

EXPLORING STAKEHOLDERS' SUPPORT FOR AND STEWARDSHIP OF MICHIGAN'S  
COASTAL WILDLIFE MANAGEMENT AREAS

By

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## **ABSTRACT**

Trends in changing socio-demographics and wildlife-related recreation participation have implications for the sustainability of wildlife conservation in the United States. State Wildlife Agencies (SWAs) seek to broaden support, both politically and financially, for wildlife management. Wildlife Management Areas (WMAs) deliver wildlife conservation on a local scale and provide opportunities to build support and foster stewards. This dissertation sought to understand stakeholder support for and stewardship of Michigan's coastal WMAs that are intensively managed for waterfowl and waterfowl hunting using quantitative surveys of four key WMA stakeholder groups—waterfowl hunters, birdwatchers, anglers, and community members.

I assessed stakeholder attitudes about and preferences for WMA wildlife and recreation management and found differences among WMA stakeholders, especially waterfowl hunters and birdwatchers. However, similarities detected between waterfowl hunters and birdwatchers may provide opportunities for agencies to leverage this common ground. Attitudinal similarities and differences have implications for agencies to understand how management actions may or may not be supported by stakeholders, identify potential points of conflict or points of complementariness for recreational activities, consider trade-offs for management actions, and make improved decisions that serve a broader set of stakeholders. An investigation of stakeholder perceptions of ecosystem services (ES) revealed that stakeholders largely valued ES and thought that WMA management actions were providing key ES. I recommended that agencies leverage this information and connect management actions to the ES benefits that are most important to their stakeholders.

I explored variables that influence frequency of conservation behaviors and found that recreation participation variables (centrality of activity and membership in an

environmental/conservation organization) and identity salience variables (waterfowl hunter, outdoor enthusiast, and conservationist) had positive associations. I provided recommendations for agencies to prioritize communications and engagement with members of existing organizations to strengthen group norms for conservation behaviors and potentially WMA stewardship. I also recommended strategies that appeal to conservationist identities and facilitate positive relationships between hunting and non-hunting stakeholders to socially connect and build and foster group identity and norms.

An investigation of support for a diversity of funding options among WMA stakeholders determined that there is support for a broader suite of funding policies for WMAs, although groups differed in their support. Results suggest that birdwatchers hold potential for increased support of WMAs and appear to be interested in contributing financially to WMAs, however not necessarily in current or traditional ways. Variables that influenced support for funding options included frequency of conservation behavior; identity salience as a birdwatcher, waterfowl hunter, and conservationist; and membership in an environmental/conservation organization. I proposed a typology of stakeholders useful for making predictions about how funding options might appeal to certain groups and informing targeted communication and marketing strategies. I recommended that agencies seek to develop a diversified portfolio of traditional and new funding mechanisms that could be supported by a wide range of stakeholders and that facilitates broader support for WMAs.

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## TABLE OF CONTENTS

Chapter 1: Introduction and Organization .....	1
Chapter 2: Comparing Attitudes and Preferences of Wildlife Management Area Stakeholders....	8
Abstract .....	8
Introduction.....	9
Methods.....	15
Results.....	25
Discussion .....	35
Tables.....	46
Figures.....	55
Chapter 3: Stakeholder Perceptions of Ecosystem Services Provided by Wildlife Management Areas .....	56
Abstract .....	56
Introduction.....	57
Methods.....	66
Results.....	69
Discussion .....	73
Tables.....	80
Figures.....	84
Chapter 4: Predicting Conservation Behavior of Wildlife Management Area Stakeholders .....	87
Abstract .....	87
Introduction.....	88
Methods.....	97
Results.....	102
Discussion .....	105
Tables.....	113
Chapter 5: Predicting Support and a Typology for Wildlife Management Area Funding.....	117
Abstract .....	117
Introduction.....	118
Methods.....	128
Results.....	134
Discussion .....	141
Tables.....	150
Figures.....	157
Chapter 6: Conclusion and Recommendations .....	158
REFERENCES .....	167
APPENDIX A: SPRING AND SUMMER 2018 COASTAL WILDLIFE MANAGEMENT AREA VISITOR USE SURVEY PRELIMINARY RESULTS.....	182

APPENDIX B: FALL 2018 COASTAL WILDLIFE MANAGEMENT AREA VISITOR USE SURVEY PRELIMINARY RESULTS .....	210
APPENDIX C: MICHIGAN COASTAL WILDLIFE MANAGEMENT AREA ANGLER SURVEY.....	231
APPENDIX D: MICHIGAN COASTAL WILDLIFE MANAGEMENT AREA BIRDWATCHER SURVEY .....	249
APPENDIX E: MICHIGAN COASTAL WILDLIFE MANAGEMENT AREA COMMUNITY MEMBER SURVEY .....	268
APPENDIX F: MICHIGAN COASTAL WILDLIFE MANAGEMENT AREA WATERFOWL HUNTER SURVEY .....	286
APPENDIX G: NON-RESPONSE TABLES.....	305



## **Chapter 1: Introduction and Organization**

Wildlife is managed in the United States by the Public Trust Doctrine that recognizes wildlife as a public trust resource and where federal and state wildlife agencies (SWAs) are charged with managing wildlife resources for all beneficiaries (Geist et al., 2001). However, hunters have largely funded wildlife conservation in North America during the last 85 years through a user-pay system of purchases of hunting licenses and other hunting equipment (Heffelfinger et al., 2013). While this model has proven successful (Geist et al., 2001; Heffelfinger et al., 2013; Mahoney & Jackson, 2013), there are reasons to believe that dependence on this one user-pay mechanism to fund wildlife conservation may not be sustainable given current recreation and demographic trends (Jacobson et al., 2010). Additionally, some people argue that the current hunter-based funding mechanism results in agencies giving preference to hunters and management of game species (McKinney et al., 2005; Dalrymple et al., 2012; Decker et al., 2016; Duda et al., 2021). Hunting participation is experiencing a declining trend (Cordell, 2012; Winkler & Warnke, 2013; USFWS, 2016a) while participation in wildlife-related recreation (e.g., wildlife watching) is increasing (USFWS, 2016a). As numbers of non-hunting wildlife recreationists increase and hunters decrease, it is unclear how the current model for wildlife conservation will be affected by the changing nature of investments in wildlife management from this shift in wildlife stakeholders. As the United States becomes more ethnically diverse, more urbanized, and more mutualistic in wildlife value orientations, it is also unclear how these changing demographics will affect wildlife conservation and the relevancy of federal and SWAs (Jacobson et al., 2010; Teel & Manfredo, 2010; Echols et al., 2019).

SWAs are concerned about this looming loss of relevancy to a changing set of beneficiaries and have made urgent calls for agencies to broaden interest, participation, and support for wildlife management beyond traditional stakeholders such as hunters (Jacobson & Decker, 2006; Jacobson et al., 2010; Decker et al., 2016; AFWA, 2019). Additionally, there is a growing demand for increased attention to a broader set of beneficiaries and more inclusive and diverse participation in wildlife conservation policy and decision-making (Jacobson et al., 2010). To address concerns about the future of wildlife conservation support and funding, relevancy of agencies, and long-term sustainable wildlife management, there have been recommended strategies such as increasing and diversifying outdoor recreation opportunities, connecting wildlife conservation to the broader ecosystem services (ES) provided by wildlife management actions, and exploring broad-based funding mechanisms. There have also been recommendations for increasing social science research to investigate strategies for agencies to engage and serve a broader set of stakeholders to grow financial and political support for wildlife conservation (Messmer & Enck, 2012; AFWA & WMI, 2019).

