific Islander, 4% (n = 5) identified as Hispanic/Latino, 2% (n = 3) identified as Native American/American Indian, and 2% (n = 3) identified as “Other” which included Moroccan, Indian, and Unspecified (Figure 11).

Figure 11
Racial and Ethnic Distribution of Shoreline Anglers (n = 134)

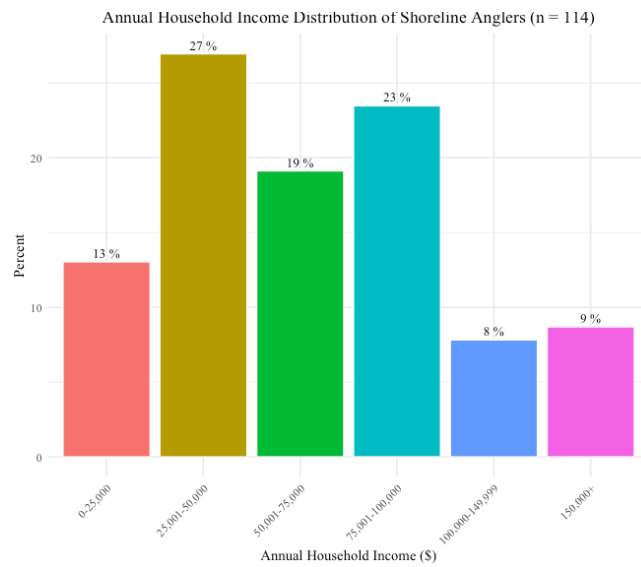


Note: Pie chart of the racial and ethnic distribution of shoreline anglers from the 2023 shoreline angler survey.

In addition to ethnicity, survey respondents were asked to provide approximate annual household income, though to increase responsiveness and respect privacy, this question was optional. Of the 134 survey respondents, 86% provided income information (n = 116). The average household income of survey respondents was \$77,567 and median household income was \$60,000. According to the 2022 US Census Bureau, the median household income for Milwaukee County residents from 2017-2021 was \$45,318. From the survey results, 13% (n = 15) of respondents indicated their annual household income was between \$0-25,000, 27% (n =

31) indicated their annual household income was between \$25,001-50,000, 18.96% (n = 22) indicated their annual household income was between \$50,001-75,000. Further, 23% (n = 27) indicated their annual household income was between \$75,001-100,000, and 16% (n = 19) indicated their annual household income was greater than \$100,000 (Figure 12).

Figure 12

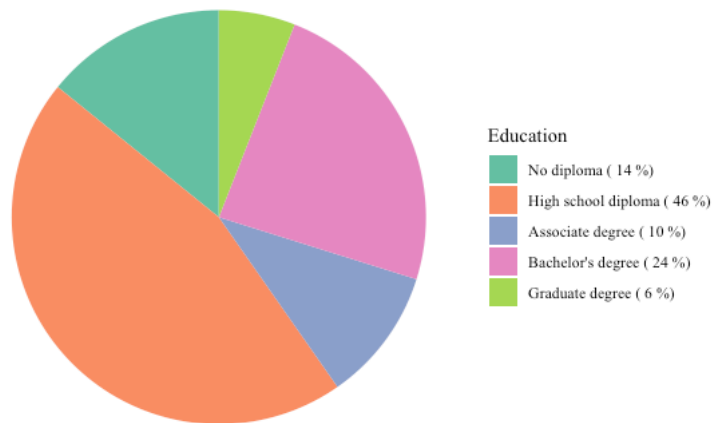


Note: Annual household income of shoreline anglers surveyed during the 2023 Shoreline Angler Survey.

Highest degree or level of school completed was another demographic metric gathered in this survey. From this survey a majority of respondents (60%, n = 80) have a high school degree (or equivalent) or less, with 14% (n = 19) not having received a high school diploma and 46% (n = 61) with a maximum educational attainment of a high school diploma. Of the survey respondents, 10% (n = 14) received an Associate degree or equivalent, 24% (n = 32) received a Bachelor's degree, and 6% (n = 8) completing a graduate degree with included either a Master's, Doctorate, Medical, Law or equivalent (Figure 13).

Figure 13

Educational Distribution of Shoreline Anglers (n = 134)



Note: Educational attainment of surveyed shoreline anglers.

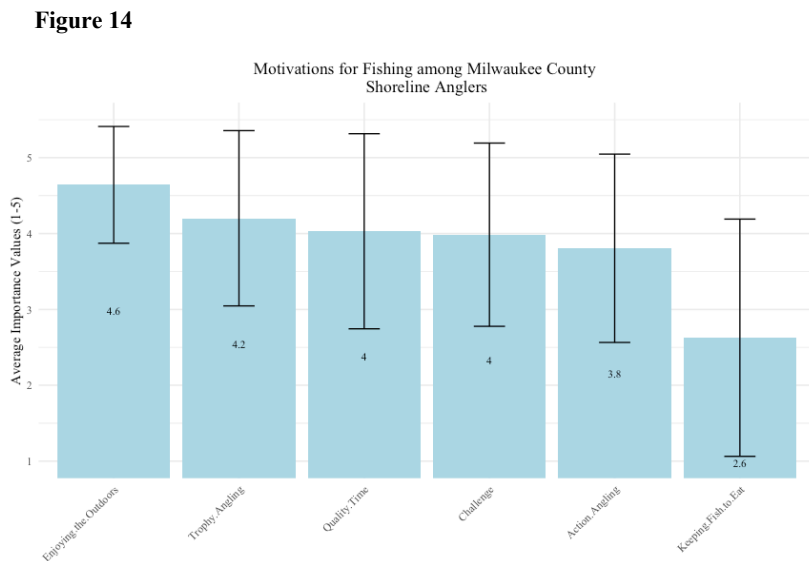
Shoreline Angler Motivations

The data gathered on this question revealed several interesting results. First, on average, the most important reason for fishing across the collective shoreline angling community surveyed was enjoyment of natural scenic beauty (Figure 14). Catching a big fish, fishing as a means of spending quality time with family and friends, the challenge of fishing, and catching a lot of fish all received similar importance values between 4.2 and 3.8, respective. Contrary to the hypothesis outlined in Chapter 1.2, catching fish to eat was the least important motivator for fishing among Milwaukee County Shoreline Anglers. The importance of fishing as a means of spending quality time with family and friends, and the general challenge of fishing both received an average importance of 4. To further analyze these results, these same motivations were evaluated by race/ethnicity, income, and education level.

Motivations for Fishing by Race/ Ethnicity

The most important motivator for fishing on average is “Enjoying Natural Scenic Beauty,” which varied by race/ethnicity from 4.6 to 4.9. This is the most important motivation for most race/ethnic groups,

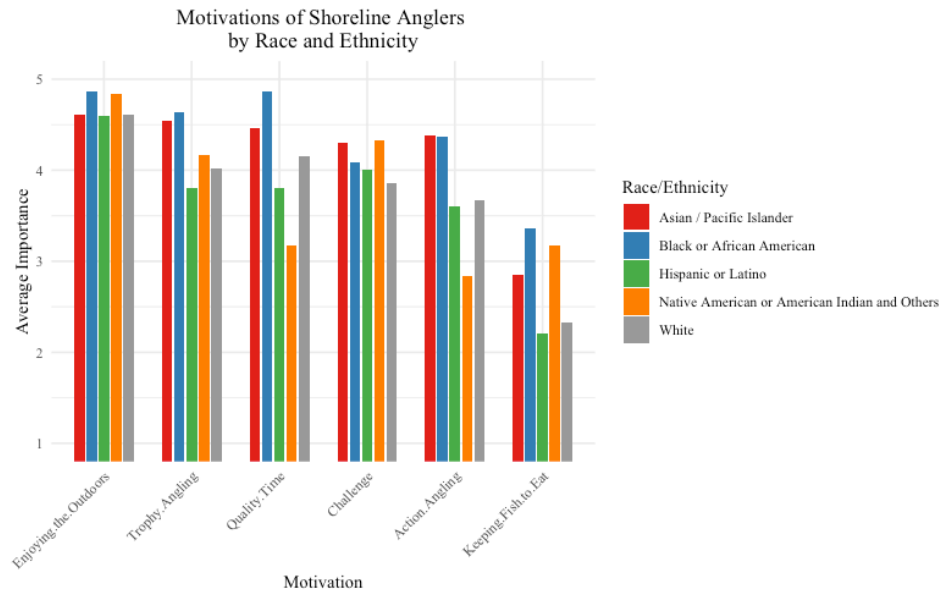
except for Black/African American shoreline anglers. Catching a trophy fish is the second most important motivator for shoreline anglers with a mean importance value of 4.2, however was comparatively



Note: Motivations for engaging in fishing activities among surveyed shoreline anglers.

more important for Asian/Pacific Islander and Black/African American anglers than the remaining demographic groups. Catching a trophy fish was least important for Hispanic/Latino anglers. Spending time with

Figure 15



Note: Average importance for fishing among Shoreline Angler Survey respondents.

family and friends was another important motivator among shoreline anglers, particularly among Asian/Pacific Islander and Black/African American respondents compared to the other groups. Furthermore, this was the most important reason for fishing for Black/African American respondents across all possible motivations. The average importance of the challenge of fishing as a motivator followed closely behind with a mean importance value of 3.98. Harvesting fish was the least important overall motivation for fishing among shoreline anglers with a mean importance across ethnic groups of 2.6. Among ethnic groups, harvesting fish was most important among Black/African American and Native American/American Indian anglers and other groups (Figure 15).

Motivations for Fishing by Income Groups

A comparative analysis of shoreline angler motivations was also conducted by income level. Respondents were binned into Annual Household Incomes between \$0-49,999, \$50,000-74,999, \$75,000-99,999, \$100,000-149,999, and \$150,000+. Doing so approximately identified

the respondents who fall below the median household income, those above, and those who make approximately more than double the median household income for Milwaukee County.

This analysis revealed several trends, many that mirror the same motivation trends as for racial and ethnic groups,

however unique patterns

also emerged. Enjoying

natural scenic beauty was

again the most important

motivation for fishing

across all income brackets.

Comparatively, enjoyment

of natural scenic beauty

was highest among the

lowest income respondents than other income groups with a mean importance value of 4.8.

Trophy angling was highest among middle income earners (\$50,000-74,999 and \$75,000-99,999)

with mean importance values of 4.4 and 4.2, respectively. Trophy angling was least important

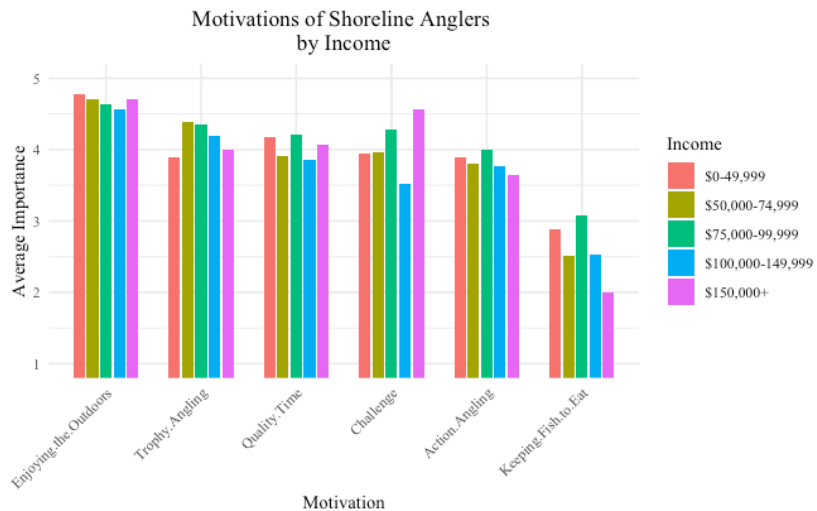
among low-income earners with a mean importance value of 3.9. The importance of fishing as a

means of spending time with family and friends and action angling was similar across income

groups, with no discernible trends. The challenge of fishing and harvest angling was also

variable across income groups with no discernible relationship across income groups (Figure 16).

Figure 16



Note: Motivations for fishing among Shoreline Angler Respondents by income groups.

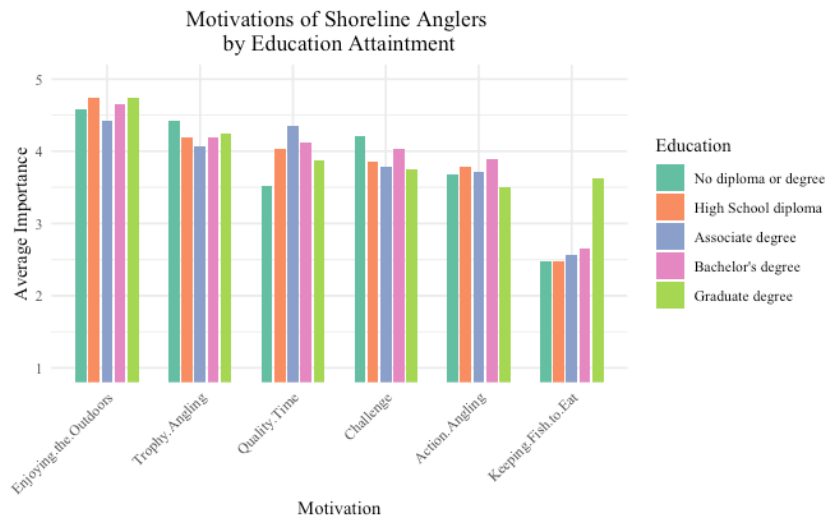
Motivations for Fishing by Education-Attainment

The motivations for fishing varied across different educational attainment groups, with the enjoyment of natural scenic beauty emerging as the primary motivator across all groups, with mean importance values ranging from 4.1 to 4.8. However, the importance of catching trophy fish showed a slight variation, being highest among anglers with no diploma or degree with a mean importance value of

4.4, and lowest among those with an Associate degree with a mean importance value of 4.1. Similarly, the significance of fishing as a means of spending time with family and friends was relatively consistent across

education groups but slightly more important for anglers with a high school diploma or graduate degree with mean importance values of 4.8 for both compared to those with no diploma (mean importance value of 3.5). The challenge of fishing appeared to follow a weak trend where it was more significant for anglers with lower education levels (mean importance value of 4.2 for no degree or diploma holders) and less important for those with higher education attainment (mean importance value of 3.8 for graduate degree holders). Action angling was consistently important across all education groups, with average importance values between 3.5 and 3.9. The importance of harvesting fish to eat was the least important motivator for fishing among

Figure 17



Note: Motivations for fishing among Shoreline Angler Survey respondents.

respondents, with an average importance value of 3.6 for those with higher education and 2.5 for those with lower education (Figure 17).

Shoreline Angler Satisfaction

The 2023 Shoreline Angler Survey also quantified respondents' satisfaction with shoreline angling, namely satisfaction with the number of fish caught, and the overall size and quality of fish caught. Quantifying anglers' satisfaction with the number of fish caught provides valuable insights into the overall satisfaction of fishing experiences. Additionally, evaluating anglers' satisfaction with the size and quality of fish caught is important as it offers a nuanced perspective on the recreational value of fishing. The size and quality of fish directly contribute to the enjoyment and fulfillment anglers derive from their experiences, impacting resource usage.

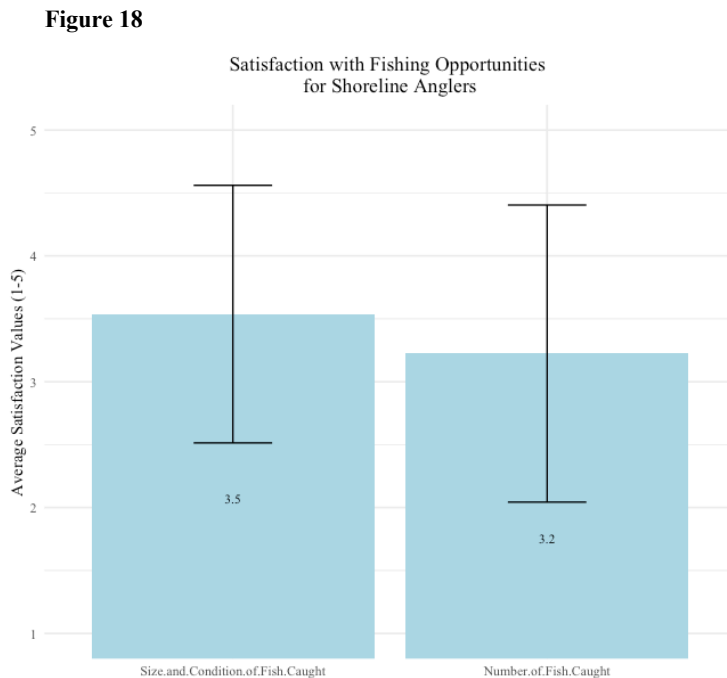
When survey participants were asked, “On a scale of 1 to 5, what is your overall satisfaction with the number of fish typically caught per trip?” and “On a scale of 1 to 5, what is your overall satisfaction with the

size and quality of fish typically caught per trip?” survey

respondents responded with mean satisfaction values of 3.2 and 3.5, respectively (n = 134). These

results indicate shoreline anglers are neutral to moderately satisfied with both the number, and size and quality of fish being caught.

However, similar to motivations for



Note: Average satisfaction with both the size and condition and number of fish typically caught per trip among Shoreline Angler Survey respondents.

fishing, satisfaction with fishing opportunities varied by demographic groups including racial groups, income groups, and educational groups (Figure 18).

Satisfaction with Fishing Opportunities by Race/Ethnicity

Among survey

respondents, Black

and African

American shoreline

anglers were the most

satisfied with the

number of fish caught

per trip with a mean

satisfaction value of

3.60 (n = 22). White

shoreline anglers followed closely behind with a mean satisfaction for number of fish caught of

3.54 (n = 89). Asian and Pacific Islander shoreline anglers had a mean satisfaction value of 3.15

(n = 13) and Native American and Others had a mean satisfaction value of 3.14 (n = 8). Hispanic

or Latino shoreline anglers were the least satisfied with the number of fish caught per trip with a

mean satisfaction value of 3.00 (n = 5). Satisfaction with the size and quality of fish caught per

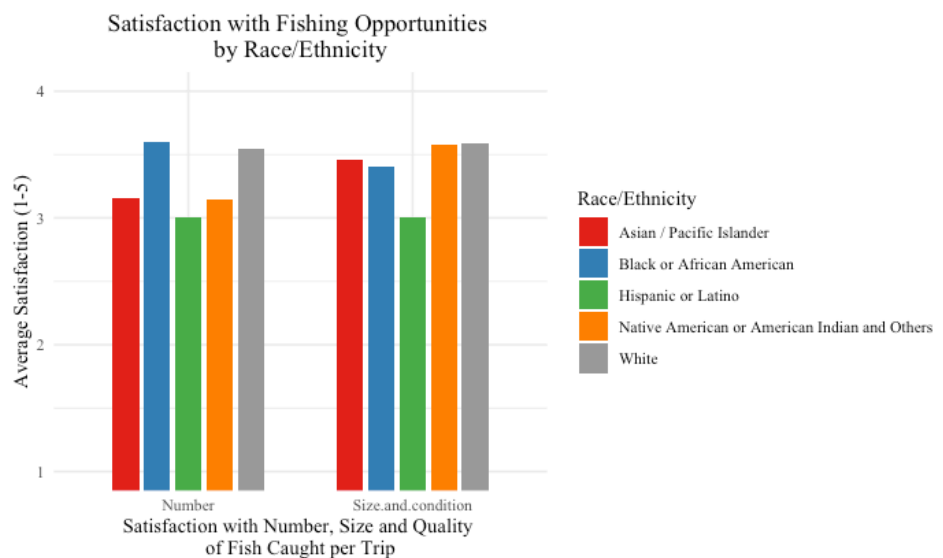
trip differed, with white shoreline anglers responding with a mean satisfaction value of 3.59,

followed closely behind with Native American and Others with 3.58. Asian and Pacific Islander

shoreline anglers responded with a mean satisfaction value of 3.46 and Black and African

American anglers with a reported satisfaction value of 3.4. Similar to satisfaction with the

Figure 19



Note: Average satisfaction with both the number, and size and condition of fish typically caught per trip among surveyed shoreline anglers by race and ethnicity.

number of fish typically caught per trip, Hispanic and Latino anglers again reported the lowest satisfaction with a mean value of 3.0 (Figure 19).

Satisfaction with Fishing Opportunities by Income Groups

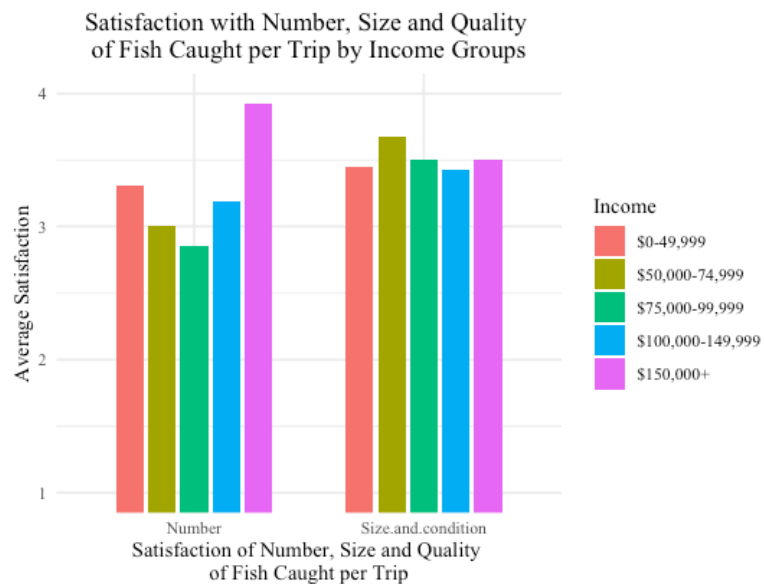
To analyze shoreline satisfaction data further, mean satisfaction values were also broken out by income groups. High income shoreline anglers (>\$150,000 annual household income) reported the highest satisfaction with the number of fish caught per trip, with a mean satisfaction value of 3.92 (n = 10). Low-

income anglers (<\$49,999 annual household income) were the second most satisfied, with a reported mean value of 3.31 (n = 15). Middle income anglers (\$50,000-74,999, \$75,000-99,999, and \$100,000-149,999) each with similar satisfaction

values of 3.00 (n = 22), 2.85

(n = 27), and 3.19 (n = 9), respectively. There were no detectable trends in satisfaction with the size and quality of fish caught per trip by income groups with satisfaction ranging between 3.42 and 3.67 (Figure 20).

Figure 20



Note: Average satisfaction with both the number, and size and condition of fish typically caught per trip among surveyed shoreline anglers by income groups.

Satisfaction with Fishing Opportunities by Education-Attainment Groups

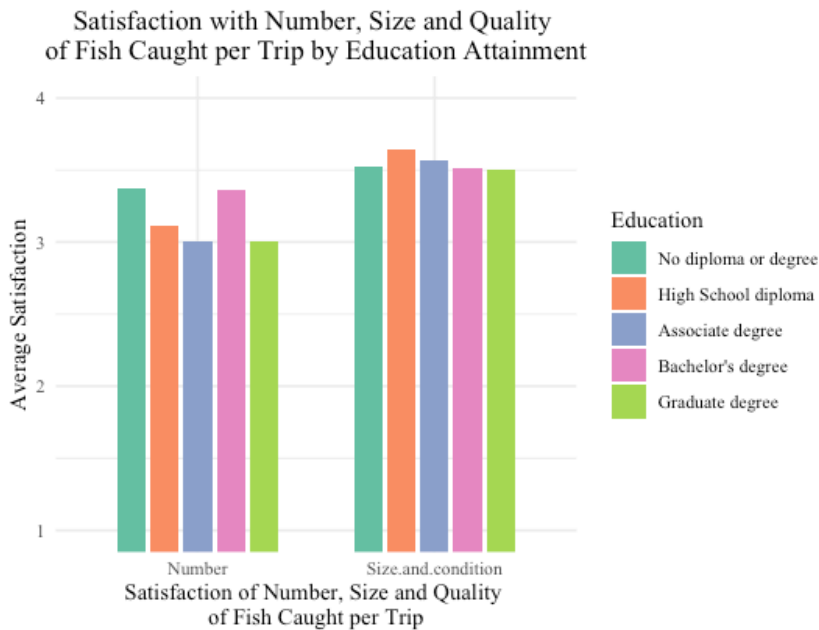
Lastly, satisfaction with the number, and size and condition of fish caught was analyzed by survey respondent’s education level, again with no discernible trends. Variance by education level from the mean satisfaction for the size and quality of fish caught was extremely low, with

all education groups reporting a mean satisfaction between 3.50 for graduate degree holders and 3.63 for respondents holding a high school diploma. Associate degree holders reported a mean satisfaction of 3.58, no diploma reported a mean satisfaction of 3.52, and bachelor’s degree holders reported a mean satisfaction of 3.51 (Figure 21).