The potential wildlife conservation funding dilemma has impacts at multiple scales, including at the federal and SWA wildlife management area (WMA) level where management activities are also largely funded by hunters. For example, the Michigan Department of Natural Resources (MDNR) has concerns about potential future funding shortages for WMAs in Michigan and is seeking information to assist them with broadening support for WMAs by exploring stewardship potential of stakeholders and identifying alternative funding mechanisms for their coastal WMAs that are intensively managed for waterfowl habitat and waterfowl hunting opportunities. These coastal WMAs are a priority because the management and infrastructure maintenance costs are typically higher at these areas and the MDNR has made

significant financial investments in wetland management infrastructure. Whereas the management at these areas results in high-quality wetland habitat for waterfowl and waterfowl hunting, these areas also attract a diversity of other wildlife species and non-hunting recreational opportunities (e.g., wildlife watching, fishing, paddling).

Little is known about stakeholders' attitudes towards and preferences for management and the ecological and human well-being benefits these WMAs provide. Increasing political and financial support for wildlife conservation on these coastal WMAs will benefit from building a group of diverse wildlife stewards. Stewardship potential can be addressed by exploring recreation participation and opportunities, social values of ES, conservation behaviors, and support for a suite of funding mechanisms.

Increasing the amount or types of recreational opportunities is a potential approach to increasing the numbers of stakeholders that use, value, and support WMAs and wildlife conservation. Participation in outdoor recreation has been associated with increased pro-environmental behaviors (PEB) and environmental stewardship (Theodori et al., 1998; Tarrant and Green, 1999; Tiesl & O'Brien, 2003; Manfredo, 2008; Zaradic et al., 2009; Cooper et al., 2015; Doyle-Capitman et al., 2017; Ghasemi & Kyle, 2021). Wildlife-related recreationists may have a vested interest in conserving wildlife because their recreational pursuits rely on healthy wildlife habitat and populations (Cooper et al., 2015; Ghasemi & Kyle, 2021). Federal and state WMAs provide a range of hunting and non-hunting opportunities, and these agencies could leverage this diversity of recreation to gain wildlife conservation stewardship on these areas (Cooper et al., 2015; Ghasemi & Kyle, 2021). Understanding the attitudes and preferences of a diversity of stakeholders that use WMAs is a first step (AFWA & WMI, 2019; van Eeden, 2020),

especially when increased amount and diversity of wildlife-compatible recreation may lead to potential conflicts or complementariness of the activities.

An increased understanding of the similarities and differences between and among coastal WMA stakeholders (e.g., waterfowl hunters, birdwatchers, and anglers) will address a need to determine the types of habitat and recreation management that are important to hunting and non-hunting stakeholders (Cooper et al., 2015). For example, waterfowl hunting and birdwatching are extremely popular recreational activities at Michigan's coastal WMAs and there are key differences and similarities between these two stakeholder groups (McFarlane, 1994; McFarlane & Boxall, 1996; Adams et al., 1997; Daigle et al., 2002; Teisl & O'Brien, 2003; Schroeder et al., 2006b; Cooper et al., 2015) that can be used to develop strategies to build broad-based use and support of WMAs.

Although WMAs are managed primarily for wildlife habitat and wildlife-related recreation, these areas also provide a broad suite of other ES (Ingraham & Foster, 2008; Mushet et al., 2022). There have been several recommendations for agencies to communicate and connect various publics to the diversity of ES and human well-being benefits that result from wildlife conservation, specifically those ES that the public needs and cares about most (NAWMP, 2018; AFWA & WMI, 2019), to build greater public support for conservation (Scholte et al., 2016; NAWMP, 2018). Social science research can address how stakeholders perceive the values of ES, including those ES provided by WMA management (deGroot et al., 2002; Asah et al., 2014; AFWA & WMI, 2019). Previous studies have demonstrated benefits to conservation efforts when a diversity of ES are incorporated into management including better policy and management decisions (Cole et al., 2015), increased public support by highlighting human well-being benefits (Annis et al., 2017), improved policy compliance (Asah et al., 2014),

and motivated conservation behavior (Asah et al., 2014; Clarke et al., 2021). Gaining insight into how stakeholders perceive ES provided by coastal WMA management presents an opportunity to potentially build support for these areas and wildlife conservation in general while maximizing the ecological benefits most important to stakeholders and continuing to meet habitat and wildlife-related recreation goals.

Examining PEBs, and specifically conservation behaviors, of WMA stakeholders can provide insight about stewardship potential. To understand this potential, it is important to know what factors influence conservation behaviors so that agencies can take actions to increase positive associations. There have been recommendations for increased knowledge of the factors that influence PEBs (e.g., recreation participation, recreation specialization, values, motivations, identity, place attachment) to inform the facilitation of stewardship opportunities (Cooper et al., 2015; Landon et al., 2018; Larson et al., 2018).

SWAs have identified securing alternative broad-based long-term wildlife conservation funding solutions as a priority (Jacobson et al., 2007). To accomplish this, additional knowledge is needed to understand the public's support for a diversity of wildlife conservation funding options (AFWA & WMI, 2019; Nkansah et al., 2021) as well as understanding political constraints to implementation (Jacobson et al., 2007; Larson et al., 2021). There are examples of public support of multiple funding mechanisms at state and national scales (e.g., state taxes, natural resource extraction fees, user-based taxes on outdoor gear) (Dalrymple et al., 2012; Henderson et al., 2021; Larson et al., 2021; Nkansah et al., 2021), however there is a paucity of understanding about support for wildlife funding mechanisms at smaller scales (e.g., WMA scale) (Nkansah et al., 2021). Related, understanding the factors that influence support for a diversity of funding mechanisms (e.g., participation in outdoor recreation, past conservation

behavior, wildlife value orientations, place attachment, and trust in SWAs) (Dalrymple et al., 2012; Manfredo et al., 2017; Henderson et al., 2021; Larson et. al, 2021), can provide agencies with information to consider a diversity of funding mechanisms, develop targeted communication and engagement strategies and develop and implement new sustainable funding policies that may result in a group of diverse constituents that support, both politically and financially, wildlife conservation.

My dissertation research seeks to understand the support for and stewardship potential of key stakeholders associated with coastal WMAs to address concerns about sustainable wildlife conservation. With this purpose, the dissertation research was directed by five objectives: 1) assess stakeholder attitudes about and preferences for management objectives and actions at WMAs; 2) investigate stakeholder perceptions of ES and their attitudes about ES resulting from WMAs; 3) explore key variables that influence conservation behaviors; 4) explore support for a diversity of funding options among WMA stakeholders; and 5) suggest recommendations for SWAs to facilitate stewardship opportunities and build support for WMA management. To accomplish these research objectives, I used quantitative surveys of four key WMA stakeholder groups: waterfowl hunters, birdwatchers, anglers, and community members. Funding for this research project came from the MDNR Wildlife Division through U.S. Fish and Wildlife Service Pittman-Robertson Wildlife Restoration Act Grant MI W-155-R.

My dissertation includes an introductory chapter, four chapters that use data from the stakeholder surveys and are written and formatted for future submission to peer-reviewed journals, and a concluding chapter. Chapter 2 compares attitudes and preferences for WMA management to inform management strategies to complement a diversity of recreation. Chapter 3 reports findings of stakeholders' perceived importance of ES and their attitudes about ES

resulting from WMA management to inform policy and management decisions that maximize ES and provide an opportunity to build support for wildlife conservation. Chapter 4 explores the factors that influence stakeholder conservation behaviors to develop strategies that increase stewardship potential on WMAs. Chapter 5 compares stakeholder support for a diversity of WMA funding options, explores influences on support for WMA funding options, and proposes a typology based on support for WMA funding options to inform new sustainable funding policies. Finally, Chapter 6 provides a summary of key findings; contributions to theory, policy, and practice; and recommendations for agencies to increase stakeholder support for and stewardship of coastal WMAs.

## **Chapter 2: Comparing Attitudes and Preferences of Wildlife Management Area Stakeholders**

### **Abstract**

As hunting participation decreases and participation in non-hunting recreation increases, there are consequences to the current user-pay funding model for wildlife conservation. One response by state wildlife agencies (SWAs) has been to diversify recreational opportunities on wildlife management areas (WMAs), however impacts of increased interactions between a broad set of users (e.g., hunters and non-hunting recreationists) are largely unknown. The purpose of my study is to compare attitudes and preferences for management objectives and actions of key hunting and non-hunting stakeholders that use WMAs to inform strategies that may complement a diversity of recreation. Coastal wetlands that are managed primarily for waterfowl and waterfowl hunting provide a unique case study to compare stakeholders because of the intensity of management for both wetland habitat and hunting recreation, and because they provide abundant and diverse non-hunting opportunities. Using internet and mail-back surveys, I received responses from waterfowl hunters ( $n = 316$ ), birdwatchers ( $n = 1,133$ ), anglers ( $n = 254$ ), and community members ( $n = 84$ ) in 2019 at six WMAs in southeastern Michigan, USA. Chi-Square and one-way ANOVA tests followed by post-hoc pairwise comparisons were used to compare the four stakeholder groups' responses related to recreation specialization, strength of identities, use of public and private lands for recreation, knowledge and use of WMAs, attitudes about and preferences for current and future wildlife and recreation management at WMAs, and socio-demographics. I found differences among WMA stakeholders, and especially between waterfowl hunters and birdwatchers in their attitudes about wildlife species, habitat, and recreation management, and their preferences for changes to management. I found that, compared to birdwatchers, waterfowl hunters place more importance on game species and



hunting management and do not generally desire changes to management. However, birdwatchers and waterfowl hunters were similar in the great importance they placed on wildlife and habitat management objectives and in their increased specialization and commitment to their recreation type, including stronger identities associated with their recreation, stronger identification as conservationists, and increased likelihood of belonging to environmental/conservation organizations as compared to the other two groups. My results indicate that birdwatchers may have high potential to contribute to WMAs. The similarities and differences between waterfowl hunters and birdwatchers can be used by SWAs to identify potential conflicts and opportunities for complementary management actions that serve a broader set of WMA stakeholders. I provide recommendations for SWAs to build on common ground and to develop strategies that facilitate positive interactions between a diversity of stakeholders to build support for WMA management.

## **Introduction**

There are urgent calls for SWAs to broaden interest and support for wildlife management beyond traditional stakeholders such as hunters (Jacobson & Decker, 2006; Jacobson et al., 2010; Decker et al., 2016; AFWA, 2019). This has become increasingly important as participation in traditional outdoor recreation such as hunting decreases and has serious implications for the current user-pay mechanism for wildlife conservation funding (Jacobson et al., 2010). Participation in hunting has been declining in the United States and is predicted to continue to decline (Cordell, 2012; Winkler & Warnke, 2013; USFWS, 2016a). In contrast, the number of wildlife watchers increased 20% from 2011 to 2016, with 86 million people participating in wildlife watching activities, and more than 45 million of those participants were viewing birds (USFWS, 2016a). Hunting participation decreased 16% in the same time with 11.52 million

hunters in 2016, and specifically migratory bird hunters decreased by 9%, with 2.4 million participants in 2016 (USFWS, 2016a). To meet the needs of increasing non-hunting recreationists, SWAs are employing strategies such as increasing and diversifying outdoor recreation opportunities on WMAs. Social science research can address the lack of information about diverse stakeholder perceptions of wildlife management, identify the types of experiences desired by diverse stakeholders, and assess the potential conflicts or complementariness of a broader set of recreational opportunities to realize management outcomes (AFWA & WMI, 2019; vanEeden et al., 2020).

In North America, hunters contribute to wildlife conservation and management via purchases of hunting licenses and other hunting equipment. Under this aspect of what has been described as the North American Model of Wildlife Conservation (the Model), state wildlife conservation is primarily funded by hunters, trappers, and shooters through revenue from license sales and Pittman-Robertson (P-R) Wildlife Restoration funds (excise taxes on firearms and ammunition). The Public Trust Doctrine (PTD) is the foundation of the Model, and a key component is that wildlife is a public trust resource where all citizens are beneficiaries (Geist et al., 2001). The Model has been described as a success for wildlife conservation (Geist et al., 2001; Heffelfinger et al., 2013; Mahoney & Jackson, 2013) with hunters having contributed billions of dollars to wildlife conservation that benefit many different wildlife species, habitats, and stakeholders. The revenue from these license sales and taxes have been used for habitat conservation, law enforcement, monitoring and management of populations, agency infrastructure, population restoration, research, hunter education programs, and public outreach (Heffelfinger et al., 2013). However, there are concerns that the Model is not sustainable if hunter numbers decline and could lead to reduced funding for wildlife management, the need for

SWAs to reform, and the need for non-hunting stakeholders to contribute financially (Heberlein, 1991; Adams et al., 1997; Jacobsen & Decker, 2006; Jacobsen et al., 2010). Jacobsen et al. (2010:203) state that dependency on hunters has left the wildlife management institution “poorly positioned to meet changing ecological and social complexities” and the changing needs of society. Along with declining hunter numbers, there has also been increasing interest from nontraditional stakeholders for better access and more services related to wildlife as well as a desire to be involved in decision making related to wildlife management (Jacobsen & Decker, 2006). Jacobson et al. (2010) note that the current user pay system is not consistent with the PTD because it only relies on one set of stakeholders instead of all stakeholders and provide recommendations for an improved wildlife management institution that includes broad-based funding; trustee-based governance disassociated from political interests; multidisciplinary science; and a diverse and involved set of stakeholders.

Waterfowl hunters provide additional funds for wetland habitat and waterfowl conservation via purchases of Federal Migratory Bird Hunting Conservation Stamps, which are required for hunting waterfowl. More than 98% of funding from “duck stamp” sales are used to purchase or lease waterfowl habitat in the National Wildlife Refuge system and sales have generated more than \$850 million (USD), which has been used to help purchase or lease over 6.0 million acres of waterfowl habitat (Madison, 2016; USFWS, 2016b). If numbers of waterfowl hunters decline, there could be severe losses in future wetland habitat conservation (Vrtiska et al., 2013) unless other sources of revenue are created. Without conservation of additional wetlands, there will be negative effects to other wildlife species as well as human well-being because of the far-reaching benefits derived from wetlands. The waterfowl management community has placed importance on growing the numbers of non-hunting recreationists that use

and actively support waterfowl and wetlands conservation to mitigate potential future wetland losses, and there is a call for increased human dimensions research to inform strategies to support this goal (NAWMP, 2018).