Primary Sources of Fishing Information Among Shoreline Anglers

Shoreline anglers in Milwaukee County rely on a variety of sources of information for fishing opportunities, regulations, and policies. Understanding the preferences and patterns of

Figure 21



Note: Average satisfaction with both the number, and size and condition of fish typically caught per trip among surveyed shoreline anglers by income groups.

different groups within this angling community is crucial for tailoring effective communication and engagement strategies. To evaluate primary sources of information, respondents were allowed to check multiple options from a list including social media and online platforms to talking with local bait and tackle shop owners, state regulations, DNR sources, government-hosted public meetings and conversations with other anglers. These data offer useful insights into the diverse channels through which shoreline anglers access fishing information.

Based on the data obtained through the Shoreline Angler Survey, across all groups, the

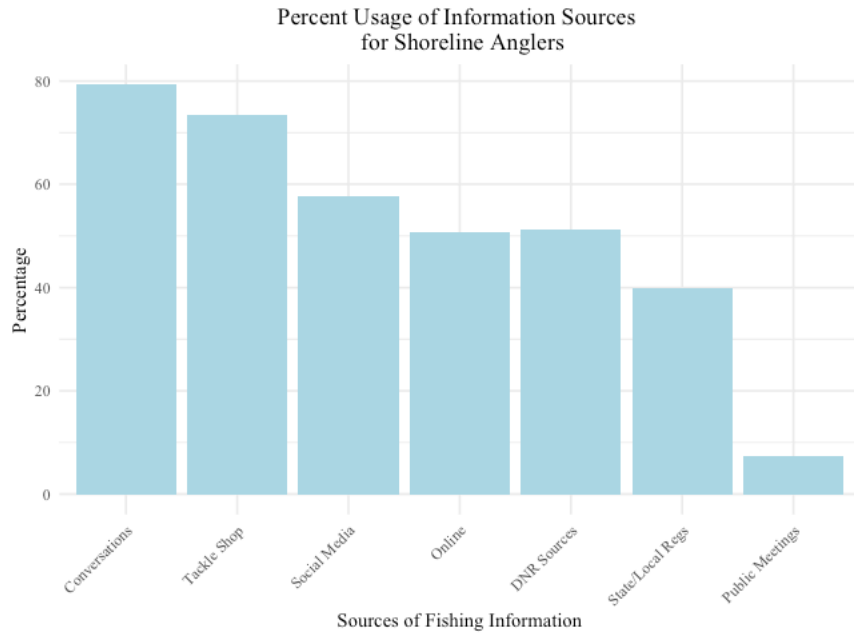
most common source of information is conversations with other anglers with 79% of survey responses (n = 134). Information at tackle shops also emerged as the second most preferred important

information source with 73% utilizing that information

source. Social media also plays a significant role, with 58% of respondents relying on these platforms. Online and DNR sources were essentially tied with approximately half of survey respondents using these communication channels. Only 40% of respondents turn to state and local regulations for information. The least utilized among respondents were public meetings, with only 7% using these to obtain information. The dataset showcases the variety of channels through which anglers access information (Figure 22).

By evaluating these information channels based on racial/ethnic groups, the results diverge more sharply than with prior questions about preferences and motivations, as discussed in the following section.

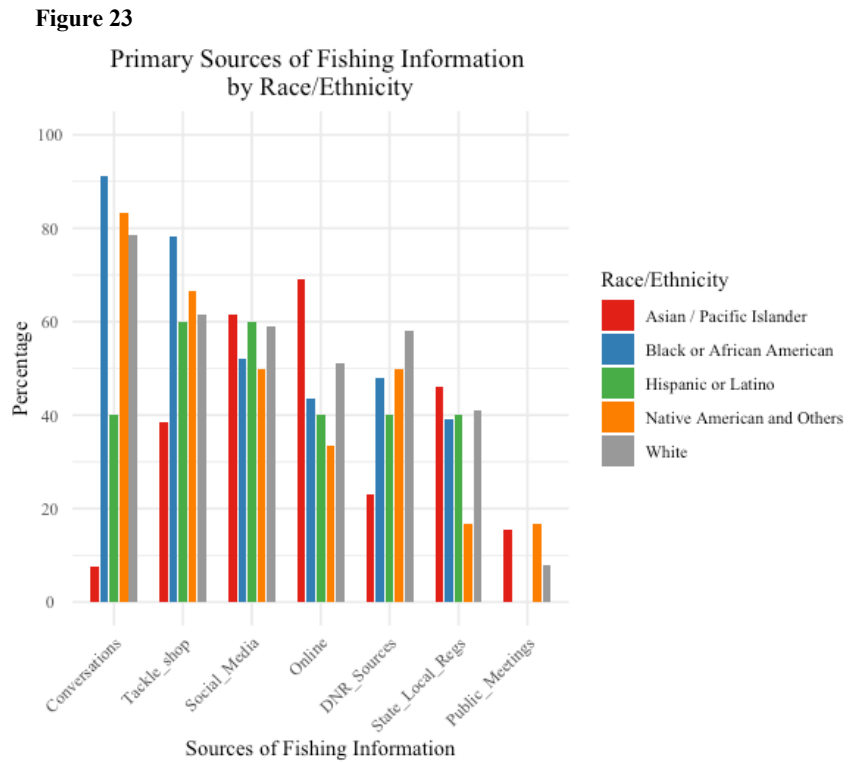
Figure 22



Note: Percentage of shoreline anglers who reported using sources of information on fishing opportunities, regulations, and policies.

Primary Fishing Information Sources by Race/Ethnicity

As noted, shoreline anglers across Milwaukee County represent diverse racial backgrounds, and this data demonstrate each racial group has unique preferences for obtaining fishing information. Specifically, among Asian and Pacific Islander shoreline anglers (n = 13), online sources of information were the most preferred, with 69% relying on this information channel,



Note: Sources of fishing information utilized by shoreline anglers organized by race/ethnicity.

followed by 62% using social media. State and local regulations (46%), information provided at bait and tackle shops (38%), DNR Sources (23%), information provided through public meetings (15%), and conversations with other anglers (8%) are less preferred sources of information among Asian/Pacific Islander shoreline anglers in Milwaukee. Black or African American shoreline anglers (n=22) strongly preferred conversations with other anglers as a preferred fishing information source with 91% reporting use of this channel. Information from bait and tackle shops followed behind with 78% of respondents using this source of information. Social media (52%), DNR sources (48%), and other online sources of fishing information (43%) were used by approximately half of Black/African American Survey respondents. Lesser used were

state and local regulations (38%) and Public Meetings (0%) for sources of fishing information among this demographic group. Hispanic or Latino anglers (n = 5) relied equally on bait and tackle shops and social media platforms (60%), followed by online forums, DNR sources, and state/local regulations (40%). No Hispanic/Latino shoreline anglers indicated attending public meetings for fishing information. Native American and other racial/ethnic survey respondents (n=6) prioritize conversations with other anglers (83%) and information from bait and tackle shops (67%). Social media and DNR sources were both used by half (50%) of respondents in this demographic group. Among shoreline anglers, 33% used online sources, while 17% used state and local regulations and public meetings for fishing information. White anglers (n = 89) mirror the preference for conversations with other anglers (78%) and utilize tackle shops (61%), social media (59%), and DNR information (58%), and approximately half (51%) using online sources. State/local regulations (41%) and public meetings (8%) were less utilized overall among respondents in this group.

Primary Fishing Information Sources by Income Groups

Of Milwaukee County shoreline anglers in the annual household income bracket between \$0 to \$49,999 per year (n = 46), 81% reported utilizing conversations with other anglers as their primary source of fishing information. Information provided at bait and tackle shops is the second most frequently utilized by low-income shoreline anglers with 70% of respondents relying on these locations for fishing information. DNR sources are the second most preferred information source, with 63% of anglers accessing information through this channel. Social media platforms and online resources are the third most utilized fishing information source with 41% of anglers in this income bracket. State and local regulations are used by 35% of shoreline

anglers and 3% of low-income survey respondent reporting receiving information from public meetings (Figure 24).

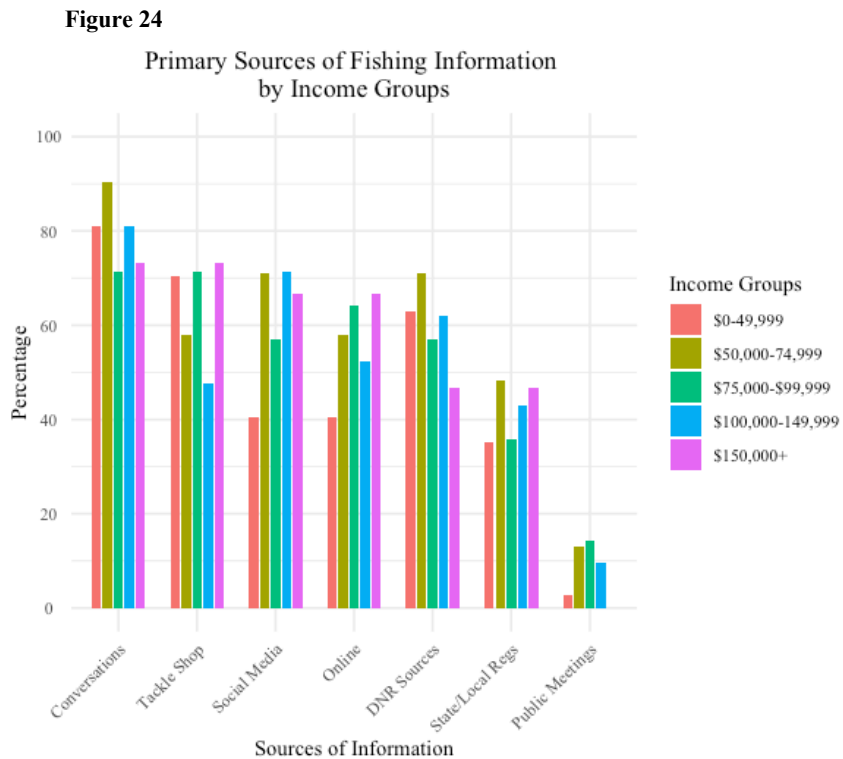
For shoreline anglers with annual household income ranging from \$50,000 to \$74,999 (n = 22), conversations with

other anglers are again the most prevalent source of information, with 90% of respondents indicating this as a means of accessing fishing information. Social media platforms and state and DNR sources of information are the

second most utilized by shoreline anglers, with

71% of anglers in this income group. Among survey respondents, 58% indicated using bait shops and online sources such as fishing forums or other web applications for receiving fishing information. State and local regulations are used by 48% of shoreline anglers, and 13% or respondents used public meetings to obtain fishing information.

Middle income anglers with a household income ranging from \$75,000 to \$99,999 (n = 27) reported conversations with other anglers are the primary source of information, with 71% reporting receiving fishing information from other anglers. Similarly, however, information



Note: Sources of fishing information utilized by shoreline anglers organized by income groups.

provided from bait shops was also a preferred information source among 71% of respondents within this income group. Additionally, online sources served as the third most common source, with 64% of anglers accessing information through online fishing forums and web applications. Social media platforms and state and DNR sources are utilized by 57% of anglers in this income bracket. State and local regulations are used by 36% of middle-income shoreline anglers. Public meetings exhibited the lowest preference rate at 14% of middle-income shoreline anglers reported attending a public meeting for fishing information.

Of middle-upper income earners with an annual household income ranging from \$100,000 to \$149,999, 81% reported utilizing conversations as a primary source of information (n = 9). Social media platforms and online resources were the second most utilized with 71% of shoreline anglers in this income bracket. DNR sources were the third most frequently utilized among these anglers, with 62% of shoreline anglers accessing fishing information such as maps and databases. Information provided at bait shops is also popular within this income group, with 48% of respondents using these nodes of fishing-related information. State and local regulations were reported used by 43% of shoreline anglers. Lastly, Public meetings were minimally utilized with middle-upper income anglers, with only 10% having received information in these forums.

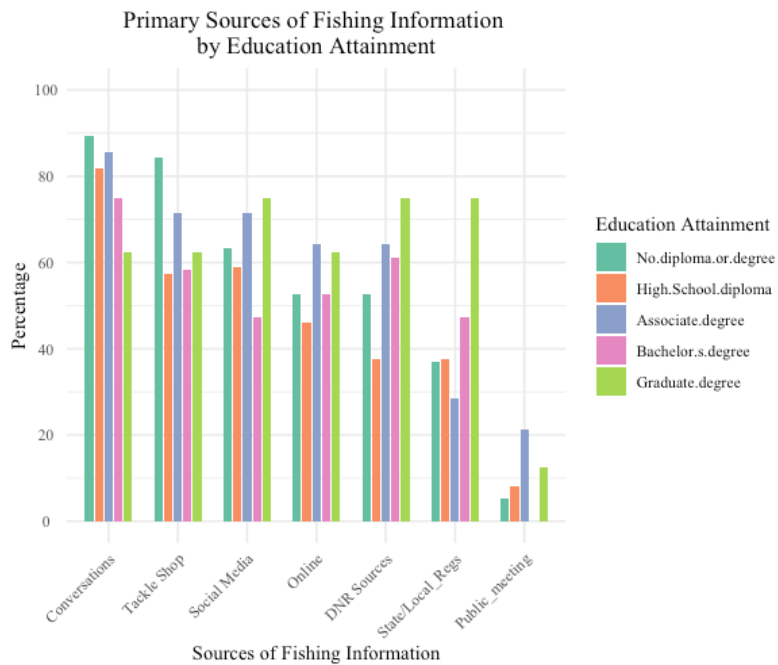
Among Milwaukee County shoreline anglers earning \$150,000 or more annually, 73% indicated that information from conversations with other anglers and information provided at bait shops are the preferred sources of fishing information. Social media platforms and online resources were the second most utilized source of fishing information by 67% of anglers in this income bracket. Additionally, DNR sources and state and local regulations were the third most common source, with 47% of shoreline anglers accessing information through these channels. Public meetings were attended by just 7% of participants earning \$150,000 or more annually.

Primary Fishing Information Sources for Shoreline Anglers by Education Attainment

Exploring the varied sources of information accessed by Milwaukee County shoreline anglers across educational attainment levels also reveals the diverse information-seeking behaviors within this community (Figure 25). Milwaukee County shoreline anglers without a diploma or degree (n = 19) overwhelmingly rely on conversations with other anglers as their

primary source of fishing information, with 89% using this source. Bait and tackle shops follow closely, with 84% of respondents utilizing them for fishing information. Social media platforms are used by 63% of anglers, while 53% access online resources and DNR sources. State and local regulations are less frequently cited, with only 37% considering them a primary source. Public meetings have the lowest utilization rate at 5%.

Figure 25



Note: Sources of fishing information utilized by shoreline anglers organized by educational attainment groups.

Among shoreline angler survey respondents with a high school diploma (n = 61), conversations with other anglers remained the preferred source of fishing information, with 82% using this channel. Social media was the second most commonly used source at 59%, followed by information from bait ships (57%) and online resources (46%). DNR sources and state and

local regulations were utilized by 38% of high school diploma-holding shoreline anglers. Public meetings had the lowest preference at 8% among this group.

Shoreline anglers with an Associate degree or equivalent (n = 14) primarily relied on conversations with other anglers as their source of fishing information, with 86% favoring this method. Bait shops and social media were heavily utilized as the second most used sources, with 71% of respondents relying on information from these channels. Online and DNR sources were accessed by 64% of anglers in this group, while state/local regulations were used by 29%. Public meetings had the highest utilization rate across all education-attainment groups at 21% among shoreline anglers with an Associate degree.

Shoreline anglers with a Bachelor's degree (n = 31) primarily relied on conversations with other anglers as their main source of fishing information, with 75% of respondents indicating this preference. DNR-provided information was the second most common source, utilized by 61% of anglers in this demographic. Bait shops followed closely behind as the third most important source, with 58% of respondents using this channel. Additionally, 53% accessed online resources, and 47% utilized both social media and state or local regulations. Public meetings were not utilized as an information source among shoreline anglers with a Bachelor's degree.

Shoreline anglers holding graduate degrees (n = 8) showed a preference for digital sources of fishing information such as online social media, DNR sources, and state/local regulations, with 75% indicating use of these channels. Conversations with other anglers, information from bait shops, and other online sources were the second most frequent information sources, utilized by 63% of anglers in this demographic. Public meetings had minimal attendance among shoreline anglers with graduate degrees, with only 13% indicating usage.

3.3 Shoreline Angler Survey Results Summary

The 2023 Milwaukee County Shoreline Angler Survey provided insights into the demographics, motivations, satisfaction levels, and information-seeking behaviors of shoreline anglers. Over the survey period, a diverse group of anglers participated, representing various racial/ethnic backgrounds, income levels, and educational attainment. Enjoying natural scenic beauty emerged as the primary motivation for fishing among respondents, followed closely by the thrill of catching a big fish. Despite variations among demographic groups, overall satisfaction with fishing experiences was positive, with anglers generally content with both the number and size/quality of fish caught per trip. Notably, conversations with other anglers and information provided at local bait/tackle shops were identified as the most prominent sources of fishing information, followed by digital platforms, and resources provided by the DNR and other units of government.

Understanding the nuanced preferences and behaviors of shoreline anglers is essential for effective fisheries management and engagement strategies. By recognizing the demographics, motivations, and preferred information sources within this community, policymakers and stakeholders can tailor outreach efforts and management decisions to better meet the needs and preferences of shoreline anglers.

Shoreline Angler Demographics

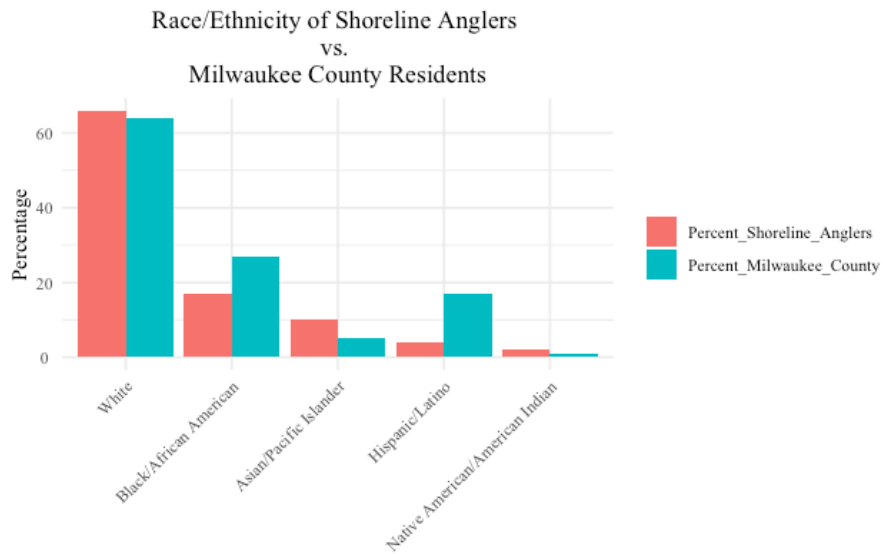
Shoreline Angler Races/Ethnicities

The results of the 2023 Shoreline Angler Survey found that the proportion of white to non-white anglers is representative of Milwaukee County demographics, however representativeness diverges among non-white anglers (Figure 26). Although this comparison revealed both under and over-representation of particular racial groups within the shoreline

angling community, the results reveal a nearly proportional level of engagement in shoreline fishing activities among white and non-white participants. However, Black/African American anglers were underrepresented among shoreline anglers relative to their share of the county population, indicating potential barriers to participation or lower levels of interest within this demographic. Similarly, Hispanic/Latino anglers were also less represented among shoreline anglers compared to

their population proportion, suggesting a need for targeted outreach and engagement efforts to increase their involvement in fishing activities. The overrepresentation of

Figure 26



Note: Comparison of races/ethnicities between Milwaukee County residents and surveyed shoreline anglers (US Census, 2022).

Asian/Pacific Islander anglers and Native American anglers, on the other hand, may indicate specific cultural or social factors that contribute to their higher participation rates in shoreline fishing compared to their proportion of the county population. Additional potential factors may include response bias among racial or ethnic groups, however demographic data was not collected among non-respondents, and therefore cannot be quantified.

Shoreline Angler Income Groups

The examination of household income distribution among respondents in the shoreline angler survey also reveals a diverse economic landscape within the angling community.

Respondents reported a spectrum of income levels, with a median household income of \$60,000 among the survey respondents who elected to disclose this information. A comparative analysis of these income metrics with the median household income for Milwaukee County residents, sourced from the 2022 US Census Bureau data spanning 2017-2021 reveals useful information about shoreline angler socioeconomic status. The median household income for Milwaukee County is \$45,318, significantly lower than the median income reported by survey respondents. This implies that shoreline anglers in Milwaukee County may, on average, possess higher household incomes compared to the broader population.

Shoreline Angler Educational Attainment

The Shoreline Angler Survey also offers valuable insights into the educational attainment levels of surveyed anglers. Understanding the educational background of this stakeholder group is paramount for establishing communication pathways between anglers and decision-makers. Analysis of survey data reveal that a significant proportion of respondents (46%, n = 61) possess a high school diploma, with 14% (n = 19) indicating they have not completed high school. Furthermore, 10% (n = 14) of respondents have attained an Associate degree or equivalent, 24% (n = 32) hold a Bachelor's degree, and 6% (n = 8) have completed advanced degrees, including Master's, Doctorate, Medical, Law. Comparatively, based on 2022 US Census data for Milwaukee County residents over the age of 25, 10% do not hold a high school diploma, 48% carry a high school diploma, 8% have an Associate degree or equivalent, 21% hold a Bachelor's degree, while 13% hold a graduate degree (Figure 27).

The comparison reveals several noteworthy trends. First, Shoreline anglers have a higher proportion of individuals with a high school diploma or less than the general Milwaukee County population. Conversely, a higher

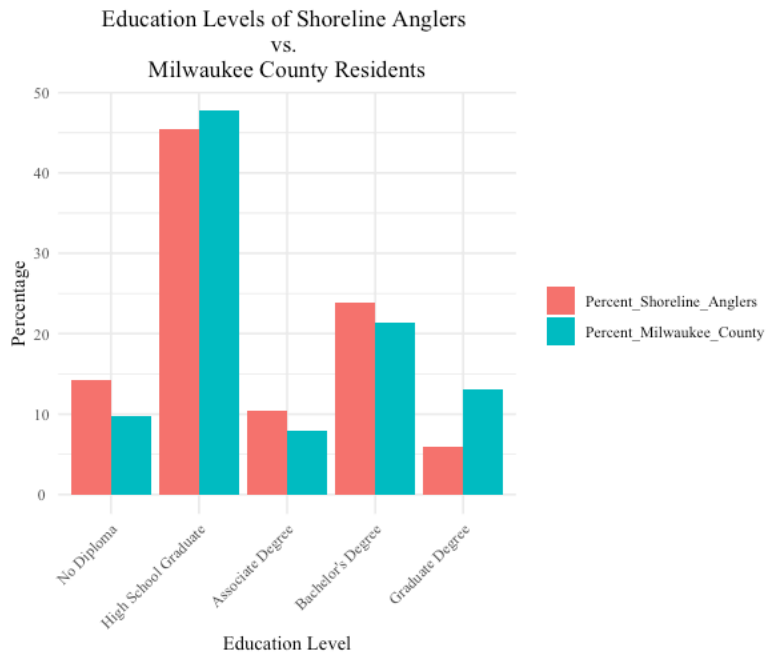
proportion of shoreline anglers hold both Associate and Bachelor's degrees than Milwaukee County residents. Lastly, fewer shoreline anglers hold a graduate degree or equivalent than Milwaukee County residents. This suggests that shoreline anglers have a

generally lower educational

attainment level than the general county population. Understanding these differences is crucial for tailoring communication strategies and engagement approaches to effectively reach and engage shoreline anglers from lower educational backgrounds.