WMAs are usually purchased and managed with funds from hunting licenses and hunting-related revenue, however these areas are also destinations for non-hunting recreation (e.g., wildlife watching, fishing, paddling, hiking, etc.). As SWAs are encouraged to diversify their management to provide more diverse recreational opportunities on WMAs (AFWA & WMI, 2019), there are tradeoffs associated with these changes to be considered (e.g., increasing access for one activity could decrease access for another). Recreation conflict literature provides insights to manage these interactions among WMA users and has typically focused on the direct conflicts between recreation types with strategies to restrict certain activities spatially or temporally (Roe & Benson, 2001; Hidalgo & Harshaw, 2012) and educate recreationists to modify expectations (Blahna et al., 1995; Manning et al., 1996; Whittaker et al., 2001).

Although less common, recreation user conflicts aren't always based on direct interactions. The social value conflict theory posits that conflicts can occur due to differing norms and values of recreationists (Vaske et al., 1995; Carothers et al., 2001), further highlighting the need for managers to understand their stakeholders. A common example of this is hunter and non-hunter conflicts in the acceptable uses of wildlife (Vaske et al., 1995). Under these circumstances, education about reasons for recreation management actions may be effective (Carothers et al., 2001).

Some researchers argue that the approach to managing recreation conflict does not have to be conflict-based and have developed models based on compatibility of recreation types that recognize both negative and positive interactions (Scott et al., 2005; Marcouiller et al., 2008).

These models pivot from “a glass half empty, problem-based approach to a glass half full, more positive approach” (Scott et al., 2005:26) and recognize four general types of interactions: antagonistic (one activity does not allow the other), competitive (one activity decreases while the other increases), supplementary (one activity does not impact the other), and complementary (one activity stimulates or increases the other). These models also include the influence and importance of management actions, including thoughtful planning, on the user interactions to produce positive outcomes. Management tools for antagonistic and competitive interactions would include separation and regulation, while supplementary and complementary interactions would require monitoring and encouragement (Scott et al., 2005; Marcouiller et al., 2008). Based on this thinking, SWAs would attempt to maximize the supplementary and complementary interactions and minimize the antagonistic and competitive ones. I use the analogy of a pie where planning and managing for complementary recreation is similar to expanding the pie, while managing for direct conflicts is like dividing the existing pie (Forester, 1984). Research is lacking on the characteristics (e.g., attitudes and perceptions) of both hunting and non-hunting wildlife-related recreationists to identify potential complementary actions to be able to move beyond perceived competition and toward cooperation. Shifting from a mindset of scarcity (competing for the current pieces of pie) to complementary (expanding the pie for all) will take additional exploration and a commitment from SWAs to think about recreation management on WMAs differently.

Previous research provided knowledge about characteristics and motivations of recreationists such as waterfowl hunters and birdwatchers (Adams et al., 1997; Hvenegaard, 2002; Schroeder et al., 2006b; Brunke & Hunt, 2008; Sali et al., 2008; Schroeder et al., 2012). However, there is not a clear understanding of the similarities and differences between key

WMA stakeholders (e.g., hunters, birdwatchers, other recreational users, local community members) and their perceptions of the types of habitat management that are important to them (Cooper et al., 2015). Several studies have found differences in wildlife viewers' and hunters' beliefs, attitudes, subjective norms, perceptions of behavioral control, and wildlife value orientations (Daigle et al., 2002); socio-demographics such as age, gender, income, and education (Adams et al., 1997; Cooper et al., 2015); and commitment to recreation (Adams et al., 1997). Regarding opinions about SWA engagement with stakeholders, Adams et al., (1997) found that birdwatchers did not think their interests were addressed by the agency and that there was more emphasis placed on hunters' opinions and game species management. Despite differences, wildlife viewers and hunters have many similarities such as wildlife enjoyment (Daigle et al., 2002); recreational motivations (McFarlane, 1994; Adams et al., 1997; Schroeder et al., 2006b; Hinrichs et al., 2020); environmental beliefs and conservation behaviors (Cooper et al., 2015); and interest in habitat management (Teisl & O'Brien, 2003). Wildlife watchers and hunters have also been found to report similar rates of involvement in environmental/conservation organizations as well as similar monetary contributions to these organizations (McFarlane & Boxall, 1996; Teisl & O'Brien, 2003; Benson, 2010; Scott, 2013).

### ***Purpose of Study and Objectives***

My study sought to explore the attitudes about and preferences for management of a diversity of stakeholders associated with WMAs to inform strategies to diversify outdoor recreation on WMAs while considering a range of potential interactions (including complementary) associated with changes in management. WMA managers can use this knowledge to consider a broader range of management options that will complement a diversity of recreation. More widely, this study yields insights into policy and practice efforts to grow the

numbers of stakeholders that use WMAs and actively support (politically and financially) wildlife management. Specifically, my study compares key stakeholders using WMAs that are intensively managed for waterfowl habitat and waterfowl hunting in southeastern Michigan, USA and explores outdoor recreation specialization measures (e.g., participation, amount of participation, centrality of activity); strength of identity as multiple types of stakeholders; knowledge and use of WMAs; attitudes about current wildlife and recreation management at WMAs and opinions about future wildlife and recreation management; and socio-demographics.

## **Methods**

### ***Study Area***

The study area included five state-owned WMAs and one federally-owned coastal WMA located in southeastern Michigan, USA from Lake Huron's Saginaw Bay region south to western Lake Erie (Figure 1). These six areas were chosen because of their intensive management of both coastal wetland habitat and recreational use. Wetlands that are managed primarily for waterfowl and waterfowl hunting provide a unique case study to compare stakeholders because of the intensity of management for both wetland habitat and hunting recreation. The state-owned lands (Nyanquing Point State Wildlife Area, Fish Point State Wildlife Area, Shiawassee River State Game Area, St. Clair Flats State Wildlife Area, and Pte. Mouillee State Game Area) prioritize waterfowl habitat management and waterfowl hunting opportunities over other species management and other recreation. Waterfowl hunting is strictly controlled through the issuance of daily permits at on-site drawings for specific hunting zones. Many rules and regulations control the managed hunts (e.g., shot shell limits, shot size limits, hunting times, etc.), and access for other recreational activities is limited during the waterfowl hunting season. These state-owned WMAs historically have focused heavily on waterfowl hunters as the primary

stakeholders which has facilitated a clientele that may be particularly resistant to SWA efforts to diversify management and increase engagement with non-hunting stakeholders. These WMAs also rely on revenue from Michigan Waterfowl Hunting Licenses (Michigan Natural Resources and Environmental Protection Act, 2017) for management in addition to P-R, further emphasizing the dependence on hunter funded management. Although managed primarily for waterfowl, the high-quality wetland habitats resulting from intensive management attract abundant and diverse bird species that in turn provides plentiful birdwatching opportunities. Indeed, three of the six WMAs are recognized as some of the top birding areas in Michigan (White, 2016). The WMAs also provide ample opportunity for other non-hunting recreation such as paddling, fishing, and hiking. The federally-owned Shiawassee National Wildlife Refuge (NWR) also carries out intensive wetland habitat management, however the NWR's primary objective is to provide a wildlife refuge for migratory birds. Limited hunting (e.g., waterfowl, small game, and deer) opportunities are allowed under permit at the NWR, and the NWR has objectives to provide a diversity of recreational opportunities for surrounding urban areas. To meet their objectives, state and federal agencies have made significant financial investments in the WMAs in terms of wetland management infrastructure and habitat management. This intensive management of coastal habitats and recreation provides an opportunity to understand how these state and federal investments benefit stakeholders using the WMAs.

### ***Sampling and Data Collection***

WMA visitor use surveys during 2018 revealed that most visitors (82%) resided within a 50-mile radius of the WMA they were visiting, which includes all of or parts of 31 counties in central and southeastern Michigan, USA (Appendices A and B). This residency information was



used to develop the sampling frame for stakeholder surveys. The visitor use surveys also found that the most dominant year-around recreational use at the WMAs was fishing. Thus, I chose to include anglers as key WMA stakeholders.

To compare attitudes and preferences of key WMA stakeholders for management of coastal WMAs, I constructed quantitative survey instruments administered to a random selection of participants in four groups—waterfowl hunters, birdwatchers, anglers, and community members—following a modified version of the Tailored Design Method (Dillman et al., 2014). Draft questionnaires were piloted by volunteers for the waterfowl hunter, birdwatcher, and angler surveys to test the clarity of questions and responses, and the survey instrument was revised and finalized based on feedback from pilot survey participants (Vaske, 2008). The survey instruments and data collection protocols were approved by Michigan State University Institutional Review Board on August 9, 2019 (Project 00003031). Adaptive Survey Design techniques, consisting of sending a paper questionnaire with the third survey reminder, were also implemented for low response rates of waterfowl hunters and anglers (Schouten et al., 2017).

The sample frame for birdwatchers included a list of registered eBird users provided by the Cornell Lab of Ornithology that reported bird sightings in the 31-county area and that resided in Michigan. eBird is a citizen science project developed and administered by the Cornell Lab of Ornithology that allows birdwatchers to submit their observations and keep track of them via sharable online checklists. Individuals provide an email address when registering to use eBird and have the option to provide a physical mailing address. A total of 5,580 eBird users were contacted via email and invited to complete a web-based Qualtrics survey. Three reminder emails were sent at approximately two-week intervals.

Purchasers of a 2018 Michigan Resident Waterfowl Hunting License that resided in the 31-county area and hunters that registered for 2018 managed waterfowl hunts at the WMAs of interest provided the sampling frame for waterfowl hunters. Individuals in the WMA registered hunter sample were removed from the license purchaser sample. A total of 2,500 waterfowl hunters (1,500 license purchasers and 1,000 WMA registered hunters) were randomly sampled and invited to participate in the study. Email addresses were available for 55.6% of the sample and those individuals were emailed an invitation to take a web-based Qualtrics survey, with the remainder mailed invitations. A total of four contacts were made, with three reminder invitations emailed or sent approximately two to three weeks apart.

Purchasers of a 2018 Michigan Resident Fishing License that resided in the 31-county area provided the sampling frame for anglers. Prior to sampling, the angler sample was compared to the waterfowl hunter sample and duplicates were removed. A random sample of 2,500 anglers were selected and contacted. Email addresses were available for 26.0% of the angler sample and those individuals were emailed an invitation to take a web-based Qualtrics survey, with the remainder mailed invitations. Similar to the waterfowl hunter sample, anglers were sent three reminder emails or letters approximately two to three weeks apart.

The sampling frame for community members was defined as all non-seasonal, currently occupied residences within a 50-mile radius of one of the six WMAs of interest, and a randomly selected address-based sample of 3,000 was purchased from Dynata, Inc. Households were mailed an invitation to take a web-based Qualtrics survey. Email addresses were not available for this sample. A total of three contacts were made and paper questionnaires were mailed with the second reminder in an attempt to increase response rates.

Data was collected between August 2019 and March 2020 for the four surveys (Appendices C, D, E, and F). After accounting for undeliverable invitations and refusals to participate, response rates were 24.0% for birdwatchers (1,133 completed surveys), 14.8% for waterfowl hunters (316 completed surveys), 10.2% for anglers (254 completed surveys), and 2.8% for community members (84 completed surveys).

To assess potential non-response bias, I randomly selected non-respondents from each of the samples (452 birdwatchers, 500 waterfowl hunters, 500 anglers, and 500 community members) that were mailed a shortened version of the questionnaire. I received 117 birdwatcher responses (25.9% response rate), 198 waterfowl hunter responses (39.6% response rate), 48 angler responses (9.6% response rate), and 13 community member responses (2.6% response rate). Chi-square and t-tests with significance at  $p < 0.05$  were used to compare respondents and non-respondents (Appendix G). Socio-demographics were comparable; in the angler sample, there were slightly more black or African American non-respondents, and in the waterfowl sample, there were slightly fewer white non-respondents. Also, birdwatchers in the non-respondent sample were slightly older. Participation rates were also comparable; the number of trips taken differed with non-respondents having slightly higher trips in the angler sample, slightly fewer trips in the waterfowl hunter sample, and slightly fewer birdwatcher non-respondents that went birding at least once. Knowledge and visitation were similar except slightly more non-respondents had knowledge of WMAs in the angler sample and slightly fewer community members had visited a WMA in the past 12 months. Waterfowl hunter non-respondents had lower scores for centrality of waterfowl hunting and identity as a waterfowl hunter, suggesting that non-respondents may have been less avid waterfowl hunters. Because

only slight differences between respondents in the original and non-response samples were detected, I chose not to weight data.

### ***Variables Measured***

**Recreational Specialization, Identity, and Land Type.** Items for participation in nature-based activities were adapted from previous survey efforts (USFWS, 2016a; Harshaw, 2018a; Harshaw, 2018b; Wilkins & Miller, 2018; Patton, 2021a; Patton, 2021b). Respondents were asked to select from a list of 10 nature-based activities that they had participated in during the past 12 months. To measure amount of participation, birdwatcher, waterfowl hunter, and angler samples were asked to report the number of trips taken for their recreational activity during the past year. Respondents were only asked about trips for their survey group (e.g., birdwatchers were only asked about birdwatching trips, not hunting or fishing trips). For birdwatchers, this was defined as trips at least one mile from their home (Cooper et al., 2015; USFWS, 2016a).