By recognizing the over- and under-representation of certain racial and socioeconomic groups, policymakers can develop inclusive outreach efforts to bridge communication gaps, ensuring that communication pathways are effectively established between shoreline anglers and natural resource policymakers. Building robust communication bridges informed by quantifying the demographic make-up of shoreline anglers enables policymakers to solicit meaningful input, leading to more informed decision-making processes and inclusive management strategies for local fisheries and natural resources.

Figure 27



Note: Comparison of educational attainment between Milwaukee County residents and surveyed shoreline anglers (US Census, 2022).

Shoreline Angler Motivations

The Shoreline Angler Survey also explored the motivations driving participation in shoreline fishing, providing insights across various demographic groups. This analysis revealed that enjoying natural scenic beauty is the primary motivation for fishing, followed by the pursuit of catching trophy fish, fishing as a social activity, the challenge of fishing, and catching a lot of fish. Least important among shoreline anglers, and across most demographic groups, was catching fish to eat. These findings, contrary to Hypothesis 1 in Chapter 1, emphasize the significance of natural scenic beauty within the shoreline angling community.

The analysis of shoreline angler motivations by racial groups provides insights into the drivers behind angling participation. While enjoyment of natural scenic beauty emerges as the primary motivator across all racial and ethnic groups, there are variations in the importance placed on other motivations. For instance, fishing as a means of spending time with family and friends emerged as a prominent motivator, especially among Asian/Pacific Islander and Black/African American respondents, emphasizing the importance of fishing as a social activity within these groups. The challenge of fishing is highest among Asian and Native American shoreline anglers, with moderate ranking among Black/African American and Hispanic/Latino anglers, while the challenge of fishing is least important among White shoreline anglers. Action angling was substantially more important with Asian/Pacific Islander shoreline anglers than the remaining racial groups. Lastly, as previously noted, harvesting fish to eat was the least important motivator for fishing across all demographic groups. However, it is more important for Black/African American and Native American shoreline anglers, and least important for White shoreline anglers.

These findings demonstrate the importance of natural resource managers continuing to provide and support harvesting opportunities in urban areas. This is currently done through the DNR's Urban Pond Stocking program, which provides harvestable size rainbow trout across Milwaukee County's urban ponds. This program is an example of fisheries management for these specific groups, and should be promoted through targeting communication channels to these groups. Additionally, these fishing locations can be utilized as locations of sharing fishing information, or soliciting stakeholder input through angler preference and creel surveys.

The analysis of shoreline angler motivations by income level reveals several trends that also hold implications for fisheries policy. Most notably, consistent prioritization of enjoying natural scenic beauty across all income brackets underscores the importance of preserving and enhancing natural habitats and ecosystems.

Analyzing angler motivations by various education-attainment levels reveals nuanced trends with implications for communication approaches in fisheries management. First, the slight variation in the importance of fishing as a means of spending time with family and friends across education groups suggests the universality of angling as a social activity, regardless of educational attainment. Communication strategies could leverage this finding by emphasizing the social aspects of angling, such as family bonding and social interactions, to appeal to a broad audience of anglers across different backgrounds.

Shoreline Angler Satisfaction

Satisfaction levels among shoreline anglers provides some insights into the recreational value derived from fishing experiences, and allows us to infer factors influencing satisfaction across demographic groups. Anglers generally expressed moderate-high satisfaction with both the number of fish caught per trip and the size and quality of the fish. However, variations were

observed among different demographic segments, including ethnicity, income level, and education level.

Among racial groups, Black and African American anglers reported the highest satisfaction with the number of fish caught per trip, while Hispanic or Latino anglers were the least satisfied in this aspect. Similarly, satisfaction with the size and quality of fish caught per trip varied across racial groups, with White and Native American anglers expressing the highest satisfaction and Hispanic/Latino anglers were least satisfied. These findings suggest that shoreline anglers are generally pleased with the quality of fishing opportunities, and may be related to non-fishing related motivations for engaging in fishing activities.

Furthermore, analyzing satisfaction levels by income brackets revealed interesting trends, with high-income anglers reporting the highest satisfaction with the number of fish caught per trip and middle-income earners being least satisfied. However, no clear trends were discernible in satisfaction with the size and quality of fish caught per trip among income groups.

Similarly, satisfaction levels by education level exhibited variability, with respondents holding no high school diploma reporting the highest satisfaction with the number of fish caught per trip and well-educated graduate degree holding anglers reporting the lowest satisfaction. Despite minor variations, there were no significant differences in satisfaction with the size and quality of fish caught per trip across education groups. From these findings, it is challenging to infer an interplay between socioeconomic factors and angler satisfaction. The answer may be as simple as shoreline anglers are just happy to be out fishing, and fishing outcomes do not correlate with satisfaction.

Primary Sources of Fishing Information Among Shoreline Anglers

Varying primary information sources among shoreline anglers in Milwaukee County demonstrates the diverse channels through which anglers access fishing-related information. Conversations with other anglers and information obtained at bait and tackle shops emerged as the most preferred sources of fishing information across demographic groups. Social media platforms and online resources also played significant roles in providing fishing-related information. It's important to note the survey was administered through social media platforms, creating potential selection bias. However, there were also variations in the utilization rates of different information channels across demographic groups, emphasizing the importance of understanding the preferences and patterns within the angling community for targeted communication strategies.

Analyzing information-seeking behaviors by ethnicity revealed distinct preferences. For example, Asian and Pacific Islander anglers exhibited a higher reliance on online sources for fishing information than other racial groups, while Black and African American anglers favored conversations with other anglers and information provided at bait and tackle shops. Hispanic and Latino anglers also showed preferences for bait/tackle shops and social media platforms. These findings suggest the need for a suite of communication strategies that cater to the specific preferences of targeted audiences, such as leveraging online platforms and promoting community-based information sharing.

Similarly, income level influenced the utilization of different information channels among shoreline anglers. Low-income anglers relied more heavily on conversations with other anglers and information from tackle shops for fishing information, while high-income anglers showed greater engagement with online platforms and DNR sources. Education level also

influenced shoreline anglers' preferred sources of fishing information, with higher-educated anglers showing a greater reliance on digital platforms and DNR sources compared to those with lower educational attainment who relied on conversations with other anglers as a primary means of accessing fishing information.

The implications of these findings for targeted communication strategies and outreach efforts are noteworthy. Previous literature in Chapter 2 identified implementing an array of communication techniques and novel methods of collecting angler preference data. This chapter identified the preferred communication channels among the various segments within the shoreline angling community. In contrast, as is discussed in detail in Chapters 4 and 5, the DNR's reliance on traditional communication channels such as print and digital media, and use of public meetings as a forum to solicit public input on management decisions fails to consider these preferences, thereby illuminating the communication gap between shoreline anglers and natural resource managers. By understanding the preferred information channels and behaviors of shoreline anglers across different demographic segments, fisheries management stakeholders can enhance the effectiveness of communication strategies, ultimately leading to more informed and engaged shoreline angler communities.

Chapter 4: DNR Staff Survey

4.1 DNR Staff Survey Methods

In addition to the Shoreline Angler Survey, a companion DNR Fisheries Management Staff Survey was conducted by Graduate Research Fellow Joseph Bevington from November 23rd, 2024 and a deadline to respond by December 4th, 2023, to evaluate existing policies regarding stakeholder engagement among shoreline anglers, and perceptions of current shoreline

angling in policy and management decisions (Addendum 2). The purpose of this survey was to gather information about current policies and initiatives related to stakeholder engagement within DNR's Bureau of Fisheries Management. The survey of DNR fisheries staff aimed to fill knowledge gaps of current and active plans to integrate shoreline angler perceptions and preferences into stakeholder engagement that may not be reflected in existing policies. This quantitative survey included 10 questions, some open-ended to give respondents the opportunity to provide additional information and nuance. The survey was administered to 90 DNR staff who participate in the Bureau of Fisheries Management Policy and Management across the state of Wisconsin to official government email addresses, which were obtained through an Open Records Request. This quantitative survey was administered electronically via an online survey questionnaire.

Similar to the Shoreline Angler Survey, data collected from the quantitative DNR staff survey was cleaned and prepared for analysis, then analyzed using a variety of techniques including descriptive and thematic analyses utilizing methods employed and suggested under the direction and advisement of Melissa Scanlan. This involved checking the collected data for errors, missing values, and statistical outliers. The final phase of data analysis was data visualization and interpretation. The results of the various statistical analyses were visualized by a variety of means including graphs, charts, and maps to represent the data using RStudio. Data visualization also identified trends, patterns, and outliers within the dataset.

Additionally, the DNR Staff Survey included open-comment opportunities and qualitative data to be gathered in conjunction with quantitative response data. This qualitative data was analyzed following the Morgan and Nica (2020) Iterative Thematic Inquiry method. This method first included identifying recurring themes throughout the survey responses.

Responses were then coded to fit into each of the identified themes. Qualitative responses to each question were analyzed and categorized into the following themes: Funding/Staffing, Public Meetings/Events, Online Resources, Infrastructure, Surveys, Representation through Clubs/Organizations, General Communications, Effort, and N/A. This mixed-methods thematic analysis approach allowed for qualitative data to be analyzed and visualized quantitatively. The results of these analyses were visualized and interpreted in a manner that relays important information. From the survey analyses and visualizations, we were able to make inferential conclusions, which are incorporated into the policy recommendations in Chapter 6.

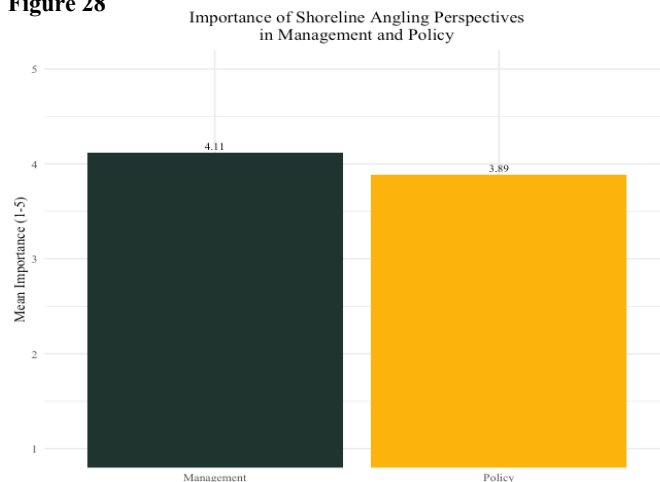
4.2 DNR Staff Survey Results

To complement the survey of shoreline anglers, their perspectives, motivations, and preferred sources of information, a survey of DNR staff was conducted to gather information on approaches to stakeholder engagement, specifically as it relates to shoreline anglers. This survey was administered electronically to 90 staff within the DNR’s Bureau of Fisheries Management, with 44 survey responses for a response rate of 46.8%.

Incorporating Shoreline Angler Perspectives in Management Decisions and Policy Processes

Questions 1 and 2 asked the respondents to reply to the following questions on a scale of 1 -5, with one being “Not Important” and five being “Very Important”. First, in response to the prompt “*From your perspective, how important is it for DNR fishery management plans to emphasize*

Figure 28



Note: Average importance values for incorporating shoreline angler perspectives in management and policy among DNR staff respondents.

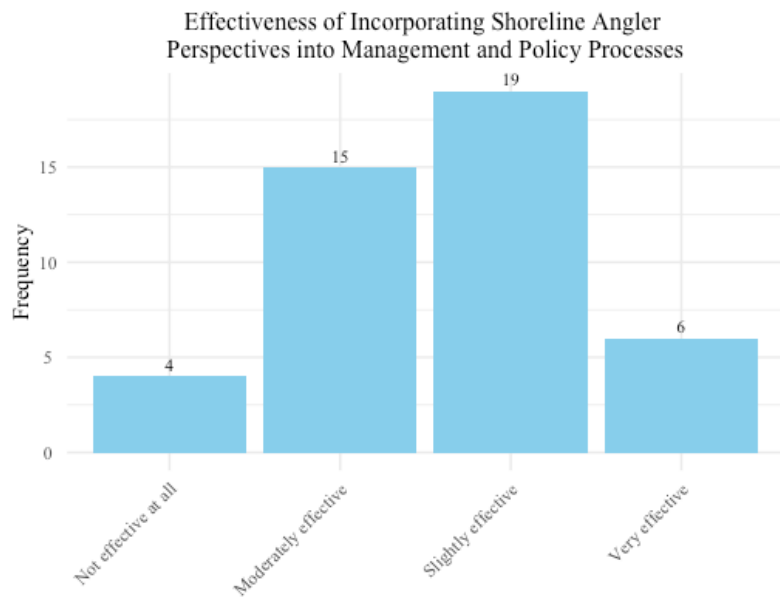
shoreline angling opportunities?” survey respondents indicated a mean importance value of 4.11. Similarly, in response to Question 2, *“From your perspective, how important is it to engage shoreline anglers in policymaking processes?”* survey respondents reported a mean importance value of 3.89 (Figure 28).

Effectiveness of Incorporating Shoreline Angler Perspectives into Policy Processes

Question 3 gauged the perceived effectiveness of incorporating shoreline angler perspectives into policy making decisions by asking *“In your experience, how effective has the program been in incorporating shoreline angler perspectives into policymaking decisions?”* on a scale of Not Effective at all to Very

Effective. Of the 44 responses, four indicated the DNR Bureau of Fisheries Management is “Not Effective at all”, fifteen said “Moderately Effective”, nineteen said “Slightly Effective”, and six thought the program was “Very Effective” in incorporating shoreline angler perspectives in policy making processes (Figure 29).

Figure 29



Note: Frequency of DNR staff respondents indicating effectiveness for incorporating shoreline angler perspectives in management and policy.

Awareness of Efforts Including Shoreline Anglers in Management and Policy Decisions

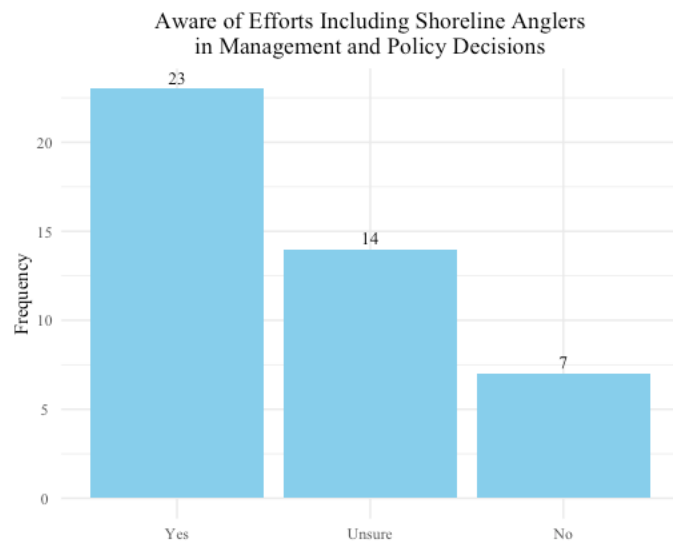
Question 4 asked *“Are you aware of any efforts to include shoreline angling opportunities or shoreline angler groups in fisheries management decisions or policies?”* and

included both a quantitative response, and an open comment to allow for additional detail to survey responses. Approximately half, or 23 of 44 responses indicated they were aware of efforts including shoreline anglers in management decisions and policies, and specified these efforts qualitatively (Figure 30). A thematic analysis of the qualitative survey responses revealed that more than half (12 of 23, 52.2%) of the known efforts to engage shoreline anglers in management and policy decisions utilized creel or mail surveys, nearly a third (7 of 23, 30.4%) indicated public meetings and events

are a mechanism to include shoreline anglers in management and policy decisions. Other known efforts include dedicated funding to shoreline opportunities, developing infrastructure such as signage at popular fishing locations, including shore fishing opportunities in web-based mapping tools, and engaging with shoreline anglers through clubs or

organizations such as Trout Unlimited. However, 48.8% of respondents were unaware of efforts to engage shoreline anglers in management and policy decisions, with one response saying “it has been as struggle to engage these anglers in participating in management decisions and to provide feedback and input into decision making” (DNR Staff Survey, Q4b, Anonymous Respondent #21, Appendix B) and another suggesting “we could be bias[ed] toward boat anglers

Figure 30



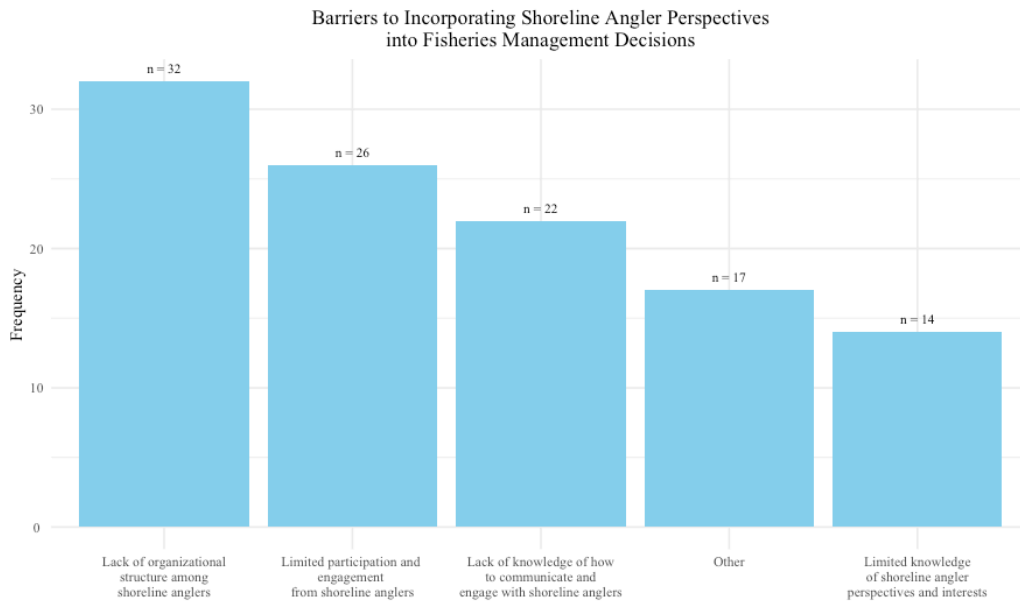
Note: Frequency of DNR staff respondents indicating awareness of efforts to include shoreline angler perspectives in management and policy.

in some instances such as managing for trophy fisheries where access might be a problem for some” (DNR Staff Survey, Q4b, Anonymous Respondent #9, Appendix B).

Barriers to Incorporating Shoreline Anglers into Management and Policy Decisions

Question 5 asked survey respondents, “*What are the barriers or challenges that prevent the DNR from effectively incorporating shoreline angler perspectives into policymaking decisions?*” and they were allowed to select one or multiple from the following options: limited knowledge of shoreline angler perspectives and interests, lack of knowledge of how to communicate and engage with shoreline anglers, limited participation/engagement from shoreline anglers, and lack of organizational structure among shoreline anglers. The most

Figure 31



Note: Frequency of DNR staff respondents indicating barriers to incorporating shoreline angler perspectives in management and policy.

common response was a lack of organizational structure among shoreline anglers, with 72% of survey respondents indicating this as a barrier to incorporating shoreline anglers in management and policy decisions. 59.1% noted limited participation from shoreline anglers, 50% suggested a lack of knowledge of how to communicate with shoreline anglers hindered the agencies abilities,

and 31.8% attributed the barriers to limited knowledge of shoreline angler perspectives and interests (Figure 31). Other barriers noted by survey respondents in open comment responses include general communication issues such as targeted education/outreach strategies and socioeconomic, language or cultural barriers. Additionally, three comments noted the lack of vocalization of angling preferences as a barrier, with one response summarizing the issue (DNR Staff Survey, Q5b, Anonymous Respondent #9, Appendix B) as follows:

The general challenge [is] incorporating the perspectives of a non-dominant group. It's easy enough to respond to and incorporate perspectives of larger groups of anglers that have representation through organized groups or associations or whose views are just very dominant in the public conversation. It's challenging to address those at the same time as addressing the perspectives of each less vocal or less dominant group which would certainly include shoreline anglers.

Overall, a “lack of shoreline fishing and shoreline angler-specific directed conversations” (DNR Staff Survey, Q5b, Anonymous Respondent #38, Appendix B) was a prevailing theme among survey respondents who reported experiencing barriers to incorporating shoreline anglers in fisheries management and policy decisions.

Successful Communication Methods for Engaging Shoreline Anglers

To evaluate successful communication strategies for engaging with shoreline anglers, DNR Fisheries Management staff were asked in Question 6, “*Are you aware of specific communication methods that have proven particularly successful in connecting with shoreline anglers?*” Of the 44 respondents, 30 (68%) indicated they were not aware or unsure of any successful examples of effective communication strategies (Figure 32). Among the 14 respondents who indicated “Yes”, 6 (43%) noted conducting in-person and online creel surveys as examples of effective communication with shoreline anglers. One respondent noted how creel

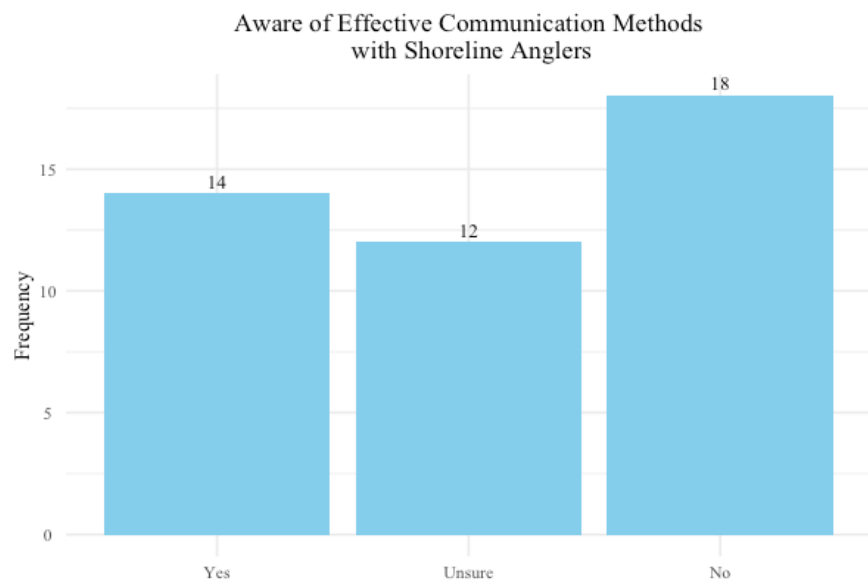
clerks are used to share information with shoreline anglers (DNR Staff Survey, Q6b, Anonymous Respondent #19, Appendix B):

Because shore anglers rarely belong to an organized fishing club, the Lake Michigan/Green Bay creel program strives to keep creel clerks informed of upcoming meetings, public comment periods, etc. so that creel clerks can inform the shore anglers they interview.

Of the survey responses, 4 out of 14 (28.6%) indicated participation in public forums such as

meetings, club events, or public demonstrations as successful communication methods for engaging with shoreline anglers. Other successful communication methods include using social media, and signage posted at popular shore fishing locations.

Figure 32



Note: Frequency of DNR staff respondents indicating knowledge of effective communication methods with shoreline anglers.