Commitment and centrality of recreation type was measured in birdwatcher, waterfowl hunter, and angler samples by asking agreement with five statements about personal participation in their recreational activity adapted from previous studies: Birdwatching/waterfowl hunting/fishing is one of the most enjoyable activities I do; Most of my friends go birdwatching/waterfowl hunting/fishing; Birdwatching/waterfowl hunting/fishing has a central role in my life; A lot of my life is organized around birdwatching/waterfowl hunting/fishing; and If I couldn't go birdwatching/waterfowl hunting/fishing, I am not sure what I would do instead (Schroeder et al., 2013; Harshaw, 2018a; Harshaw, 2018b; Patton, 2021a; Patton, 2021b). Respondents rated their agreement on the following scale: 1 = strongly disagree, 2 = somewhat disagree, 3 = neither disagree nor agree, 4 = somewhat agree, and 5 = strongly agree. I

conducted confirmatory factor analysis (CFA) to assess the construct validity of centrality based on the five statements with no error covariance specified in the model. The following model fit indices were used: comparative fit index (CFI), root mean square error of approximation (RMSEA), the Tucker-Lewis index (TLI), and standardized root mean square residual (SRMR). CFI and TLI values  $>.90$  and RMSEA and SRMR values  $<.08$  suggest an acceptable model fit. Then, Cronbach's alpha was used to assess the internal consistency reliability of the latent construct. Cronbach's alpha values  $>.70$  suggest high internal consistency (Brown 2015). My CFA results suggested an acceptable model fit for the centrality construct (CFI = .98, RMSEA = 0.09, TLI = .96, SRMR = .02) and Cronbach's alpha results (.81) indicated acceptable reliability. Identity variables were adapted from previous surveys (Harshaw, 2018a; Harshaw, 2018b; Patton, 2021a; Patton, 2021b), included on all four stakeholder surveys, and measured the strength of identification as a birdwatcher, waterfowl hunter, angler, outdoor enthusiast, conservationist, and preservationist with responses on a 5-point scale (1 = not at all, 2 = slightly, 3 = moderately, 4 = strongly, and 5 = very strongly).

Respondents were asked about their membership in the past 12 months for the following types of organizations: birdwatching/bird conservation; hunting/game species conservation, fishing/fish conservation, national/international environmental or conservation, and local/regional conservation organization. This variable was recoded as a binary variable where 1 = member of at least one organization and 0 = not a member of any organization. Birdwatching and waterfowl hunting respondents were also asked where they did most of their recreational activity to determine the land type used most often (mostly public land, mostly private land, an equal mix of public and private land, or not sure).

**Knowledge and Use of WMAs.** Respondents were asked to report if they had heard about each of the six WMAs before taking the survey to measure knowledge of WMAs. This variable was recoded to create a binary variable of have heard of at least one WMA (1) or have not heard of any WMAs (0). To measure use of WMAs, respondents indicated, of the WMAs they had heard of, which they had visited in the last 12 months. Similar to knowledge, this variable was recoded to a binary variable of have visited at least one WMA (1) or have not visited any WMAs (0).

**Attitudes and Preference for Wildlife and Recreation Management.** To measure attitudes about WMA management, respondents were asked to indicate the importance of 10 WMA management objectives that were derived from Michigan Department of Natural Resources (MDNR) and United States Fish & Wildlife Service (USFWS) WMA plans and reports as well as engagement with WMA managers:

1. Provide habitat for migrating waterfowl
2. Provide nesting habitat for waterfowl
3. Provide areas of no disturbance for waterfowl
4. Manage wetlands for diversity of wetland wildlife species
5. Protect wetlands
6. Provide waterfowl hunting opportunities
7. Provide deer hunting opportunities
8. Provide small game hunting opportunities
9. Provide wildlife trapping opportunities
10. Provide opportunities for diversity of wildlife-related recreational activities

Importance of objectives was measured on a 5-point scale (1 = not at all important, 2 = somewhat important, 3 = neither unimportant nor important, 4 = somewhat important, 5 = very important) with a response option “not sure” which were dropped from the analysis.

To measure preferences for management, respondents indicated their agreement with seven statements about wildlife habitat and species management. Similarly, respondents were presented 12 statements, some adapted from previous research (Adams et al. 1997), about management of recreational opportunities and asked to indicate their agreement. Agreement with statements about wildlife and recreation management were measured on a 5-point scale (1 = strongly disagree, 2 = somewhat disagree, 3 = neither disagree nor agree, 4 = somewhat agree, 5 = strongly agree). Respondents were then asked about their preferences for changes to management with responses on a 5-point scale (1 = greatly decrease, 2 = somewhat decrease, 3 = stay about the same, 4 = somewhat increase, 5 = greatly increase). A response option of “not sure” was also provided but dropped from the analysis. Respondents were asked if they would prefer changes to seven wildlife habitat and species management activities. Respondents were then asked if they would prefer changes to nine recreation management activities. For the agreement and preference for change questions, respondents were asked to provide responses for the WMA they were most knowledgeable about. If they were equally knowledgeable about more than one WMA, they were asked to answer questions about their favorite WMA. Engagement with MDNR WMA managers prior to questionnaire development was used to inform the wildlife habitat management, species management, and recreation management questions. During this engagement process, WMA managers were asked about current management objectives and their opinions about current and potential conflicts between different

stakeholder groups, stakeholders' desires for changes, and what comments they hear most often from stakeholders.

**Socio-Demographics.** Gender, year of birth, race, ethnicity, education level, household income, zip code of primary residence, and type of residence (large urban, medium urban, small city, small town, or rural area) were collected from respondents.

### ***Data Analysis***

Data were analyzed for missingness. Most variables had <7% of data missing, however five of the preferences for change in management items had 12–18% missing data (amount of bicycle access, number of days that waterfowl hunting is allowed in the fall, seasonal closures to avoid conflicts between different types of recreation, number of boat launches, and active wetland management). One statement measuring agreement about wildlife habitat and species management (Flooded agricultural fields are necessary to provide food for waterfowl) was dropped because 35% of data was missing. Therefore, a total of six statements were used in the analysis. Similarly, two items (the depth of managed water levels in the fall and the number of agricultural fields that are flooded in the fall) were dropped from the analysis of preferred changes to wildlife habitat and species management because >25% of data was missing. Listwise deletion was used for remaining variables during data analysis because all but two items (preferred changes to active wetland management and number of boat launches) had complete data on at least 85% of cases (Vaske, 2008). In addition, I investigated missing data patterns. The survey questions about specific WMA management actions and preferred changes may have been difficult for some respondents to answer, especially if they were not familiar with management activities or the purpose of those management activities (e.g., active wetland management, the depth of managed water levels, flooded agricultural fields).



Data from the four surveys were merged and analyzed to compare participation; centrality; strength of identity as a birdwatcher, waterfowl hunter, angler, conservationist, and preservationist; knowledge and use of WMAs; attitudes about current wildlife and recreation management; preferences for changes to wildlife and recreation management; and socio-demographics. The four survey samples (birdwatchers, waterfowl hunters, anglers, and community members) were treated as distinct groups (i.e., there were no duplicate individuals sampled in each group) to make comparisons. For dichotomous and categorical variable comparison, Chi-square tests were used. Fisher's exact test was used when one of the cells of the crosstabulation had <5 observations and likelihood-ratio Chi-square test was used when more than one cell had <5 observations. To compare mean group scores of birdwatchers, waterfowl hunters, anglers, and community members, one-way ANOVA tests with a Bonferroni correction and Tukey post-hoc tests of pairwise differences in means were used. When variables did not meet Bartlett's test for equal variances and variance differences were greater than four from smallest to largest variance, a Welch's one-way ANOVA was used with a Games-Howell post hoc test for pairwise comparisons. Stata (Version 15.1) was used to perform all analyses. Descriptive statistics are also presented to characterize differences between groups. Differences were considered statistically significant at  $p < 0.05$ .

## **Results**

### ***Socio-Demographics***

Table 1 displays the socio-demographic results for each group. The mean year of birth for birdwatchers ( $M=1961.57$ ,  $SD=14.3$ ) and community members ( $M=1963.72$ ,  $SD=17.75$ ) indicated that they were older than waterfowl hunters ( $M=1970.14$ ,  $SD=16.15$ ) and anglers ( $M=1971.10$ ,  $SD=13.02$ ). Gender differed between groups ( $\chi^2(3) = 404.94$ ,  $p < .001$ ) with male

respondents making up 96.2% of waterfowl hunters, 75.4% of anglers, 58.2% of community members, and 39.3% of birdwatchers. Most waterfowl hunters (98.3%), birdwatchers (98.2%), anglers (95.4%), and community members (82.7%) were white, and there were differences between groups for each race category. Most survey respondents were also not Hispanic or Latino, although there were differences between groups ( $\chi^2(3) = 8.50, p < .05$ ). Anglers (3.0%) had the most Hispanic or Latino respondents, followed by community members (1.4%), waterfowl hunters (0.8%), and birdwatchers (0.8%). There were differences in education levels between groups ( $\chi^2(12) = 243.33, p < .001$ ). More than 82% of birdwatchers had at least an associate or bachelor's degree compared to 72.8% of community members, 58.6% of waterfowl hunters, and 49.6% of anglers. There were also differences between groups in the size of the communities that respondents lived in at the time of the survey ( $\chi^2(12) = 25.14, p = 0.01$ ). Waterfowl hunters had the most rural residence of the four groups, with 26.0% from rural areas (population < 2,000) and 27.3% from small towns (population 2,000–10,000), followed by birdwatchers, anglers, and community members. Frequency of income categories were not different between groups ( $\chi^2(27) = 31.83, p = 0.24$ ), however waterfowl hunters and community members had 46.9% of respondents with income > \$100,000, followed by birdwatchers (38.0%) and anglers (36.4%). Similarly, anglers (23.8%) and birdwatchers (22.6%) reported income < \$50,000 more than community members (17.2%) and waterfowl hunters (14.8%).

### ***Recreation Specialization, Identity, and Land Type***

Table 2 displays results for dichotomous and categorical specialization measures and land type, and Table 3 displays results for continuous specialization measures and identity. I found differences between groups in participation of all individual nature-based activities as well as participation in at least one activity in the past 12 months. Most respondents indicated that they

participated in at least one nature-based activity in the past 12 months ranging from 95.1% of community members to 99.9% of birdwatchers. Birdwatchers participated in viewing birds (99.0%), backyard/at home nature activities (92.5%), viewing wildlife (89.7%), other nature-based activities (76.2%), non-motorized outdoor recreation activities (75.7%), and learning about nature away from home (70.1%) more than the other three groups. Waterfowl hunters participated in waterfowl hunting (95.7%), hunting other game species (80.9%), and motorized outdoor recreation activities (61.5%) more than the other three groups. Anglers participated in fishing (95.7%) more than the other three groups. There were three activities—backyard/at home nature activities, non-motorized outdoor recreation activities, and other nature-based activities—where all four groups indicated at least 62% participation in the past 12 months.

Data on the amount of participation and centrality was only collected for birdwatchers, waterfowl hunters, and anglers. Birdwatchers took an average of 25.90 trips ( $SD=54.63$ , range 0–400) at least one mile from their home for birdwatching, anglers took an average of 17.00 trips ( $SD=29.15$ , range 0–250) primarily for fishing, and waterfowl hunters took an average of 13.80 trips ( $SD=13.90$ , range 0–90) primarily for waterfowl hunting. Trips are not comparable across groups because birdwatchers are not limited by the number of days they can recreate as waterfowl hunters and anglers are by the number of days in the legal hunting and fishing seasons. Centrality of recreational activity was higher among waterfowl hunters ( $M=3.54$ ,  $SD=0.94$ ) than anglers ( $M=3.24$ ,  $SD=0.96$ ) or birdwatchers ( $M=3.15$ ,  $SD=0.89$ ).

Strength of identity as a conservationist was higher for birdwatchers ( $M=4.08$ ,  $SD=1.00$ ) and waterfowl hunters ( $M=4.01$ ,  $SD=1.00$ ) as compared to anglers ( $M=3.46$ ,  $SD=1.17$ ) and community members ( $M=3.41$ ,  $SD=1.18$ ). Birdwatchers ( $M=3.80$ ,  $SD=1.13$ ), however, identified more strongly as a preservationist than the three other groups. Waterfowl hunters

( $M=4.12$ ,  $SD=1.00$ ) had the highest mean score for strength of identity for their recreation type, followed by birdwatchers ( $M=4.01$ ,  $SD=1.04$ ) and anglers ( $M=3.26$ ,  $SD=1.32$ ). Birdwatchers ( $M=3.67$ ,  $SD=1.19$ ) scored strength of identity as an outdoor enthusiast higher than the other three groups.

The four groups differed in their membership in types of organizations as well as their membership in at least one organization ( $\chi^2(3) = 231.40$ ,  $p < .001$ ). Birdwatchers (73.1%) and waterfowl hunters (70.0%) were much more likely to belong to an organization than anglers (29.0%) and community members (26.8%). Membership in hunting organizations was highest for waterfowl hunters (69.7%) and membership in birding organizations was highest for birdwatchers (60.3%). However, only 9.8% of anglers reported being a member of a fishing organization. Birdwatchers were also more likely to be members of a national or international environmental/conservation organization (e.g., The Nature Conservancy, National Wildlife Federation, Sierra Club, World Wildlife Fund) (41.7%) and a local/regional conservation organization (24.3%) than the other three groups.

The type of land where waterfowl hunters and birdwatchers do the most of their recreational activity differed between the two groups ( $\chi^2(3) = 79.40$ ,  $p < .001$ ). Waterfowl hunters (65.2%) were much more likely to use public lands than birdwatchers (38.6%) while birdwatchers (32.6%) were more dependent on private lands than waterfowl hunters (15.9%).

### ***Knowledge and Use of WMAs***

Differences were found in both the knowledge and use of WMAs between the four groups (Table 4). There were differences between groups on their knowledge of each individual WMA as well as their knowledge of at least one WMA ( $\chi^2(3) = 89.28$ ,  $p < .001$ ). Waterfowl hunters were the most knowledgeable about the WMAs with 97.3% of them reporting that they

had heard of at least one of the WMAs, followed by birdwatchers (82.9%). Anglers and community members were similar with 71.1% reporting having heard of at least one of the WMAs. Waterfowl hunters reported having heard of the individual WMAs much more than the other groups (range 73.8–84.9%). Anglers and community members were the least familiar with each of the six WMAs individually (range 19.1–43.2%).

There were also differences between groups on their use of each individual WMA as well as their use of at least one WMA ( $\chi^2(3) = 105.56, p < .001$ ) as measured by their reported visitation in the past 12 months. Waterfowl hunters had the highest visitation of at least one WMA (84.0%), followed by birdwatchers (54.1%), anglers (53.7%) and community members (50.0%). Waterfowl hunters reported visiting Nayanquing Point (31.6%), Fish Point (41.6%), Shiawassee River (30.5%), and Harsens Island (26.5%) more than the other three groups, and birdwatchers reported visiting Shiawassee NWR (26.9%) and Pointe Mouillee (26.9%) more than the other three groups.