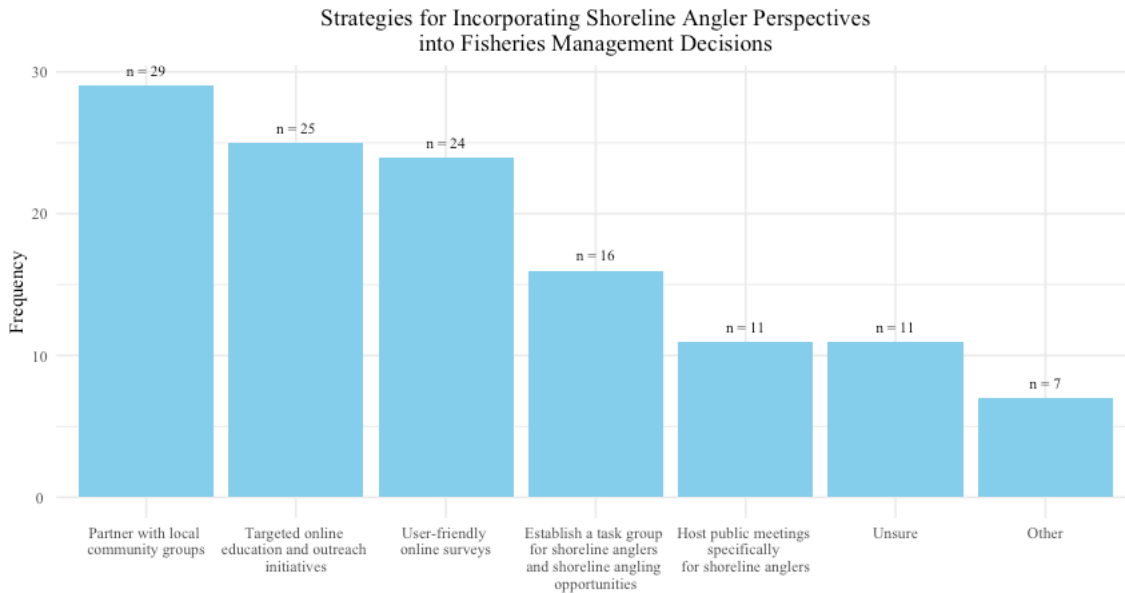
Strategies for Incorporating Shoreline Angler Perspectives into Fisheries Management

Decisions

Similarly, Question 7 asked DNR staff “*What strategies or resources do you think the DNR should use to incorporate the perspectives of shoreline anglers into policymaking decisions?*” to gauge potential mechanisms for building bridges to make fisheries management and policy reflective of shoreline angler’s interest. Respondents were allowed to select multiple options from the following: Partner with local community groups, Targeted online education and outreach initiatives, User-friendly online surveys, Establish a task group for shoreline anglers

and shoreline angling opportunities, Host public meetings specifically for shoreline anglers, Unsure, and Other. 29 of 44 (65.9%) indicated partnering with local community groups as a potential strategy for incorporating shoreline angler perspectives. 25 of 44 (56.8%) suggested

Figure 33



Note: Frequency of DNR staff survey respondents indicating potential strategies for incorporating shoreline angler perspectives into fisheries management decisions.

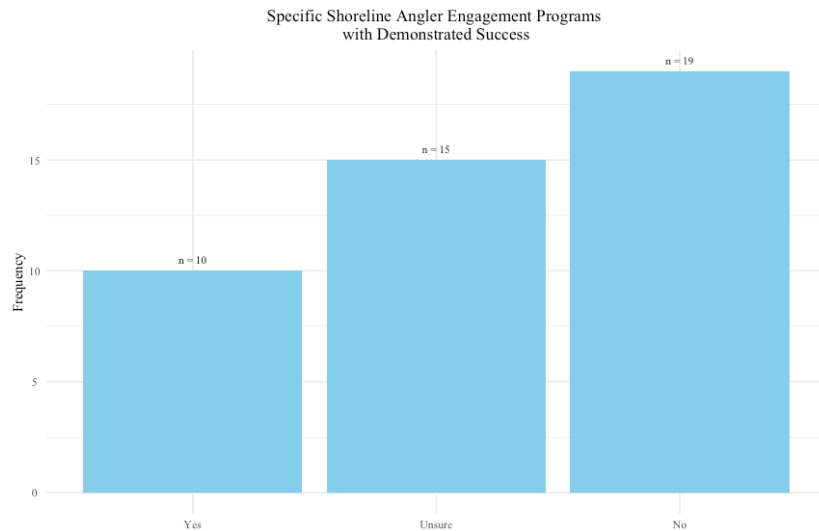
targeted online education and outreach initiatives. 24 of 44 (54.5%) marked user-friendly online surveys. 16 of 44 (36.4%) consider establishing a task group for shoreline anglers and opportunities as a strategy to involve shoreline anglers in fisheries management activities. 11 out of the 44 respondents noted convening public meetings specifically for shoreline anglers as a mechanism for incorporating shoreline angler interests in fisheries management decisions (Figure 33). Other observations noted through the open-comment option regarding potential strategies to better involve shoreline anglers included direct outreach through creel surveys, partnering with local units of government, and translating various forms of DNR communications into various languages.

Specific Engagement Programs with Demonstrated Success

According to the survey responses to Question 8 which asked, “*Are you aware of specific engagement initiatives or programs that have demonstrated success in incorporating shoreline angler perspectives into management decisions?*”, there were 10 instances where respondents indicated awareness of specific engagement initiatives or programs that have demonstrated success in incorporating shoreline angler perspectives into management decisions. Conversely, 19 respondents reported no knowledge of such initiatives, while 15 were unsure (Figure 34). To further explore the effectiveness of these initiatives, those who responded “Yes” provided examples. One common example provided is the integration of shoreline angler input via surveys. For instance, one respondent highlighted the effectiveness of creel surveys, particularly those incorporating angler preference questions, stating, "Creel Surveys with angler preference questions" (DNR Staff

Survey, Q7b, Anonymous
Respondent #16,
Appendix B) Another
respondent emphasized
the importance of
stakeholder meetings and
online platforms for
gathering input, noting
that posting meetings

Figure 34



Note: Frequency of DNR staff survey respondents indicating knowledge of engagement strategies with demonstrated success incorporating shoreline angler perspectives into fisheries management decisions.

online has led to increased participation and feedback from shoreline anglers. Additionally, the Lake Michigan Trout and Salmon Angler survey and the Winnebago spearer surveys were

mentioned as initiatives specifically aimed at understanding the views of shoreline anglers. Furthermore, the establishment of dedicated stakeholder engagement teams and the inclusion of shoreline angler perspectives in management plans demonstrate organizational efforts to formalize and institutionalize the incorporation of shoreline angler input into decision-making processes.

Improving Communication and Outreach Efforts for Shoreline Angler Involvement

Question 9 prompted survey respondents “*How can the DNR improve its communication and outreach efforts to ensure that shoreline anglers have the opportunity to provide input into fisheries management decision-making process?*”, to which 33 of the 44 survey respondents provided comments. Suggestions include integrating contact information collection during creel surveys, dedicating more resources to outreach initiatives, and deploying technology like QR codes at popular fishing locations to direct anglers to relevant resources. Moreover, there is a consensus on the need for proactive engagement strategies, such as DNR staff actively seeking out shoreline angler perspectives in the field and expanding outreach efforts within the angling community. As Anonymous Survey Respondent #16 summarized in response to Q10 (Appendix B),

DNR needs to reach out to this community more intentionally and in different ways than standard communication pathways. These groups are often underserved in other areas of society and DNR doesn't reach these folks enough, or effectively even though every urban area has lots of shore anglers in WI, we don't even have a way to quantify the # of shore anglers across the state to understand the need or gaps.

Respondents also highlighted the importance of understanding the demographics and preferences of shoreline anglers, particularly in urban areas, to tailor outreach efforts effectively. While three respondents expressed reservations about singling out shoreline anglers from other user groups, there was a common thread among five respondents emphasizing the need for improved access

to quality shoreline fishing locations, particularly along lakes and rivers. Lastly, several participants noted the geographic heterogeneity of shoreline angling on the landscape, with many shoreline anglers centralized in urban centers across the state, with fewer in rural areas. Consequently, DNR staff with areas of responsibility in rural parts of the state don't see the need to single out the shoreline angler user group in management decisions, while simultaneously recognizing the importance of engaging shoreline anglers in urban fisheries.

Other Thoughts and Ideas Regarding Shoreline Angler Participation in Fisheries

Management

The last question provided survey respondents an open comment opportunity to capture any remaining thoughts on the topic that the survey instrument may not have prompted by asking *“Do you have any other thoughts, suggestions, or ideas regarding shoreline angling opportunities and shoreline angler participation in the Bureau's policymaking processes?”*.

There is a recurring theme among the 16 comments regarding the need for enhanced communication and outreach efforts to engage shoreline anglers effectively. One respondent emphasized the importance of identifying and contacting shoreline anglers directly, "We need to identify who shoreline anglers are and how to contact them" (DNR Staff Survey, Q10, Anonymous Respondent #4, Appendix B). Further, there were calls for more intentional outreach efforts, particularly targeting underserved communities of shoreline anglers. One respondent emphasized the need for alternative communication pathways, stating, "DNR needs to reach out to this community more intentionally and in different ways than standard communication pathways" (DNR Staff Survey, Q10, Anonymous Respondent #16, Appendix B). Additionally, suggestions were made to focus outreach efforts on areas with abundant shoreline

fishing opportunities and to encourage DNR staff to gain firsthand experience with shoreline fishing to better understand the needs of this stakeholder group.

Respondents also touched on the need to integrate diversity, equity, and inclusion (DEI) goals into shoreline opportunity objectives and collaborate with programs like the Recruit, Retain, Reactivate (“R3”) program to obtain angler feedback. This program within the DNR “recruitment, retention and reactivation of hunters, anglers and shooting sports participants” and focuses their efforts “on the needs of individuals and the process required to ensure their starting and continued participation in hunting, angling and shooting sports” (Recruit, Retain and Reactivate Hunters and Anglers | Wisconsin DNR, n.d.) However, there were also perspectives expressing satisfaction with the current level of representation for shoreline anglers or suggesting that shoreline anglers make up a relatively small proportion of the overall angling community in certain regions.

Chapter 5: DNR Fisheries Management Policy and Communication

Analysis

Effective policy development and communication are essential for ensuring sustainable resource utilization and stakeholder satisfaction. To understand Fisheries Management policies, it's essential to first understand the context of fisheries management in Wisconsin. The Wisconsin DNR is responsible for managing the state's diverse fisheries resources, including lakes, rivers, and streams, covering over 15,000 lakes and over 13,500 miles of navigable rivers and streams (Wisconsin Water Library). The DNR’s Bureau of Fisheries Management aims to balance the ecological health of aquatic ecosystems with the socioeconomic interests of anglers, recreational users, and other stakeholders through various adaptive management plans. These

plans, developed by agency experts in consultation with stakeholders, and reviewed by policymaking bodies within the agency, serve as guiding documents for DNR fisheries policy and management efforts, and outline the visions, goals, objectives, and tactics to meet ecological and social demands. Fisheries management plans are adaptive, undergoing regular review, analysis, and updates to accommodate the evolving dynamics of ecosystems and resource demands in ten-year cycles. They rely on current, scientifically driven data and public input to ensure management goals are met.

This chapter provides an in-depth analysis of the DNR fisheries policies by reviewing and analyzing seven active and publicly available DNR Fisheries Management Plans to identify the role of shoreline angling in fisheries management and the agency's approaches to communication and stakeholder engagement in policy processes. Section 5.1 focused specifically on identifying references to shoreline angling, communication strategies, and approaches to stakeholder engagement in fisheries management planning. It then aligns goals and objectives from plans with DNR Staff Survey results in Chapter 4, assessing their actual implementation on the landscape. Section 5.2 provides comprehensive view into the DNR's communication and stakeholder engagement approaches by comparing the goals of the management plans with DNR staff actions. Section 5.3 focuses on the barriers to effective communication and engagement by illuminating deficiencies in DNR policies, and then supports those findings with results from DNR Staff survey responses. By examining these critical aspects, the purpose of this chapter is to provide a comprehensive understanding of the current stakeholder engagement strategies and identify barriers to effective communication and engagement with shoreline anglers.

Understanding the current state of fisheries policy and communication and identifying

communication barriers with shoreline anglers creates an opportunity to improve participation and collaboration with this stakeholder group in fisheries management policy processes.

5.1 Analysis of Current DNR Policies Regarding Shoreline Angling in Fisheries Management Plans

Fisheries Management Plan Analysis Methods

The review of DNR fisheries management plans for policies related to including shoreline angling involved several key steps. The purpose of this methodology was to determine if fishery management plans are developed and implemented to provide shoreline angling opportunities and incorporate shoreline angler interests and perspectives in management actions. To do so, it was imperative to identify the existing policies within the Wisconsin DNR, and Bureau of Fisheries Management specifically, related to shoreline anglers and stakeholder engagement. This included a review of all publicly available and active species- and waterbody-specific management plans for items related to shoreline angling, stakeholder engagement, and communications strategies.

First, we obtained publicly available DNR Fisheries Management plans from the Wisconsin DNR website. Additionally, we submitted an Open Records Request to obtain remaining management plans that may not be listed publicly online. In total, we obtained six active management plans and relevant appendices:

1. “A Ten-Year Strategies Plan of Fisheries Management in Wisconsin. 2015-2025.”
2. “Lake Michigan Integrated Fisheries Management Plan. 2017-2026.”
3. “Lake Michigan Integrated Fisheries Management Plan. 2017-2026. Supplemental Appendix. Responses to Comments on Draft Plan.”

4. “Wisconsin Inland Trout Management Plan. 2020-2029.”
5. “A 10-Year Strategic Plan of Managing Wisconsin’s Panfish (2015).”
6. “Walleye 2022 – An Updated 10-Year Walleye Management Plan for Wisconsin.”

This study selected the species-specific plans of walleye, panfish, and trout because of their accessibility for shoreline angling and desirability for shoreline anglers in Milwaukee County.

Then, a comprehensive review of these fisheries management plans was conducted by searching for references with key words including: “shore”, “shoreline”, “shore-based”, “nearshore”, “stakeholder”, “communication”, “engagement” and “anglers” to evaluate the approaches to public communication, stakeholder engagement, and shoreline angling opportunities in fisheries policy. References to these key words were pulled and organized within each plan's framework to align with specific goals, objectives, strategies, or actions into a working outline, which enabled a focused analysis of these themes.

DNR Fisheries Management Plan Analysis Summary

While several management plans (Fisheries Management Strategic Plan, Lake Michigan Integrated Fisheries Management Plan and Appendix, and Wisconsin Inland Trout Management Plan) reference various intentions to incorporate shoreline angling in management decisions, the remaining (Panfish Management Plan, Walleye Management Plan) fall short in addressing the unique perspectives, interests, and opportunities among shoreline anglers.

The Fisheries Management Strategic Plan recognizes the “changing demographics, values and information sources among resource users” and emphasizes the need to “plan for traditional user groups requiring difference resources [...] such as providing more shorefishing locations and opportunities in areas other than those they have traditionally fished, especially in urban

areas” (Wisconsin DNR, 2015, p. 8) Specifically, within Goal 2 of “providing a variety of opportunities for diverse sustenance, recreational, and commercial fisheries based activities” objective 2.1 states the program will “manage and provide for diverse recreational fishing opportunities, including trophy, action, put-grow-and-take, angler access, and changing demands” by, to the extent feasible, “identify[ing] good shorefishing and other angler access opportunities on Department-owned properties and emphasize those that will incur the greatest use, serve communities where most needed, and comply with the ADA; ensure that such angling opportunities are considered and identified when setting property objectives in DNR Plans” (Wisconsin DNR, 2015, p.16). Looking ahead, the program “maintains a commitment to achieving excellence in these same areas, such as maintaining the program’s safety culture, developing our hatchery system and shorefishing opportunities, and investing in staff” (Wisconsin DNR, 2015, p. 4).

The Lake Michigan Integrated Fisheries Management Plan recognizes the ecological importance of shoreline and nearshore zones throughout the document. However, as it relates to resource usage, Goal C aims to “enhance tributary, shore, and near-shore fishing opportunities” and recognizes the resource demand of shoreline fishing and the implications for angler recruitment (Wisconsin DNR, 2017, p. 33). It also notes the request among anglers to evaluate and enhance the shore and nearshore fishery of Lake Michigan. Objective 1 “seek[s] to improve both quality and quantity of access to shore, near-shore, and tributary fishing opportunities” by Tactic A - working with private sector and other governmental groups for increasing shoreline access, and Tactic C - improving public knowledge of existing shoreline access locations through maps on webpages and other media (Wisconsin DNR, 2017, p. 33-34).

The Wisconsin Inland Trout Management Plan also references the goal of providing diverse stream and bank angling opportunities in Goal 2, Objective 2.2, Strategy 2.2.D, Action 2.2.D.1 and Action 2.2.D.2. by, to the extent feasible, “provide increased opportunities for anglers and remove barriers to resource access” by “improv[ing] and develop[ing] good shorefishing or angler access opportunities on DNR-owned and other public properties; utilize pier grant program and other resources to provide public fishing areas near fishery areas with trout streams and lakes [...] and prioritize habitat project locations to meet angling demographics, changing populations, and in urban areas to meet angler demands” (Wisconsin DNR, 2019, p. 50)

While four of the DNR Fisheries Management policy documents reference the importance of accommodating and engaging shoreline anglers, two fail in integrating shoreline angler perspectives and needs into policy frameworks, underlining the need for more inclusive policy approaches moving forward: *Walleye 2022 – An Updated 10-year Management Plan for Wisconsin Walleye* and *A 10-Year Strategy for Managing Wisconsin’s Panfish*. While the remaining management plans reference these search terms, they are only referenced in the context of ecological function or habitat, and not in reference to resource usage or angling efforts. Of particular note is the lack of reference to shoreline anglers or angling in the Panfish Management Plan. Based on the results of the Shoreline Angler Survey, 91 out of 134 (67.9%) survey respondents indicated panfish as a primary target species when fishing from shore. This illustrates a policy disconnect for panfish management specifically. An area for improvement across all of the plans reviewed is to incorporate shoreline angling and angler perspective to improve satisfaction, communication and engagement with this stakeholder group.

5.2 Approaches to Stakeholder Engagement

Stakeholder engagement is a critical aspect of effective fisheries management, and is a cornerstone for decision-making processes and the DNR’s public trust responsibilities (Fisheries Management Strategic Plan 2015-2025). Furthermore, effective stakeholder engagement allows the DNR to gather knowledge, identify concerns, and solicit feedback on management and policy decisions, with the goal of building trust, fostering transparency, and promoting public and private partnerships to achieve management goals. Based on the results of the DNR management plan analysis and staff survey, the DNR’s approaches to stakeholder engagement fall into four key thematic categories: 1) Public Meetings and Demonstrations, 2) Advisory Committees and Working Groups, 3) Partnerships, and 4) Creel and Angler Preference Surveys. In this section, we provide an in-depth look at the DNR's communication and stakeholder engagement strategies by examining how DNR staff actions align with the goals outlined in the management plans.

Public Meetings and Demonstrations

A policy analysis of the six management plans/appendices revealed reference to public meetings and demonstrations as a key strategy for stakeholder engagement. Goal 3, Objective 3.1, and Strategy 3.1.F of the Fisheries Management Strategic Plan aims to, to the extent feasible, “keep the general public informed and gather input, when necessary, on important emerging issues through public meetings...” (Wisconsin DNR, 2015, p. 19.). Additionally, Goal 4 of the Fisheries Management Strategic Plan aims to engage new and existing anglers and recognizes the increasing diversity among anglers, particularly in urban areas where shorefishing is more prevalent (Wisconsin DNR, 2015, p. 8). Within Goal 4, Objective 4.3 seeks to “Improve access to information on fishing opportunities and regulations through online, Smartphone, or other media resources for shorefishing and boat launch locations” by Strategy 4.3.C, “Maintain

the online fisheries regulation database and smartphone application. Integrate additional information, such as shorefishing and access sites, and other details where appropriate” (Wisconsin DNR, 2015, p. 23). Vision V, Goal A, Objective 2, Tactic F of the Lake Michigan Integrated Fisheries Management Plan references public meetings as a means of engaging stakeholders to determine preferences, desires, perceptions, and experiences (Wisconsin DNR, 2017, p. 43). The “Wisconsin Inland Trout Management Plan. 2020-2029” references public meetings 5 times as part of the public involvement plan for soliciting stakeholder input into inland trout management. The formation of the 10-year Strategic Plan of Managing Wisconsin’s Panfish notes 3 public meetings being held in the formation of the plan, with stakeholders engaged through surveys at approximately 30 other public meetings, demonstrations, or other events (Wisconsin DNR, 2015, p. 30). Avenue 2 of the “Walleye 2022 – An Updated 10-Year Walleye Management Plan for Wisconsin” notes virtual public stakeholder meetings as one means of stakeholder engagement. Due to COVID-19 pandemic, the program was forced to pivot from traditional in-person meetings to virtual public meetings, and hosted 13 virtual events, with 347 people participating (Wisconsin DNR, 2022, pp. 15-16). Additionally, due to the strong interest in walleye management among sovereign tribal nations in Wisconsin, virtual public meetings with this specific stakeholder group were also conducted to solicit management and policy feedback. Furthermore, Goal 4, Objective 4.1 aims to “maintain pro-active public engagement in managing Wisconsin’s walleye/sauger waters” through “traditional input options” including “issue-specific public meetings” (Wisconsin DNR, 2022, p.44).

The results of the DNR Staff Survey also indicate the use of public meetings/events/demonstrations as a primary means of stakeholder engagement, specifically as it relates to shoreline anglers. Public meetings were indicated by a quarter of DNR survey

respondents as a strategy for involving shoreline anglers and referenced qualitatively 7 times as an effort to include shoreline anglers in fisheries management and policy decisions, 4 times as examples of successful communication methods for connecting with shoreline anglers, and 6 times as recommendations for improving communication and outreach to shoreline anglers. The alignment between the management plan analysis and the results of the DNR Staff Survey reinforces the significant role of public meetings and events as primary strategy the DNR employs for engaging stakeholders.

However, the results of the Shoreline Angler Survey found public meetings as the least utilized source of fishing information, with 7% of shoreline anglers attending and participating in these events, with several subgroups of respondents including Black/African American and Hispanic attending zero fisheries management public meetings. These findings illustrate the disconnect between this DNR stakeholder engagement strategy and shoreline anglers' preferences for how to be involved in management and policy decision-making processes.

Advisory Committees and Working Groups

Additionally, to incorporate stakeholders in management and policy decisions, the DNR convenes advisory committees, task groups, and other teams composed of external partners including anglers, conservation groups, tribal representatives, and private sector professionals. These committees provide recommendations and guidance on fisheries management policies, regulations, and initiatives.

Within the broader Fisheries Management Strategic Plan's Goal 3 of promoting public awareness, understanding, and involvement with the fisheries management program, to accomplish Objective 3.1 of proactively engaging with the public to promote understanding of

what the fisheries program does, to the extent feasible, Strategy 3.1.G specifies the program will “assess the need and feasibility of including additional non-DNR members... on teams and task groups in order to gather greater public input” (Wisconsin DNR, 2015, p.19).

The Lake Michigan Integrated Fisheries Management Plan puts heavy emphasis on participation in advisory groups such as the Wisconsin Federation of Great Lakes Sport Fishing Anglers, Commercial Fishing Board, UW Sea Grant in Vision V, Goal A, Objective 1, Tactic A, and Objective 2, Tactics C, E, and F (Wisconsin DNR, 2017, 73-76). The Trout Management Plan’s public involvement included the “formation of an advisory group... and sought diverse perspectives on managing inland trout” (Wisconsin DNR, 2019, p. 8). Additionally, this plan listed stakeholder groups, described how a stakeholder team would be formed, their roles, and the goals of stakeholder meetings (Wisconsin DNR, 2019, p. 2, 8-9).

The incorporation of advisory committees, task groups, and external partners within the DNR’s stakeholder engagement framework reflects an effort to increase participation and broader representation. However, based on the results of the Shoreline Angler Survey, just 7 out of 134 (5%) of Shoreline Angler Survey respondents indicated membership in a fishing-related club or organization. Such organizations include Salmon Unlimited, B.A.S.S., National Professional Anglers Association, Trout Unlimited, Milwaukee Bassers, Milwaukee Chapter of the Great Lakes Sportfishing Club, and Backcountry Hunters and Anglers (Addendum A). These organizations are not among those identified above by DNR as their key stakeholder groups. Further, the lack of an organizational structure for shoreline angling groups and low participation in existing broader groups poses a challenge for utilizing this strategy to incorporate shoreline anglers in these processes.

However, survey responses from the DNR staff illuminate several challenges associated with limited attendance and participation at these gatherings. The general communication challenges with engaging lower socioeconomic groups that may have cultural or language barriers, may have a compounding effect, meaning these anglers are less likely to participate in government-hosted public meetings. Results from the Shoreline Angler Survey validate this limited participation with only 19 of 134 respondents (14%) of responding shoreline anglers indicating they have previously participated in public meetings regarding fish management with 7% of all respondents indicating use of public meetings as a source of fishing information among shoreline anglers. Furthermore, there is a recognition among DNR staff that public meetings and events “tend to attract more vocal and dominant angling groups”, such as those associated with sportsman clubs (DNR Staff Survey, Q5b, Anonymous Respondent #8, Appendix B). This dynamic can marginalize the perspectives of shoreline anglers exacerbating the challenge of ensuring inclusive engagement. Despite this barrier, there is acknowledgment among responding DNR staff of the necessity to address the preferences and needs of shoreline anglers within broader fisheries management policies. However, achieving this goal will require novel approaches to overcome communication challenges that prevent the voices of shoreline anglers from being heard and integrated into decision-making processes. Recommendations on novel approaches to increasing shoreline angler engagement are detailed in Chapter 6.

Partnerships with non-DNR Entities

The DNR collaborates with various private and public sector partners, including other government agencies, non-profit organizations, academic institutions, private consulting firms, and tribal governments to enhance stakeholder engagement efforts. These partnerships leverage resources, expertise, and networks to reach a wider audience and address complex fisheries

management challenges. Partnering with non-DNR entities to accomplish fisheries management goals and objectives is a recurring theme throughout the program's various management plans.

In line with Goal 3 of the statewide Fisheries Management Strategic Plan to “promote public awareness, understanding, and involvement...” (Wisconsin DNR, 2015, p. 19). Objective 3.3 clearly states the program will “foster strong partnerships and advance the fisheries program by working with volunteers and other groups; continue to pursue new partnerships” (Wisconsin DNR, 2015, p. 20). Furthermore, Goal 4 aims to “engage new and existing anglers” and attributes a rise in license sales to “increased program partnerships with a diverse angler base that drives the program to meet a wider range of angler expectations” (Wisconsin DNR, 2015, p. 22). The results of the Shoreline Angler Survey indicated partnerships with this diverse angler group remain minimal due to the lack of organizational structure and low participation in existing broader angling groups.

The Lake Michigan Integrated Fisheries Management Plan places heavy emphasis on leveraging partnerships both for Vision IV - science-based management, as well as Vision V - effective internal and external communications (Wisconsin DNR, 2017, pp. 66, 73). The Wisconsin Inland Trout Management Plan Goal 4 is to “maintain and expand partnerships and engage diverse anglers, stakeholders, and the general public” Wisconsin DNR, 2019, p.61). Related to this goal, of the 44 DNR staff surveys, four staff reported Trout Unlimited as a key partner group. Goal 3 of the Panfish Management Plan states the program will “engage new and existing panfish anglers and partners” (Wisconsin DNR, 2015, p. 19). While Objective 1, Strategy 2, Action A calls for the program to “initiate and explore more partnerships” for habitat enhancement (Wisconsin DNR, 2015, p. 21). The Walleye Management Plan relies heavily on

the involvement of partnerships and lists an extensive collection of public and private partners for various fish management needs (Wisconsin DNR, 2022).

The emphasis on engaging stakeholders through partner groups is also evident in the thematic analysis of qualitative responses to the DNR Staff Survey, where 6 respondents indicated that working through clubs and organizations provided the Fisheries program a means of including shoreline anglers in management and policy decisions, as well as examples of successful communication methods for engaging with this stakeholder group. Through various strategies such as public meetings and demonstrations, advisory committees, creel and angler preference surveys, and partnerships with non-DNR entities, the DNR attempts to involve stakeholders to gather knowledge, identify concerns, and solicit feedback on management and policy decisions. The alignment between management plans, such as the Fisheries Management Strategic Plan and Lake Michigan Integrated Fisheries Management Plan, and the findings from the DNR Staff Survey signifies the importance of these engagement strategies for DNR. However, based on the results of the Shoreline Angler Survey, shoreline anglers have low participation rates in existing angling groups and lack an organization that focuses on shoreline angling interests, thus creating a barrier to DNR being able to effectively engage with shoreline anglers when it relies on organizations as surrogates or spokespersons for these interests.

Stakeholder engagement through partnerships plays a crucial role in ensuring that the perspectives of diverse resource users are adequately considered in fisheries management efforts. However, survey responses reveal a notable gap in the involvement of shoreline anglers in partnership initiatives: 5% of shoreline angler survey respondents indicated they participate in a fishing-related club or organization. However, the clubs and organizations noted in the open-comment responses to Question 22 of the Shoreline Angler Survey include BASS, Milwaukee

Chapter of the Great Lakes Sportfishing Club, Milwaukee Bassers, Trout Unlimited, Salmon Unlimited and the National Professional Anglers Association (Addendum A). While these groups likely include an unknown number of shoreline anglers, none are solely dedicated to shoreline angling. To the extent of the information available, fishing-related clubs and organization specifically tailored to shoreline angling in Milwaukee are non-existent. Consequently, the absence of established organizational structures among shoreline angling groups presents a significant obstacle to their effective engagement and participation in fisheries actions.

While shoreline angling-specific clubs do not exist at present time, alternative options for engaging shoreline anglers include collaboration with community and other outdoor recreation-oriented entities. The DNR does hold various public events, fishing clinics, and angler education/outreach efforts through the internal Recruit, Retain, Reactivate (“R3”) program and collaborates with community partners to provide fishing equipment and information to anglers. Specifically in Milwaukee, this program collaborates with the Sixteenth Street Community Health Center, Milwaukee Riverkeeper, and the Urban Ecology Center. With these programs already in place, venues such as fishing clinics or public demonstrations with partner groups can and should also be utilized as a venue for soliciting shoreline angler input on fisheries management decisions.

Creel and Angler Preference Surveys

The DNR conducts creel surveys not just to gather biological or resource use data, but also to gather feedback from stakeholders on management activities such as stocking, habitat restoration and regulation changes. These surveys can be administered in-person to anglers, sent electronically or mailed to license holders, and help assess public opinions, preferences, and

attitudes towards fisheries management issues. Thus, DNR heavily utilizes this strategy for stakeholder engagement. Although creel and angler surveys are not specifically referenced in the Fisheries Management Strategic Plan, the importance of using this approach to engage stakeholders is evident in the species- and waterbody-specific management plans, as well as the in the results of the DNR Staff Survey.

Analyzing the various management plans reveals multiple references to using surveys as a communication and engagement tool. In Vision V "Effective Internal and External Communication" of the Lake Michigan Integrated Fisheries Management Plan, Objective 2, Tactic D aims to "Use formal survey methods as needed to obtain public feedback on important management issues" such as creel, online, and mail surveys (Wisconsin DNR, 2017, p. 76). Stated in Goal 2 of the Inland Trout Management Plan is to "protect, develop, enhance, and restore trout populations and trout angling opportunities for diverse preferences and needs" (Wisconsin DNR, 2019, p.47). This is accomplished by Objective 2.2, which involves "providing increased opportunities for anglers and removing barriers to resource access," along with Strategy 2.3.C, which focuses on "understanding and incorporating angler preferences" (Wisconsin DNR, 2019, p. 48, 52). The DNR's Inland Trout Management Plan includes continuing to include trout questions in angler diary/creel mail surveys (2.3.C.1) and conducting follow-up mail surveys on trout fishing and trout streams (2.3.C.2) (Wisconsin DNR, 2019, p.52). Action A, Objective 3 of the Panfish Strategic Management Plan to engage and inform anglers aims to "increase the frequency with which we characterize angling preferences", accomplished by Strategy 2 "utilize novel creel techniques to measure panfish angler behavior" (Wisconsin DNR, 2015, pp. 26-27). The 2022 Walleye Management Plan also utilized a random mail/online survey in 2020 as part of an update to the plan as well as incorporates biological data

into science-based management decisions through angler creel surveys (Wisconsin DNR, 2022). Looking ahead, this plan intends to collect social data on walleye management practices again in 2030 (Wisconsin DNR, 2022). This plan acknowledges the importance of utilizing surveys to administer outreach programs (Wisconsin DNR, 2022).

The results of the DNR Staff Survey further reveal the DNR's reliance on creel and angler preference surveys as a mechanism of stakeholder engagement. Specifically, more than half (55%) of respondents to the survey indicated user-friendly online surveys as a strategy for incorporating shoreline angler perspectives into fisheries management decisions. DNR staff referenced surveys as the most common and most successful method of successful stakeholder engagement with shoreline anglers by 12 of the 44 respondents. Additionally, conducting more creel and angler preference surveys was tied with providing online resources for the most frequently suggested method of improving communication and outreach with shoreline anglers.

The DNR employs a robust survey-based approach to actively engage stakeholders in fisheries management decision-making processes. The goal of using surveys is evident across various management plans, underscoring their significance in understanding public opinions, preferences, and attitudes towards fisheries management issues. Furthermore, the findings from the DNR Staff Survey reaffirm the importance of surveys in the DNR's approach to stakeholder engagement, particularly creel and angler preference surveys, as a primary mechanism for effective stakeholder engagement. However, the 2023 Shoreline Angler Survey is the first of its kind to focus solely on shoreline anglers in Milwaukee County. This is likely the result of, and consistent with several responses in the DNR Staff Survey indicating that, funding and staff shortages remain a challenge to conducting these surveys. In fact, DNR is now correcting this data gap and will be conducting its first shoreline angler survey of Milwaukee County ponds

participating in the Urban Stocking Program in 2024. Based on our angler survey responses and innovative survey methods literature review, we offer research-informed approaches to soliciting shoreline angler perspectives and participation in Chapter 6.

5.3 Barriers to Effective Communication

Effective communication with shoreline anglers is essential for the DNR’s fisheries program to make informed policymaking decisions that align with the diverse interests and perspectives of this stakeholder group. The DNR Staff Survey identified various barriers and challenges hindering the incorporation of shoreline angler perspectives into decision-making processes. These barriers include general communication barriers such as ineffective strategies and language barriers, lack of funding and staffing shortages, limited participation in public meetings/events, and lack of organizational structures among shoreline anglers. Understanding these barriers is crucial for developing strategies to building communication bridges with this stakeholder group in fisheries management.

General Communication Barriers

DNR Fisheries staff most frequently reported general communication issues as a barrier to effective engagement with shoreline anglers. One such example are language barriers. This issue was encountered throughout the Shoreline Angler Survey administration period, and presents a limitation to this research project. However, understanding the diversity among this stakeholder group, among them a component who does not speak English as a first language, is important to bridging communication gaps. Anonymous Survey Respondent #10 surmised “shoreline anglers may be less likely to participate in public venues or receive targeted information” due to lower incomes (Addendum B, Q5b Appendix B). Additionally, as

Anonymous Survey Respondent #39 expressed, “What is an effective way that accurately represents and engages the shoreline angling group is unknown” (DNR Staff Survey, Q5b, Appendix B).

Communication barriers inhibit the Departments ability to effectively engage shoreline anglers, verifying the need for innovative targeted strategies that address cultural, linguistic, and socioeconomic disparities within this stakeholder group beyond traditional methods of outreach. As noted in Section 3.3, the primary sources of information among shoreline anglers includes conversations among anglers, information provided at bait shops, and using social media. Utilizing these preferred communication channels and implementing communication approaches such as use of visual aids, crafting communications using clear and accessible language discussed in Section 2.5 are tools that can overcome general communication barriers.

Funding Cuts and Staff Vacancies

The second most common theme regarding barriers to effective communication with shoreline anglers reported by DNR staff was funding and staffing shortages. Since 2006, the Bureau of Fisheries Management has lost 51 full-time positions (T. Kalish, personal communication, March 6th, 2023). Consequently, the program is left with fewer staff and as one DNR staff member opined that they “[...] simply do not have enough people to effectively work with all our stakeholders” (DNR Staff Survey, Q9, Anonymous Respondent #28, Appendix B). In addition to staffing shortfalls, though related, funding cuts and lack of administrative authority to create new positions dedicated to engagement and outreach or other areas of needed work prevent the program from effectively engaging with shoreline anglers. Both funding cuts and staff shortages have impeded the program’s ability to fully harness its most common mechanism of incorporating angler perspectives through creel and angler preference surveys, yet the results

of both the DNR Staff Survey and Shoreline Angler Survey reveal the importance of utilizing direct communications as pathway for engaging shoreline anglers. The challenge lies in obtaining more creel interviews of higher quality by utilizing fewer time and financial resources. To enhance the efficiency and accuracy of fishing creel and angler preference interviews, various techniques and innovations have been developed, with a primary focus on reducing the reliance on creel clerks or minimizing their hours due to spatial, temporal, and budgetary limitations. These innovations in cost-cutting creel survey techniques to increase angler participation while also reducing financial strains are detailed in Section 2.4.

Limited Participation in Public Forums

As previously discussed, public meetings and events serve as essential strategies for engaging stakeholders in fisheries management discussions. However, survey responses from the DNR Staff Survey note several challenges associated with limited attendance and participation at these gatherings. The general communication challenges with engaging lower socioeconomic groups that may have cultural or language barriers, may have a compounding effect, meaning these anglers are less likely to participate in government-hosted public meetings. Results from the Shoreline Angler Survey validate this limited participation with only 19 of 134 respondents (14%) of responding shoreline anglers indicating they have previously participated in public meetings regarding fish management. Additionally, utilizing public meetings was the least common source of fishing information among shoreline anglers, with 7% of all respondents indicating as such. Furthermore, there is a recognition among DNR staff that public meetings and events “tend to attract more vocal and dominant angling groups”, such as those associated with sportsman clubs (DNR Staff Survey, Q5b, Anonymous Respondent #8, Appendix B). This dynamic can marginalize the perspectives of shoreline anglers exacerbating the challenge of

inclusive engagement. Despite this barrier, there is acknowledgment among responding DNR staff of the necessity to address the preferences and needs of shoreline anglers within broader fisheries management policies. However, achieving this goal will require novel approaches to overcome communication challenges preventing these perspectives from being heard and integrated into decision-making processes. Recommendations on novel approaches to increasing shoreline angler engagement are detailed in Chapter 6.

Limited Participation in Fishing Clubs and Organizations

As previously noted, stakeholder engagement through private partnerships plays a crucial role in ensuring that the perspectives of diverse resource users are adequately considered in fisheries management efforts. However, survey responses reveal a notable gap in the involvement of shoreline anglers through partnerships with fishing clubs or organizations. 5% of Shoreline Angler Survey respondents indicated they participate in a fishing-related club or organization. However, the clubs and organizations noted in the survey responses include BASS, Milwaukee Chapter of the Great Lakes Sportfishing Club, Milwaukee Bassers, Trout Unlimited, Salmon Unlimited and the National Professional Anglers Association. To the extent of the information available, fishing-related clubs and organization specifically tailored to shoreline angling in Milwaukee are non-existent. Consequently, the absence of established organizational structures among shoreline angling groups presents a significant obstacle to their effective engagement and participation in fisheries actions.

While shoreline angling-specific clubs do not exist at present time, alternative options for engaging shoreline anglers include collaboration with community and other outdoor recreation-oriented entities. The DNR does hold various public events, fishing clinics, and angler education/outreach efforts through the internal “R3” (Recruit, Retain, Reactivate) program and

collaborates with community partners to provide fishing equipment and information to anglers. Specifically in Milwaukee, this program collaborates with the Sixteenth Street Community Health Center, Milwaukee Riverkeeper, and the Urban Ecology Center. With these programs already in place, venues such as fishing clinics or public demonstrations with partner groups can and should also be utilized as a venue for soliciting shoreline angler input on fisheries management decisions.

Summary

Effective communication with shoreline anglers is crucial for the DNR's fisheries program to make informed policymaking decisions that reflect the diverse interests and perspectives of this diverse stakeholder group and should be emphasized in future fisheries management planning. The barriers identified, including general communication challenges, funding cuts, staffing shortages, limited participation in public forums, and the lack of organizational structures among shoreline angling groups, highlights the need for innovative strategies to build communication bridges between these stakeholders and management decision- and policymakers. Mechanisms for improving shoreline angler engagement and recommended communication strategies are discussed further in Chapter 6.

Chapter 6: Discussion and Recommendations

6.1 Discussion

Although demographics, motivations, and primary sources of information among anglers has been well studied, this project aimed to build on the body of scientific knowledge by focusing these areas of research within a specific population, shoreline anglers, and in a new

study domain, Milwaukee County. Research from Lauber (2017), Furman (2023), and Bradshaw and Legler (2021) were the cornerstone studies this project aimed to build upon, and are discussed in detail in Chapter 2. The results of this study confirm, contradict, and build upon the findings from these studies, and offer unique insights into shoreline angler behavior, communication strategies, and policy options that advances the discipline of science and policy communications in natural resource management.

Lauber and others in 2017 looked at the demographics of anglers from across the Great Lakes region. They found between 6-15% of this population had an annual household income less than \$25,000, 20-32% made between \$25,000-50,000, 41% between \$50,000-100,000 and 39-52% made over \$100,000 annually. The results of the 2023 Shoreline Angler Survey in Milwaukee County closely mirror the socioeconomic distribution from the Lauber (2017) study, with 13% of shoreline anglers making less than \$25,000 annually, 27% between \$25,000-50,000, 41% between \$50,000-\$100,000, and 17% with an annual household income over \$100,000. These findings indicate shoreline anglers in Milwaukee County are socioeconomically representative of the broader Great Lakes angler population.

Lauber (2017) also evaluated the education attainment of Great Lakes anglers, and found nearly a third of this population had a high school diploma or less, a third had either some college or an Associate degree, while a third had a college or graduate degree. In comparison, 60% of shoreline anglers in Milwaukee had a high school diploma or less, 10% had some college education or Associate degree, and 30% held a college or graduate degree. Although shoreline anglers are representative of Great Lakes angler socioeconomic, this study adds additional detail and nuance that this subgroup holds a lower educational attainment.

Research conducted in Key West, Florida by Furman and others published in 2023 not only provided the methodological foundation for the Shoreline Anger Survey, but also offered interesting insights into shoreline angler motivations. They found 71% of the respondents in their shoreline angler assessment were motivated by the recreational purpose of shore-based fishing, while 16% were motivated by harvest opportunities. Within the 16% who valued harvest opportunities, low-income, black, and Hispanic shore anglers were more likely to harvest fish than other demographic groups. However, the 2023 Shoreline Angler Survey of Milwaukee County shore anglers found enjoyment of natural scenic beauty as the most important motivator for fishing, while keeping fish to eat was the least important motivator. Furthermore, this study did not find any relationship between race/ethnicity, and the importance of harvest opportunities in fishing. While these findings do not necessarily contest the findings in Furman (2023), they do indicate geographic heterogeneities in the importance of harvesting fish across study domains.

Bradshaw and Legler's 2021 Lake Michigan Salmon and Trout Angler Preference Survey provides the closest analog both in terms of study domain and target population. They found, among Lake Michigan salmon and trout anglers, of which Milwaukee shoreline anglers are a sub-population, primary sources of fishing information to be: 70% conversations with other anglers, 50% DNR Sources, 35% social media, 11% online, and 5% information share through DNR-hosted public meetings. The 2023 Shoreline Angler Survey affirms the popularity of these information channels, with some nuanced differences. While conversations with other anglers (78%), DNR sources (52%), and public meetings (7%), closely mirror the results of the 2021 Lake Michigan Salmon and Trout Angler Survey, a higher proportion of Shoreline Angler Survey respondents (58%) utilized social media and (52%) used online resources. These findings both validate the conclusions of the Lake Michigan Salmon and Trout Angler Preference Survey

conducted by Bradshaw and Legler, but also offer new and higher resolution insights into the primary sources of information within the shoreline angler subgroup within the broader Lake Michigan angler population.

This project contributes to the scientific knowledge of angler demographics, motivations, and information sources, particularly among on shoreline anglers in Milwaukee County. By building upon foundational studies such as Lauber (2017), Furman (2023), and Bradshaw and Legler (2021), this research offers unique insights and nuanced understanding within this specific population and geographic domain. The findings highlight the socio-economic representation of Milwaukee County shoreline anglers compared to the broader Great Lakes angler population, revealing similar income distribution but lower educational attainment. Moreover, it provides new perspectives on angler motivations, diverging from previous studies by emphasizing enjoyment of natural beauty over harvest opportunities. Additionally, the study confirms the popularity of primary information sources like conversations with other anglers and DNR sources while also revealing higher usage of social media and online resources among Milwaukee County shoreline anglers, expanding our understanding within this population. These results not only validate prior research but also deepen our comprehension of shoreline angler communities, informing communication strategies and policy recommendations in fisheries management.

6.2 Science and Policy Communication Best Practices for Shoreline Angler Engagement

Effective science and policy communication plays a pivotal role in engaging shoreline anglers, a diverse community with varied interests and backgrounds. Shoreline anglers are key

stakeholders whose participation is essential for sustainable and equitable fisheries management. By fostering engaging, accessible, and informative communication channels, policymakers, scientists, and resource managers can enhance understanding, foster engagement, and empower shoreline anglers to contribute meaningfully to decision-making processes.

Effective science communication also provides shoreline anglers with access to accurate, relevant, and understandable fishing information thus improving shoreline angling opportunities and satisfaction. By translating complex research findings into accessible language and engaging formats, such as plain language summaries, infographics, and interactive tools, fisheries managers can bridge the gap between the scientific principles of fisheries management, policy decision-making, and stakeholder engagement. This process of fostering a well-informed stakeholder group facilitates more productive and effective policymaking by focusing conversations on management decisions rather than disputes over established scientific findings or management principles.

Here, we integrate the findings on science and policy communication from the literature review, the demographics and preferred sources of fishing information from the Shoreline Angler Survey, insights on stakeholder engagement strategies from the DNR Staff Survey, with existing DNR Fisheries Management policies to build a framework of science and policy communication best practices.

- 1) ***Tailor communication strategies to suit the demographics of the shoreline angling community.*** Shoreline Anglers are a racially and socioeconomically diverse community with a lower average education attainment than the general population of Milwaukee County. With that knowledge of Milwaukee County shoreline angler demographics, fisheries related communication materials should use common

terminology and avoid technical jargon or acronyms to make key messages accessible more effectively to these diverse audiences. Maintaining conciseness is important to capture and retain the audience's attention long enough to effectively relay key information. Lastly, employing a multimedia approach using visual aids such as videos, diagrams, infographics, and maps can enhance understanding of key concepts and can ensure important science and policy information reaches these audiences through a multitude of channels, thereby catering to the varied preferred information sources utilized by shoreline anglers.

- 2) ***Utilize bait and tackle shops as trusted fisheries science and policy communication nodes.*** Bait shops can serve as communication and engagement hubs for shoreline anglers, particularly those from racially and socioeconomically diverse backgrounds and with lower educational attainment. Given the widespread usage of bait shops as sources of fishing information across various demographics, these locations present a unique opportunity to disseminate important messages regarding science and policy related to fishing practices. In Milwaukee County, there are four bait and tackle shops: Bait Mart Sportsmen's Den, A&C Live Bait, Minnesota Leeches, and R&R Sporting Goods-Fishin'. The limited number of bait and tackle shops concentrates anglers to these locations, which further enhances these locations as potential information hubs and focal points of targeted outreach. By leveraging the familiarity anglers have with these establishments, and limited number of locations, DNR could efficiently focus outreach efforts on bait shops to reach a large number of shoreline anglers. Establishing partnerships with bait shops to distribute educational materials, host workshops, or facilitate discussions could foster meaningful dialogue and

enhance understanding of fisheries management actions, regulations, and scientific findings within the shoreline fishing community.

- 3) ***Partner with local community and outdoor recreation groups to share information and solicit stakeholder input.*** The DNR Staff Survey found a primary barrier to engaging with shoreline anglers is a lack of organizational structure within this angler group. Additionally, the review of existing DNR policies on stakeholder engagement found Goals 3 and 4 of the Fisheries Management Strategic Plan aim to promote involvement and participation in fisheries activities through developing new partnerships with a diverse angler base.

Considering these findings, and consistent with previous literature to build more effective communication bridges between shoreline anglers and fisheries managers, the DNR can act on their established goals by engaging local community and outdoor recreation groups to foster in-person conversations with shoreline anglers about fisheries management activities. For Milwaukee County, potential groups to engage include: the Sixteenth Street Community Health Center, Midwest Crappie Hunters, Milwaukee Riverkeeper, and the Urban Ecology Center. These groups often host public events such as fishing clinics, outdoor education activities, and other recreation opportunities that are likely to concentrate shoreline anglers and other interested stakeholders, which will allow managers to effectively and directly engage with this important stakeholder group.

- 4) ***Incorporate and expand shoreline fishing opportunities on web-based fishing applications.*** Expanding and integrating shoreline fishing opportunities on web-based applications will increase transparency on shoreline fishing locations and is one step

in reducing the barrier of limited shoreline access reported by 62% of shoreline anglers during the Shoreline Angler Survey. Given the DNR's reliance on online media for information dissemination, the incorporation of shoreline-specific features into a web-based fishing application also aligns with shoreline anglers' primary information sources and preferences. By developing a dedicated section within a web application, complete with interactive mapping features and information resources and available on mobile devices, anglers can easily discover and access shoreline fishing locations across Milwaukee County, and the state.

- 5) ***Reframe “fishing” as a means of enjoying the outdoors and/or spending time with family and friends in promotional and marketing communications about shoreline angling to increase engagement and participation.*** Recognizing that enjoying natural scenic beauty emerged as the primary motivator for all Shoreline Angler Survey respondents highlights shoreline angling as a common and accessible means of outdoor recreation across all demographic groups. Through this reframing, promotional messaging can effectively capture shoreline angling as a holistic and accessible outdoor experience that can increase angler recruitment, retention and reactivation among anglers from diverse demographic backgrounds. By promoting fishing in this context, DNR can appeal to the motivations of shoreline anglers, particularly those from minority and lower income groups. In doing so, DNR can increase participation among interested people in these groups in fishing activities. This, paired more targeted public outreach through community groups can result in more diverse perspectives being incorporated into fisheries policy.

6) *Employ innovative and cost-cutting creel survey methods.* Creel surveys are a primary communication tool employed by the DNR to gather biological data as well as angler preference information as reflected in the DNR Staff Survey results and various fisheries management plans analyzed in Chapter 3.3. This method of communication is also a well-received mechanism among shoreline anglers as reflected in the Shoreline Angler Survey results. However, the challenge in conducting creel surveys of adequate geographic and temporal scales results from staffing shortages and funding cuts within the fisheries management program. Staffing shortages and funding cuts reduce the agency's capacity to conduct the breadth of creel surveys necessary to capture adequate representation of various user groups, including shoreline anglers. So, to continue engaging shoreline anglers by using these tools while also meeting the administrative constraints, we recommend the DNR employ the innovative and cost-cutting creel survey methods described in Section 2.4. These novel methods of collecting angler preference data include time-location sampling at Milwaukee County bait shops and disseminating translated and user-friendly surveys to targeted groups through social media channels. Implementing these innovative and cost-effective creel survey techniques is essential for maintaining effective communication with shoreline anglers, while also addressing staffing limitations and budgetary challenges within the fisheries management program.

These science and policy communication best practices provide a framework for building communication bridges between diverse stakeholder groups and natural resource policymakers. By prioritizing accessibility in communication strategies, inclusivity in stakeholder engagement,

and implementing these science and policy communication best practices, policymakers can bridge existing gaps and foster more diverse, equitable, and inclusive decision-making processes.

6.3 Policy Options and Recommendations

Effective fisheries management relies not only on effective communication and robust stakeholder engagement, but also the integration of diverse perspectives into policy processes and decisions. By actively involving stakeholders, including shoreline anglers, outdoor recreation organizations, and community groups, policymakers can gain valuable insights into the diverse perspectives, motivations, and interests related to fishing opportunities. Incorporating these perspectives ensures that management decisions are informed by a comprehensive understanding of the social, cultural, economic, and ecological dimensions of fisheries. Engaging with diverse stakeholders also fosters increased participation in decision-making processes, enhancing public trust and support for various management activities. Additionally, diverse stakeholder engagement in policy processes promotes equity and environmental justice by ensuring that the voices of marginalized or underrepresented groups are heard and considered in policy decisions that affect their quality of life.

This section outlines policy options and recommendations for the DNR's Bureau of Fisheries Management to consider in stakeholder engagement and policy development processes related to shoreline angling.

- ***Implement science and policy communications best practices outlined in Section 6.1 in promotional, informational, marketing, and public engagement initiatives to effectively reach a more diverse and inclusive angler base.*** This entails tailoring communication strategies to suit the demographics of the shoreline angling community, recognizing the diverse backgrounds and preferences within this demographic. Leveraging bait and tackle

shops as trusted nodes for fisheries science and policy communication can facilitate direct engagement with a representative cross-section of anglers. Fostering partnerships with local community and outdoor recreation groups can enhance information dissemination and solicit valuable stakeholder input from shoreline anglers. Integrating and expanding shoreline fishing opportunities in the planned Wisconsin fishing opportunities web application can improve accessibility and awareness among anglers. Promotional, educational, and informational messaging should also reframe "fishing" as a holistic outdoor experience beyond just catching fish, reflecting enjoyment of natural scenic beauty and the social aspects of fishing as primary motivators for engaging in fishing activities by shoreline anglers. Lastly, employing innovative and cost-cutting creel survey methods can enhance angler preference data collection while addressing staffing and resource constraints, ensuring continued and potentially expanded stakeholder input in management and policy decisions.

- ***Incorporate shoreline angler engagement strategies outlined in the “A Ten-Year Strategies Plan of Fisheries Management in Wisconsin. 2015-2025” in all future species- and waterbody specific management plans.*** As discussed in Chapter 3, the statewide Fisheries Management Strategic Plan is robust in its references to and emphasis on various aspects of shoreline angling. However, these goals and objectives for incorporating shoreline angling broadly are not consistently incorporated in species- and waterbody specific management plans. Therefore, per the Bureau of Fisheries Management’s strategic visions, future management plans should adapt and implement these same principles for improving shoreline fishing opportunities and shoreline angler engagement in management activities.

- ***Include and actively involve racially and socioeconomically diverse representation in DNR-convened working groups, task forces, and other advisory committees focused on fisheries management issues related to shoreline angling by partnering with outdoor recreation and community groups.*** The lack of a centralized, organizational structure was repeatedly mentioned as a barrier to incorporating shoreline angler perspectives and interests in DNR fisheries decision and policymaking processes by DNR staff. To overcome this barrier to equitable stakeholder engagement, the DNR should implement policies to seek out and actively involve partnerships with non-fishing-centric outdoor recreation and community groups where shoreline anglers are likely to be present and participate in advisory committees, work groups, and task forces. Partnering with Friends groups can also be an effective vector of improving communication with shoreline anglers and soliciting public input. There are currently 35 active Friends groups in Milwaukee County Parks, many of which participate in the Urban Stocking Program. Leveraging these partnerships can both enhance community engagement, as well as provide resource for beautifying lagoons and other shoreline angling locations. This collaborative and innovative approach can increase fishing recruitment in urban areas, enhance natural scenic beauty, and facilitate more inclusive policy development to manage shoreline fishing resources.
- ***Expand the use of online, multilingual angler preference surveys and public comment opportunities and disseminate those instruments through trusted nodes of information such as bait shops, identified online/social media groups, and at public fishing events.*** DNR is faced with a policy dilemma where in order to capture a more representative and diverse angler base in policy actions, they need to broaden its approach to gathering

angler preference data through creel surveys. However, staffing cuts and budgetary restraints limit its ability to do so. Therefore, expanding the utilization of online, multilingual angler preference surveys and public comment opportunities is a vital policy option for enhancing stakeholder engagement among shoreline anglers and ensuring diverse voices are heard in fisheries management decision-making processes.

Disseminating these instruments through trusted nodes of information and at locations where shoreline anglers aggregate further facilitates participation among these resource users. By leveraging these channels effectively, policymakers can promote inclusivity and gather comprehensive feedback and insights from a diverse range of stakeholders, leading to more informed and equitable decision-making processes. Broadening the accessibility and dissemination of these surveys and comment opportunities, including translation into multiple languages, can facilitate anglers from diverse backgrounds to participate and provide valuable input on fish management decisions.

- ***Continue to support and invest resources in the Urban Fishing Program.*** The DNR currently designates dozens of urban fishing ponds as part of this stocking program, several of which are located in Milwaukee County. Continuing to support and invest resources in the Urban Fishing Program is essential for promoting equitable access to recreational fishing opportunities, particularly in urban areas where access to water bodies may be limited. This program plays a critical role in providing accessible and affordable fishing opportunities to residents of urban communities, fostering a connection to nature, and promoting outdoor recreation. By allocating resources to maintain and expand the Urban Fishing Program, policymakers can address geographic and socioeconomic barriers to fishing participation, such as limited access to traditional

fishing locations. Thus, continuing and expanding the Urban Fishing Program demonstrates a commitment to providing shoreline fishing opportunities to diverse anglers.

- ***Prioritize nearshore habitat enhancement and water quality improvement to improve shoreline fishing opportunities and meet shoreline angler demands and preferences.***

The DNR Fisheries Management Strategic Plan aims to identify and improve shoreline angling locations to ensure these opportunities are considered when developing management objectives in DNR plans. Both the Wisconsin Inland Trout and Lake Michigan Integrated Fisheries Management plans reflect this objective as well. Therefore, consistent with existing DNR policy goals and in line with shoreline angler motivations and interests, the DNR and other resource managers should prioritize nearshore habitat and water quality improvement for both improved ecological functions, but also to enhance the natural scenic beauty of shoreline fishing locations. The Milwaukee River and Estuary Area of Concern Remedial Action Plan provides an opportunity to achieving these goals by enhancing natural scenic beauty of shoreline angling locations across Milwaukee County waterways. The benefits of doing so are manifold including increasing biodiversity, improving fish habitat to support diverse fishes at various life stages, improving water quality, reducing erosion, and providing recreational opportunities that meet shoreline angler preferences. Enhancing nearshore habitat improvement is a critical component of achieving various fisheries management objectives and can improve shoreline angler participation and satisfaction.

6.4 Limitations of Research and Future Research Needs

The research conducted in this study has provided a first of its kind dataset on shoreline anglers in Milwaukee County paired with data from a DNR staff survey. Our analysis provides new insights into the demographics of Milwaukee County shoreline anglers, their communication preferences, and avenues to build communication and engagement bridges with natural resource policy and decisionmakers. However, in any research endeavor, there are inherent limitations. The research involved a Shoreline Angler Survey, a DNR Staff Survey, and an analysis of existing DNR policies on shoreline angling in its management plans, each of which presented challenges and areas for future improvement. By critically examining these limitations, we can better contextualize the findings and identify avenues for future research to address gaps in knowledge and enhance the robustness of our understanding of shoreline angling.

Shoreline Angler Survey Limitations

There are limitations in the survey design. The Shoreline Angler Survey instrument consisted of 30 questions spanning various aspects of shoreline angling including preferences, fishing skill and knowledge, sources of information, and demographics. While this instrument was robust in the quantitative data that were collected, some of the questions such as Q8, Q16, and Q17, may have been unclear, duplicative, or leading (see Survey in Appendix B). These issues can result in potential bias or error in the survey response data. Survey questions focused on “fishing information” also does not account for the different kinds of fishing information shoreline anglers may be interested in. Greater specificity on shoreline angler sources or preferences on different information types such as fishing locations, bait to use, what to fish for, regulations, information on fishing events, or public comment opportunities would have allowed for more refined communication best practices or policy recommendations. Additionally, the

nature of quantitative survey instruments requires limited response choices, which may not capture the full range or completeness of participant responses. Correspondingly, the lack of flexibility by not offering open ended questions means we did not capture nuanced responses, and this has the potential to lead to incomplete or inaccurate data which informed the conclusions and recommendations presented in this study. Adding “neutral” survey response options, such as “All” or “Any” to Q3 focused on primary target species, would have been useful information to gather to identify “generalist” angler types, and clearly identify neutral responses. Furthermore, limited sample sizes among particular groups, namely Hispanic, and Native American/other shoreline anglers, associate and graduate degree holders, and low- and middle-upper income earners is likely too small to draw any definitive conclusions, though may provide useful signals for future analysis and research.

Logistical challenges in administering the survey may also present limitations impacting both the sample size and data collection. The methodology of administering the survey attempted to account for logistical issues by having multiple survey administration mechanisms including oral administration, electronic administration, hard-copy paper administration, and translated surveys into Spanish and Hmong for all forms. However, certain barriers proved challenging to overcome. First, the survey was administered from June through September 2023. This sampling timeframe likely missed critical periods of increased shoreline fishing activity, such as during the Spring and Fall where numerous fishes are migrating or spawning, presenting heightened fishing opportunities. Second, this project only involved a single survey clerk creating geographic and temporal constraints, such as not surveying beyond 7 p.m. Third, certain shoreline anglers proved difficult to engage with. Specifically, the primary survey administrator was able to identify Spanish-speaking anglers and engaged these individuals in several instances, though in a

limited capacity. Non-English and non-Spanish-speaking anglers could not be contacted or engaged due to language barriers. Although the survey was also translated into Hmong, we had zero respondents utilize these translated surveys. Thus, the survey results may under-represent non-English or non-Spanish speaking anglers. A third challenge occurred when engaging with a group of anglers. In many cases in these instances, only one individual participated and would sometimes consult with others in the group on survey responses, thereby influencing the data collected. These logistical limitations may have impacted the sample size of survey respondents, inadequately represent angler demographics, and result in biases in both participation and corresponding data analysis and interpretation. Lastly, weather proved to be another limiting factor. During the June-August creel survey period, 5 anglers were contacted, and 0 surveys were completed during 6 survey sessions yielding a 0% response rate in rainy conditions. Roving angler counts may be a more efficient data collection method in future studies.

DNR Staff Survey Limitations

The DNR Staff Survey was administered electronically to 94 DNR Fisheries Management Staff. In the survey instrument, particular terms such as “policy” and “shoreline” were not defined, leading to potential confusion or misunderstandings. For instance, it was not clear to respondents whether “wading”, a common practice in salmon, trout, and bass fishing, was considered shoreline fishing. Additionally, the survey was administered from Monday November 20th through Friday December 1st. This corresponded to both the Thanksgiving holiday, and Gun-Deer Hunting season, which is popular among DNR staff. The timing and duration of this survey administration period likely impacted the response rate and may have missed important responses or insights that could have been incorporated into this study. Lastly, while this survey targeted DNR Fisheries Management staff, it likely missed other valuable

perspectives and insights from other representatives of the agency such as Recruit, Retain, Reactivate (“R3”) staff, Office of Communications staff, or Office of Applied Sciences staff. These limitations and oversights create the potential for bias and may skew the results which informed the conclusions and recommendations in this study.

Analysis of DNR Fisheries Management Plans Limitations

The DNR Policy Analysis included comprehensive reviews on 6 species- and waterbody specific management plans that guide various policy and management activities conducted by the Bureau of Fisheries Management. These plans were obtained both through public facing sources, as well as through an Open Records Request. While these management plans span over several domains in fisheries management, others were unable to be obtained due to lost or corrupted files including the Black Bass Management Plan and Sturgeon Management Plan. While the risk is low, there is a potential for incomplete coverage of all existing DNR policies related to shoreline angling. Given the popularity of Bass fishing among shoreline anglers, it would have been useful in this analysis and could have provided additional insights to policy recommendations.

Directions for Future Research

Future investigations into shoreline angler dynamics and science and policy communication remains ripe for future investigations. While this study provides perhaps a deep dive into one year in Milwaukee County, it is a small piece of the statewide shoreline angler puzzle. Further, longitudinal studies to track changes in shoreline angler preferences and behaviors would provide valuable insights and trends in response to policy changes or emerging issues.

This investigation also provides a case study for evaluating the perspectives, motivations, and sources of information from diverse stakeholder groups. In this instance, it focused on

shoreline anglers and fisheries management and policy in Milwaukee County. However, the methods and analyses employed in this study can be expanded geographically to include other urban areas, or to compare user groups such as shoreline versus boat anglers in the Milwaukee County study area. One of the hypotheses was that shoreline anglers would have harvesting fish for consumption as the primary motivation for fishing, which this study indicated was false. Possible explanations for the general disinterest in harvesting fishing include the efficacy of fish consumption advisories in impaired waters, or legacy perceptions of water quality impacts on fish consumption. A study conducted by Shaw and colleagues (2023) on fish consumption behaviors among Asian women in Milwaukee, Wisconsin found 79% did not eat locally caught fish because of perceived harms from water pollution. Interestingly, 68% of participants were unaware of fish consumption advisories, so it is unclear what shaped the perception (Shaw et al., 2023). However, these factors on influencing shoreline angler preferences and motivations were not within the scope of this study and may be a fruitful line of inquiry in future studies of shoreline angler behavior.

This study also did not explore the underlying mechanisms for the various information source preferences among demographic groups. Oftentimes, race, education, and socioeconomic status are inextricably linked, and to fully grasp why particular groups have preferred information sources would shed further light on the dynamics influencing information channels among demographic groups.

This investigation collected several economic variables such as average distance traveled, expenditure per fishing trip, and annual expenditure on fishing, all of which could be used to conduct travel cost or other stated preference analyses. Lastly, while this study characterized shoreline angler demographics and preferences, it remains unclear what proportion of total

fishing pressure shoreline anglers constitute. A more robust, traditional creel survey focused specifically on shoreline anglers in conjunction with a creel survey of boat-based anglers would allow for an in-depth analysis for the overall resource usage and pressure shoreline anglers place on fisheries resources. This is a critical question as the DNR, and other natural resource management agencies weigh the necessity and urgency of incorporating the best practices and policy recommendations produced from this study.

Chapter 7: Conclusion

Shoreline anglers are an important stakeholder group in fisheries management. This study sought to build communication bridges between diverse stakeholders and natural resource policymakers, using Milwaukee's shoreline angling community as a case study. To do so, we had to first characterize shoreline anglers- their demographics, interests, and preferred sources of information. We found that racially and ethnically, shoreline anglers are representative of the broader Milwaukee County population, with a similar proportion of white versus non-white individuals, though representation among minority groups differs. Socioeconomically, the median household income for shoreline anglers is also comparable to that of Milwaukee County residents. However, the education attainment was generally lower. Their interests vary by demographic group, but enjoyment of natural scenic beauty and fishing as a means of socialization emerged as primary motivators for fishing. Conversations among anglers are the primary sources of information among this group, though information provided at bait shops is also a heavily utilized node of information and communication. And overall, shoreline anglers are generally satisfied with fishing opportunities across Milwaukee County. Based on these findings, we conclude shoreline anglers are a diverse community that places value on the

contemplative and social aspects of fishing, and overall, they are satisfied with fishing opportunities, regardless of outcome. These findings are a crucial first step in developing effective communication and stakeholder engagement strategies.

We then identified the current state of DNR Fisheries Management policies related to shoreline anglers and stakeholder engagement by surveying DNR staff in conjunction with an analysis of existing DNR fisheries management plans. This evaluation found that public meetings and creel surveys are the primary tools utilized by the DNR for sharing information and soliciting input on fisheries management actions. However, this analysis also revealed the gap between current DNR communication strategies, and how shoreline anglers prefer to receive information and share their perspectives on fish management and policy decisions, as shoreline anglers are rarely present in these forums, and rarely receive information through these channels.

With the communication gap identified, armed with the knowledge of shoreline angler demographics and preferred information sources, paired with a comprehensive literature review of science and policy communication techniques, this study then built a framework of science and policy communication best practices to connect shoreline anglers with fisheries managers and policymakers. This research found tailoring language and using multimedia platforms, sharing information through trusted nodes such as bait shops and social media groups, partnering with community and outdoor recreation organizations, expanding shoreline angling locations on web-based mobile mapping applications, reframing promotional and educational materials to better appeal to shoreline anglers interests, and soliciting stakeholder input through novel and cost-cutting survey methods are effective mechanisms for bridging the communication gap.

Bridging the gap between diverse stakeholders and policymakers requires implementing science and policy communication best practices and institutionalizing these practices into DNR

policy frameworks. This project identified policy recommendations, including integrating best practices into informational materials, emphasizing shoreline angling opportunities in fisheries management plans, seeking diverse representation in management groups, using multilingual surveys, investing in the Urban Fishing Program, and enhancing nearshore habitat to improve communication between shoreline anglers and policymakers.

This study underscores the significance of shoreline anglers as crucial stakeholders in fisheries management, and provides tools and techniques for integrating this group into fisheries management and policymaking processes. By doing so, this case study provides a framework to build communication bridges between shoreline anglers and natural resource policymakers.

References

- Ahn, M. J. (2016). Effective Policy Communication in the Age of Information Overload and YouTube. *Brookings*. <https://www.brookings.edu/blog/techtank/2014/08/11/effective-policy-communication-in-the-age-of-information-overload-and-youtube/>
- Arlinghaus, R., & Mehner, T. (2005). Determinants of management preferences of recreational anglers in Germany: habitat management versus fish stocking. *Limnologica*, 35(1-2), 2-17.
- Bacheler, N. M., Paoli, T. J., & Schacht, G. M. (2011). Controls on Abundance and Distribution of Yellow Perch: Predator, Water Quality, and Density-Dependent Effects. *Transactions of the American Fisheries Society*. <https://doi.org/10.1080/00028487.2011.603979>
- Baldwin, N. A. et al. (2000) Commercial fish production in the Great Lakes 1867–2000. *Great Lakes Fishery Commission*
- Beardmore, B., Haider, W., Hunt, L. M., & Arlinghaus, R. (2011). The importance of trip context for determining primary angler motivations: are more specialized anglers more catch-oriented than previously believed?. *North American Journal of Fisheries Management*, 31(5), 861-879.
- Beck, David R.M. (1995). Return to *Namä' o Uskiwämît*: The Importance of Sturgeon in Menominee Indian History. *The Wisconsin Magazine of History*, 79(1), 32–48. <http://www.jstor.org/stable/4636602>
- Bennett, A., Basurto, X., Virdin, J. et al. (2020) Recognize fish as food in policy discourse and development funding. *Ambio* 50, 981–989. <https://doi.org/10.1007/s13280-020-01451-4>
- Beskid, T. R. M. (2022). Multigenerational Communication Preferences in the Workplace (Doctoral dissertation, Franklin University).
- Besley, J. C. (2010). Public Engagement and the Impact of Fairness Perceptions on Decision Favorability and Acceptance. *Science Communication*, 32(2), 256–280. <https://doi.org/10.1177/1075547009358624>
- Besley, J. C. (2010). Public Engagement and the Impact of Fairness Perceptions on Decision Favorability and Acceptance. *Science Communication*, 32(2), 256–280. <https://doi.org/10.1177/1075547009358624>
- Besley, J. C., Lee, N. M., & Pressgrove, G. (2021). Reassessing the Variables Used to Measure Public Perceptions of Scientists. *Science Communication*, 43(1), 3–32. <https://doi.org/10.1177/1075547020949547>
- Besley, J.C. (2020), "Five thoughts about improving science communication as an organizational activity", *Journal of Communication Management*, Vol. 24 No. 3, pp. 155-161. <https://doi.org/10.1108/JCOM-03-2020-0022>

- Bielak, A. T., Campbell, A., Pope, S., Schaefer, K., & Shaxson, L. (2008). From science communication to knowledge brokering: the shift from ‘science push’ to ‘policy pull’. *Communicating science in social contexts: New models, new practices*, pp. 201-226.
- Bogue, M. B. (2001). *Fishing the Great Lakes: An Environmental History, 1783–1933*. Amsterdam University Press.
- Bradshaw, L. and Legler, N. 2021. *A Profile of Behaviors, Awareness and Management Opinions of Wisconsin’s Lake Michigan Salmonid Anglers*. Internal Report to Bureau of Fisheries Management. Wisconsin Department of Natural Resources, Madison, WI.
- Brenden, T. O., Brown, R. W., Ebner, M. P., Reid, K., Newcomb, T. J. (2010). *Great Lakes Commercial Fisheries: Historical Overview and Prognoses for the Future*. In canr.msu.edu. Michigan State University.
[https://www.canr.msu.edu/qfc/publications/pdf-publications/2011-publications/GLFPM Commercial Fishing Chapter Submitted Revision_031110.pdf](https://www.canr.msu.edu/qfc/publications/pdf-publications/2011-publications/GLFPM_Commercial_Fishing_Chapter_Submitted_Revision_031110.pdf)
- Brown, R., Ebner, M., and Gorenflo, T. (1999). *Great Lakes Commercial Fisheries: Historical Overview and Prognosis for the Future*. Pages 307–354 in *Great Lakes Fisheries Policy and Management*. Michigan State University Press, East Lansing, Michigan.
- Bureau of Fisheries Management, Administrative Report No. 80. Lake Michigan Integrated Fisheries Management Plan (2017). Madison, WI; Wisconsin Department of Natural Resources.
- Bureau of Fisheries Management, Administrative Report No. 80 Lake Michigan Integrated Fisheries Management Plan. 2017-2026. Supplemental Appendix. Responses to Comments on Draft Plan (2017). Madison, WI; Wisconsin Department of Natural Resources.
- Bureau of Fisheries Management, Hansen, J., & Wolter, M., A 10-Year Strategic Plan of Managing Wisconsin’s Panfish (2015). Madison, WI; Wisconsin Department of Natural Resources.
- Bureau of Fisheries Management, In the Year 2025: A Ten Year Strategic Plan for Fisheries Management in Wisconsin. 2015 - 2025. (2015). Madison, WI; Wisconsin Department of Natural Resources.
- Bureau of Fisheries Management, Walleye 2022 – An Updated 10-Year Walleye Management Plan for Wisconsin. (2022). Madison, WI; Wisconsin Department of Natural Resources.
- Bureau of Fisheries Management, Wisconsin Inland Trout Management Plan. 2020-2029. (2019). Madison, WI; Wisconsin Department of Natural Resources.
- Clapp, D. F., & Dettmers, J. M. (2004). Yellow Perch Research and Management in Lake Michigan. *Fisheries*, 29(11), 11–19.

- Cleland, C. E. (1982). The inland shore fishery of the northern Great Lakes: its development and importance in prehistory. *Society for American Archaeology* 47:761–784.
- Coble, D. W., Bruesewitz, R. E., Fratt, T. W., & Scheirer, J. W. (2011). Lake Trout, Sea Lampreys, and Overfishing in the Upper Great Lakes: A Review and Reanalysis. *Transactions of the American Fisheries Society*, 119(6), 985–995.
- Collingsworth, P. D., Bunnell, D. B., Murray, M., Kao, Y., Feiner, Z. S., Claramunt, R. M., Lofgren, B. M., Höök, T. O., & Ludsin, S. A. (2017). Climate change as a long-term stressor for the fisheries of the Laurentian Great Lakes of North America. *Reviews in Fish Biology and Fisheries*, 27(2), 363–391. <https://doi.org/10.1007/s11160-017-9480-3>
- Cooke, S. J., Venturelli, P., Twardek, W. M., Lennox, R. J., Brownscombe, J. W., Skov, C., Hyder, K., Suski, C. D., Diggles, B. K., Arlinghaus, R., & Danylchuk, A. J. (2021). Technological innovations in the recreational fishing sector: implications for fisheries management and policy. *Reviews in Fish Biology and Fisheries*, 31(2), 253–288. <https://doi.org/10.1007/s11160-021-09643-1>
- Dedual, M., Sague Pla, O., Arlinghaus, R., Clarke, A., Ferter, K., Geertz Hansen, P., ... & Ueberschär, B. (2013). Communication between scientists, fishery managers and recreational fishers: lessons learned from a comparative analysis of international case studies. *Fisheries Management and Ecology*, 20(2-3), 234-246.
- Dow, B. (2022). Remedial Action Plan Update for the Milwaukee River Estuary Area of Concern. In wi.dnr.gov. *Wisconsin DNR*. https://widnr.widen.net/s/pklpq26wcm/gw_mke_rap2021
- Doxtator, A. J., & Zakhar, R. J. (2011). *American Indians in Milwaukee*. Arcadia Publishing Library Editions.
- Druschke, C. G., & McGreavy, B. (2016). Why rhetoric matters for ecology. *Frontiers in Ecology and the Environment*, 14(1), 46-52.
- Dudo, A., & Besley, J. C. (2016). Scientists' Prioritization of Communication Objectives for Public Engagement. *PLOS ONE*, 11(2), e0148867. <https://doi.org/10.1371/journal.pone.0148867>
- Dusek, G. A., Yurova, Y. V., & Ruppel, C. P. (2015). Using social media and targeted snowball sampling to survey a hard-to-reach population: A case study. *International Journal of Doctoral Studies*, 10, 279-299. Retrieved from <http://ijds.org/Volume10/IJDSv10p279-299Dusek0717.pdf>
- Ebener, M. et al. (2008). Management of Commercial Fisheries for Lake Whitefish in the Laurentian Great Lakes of North America. International governance of fisheries ecosystems: Learning from the past, finding solutions for the future. *International Governance of Fisheries Ecosystems*, 62 (99-143).

- Egan, D. (2018). *The Death and Life of the Great Lakes*. W. W. Norton Company.
- Egerton, F. N. (2018). History of Ecological Sciences, Part 60: American Great Lakes before 2000. *Bulletin of the Ecological Society of America*, 99(1), 77-136.
- Elliott, M., Snoeijs-Leijonmalm, P., & Barnard, S. (2017). “The dissemination diamond” and paradoxes of science-to-science and science-to-policy communication: Lessons from large marine research programmes. *Marine Pollution Bulletin*, 125(1-2), 1-3. <https://doi.org/10.1016/j.marpolbul.2017.08.022>
- Encyclopedia of Milwaukee. (2021). *Recreational Fishing - Encyclopedia of Milwaukee*. <https://emke.uwm.edu/entry/recreational-fishing/>
- Fall shore fishing Close to Home - Milwaukee | Fishing Wisconsin | Wisconsin DNR. (n.d.). <https://dnr.wisconsin.gov/topic/Fishing/lakemichigan/fallfishing.html>
- Ferter, K., Otterå, H., Christman, M., Kleiven, A., Weltersbach, M., Gundersen, S., Djønne, C., Bjelland, O., Hartill, B., Lyle, J., Hyder, K., Borch, T., & Vølstad J.H., (2022). Integrating complementary survey methods to estimate catches in Norway’s complex marine recreational hook-and-line fishery. *Ices Journal of Marine Science*, 80(1), 107–121. <https://doi.org/10.1093/icesjms/fsac216>
- Furman, K. L., Harlan, S. L., Barbieri, L., & Scyphers, S. B. (2023). Social equity in shore-based fisheries: Identifying and understanding barriers to access. *Marine Policy*, 148, 105355.
- Golebie, Elizabeth J., et al. “Heterogeneity of Salmonid Anglers in the Southern Lake Michigan Fishery.” *Human Dimensions of Wildlife*, vol. 25, no. 2, 2019, pp. 171–186., <https://doi.org/10.1080/10871209.2020.1698080>.
- Gould, L. T. (1914). The Making of Milwaukee. *Journal of Geography*, 12(8), 279-288.
- Griffiths, S. P., Zischke, M. T., Tonks, M. L., Pepperell, J. G., & Tickell, S. (2012). Innovative and cost-effective approaches for surveying specialized recreational longtail tuna fishers in Australian waters. *Second Working Party on Neritic Tunas, Penang, Malaysia*, 19-21. <https://www.fao.org/3/bi372e/bi372e.pdf>
- Gurda, J. (2018). *The Story of Milwaukee’s Lost Fishing Village*. Milwaukee Magazine.
- Harbor District. (2019). *Water and Land Use Plan*. <https://harbordistrict.org/plan/>
- Hartill, B., Payne, G. W., Rush, N., & Bian, R. (2016). Bridging the temporal gap: Continuous and cost-effective monitoring of dynamic recreational fisheries by web cameras and creel surveys. *Fisheries Research*, 183, 488–497. <https://doi.org/10.1016/j.fishres.2016.06.002>
- Hartley, T. W., & Robertson, R. A. (2008). Stakeholder collaboration in fisheries research: integrating knowledge among fishing leaders and science partners in northern New England. *Society and Natural Resources*, 22(1), 42-55.

- Hultkrantz, Å. (1983). Water Spirits: The Elders of the Fish in Aboriginal North America. *American Indian Quarterly*, 7(3), 1–22. <https://doi.org/10.2307/1184254>
- Johnston, F. D., Simmons, S., Poorten, B. V., & Venturelli, P. (2022). Comparative analyses with conventional surveys reveal the potential for an angler app to contribute to recreational fisheries monitoring. *Canadian Journal of Fisheries and Aquatic Sciences*, 79(1), 31-46. <https://doi.org/10.1139/cjfas-2021-0026>
- Kenny, J. T. (1995). Making Milwaukee famous: Cultural capital, urban image, and the politics of place. *Urban Geography*, 16(5), 440-458.
- Lauber, T. B., Connelly, N. A., Niederdeppe, J., & Knuth, B. A. (2017). Urban anglers in the Great Lakes region: Fish consumption patterns, influences, and responses to advisory messages. *Science of the Total Environment*, 590, 495-501
- Lems, P., Aarts, N., & van Woerkum, C. (2013). When Policy Hits the Ground. An Empirical Study of the Communication Practices of Project Managers of a Water Board in Conversations for Collaborative Governance. *Environmental Policy and Governance*, 23(4), 234–246. <https://doi.org/10.1002/eet.1618>
- Lewenstein, B. (2003). *Models of Public Communication in Science and Technology* (Public Understanding of Science & Departments of Communication and of Science & Technology Studies, Eds.) [University Publication]. Cornell University.
- Lewin, W. C., Arlinghaus, R., & Mehner, T. (2006). Documented and potential biological impacts of recreational fishing: insights for management and conservation. *Reviews in Fisheries Science*, 14(4), 305-367.
- Lower, E., Cutts, B., Williams, J., Norris, C., Lutsch, K., Zouras, J., O’Laughlin, M., Luo, N., Zhou, K., Fang, D., Greenlee, A., Department of Natural Resources and Environmental Sciences, & Department of Urban and Regional Planning. (2015). *Urban Environmental Equity Field Report 2: Perceptions of Fish in the Milwaukee Estuary AOC*. University of Illinois at Urbana-Champaign. http://publish.illinois.edu/urbanequity/files/2015/11/Community-Perceptions-of-Fish-in-the-Milwaukee-Estuary_final_10.30.pdf
- Lowry, D., Stick, K., Lindquist, A., & Cheng, Y. W. (2015). Evaluation of Creel Survey Methods to Estimate Recreational Harvest of Surf Smelt in Puget Sound, Washington. *North American Journal of Fisheries Management*, 35(3), 403–417.
- Lyons, J. C. (2022). Discovering a Fish Fauna: A History of the Fishes and Fish Scientists of Wisconsin Up to the Publication of George C. Becker’s Fishes of Wisconsin in 1983. *American Current*, 47(1), 9. <http://www.nanfa.org/ac/wisconsin-fish-fauna-history.pdf>
- Martin, D. R., Chizinski, C. J., Eskridge, K. M., & Pope, K. L. (2014). Using posts to an online social network to assess fishing effort. *Fisheries Research*, 157, 24-27. <https://doi.org/10.1016/j.fishres.2014.03.013>

- McCluskey, S. M., & Lewison, R. L. (2008). Quantifying fishing effort: a synthesis of current methods and their applications. *Fish and Fisheries*, 9(2), 188–200. <https://doi.org/10.1111/j.1467-2979.2008.00283.x>
- McCormick, J. L., Whitney, D., Schill, D. J., & Quist, M. C. (2015). Evaluation of angler reporting accuracy in an off-site survey to estimate statewide steelhead harvest. *Fisheries Management and Ecology*, 22(2), 134–142. <https://doi.org/10.1111/fme.12109>
- Metag, J., & Schäfer, M. S. (2018). Audience segments in environmental and science communication: Recent findings and future perspectives. *Environmental Communication*, 12(8), 995-1004.
- Morgan, D. L., & Nica, A. (2020). Iterative Thematic Inquiry: A new method for analyzing qualitative data. *International Journal of Qualitative Methods*, 19, 160940692095511. <https://doi.org/10.1177/1609406920955118>
- National Atmospheric and Oceanic Administration (n.d.). *Fisheries Economics of the United States*. NOAA. <https://www.fisheries.noaa.gov/national/sustainable-fisheries/fisheries-economics-united-states>
- Newcomb, T., Simonin, P. W., Martinez, F. A., Chadderton, W. L., Bossenbroek, J. M., Cudmore, B., Hoff, M. H., Keller, R. P., Ridenhour, B. D., Rothlisberger, J. D., Rutherford, E. S., Van Egeren, S., & Lodge, D. M. (2021). A Best Practices Case Study for Scientific Collaboration between Researchers and Managers. *Fisheries*, 46(3), 131–138. <https://doi.org/10.1002/fsh.10536>
- Nieman, C. L., Iwicki, C., Lynch, A. J., Sass, G. G., Solomon, C. T., Trudeau, A., & van Poorten, B. (2021). Creel Surveys for Social-Ecological-Systems Focused Fisheries Management. *Reviews in Fisheries Science & Aquaculture*, 29(4), 1–20. <https://doi.org/10.1080/02755947.2015.1009658>
- Parkins, A. E. (1918). The Indians of the Great Lakes region and their environment. *Geographical Review*, 6(6), 504-512.
- Pearson, H. (2017, February 22). Helen Pearson on science writing: “Surprise me!” *The Guardian*. <https://www.theguardian.com/science/2013/apr/17/helen-pearson-science-writing>
- Phelps, N. (2023). *Fishing interest holds strong, generates billions in economic activity for Wisconsin*. Spectrum News 1 Wisconsin. <https://spectrumnews1.com/wi/milwaukee/news/2023/04/13/fishing-interest-hold-strong>
- Proffitt, J. (2019). Great Lakes Fishery: The start of the industry and the fall of fish populations. *Great Lakes Now*. <https://www.greatlakesnow.org/2019/11/great-lakes-commercial-fishing-history/>

- R3 Resources | Recruit, retain and reactivate hunters and anglers | Wisconsin DNR.* (n.d.). <https://dnr.wisconsin.gov/Education/OutdoorSkills/R3resources>
- Regier, H. A., Whillans, T. H., Christie, W. J., & Bocking, S. A. (1999). Over-fishing in the Great Lakes: the context and history of the controversy. *Aquatic Ecosystem Health & Management*, 2(3), 239-248.
- Robertson, M. D., Midway, S. R., Embke, H. S., Kaz, A. L., Lang, M., Paukert, C., Sievert, N. A., Lyndsie Wszola, & Lynch, A. J. (2023). Estimating lentic recreational fisheries catch and effort across the United States. *Fisheries Management and Ecology*, 31(1). <https://doi.org/10.1111/fme.12650>
- Santucci, V. J., Eggold, B. T., Kalish, T. G., Price, J., Gorenflo, T. K., Illinois Department of Natural Resources, Wisconsin Department of Natural Resources, Michigan Department of Natural Resources, Indiana Department of Natural Resources, & Chippewa-Ottawa Resource Authority. (2014). Lake Michigan Yellow Perch Summit. In *Wisconsin Department of Natural Resources*. Lake Michigan Committee. https://dnr.wisconsin.gov/sites/default/files/topic/Fishing/LM_LakeMichiganYellowPerchSummitReport.pdf
- Sahrhage, D., & Lundbeck, J. (2012). *A History of Fishing*. Springer Science & Business Media.
- Scheufele, D. A., & Krause, N. M. (2019). Science audiences, misinformation, and fake news. *Proceedings of the National Academy of Sciences*, 116(16), 7662-7669.
- Schroeder, S. A., Nemeth, M. L., Sigurdson, R. E., & Walsh, R. J. (2008). Untangling the line: constraints to fishing participation in communities of color. In *American Fisheries Society Symposium* (Vol. 67, pp. 97-112).
- Scott, D., & Kim, C. (1998). Outdoor recreation participation and barriers to involvement. *Texas outdoors: A vision for the future*.
- Shaw, S., He, X., Haban, A., Tomasallo, C., & Meiman, J. G. (2023). A Focus Group Study of Fish Consumption Behaviors among Asian Women in Milwaukee, Wisconsin. *Preventive Medicine Reports*, 36, 102528. <https://doi.org/10.1016/j.pmedr.2023.102528>
- Slater, M. D., & Gleason, L. S. (2012). Contributing to theory and knowledge in quantitative communication science. *Communication Methods and Measures*, 6(4), 215-236.
- State Historical Society of Wisconsin. (1895). *Collections of the State Historical Society of Wisconsin*. Volume 16. Democrat Printing Company, State Printers. <https://memory.loc.gov/service/gdc/lhbum/7689e/7689e.pdf>
- Taylor, S. M., Blight, S. J., Desfosses, C. J., Steffe, A. S., Ryan, K. L., Denham, A. M., & Wise, B. S. (2018). Thermographic cameras reveal high levels of crepuscular and nocturnal shore-based recreational fishing effort in an Australian estuary. *ICES Journal of Marine Science*, 75(6), 2107–2116. <https://doi.org/10.1093/icesjms/fsy066>

- Tingley III, R. W., Hansen, J. F., Isermann, D. A., Fulton, D. C., Musch, A., & Paukert, C. P. (2019). Characterizing angler preferences for largemouth bass, bluegill, and walleye fisheries in Wisconsin. *North American Journal of Fisheries Management*, 39(4), 676-692.
- Valentine, B. R. (2003). *Recreation specialization: Management preferences and behaviors of Upper Manistee River shoreline owner anglers*. Michigan State University.
- Vermeulen, I., & Hartmann, T. (2015). Questionable research and publication practices in communication science. *Communication Methods and Measures*, 9(4), 189-192.
- Venturelli, P. A., Hyder, K., & Skov, C. (2016). Angler apps as a source of recreational fisheries data: opportunities, challenges and proposed standards. *Fish and Fisheries*, 18(3), 578–595. <https://doi.org/10.1111/faf.12189>
- Walzer, J. (2011). Soul of a Port: The History and Evolution of the Port of Milwaukee by Leah Dobkin. *Michigan Historical Review*, 37(2), 103-105.
- Wilberg, M. J. (2000). *Historic and modern lake trout abundance, effects of fishing on lake trout, and dynamics of the commercial lake trout fishery in Michigan waters of Lake Superior*. University of Wisconsin – Stevens Point
- Wilberg, M. J., Bence, J. R., Eggold, B. T., Makauskas, D., & Clapp, D. F. (2005). Yellow Perch Dynamics in Southwestern Lake Michigan during 1986–2002. *North American Journal of Fisheries Management*, 25(3), 1130–1152. <https://doi.org/10.1577/m04-193.1>
- Willoughby, J. F., & Smith, H. (2016). Communication strategies and new media platforms: exploring the synergistic potential of health and environmental communication. *Science Communication*, 38 (4), 535-545. <https://doi.org/10.1177/1075547016648151>
- Wisconsin Water Facts – Wisconsin Water Library*. (n.d.) <https://waterlibrary.aqua.wisc.edu/water-facts/>

Appendices

Appendix A: Shoreline Angler Survey Questionnaire and Results

Section 1: Preferences

1. People often have multiple motivations for going fishing. Please indicate how important the following are to your fishing experience. (1 = not important, 5 = very important)
 - a. Spending time with family/friends
 - b. Enjoying natural scenic beauty
 - c. Challenging Myself
 - d. Catching fish to eat
 - e. The thrill of the catch
 - f. Experiencing something new
 - g. Catching a big fish
 - h. Catching a lot of fish
2. How important is it to you to have opportunities for shoreline fishing in your local area? (1 = not important, 5 = very important)
3. What is your primary target species when fishing from the shoreline? (Check all that apply)
 - a. Trout/Salmon
 - b. Bass
 - c. Northern Pike
 - d. Panfish
 - e. Other (please specify)
4. How often do you harvest fish for consumption when fishing from the shoreline?
 - a. Always
 - b. Usually
 - c. Sometimes
 - d. Rarely
 - e. Never
5. On average, how satisfied or dissatisfied are you with the number of fish you catch per trip? (1 = very dissatisfied, 5 = very satisfied)
6. On average, how satisfied or dissatisfied are you with the general size and condition of fish you catch? (1 = very dissatisfied, 5 = very satisfied)
7. What problems have you experienced with public access sites when fishing from the shoreline? (Check all that apply)
 - a. Insufficient parking
 - b. Limited shoreline access
 - c. Poor maintenance of facilities
 - d. Safety concerns
 - e. None
 - f. Other (please specify)

Section 2: Skill and Knowledge

8. How would you describe your skill level as an angler?
 - a. Beginner

- b. Intermediate
 - c. Advanced
9. How many days per year do you typically fish from the shoreline?
 - a. 1-5 days
 - b. 6-10 days
 - c. 11-25 days
 - d. 26-50 days
 - e. More than 50 days
 10. On average, approximately how many hours did you spend fishing on each day that you fished over the last year?
 - a. <1
 - b. 1 -2 hours
 - c. 2-4 hours
 - d. 4-8 hours
 - e. More than 8 hours
 11. On average, how many one-way miles did you travel to access a fishing location over the last year?
 - a. Less than 10 miles
 - b. 10-25 miles
 - c. 26-50 miles
 - d. More than 50 miles
 12. On average, approximately how much money did you spend per fishing trip over the last year (consider licenses, food, gas, lodging, cost of a charter trip, and any equipment purchased, etc.)?
 - a. Less than \$50
 - b. \$51-\$100
 - c. \$101-\$200
 - d. More than \$200
 13. How much do you typically spend on fishing gear and equipment annually?
 - a. \$0-\$100
 - b. \$101- \$500
 - c. \$501-\$1000
 - d. \$1001-\$2000
 - e. More than \$2000

Section 3: Information Sources

14. How do you typically learn about fishing-related opportunities, regulations, or policies? (Check all that apply)
 - Social media (e.g., Facebook, Instagram)
 - Fishing forums or online communities
 - Local tackle shops
 - State or local fishing regulations and reports
 - Conversations with other anglers
 - Public meetings
 - DNR Sources (website, newsletters, etc.)
 - None

Other (please specify)

15. Which sources of fishing-related information (regulations, access locations, etc.) do you find most helpful? (Check all that apply)
- Social media (e.g., Facebook, Instagram)
 - Fishing forums or online communities
 - Local tackle shops
 - State or local fishing regulations and reports
 - Conversations with other anglers
 - Public meetings
 - DNR Sources (website, newsletters, etc.)
 - None
 - Other (please specify)
16. How would you prefer to receive information on opportunities to participate in fisheries management decisions?
- Social media (e.g., Facebook, Instagram)
 - Fishing forums or online communities
 - Local tackle shops
 - State or local fishing regulations and reports
 - Conversations with other anglers
 - Public meetings
 - DNR Sources (website, newsletters, etc.)
 - None
 - Other (please specify)
17. Indicate how much you agree/disagree with the following statements:
- a. It is easy to find information about fishing-related opportunities, regulations, or policies.
 - b. It is easy to understand the information you find about fishing-related opportunities, regulations, or policies.
 - c. The information you find about fishing-related opportunities, regulations, or policies is useful
 - d. You trust the information you find about fishing-related opportunities, regulations, or policies.
18. Have you ever participated in a DNR public meeting regarding fish management?
- a. Yes
 - b. No
19. Do you have interest in participating in DNR public meetings regarding fish management in the future?
- a. Yes
 - b. No
20. What is the best way to share information with you regarding upcoming DNR public meetings, regulation changes, or other fisheries management activities?

- DNR Website
 - Newspaper/Newsletters
 - Social Media
 - Email
 - Community Outreach
 - Flyers posted at fishing locations
 - Not Interested
 - Other (Please specify)
21. How would you prefer to share your opinions about fish management to the DNR?
- In-Person Public Meeting
 - Virtual Public Meeting
 - Online Surveys
 - Mail Surveys
 - Not Interested
 - Other (Please specify)
22. Which fishing related organization, association or club are you a member of? If more than one, please list all. (Open comment)

Section 4: Demographics

23. Age (Open comment)
24. Gender
- Male
 - Female
 - Non-binary/other
 - Prefer not to answer
25. Annual Household Income (Open comment)
26. Highest degree or level of school completed
- Some high school, no diploma
 - High school graduate
 - Associate degree
 - Bachelor's degree
 - Master's degree
 - Doctorate degree
27. Ethnicity
- White
 - Hispanic or Latino
 - Black or African American
 - Native American or American Indian
 - Asian/Pacific Islander
- Other
28. Zip Code of Residence (Open comment)

2023 Shoreline Angler Survey raw data published on https://github.com/jtbevington/2023-Shoreline-Angler-Thesis-Data/blob/main/Shoreline%20Angler%20Survey_rawdata.csv

Appendix B: DNR Staff Survey and Results

Q1. From your perspective, how important is it for DNR fishery management plans to emphasize shoreline angling opportunities? Selected Choice - (1 - Not Important, 5 - Very Important)

Q2. From your perspective, how important is it to engage shoreline anglers in policymaking processes? Selected Choice - (1 - Not Important, 5 - Very Important)

Q3. In your experience, how effective has the program been in incorporating shoreline angler perspectives into policymaking decisions? Selected Choice - (Not effective at all, Moderately effective, Slightly effective, Very effective)

Q4a. Are you aware of any efforts to include shoreline angling opportunities or shoreline angler groups in fisheries management decisions or policies? Selected Choice - (Yes, Unsure, No)

Q4b. Are you aware of any efforts to include shoreline angling opportunities or shoreline angler groups in fisheries management decisions or policies? - (Open comment)

Anonymous Respondent #3: There is dedicated funding to develop shoreline opportunities and shoreline opportunities are somewhat highlighted on DNR website

Anonymous Respondent #5: DNR Spring Hearings are open to anyone however generally a small number of individuals participate

Anonymous Respondent #8: Incorporation of shoreline angling opportunities like shore fishing stations and accessible piers into online mappers and featured in communications and Consideration of shoreline angling communities in relevancy analyses and recreational opportunity analyses like SCORP

Anonymous Respondent #9: I think all the decisions we make affect all anglers. I think all the decisions we make affect all anglers We could be bias toward boat anglers in some instances such as managing for trophy fisheries where access might be a problem for some

Anonymous Respondent #10: Creel surveys with angler preference questions solicit feedback from shoreline anglers Recent creel surveys on Lake Wisconsin Lower Wisconsin River and Devils Lake all made sure that shoreline anglers were interviewed That feedback goes into making management decisions Mail surveys of all license buyers should also be randomly including anglers who fish from shore Shoreline anglers may also participate in public meetings or hearings The Yahara Fishing club in Madison produces an informational pamphlet on public and accessible shore fishing locations in the Madison area

Anonymous Survey Respondent #14: Public hearings & meetings, Beaver Summits, Brule River stakeholder meetings.

Anonymous Survey Respondent #15: I would say in general that we don't have much of an effort. Except up here in my area there is a lot of trout angling, I would say 90% of trout anglers fish from the shoreline or wade. We spend a lot of time communicating with trout angling groups. So from a trout perspective, we have this covered pretty well. But from a warm water standpoint we do not.

Anonymous Survey Respondent #18: Shoreline anglers are included in creel counts in northern WI. We have been actively trying to increase shoreline opportunities by creating trails and piers.

Anonymous Survey Respondent #16: DNR FM has attempted to conduct angler creel and angler preference surveys in urban areas and other places outside of the Ceded territory in recent years. However, these efforts have had mixed results and hamstrung by staff vacancy issues and funding shortfalls.

Anonymous Survey Respondent #18: Shoreline anglers are included in creel counts in northern WI. We have been actively trying to increase shoreline opportunities by creating trails and piers.

Anonymous Survey Respondent #21: Shoreline and tributary opportunities are included in the Lake Michigan Fisheries Plan and these anglers were engaged in the development of the plan; Lake Michigan Fisheries Forum has tributary representatives; Great Lakes creel surveys include surveying shore, pier, and tributary fisheries. I believe shore angler opportunities are part of the Fisheries Strategic Plan. The GB and LM fishing report includes shore opportunities and shore fishing opportunities are mapped in online pdfs for Lake Michigan and Green Bay. The Urban Fishing program/ponds are geared toward shore fishing as are many other unofficial ponds/urban waters that are managed specifically for shore opportunities. Staff are regularly engaged with communities, US Forest Service, local municipalities, State Parks, and clubs in developing and maintaining shoreline fishing opportunities. Much of the trout habitat program is designed to improve shore fishing or wade fishing along trout streams. We have many opportunities for trout and warmwater species on Fisheries owned properties. We have many shoreline fishing opportunities and management actions to maintain and improve shoreline fishing; however, it has been a struggle to engage these anglers in participating in management decisions and to provide feedback and input into decision making.

Anonymous Survey Respondent #24: Shore angling for walleyes is very popular in tributaries to Green Bay in the spring. The minimum length limit is 15 inches to allow for harvest of one walleye per day by shore anglers. Each year, staff receive multiple requests to raise the minimum length limit during spring spawning walleye runs, but we have always maintained that these runs provide a unique harvest opportunity for shore anglers so we don't intend to raise the minimum length limit for this fishery.

Anonymous Survey Respondent #26: Trout creel surveys and lake creel surveys that have shoreline fishing opportunities. Those are direct ways to communicate with shoreline anglers. Some waterbodies have limited shoreline fishing opportunities, if there is a

specific meeting regarding that lake all anglers are welcome to join. If there are efforts just focusing on shoreline fishing opportunities from a statewide level I know there is some work in central office and work to get more streambank protection easements or fee lands.

Anonymous Survey Respondent #27: Stocking of nearshore strains of rainbow, brown and brook trout, Stakeholder meetings, Club Meetings

Anonymous Survey Respondent #28: Species management plans, angler mail surveys, Wisconsin Conservation Congress spring hearings, creel surveys, outreach events

Anonymous Survey Respondent #30: Shoreline anglers are members of other clubs such as Trout Unlimited and Rod and Gun Clubs

Anonymous Survey Respondent #31: Stakeholder meetings include shoreline angler groups, we also attend angler group meetings in the winter which often include shore anglers

Anonymous Survey Respondent #33: Inland trout anglers are nearly all shoreline anglers. Trout Unlimited is a group we frequently collaborate with. If trout fishing is considered shoreline angling (which I think it is), then shoreline angling is by far the most common type of angling in the area I cover (i.e., non-Miss R. waterbodies in Monroe, Vernon, La Crosse and Crawford Counties).

Anonymous Survey Respondent #35: Statewide boat and shorefishing access mapping application. In the COVID pandemic shorefishing opportunities for "Fish Near Home" were compiled, but not released (as I recall).

Anonymous Survey Respondent #37: Trout angling groups such as Trout Unlimited are great partners and play a large role in management decisions in the driftless area.

Anonymous Survey Respondent #38: When making Lake Michigan management/stocking decisions, we solicit input from all stakeholders including shoreline anglers and angler groups.

Anonymous Survey Respondent #39: Reporting fishing shoreline fishing access points in the new fishing app and within the current surface water data viewer. Creel surveys occur target all anglers but focuses on boat launches and may miss some shoreline areas when getting catch information. Some bus route trout creels occur that likely intercept shore anglers.

Anonymous Survey Respondent #40: Normal rules making processes and normal stocking decision processes; Pier planning and grants processes, etc.; Creel surveys, etc.

Anonymous Survey Respondent #44: From my experience, we do not preferentially target any one particular angler group in fisheries management discussions.

Q5a. What are the barriers or challenges that prevent the DNR from effectively incorporating shoreline angler perspectives into policymaking decisions? Check all that apply – (Limited knowledge of shoreline angler perspectives and interests, Lack of knowledge of how to communicate and engage with shoreline anglers, Limited participation/engagement from shoreline anglers, Lack of organizational structure among shoreline anglers, Other (Please specify))

Q5b. What are the barriers or challenges that prevent the DNR from effectively incorporating shoreline angler perspectives into policymaking decisions? (Open comment)

Anonymous Survey Respondent #8: The general challenge of incorporating the perspectives of a non dominant group. Its easy enough to respond to and incorporate perspectives of larger groups of anglers that have representation through organized groups or associations or whose views are just very dominant in the public conversation Its challenging to address those at the same time as addressing the perspectives of each less vocal or less dominant group which would certainly include shoreline anglers

Anonymous Survey Respondent #10: Publicly accessible shoreline anglers are more likely to represent lower socioeconomic groups than anglers who can afford boats or private access This can also correlate with minority groups. Often times this also means they are less likely to participate in public venues or receive targeted information.

Anonymous Survey Respondent #15: My answers are in regard to warm water shoreline anglers. I think a major barrier for warm water shoreline angler decisions is the lack of funding in the program, if we had the money to buy more warmwater shoreline property and the staff to maintain trails and piers, etc. then we could set up kiosks or do a better targeted approach to getting warmwater shoreline anglers perspectives.

Anonymous Survey Respondent #16: staff vacancies, funding cuts, lack of position authority to create new positions in other areas of needed work

Anonymous Survey Respondent #18: Difficult to determine who is ALWAYS a shoreline angler, SOMETIMES a shoreline angler, or NEVER a shoreline angler. How is wading (trout streams) classified? It's not always a clean definition or type of person.

Anonymous Survey Respondent #20: Staff level, time and program funding (the usuals)

Anonymous Survey Respondent #21 1.Cultural and language barriers--There is a component of shore anglers who do not speak English and are of various specific ethnic groups who traditionally are not engaged with DNR. 2. A lot of attention for shore anglers is focused on large urban communities while smaller communities and rural areas do not receive as much attention for shoreline fishing opportunities.

Anonymous Survey Respondent #25: Members of sportsman's clubs/others that are more invested in the sport seem to be more involved.

Anonymous Survey Respondent #26: I guess you have to define what policy you're talking about. At meetings, I don't ask those who attend if they shoreline fish or if they fish from a boat (for lake meetings). Trout meetings, everyone uses SBEs whether to access the water to fish in the water or to fish from shore. I don't ask who does what. Public turnout is overall low in my opinion at meetings. The Master Planning Meeting for the ecoregions I was involved with was low and no angler attended to talk about shoreline fishing. Not many anglers attended. Even when we had in-person WCC spring meetings the attendance was dropping. I think from my perspective when I work locally with cities, towns, villages, lake groups were always looking for opportunities to add ADA fishing piers or docks for more fishing opportunities. Using SFR, ARDC, etc. for grants. When we manage SBEs or acquire more SBEs or land we're always thinking about all anglers.

Anonymous Survey Respondent #28: I am not aware of any barriers, probably the same barriers we face with off shore anglers.

Anonymous Survey Respondent #31: There may be a high number of shoreline anglers but in general, they are less vocal than boat anglers.

Anonymous Survey Respondent #33: Again, if we are considering trout anglers shoreline anglers, than, from my perspective, I think we do a pretty good job.

Anonymous Survey Respondent #35: Valid assumption that managing sportfish populations and public access according to the preferences of anglers in general will include the subset of anglers who fish from shore.

Anonymous Survey Respondent #38: Lack of shoreline fishing and shoreline angler specific/directed conversations

Anonymous Survey Respondent #39: The barrier seems more of how to effectively engage and communicate. Fisheries management engages with the angling community in a number of ways such as online posts and reports, creel surveys, in person meetings. What is an effective way that accurately represents and engages the shoreline angling group is unknown.

Anonymous Survey Respondent #40: This is a biased question - I don't feel that there are barriers or extra challenges; Most shore anglers also fish from boats and vice-versa

Anonymous Survey Respondent #41: Popularity of boating; Strength of boating industry lobby

Q6a. Are you aware of specific communication methods that have proven particularly successful in connecting with shoreline anglers? - Selected Choice - (Yes (Please Specify), No, Unsure)

Q6b. Are you aware of specific communication methods that have proven particularly successful in connecting with shoreline anglers? - (Open comment)

Anonymous Survey Respondent #2: Roving creel surveys

Anonymous Survey Respondent #5: It seems social media is how everyone communicates these days...but perhaps a boots on the ground approach might work also.

Anonymous Survey Respondent #9: We have in many cases highlighted shoreline opportunities during outreach especially for opening day. Such as for the stocked trout fisheries, one of our best examples of shore fishing success.

Anonymous Survey Respondent #14: Online and Creel surveys.

Anonymous Survey Respondent #15: We do a good job of engaging our shoreline trout anglers. We have communications through TU chapters, have public meetings about the management of the property around some of our larger rivers.

Anonymous Survey Respondent #16: in-person angler creel surveys and angler preference surveys

Anonymous Survey Respondent #19: Because shore anglers rarely belong to an organized fishing club, the Lake Michigan/Green Bay creel program strives to keep creel clerks informed of upcoming meetings, public comment periods, etc. so that creel clerks can inform the shore anglers they interview. However, this method varies widely in its effectiveness, depending on the individual creel clerk.

Anonymous Survey Respondent #21: Communication through creel interviews. Signage at fishing locations. Online fishing reports. Social media post. Observations by encouraging DNR staff to visit shore fishing locations to observed fishing activity.

Anonymous Survey Respondent #26: Karl always asks the biologists for shoreline fishing opportunities in our areas for the webpage or Facebook posts before the fishing opener.

Anonymous Survey Respondent #28: I often connect with a variety of anglers during outreach events such as sport shows, state fair conservation congress. This is an informal process, but it provides local feedback from all anglers for management purposes.

Anonymous Survey Respondent #33: Streamside electrofishing demonstrations, engaging anglers on the stream while engaged in field work, attending TU meetings and sharing information with them. Being an active stream angler and part of the local angling community also helps.

Anonymous Survey Respondent #35: Signage and feedback opportunities at developed and undeveloped shorefishing access points.

Anonymous Survey Respondent #37: Local meetings with stakeholder groups such as Trout Unlimited and Sportsmen Clubs

Anonymous Survey Respondent #40: Creel surveys

Q7a. What strategies or resources do you think the DNR should use to incorporate the perspectives of shoreline anglers into policymaking decisions? Check all that apply – (Targeted online education and outreach initiatives, Host public meetings specifically for shoreline anglers, User-friendly online surveys, Establish a task group for shoreline anglers and shoreline angling opportunities, Partner with local community groups, Unsure, Other (Please specify))

Q7b. What strategies or resources do you think the DNR should use to incorporate the perspectives of shoreline anglers into policymaking decisions? (Open comment)

Anonymous Survey Respondent #21: Direct outreach through creel programs or directly engaging shore anglers during popular fishing times. Signage or voluntary surveys at fishing access locations.

Anonymous Survey Respondent #26: Creel surveys

Anonymous Survey Respondent #28: Public meetings are typically under attended with minimal feedback, however these can be implemented virtually which has possibly improved participation.

Anonymous Survey Respondent #33: You might need to specify if you are considering trout anglers shoreline anglers or not, because including them or excluding them would change my response.

Anonymous Survey Respondent #40: Nothing special needs to be done - they are already adequately represented and heard from

Anonymous Survey Respondent #41: Outreach to municipal and county governments who could promote shoreline opportunities more effectively at the municipal and county levels. Hire multi-lingual staff to improve communication and translation between and among non-English-speaking shoreline anglers.

Anonymous Survey Respondent #42: Communication of participation opportunities through signage at shoreline congregation areas

Q8a. Are you aware of specific engagement initiatives or programs that have demonstrated success in incorporating shoreline angler perspectives into management decisions? - Selected Choice (Yes (Please provide an example), No, Unsure)

Q8b. Are you aware of specific engagement initiatives or programs that have demonstrated success in incorporating shoreline angler perspectives into management decisions? – (Open comment)

Anonymous Survey Respondent #6: WCC/NRB meetings. Shoreline anglers have the same opportunities as other user groups.

Anonymous Survey Respondent #8: SCORP analyses have done a decent job.

Anonymous Survey Respondent #9: The Lake Michigan angler survey by Nick Legler and the 2021 Winnebago spearer surveys targeted all spearers.

Anonymous Survey Respondent #10: Creel Surveys with angler preference questions.

Anonymous Survey Respondent #15: We do opening weekend trout creel surveys where we drive around and interview anglers and make counts. This has been a good way to gather input from these anglers. We also do remote creel surveys using trail cameras and kiosks at our stocked trout waters, this has allowed anglers to give input on the questionnaires they fill out.

Anonymous Survey Respondent #21: Creel surveys, communications & partnerships with communities and NGO's

Anonymous Survey Respondent #24: There is a Team USA street fishing team that competes in the street fishing world championships. All of the fishing in these events must be done from shore. This organization does a lot to promote shore fishing opportunities and is an organization that can share perspectives of shore anglers.

Anonymous Survey Respondent #28: We established a "Stakeholder Engagement Team" which provides structure on how to best implement outreach efforts and incorporate feedback into management decisions. The recent Walleye management plan incorporated shore anglers' views.

Anonymous Survey Respondent #31: Our stakeholder meetings attract some shoreline anglers. Since we have been posting those meetings online and asking for emailed comments we have seen more input from shoreline anglers.

Anonymous Survey Respondent #40: Creel surveys and normal rule and decision making processes

Q9. Optional: How can the DNR improve its communication and outreach efforts to ensure that shoreline anglers have the opportunity to provide input into fisheries management decision-making process? (Open comment)

Anonymous Survey Respondent #4: When conducting creel surveys ask shoreline anglers if they would like to give contact info to be contacted to complete surveys of get information relevant to them.

Anonymous Survey Respondent #5: Dedicate more staff and staff time to this effort.

Anonymous Survey Respondent #8: More outreach/education to underrepresented groups about getting involved with the Wisconsin Conservation Congress

Anonymous Survey Respondent #9: Ensure we note these at every opportunity, annual fishing report etc, opening day outreach, facebook QnAs.

Anonymous Survey Respondent #10: Appropriate signage and information displayed in high use publicly accessible shoreline areas. Use QR codes and prompts to direct anglers to resources on the web.

Anonymous Survey Respondent #16: DNR needs to reach out to these shore anglers instead of only listening to the loudest, most well-funded, and well organized angler groups

Anonymous Survey Respondent #17: Creel Surveys

Anonymous Survey Respondent #18: Post meeting information or survey QRC codes at popular shoreline fishing spots (piers).

Anonymous Survey Respondent #21: Better shoreline fishing location mapping. Further shoreline access development (e.g., more fishing piers). Better use creel to obtain social economic data and angler opinions.

Anonymous Survey Respondent #23: I think we have to go to them and not expect them to come to us. In other words, DNR staff on the landscape seeking out shore angler perspectives.

Anonymous Survey Respondent #26: I think the department should identify what policy-making processes (define those) they could do better to specifically engage shoreline anglers. Then build a plan to engage shoreline angler, etc.

Anonymous Survey Respondent #28: recover 20+ fisheries positions, we simply do not have enough people to effectively work with all our stakeholders.

Anonymous Survey Respondent #29: Better tools for helping the average person identify where shore fishing opportunities exist, especially QUALITY opportunities. People need an easier way to find out where the good and SAFE shorefishing opportunities are.

Anonymous Survey Respondent #40: They are already adequately represented

Anonymous Survey Respondent #44: better target communication/inclusion in management discussions/meetings

Q10: Optional: Do you have any other thoughts, suggestions, or ideas regarding shoreline angling opportunities and shoreline angler participation in the Bureau's policymaking processes? (Open comment)

Anonymous Survey Respondent #3: The mapping of shore-access sites on DNR website is incomplete, it is missing a lot of sites.

Anonymous Survey Respondent #4: We need to identify who shoreline anglers are and how to contact them.

Anonymous Survey Respondent #5: no

Anonymous Survey Respondent #6: Policymaking needs to be defined. The shoreline anglers have the same opportunity to attend WCC/NRB/other meetings as everyone else. They need to show initiative.

Anonymous Survey Respondent #9: support the WCC hearings and take input there.

Anonymous Survey Respondent #16: DNR needs to reach out to this community more intentionally and in different ways than standard communication pathways. These groups are often underserved in other areas of society and DNR doesn't reach these folks enough, or effectively even though every urban area has lots of shore anglers in WI, we don't even have a way to quantify the # of shore anglers across the state to understand the need or gaps.

Anonymous Survey Respondent #17: Focus these outreach efforts on waters where shoreline fishing opportunities are abundant.

Anonymous Survey Respondent #18: Encourage staff to try shoreline fishing (if they don't commonly do it) so they can have the firsthand experience to draw from on where the opportunities and obstacles are for those types of anglers. People who exclusively fish out of boats may benefit from that exercise.

Anonymous Survey Respondent #20: recognize river and streambank anglers as a relevant part of this group

Anonymous Survey Respondent #21: Better meld DEI and environmental justice goals with shoreline opportunity goals. Many of these goals are complementary but we are not skilled or comfortable in speaking in these terms.

Anonymous Survey Respondent #28: reduce fish stocking, move positions from fish culture to fish management, utilize positions to implement additional outreach efforts. Collaborate with R3 program to obtain angler feedback.

Anonymous Survey Respondent #29: We need to do more to increase the number of good, safe shorefishing spots along our waters, with lakes and larger rivers getting much

of the focus. We do great at offering trout fishing opportunities along streams. Lakes and rivers is where we fall short.

Anonymous Survey Respondent #30: In rural WI, shoreline anglers are part of other angling groups and likely make up a small proportion of the angling public. In my management area, I don't see a need to single out this small user group to make policy decisions. In urban areas, where there are more shoreline anglers it is logical to reach out to them prior to making policy changes.

Anonymous Survey Respondent #35: No. Questions from anglers about shorefishing and shorefishing access represent a very small percentage of the inquiries that I answer each year in northern Wisconsin.

Anonymous Survey Respondent #39: Having an understanding of what proportion of the angling community shoreline anglers represent within the entire angling community and the various angling strata (great lakes, rivers, streams, inland lakes) would be useful. This also may be geographically distinct. Maybe shoreline is more important for the great lakes areas and trout streams vs inland lakes.

Anonymous Survey Respondent #40: They are adequately represented

Anonymous Survey Respondent #42: The program has a poor track record of development of QUALITY shoreline angling opportunities has

DNR Staff Survey raw data published at https://github.com/jtbevington/2023-Shoreline-Angler-Thesis-Data/blob/main/Shoreline%20Angler%20Survey_rawdata.csv