### ***Attitudes and Preferences for Wildlife and Recreation Management***

**WMA Objectives.** Results for the importance that respondents placed on WMA objectives are found in Table 5. Generally, all groups' mean scores of importance for wildlife-related objectives were higher than recreation-related objectives. Waterfowl hunters ( $M=4.92$ ,  $SD=0.39$ ) and birdwatchers ( $M=4.90$ ,  $SD=0.37$ ) scored the importance of providing habitat for migrating waterfowl higher than anglers ( $M=4.40$ ,  $SD=0.93$ ) or community members ( $M=4.60$ ,  $SD=0.79$ ). Similarly, waterfowl hunters ( $M=4.88$ ,  $SD=0.45$ ) and birdwatchers ( $M=4.88$ ,  $SD=0.39$ ) scored the importance of providing nesting habitat for waterfowl higher than anglers ( $M=4.42$ ,  $SD=0.91$ ) or community members ( $M=4.58$ ,  $SD=0.79$ ). Managing wetlands for a diversity of wetland wildlife species, providing areas of no disturbance for waterfowl, and

protecting wetlands were also scored higher by waterfowl hunters and birdwatchers as compared to anglers and community members. Overall, for these wildlife-related objectives, waterfowl hunters and birdwatchers scored objectives the highest and anglers scored the objectives the lowest of all four groups. However, all four groups indicated that these wildlife-related objectives were important (scores > 4.25). Waterfowl hunters' scores (M=4.88, SD=0.46) for providing waterfowl hunting opportunities were much higher than the other three groups. Angler (M=4.04, SD=1.21) and waterfowl hunter (M=4.02, SD=1.10) scores were higher for the importance of providing deer hunting opportunities than community members (M=3.29, SD=1.47) or birdwatchers (M=2.80, SD=1.39). Similarly, waterfowl hunter (M=4.10, SD=1.03) and angler (M=3.98, SD=1.18) scores were higher for the importance of providing small game hunting opportunities than community members (M=3.33, SD=1.47) or birdwatchers (M=2.60, SD=1.35). Birdwatchers had the lowest scores of importance for hunting-related objectives. All four groups scored the importance of providing wildlife trapping opportunities the lowest of the ten objectives, although waterfowl hunters' mean score (M=3.83, SD=1.14) was higher than the other three groups. There were no differences, however, in the mean scores for the importance of providing opportunities for a diversity of wildlife-related recreational activities and all four groups scored this objective relatively high (>4.07).

**Agreement with Wildlife Habitat and Species Management.** There were differences detected between the four groups in their agreement with several statements about the management of wildlife habitat and species management at the one WMA that they were the most knowledgeable about (Table 6). Waterfowl hunters had the highest mean agreement scores for game species management statements and birdwatchers had the highest mean agreement scores for non-game species management statements. When asked if waterfowl habitat

management should be prioritized over other wildlife species management, waterfowl hunters had the highest agreement score ( $M=4.05$ ,  $SD=1.10$ ), followed by community members ( $M=3.48$ ,  $SD=1.20$ ) and waterfowl hunter scores were higher than birdwatchers ( $M=2.86$ ,  $SD=1.05$ ) and anglers ( $M=3.01$ ,  $SD=1.08$ ). Birdwatchers had higher agreement scores ( $M=4.05$ ,  $SD=0.87$ ) than anglers ( $M=3.73$ ,  $SD=0.99$ ) or waterfowl hunters ( $M=3.48$ ,  $SD=1.07$ ) when asked if threatened and endangered species should be prioritized over other species management. Community members ( $M=4.22$ ,  $SD=0.85$ ) and birdwatchers had ( $M=3.97$ ,  $SD=0.91$ ) had higher agreement scores for the statement “Management to provide habitats for a large variety of wildlife species should be prioritized over habitat management for a few specific wildlife species” compared to the other two groups. When asked if current management benefits primarily game species, the only statistically significant difference in agreement scores were between waterfowl hunters ( $M=3.56$ ,  $SD=0.97$ ) and birdwatchers ( $M=3.34$ ,  $SD=0.91$ ) but scores did not differ greatly. Waterfowl hunters ( $M=3.78$ ,  $SD=1.04$ ) had higher agreement scores than birdwatchers ( $M=3.52$ ,  $SD=0.96$ ) and anglers ( $M=3.43$ ,  $SD=0.98$ ) when asked if wetlands are currently managed sufficiently to provide wildlife habitat. Waterfowl hunters ( $M=4.47$ ,  $SD=0.88$ ) and birdwatchers ( $M=4.31$ ,  $SD=0.90$ ) had higher scores than anglers ( $M=3.86$ ,  $SD=1.04$ ) when asked if areas closed to public access are necessary to provide resting areas for wildlife.

**Agreement with Recreation Management.** When asked about agreement with several statements about management of recreational opportunities at WMAs, there were several differences between groups (Table 6). Waterfowl hunters ( $M=4.00$ ,  $SD=1.03$ ) and anglers ( $M=3.83$ ,  $SD=0.94$ ) had higher agreement scores than birdwatchers ( $M=3.42$ ,  $SD=1.25$ ) when asked if they can access the areas that they want to at the time of year they want. Waterfowl

hunters ( $M=4.02$ ,  $SD=1.00$ ) had the highest agreement and were different from birdwatchers ( $M=3.66$ ,  $SD=1.02$ ) when asked if they can access the areas that they want to for their recreational activity without much trouble. Waterfowl hunters ( $M=4.21$ ,  $SD=0.89$ ) had higher agreement than the other three groups when asked if controlled water levels allowed them to access the areas that they want to in the fall. Birdwatchers ( $M=3.76$ ,  $SD=0.98$ ) had the highest mean score of agreement of the four groups for the statement “I experience little disturbance from other recreational users” but scores did not differ greatly. When asked if they feel safe and secure when they participate in wildlife-related recreation at the WMA, groups were similar in their agreement with mean scores ranging from 4.00 (anglers) to 4.29 (waterfowl hunters).

There were differences detected between birdwatchers and waterfowl hunters for several recreation-related statements. When asked if current management provides a diversity of opportunities for wildlife-related recreation, the only statistically significant difference was between agreement scores for waterfowl hunters ( $M=4.03$ ,  $SD=0.86$ ) and birdwatchers ( $M=3.80$ ,  $SD=0.87$ ) with waterfowl hunters having the highest mean score and birdwatchers the lowest. Waterfowl hunters ( $M=3.94$ ,  $SD=1.15$ ) also had higher mean agreement as compared to the other three groups when asked if waterfowl hunting management should be prioritized over the management for other wildlife-related recreation. The only difference in agreement scores for “Having a variety of wildlife habitats is important for me to enjoy my recreational activity” was between birdwatchers ( $M=4.44$ ,  $SD=0.74$ ) and waterfowl hunters ( $M=3.89$ ,  $SD=1.02$ ) with birdwatchers having the highest mean score and waterfowl hunters the lowest. Similarly, birdwatchers ( $M=4.20$ ,  $SD=0.89$ ) had the highest mean agreement for “Providing wildlife habitat is more important than providing wildlife-related recreational opportunities” and higher mean scores than anglers ( $M=3.66$ ,  $SD=0.87$ ) and waterfowl hunters ( $M=3.53$ ,  $SD=1.07$ ). Waterfowl



hunters ( $M=3.72$ ,  $SD=0.94$ ) and birdwatchers ( $M=3.19$ ,  $SD=0.96$ ) also differed in agreement with the statement “An appropriate balance currently exists between management for hunting and non-hunting recreational opportunities” with waterfowl hunters having the highest mean scores and birdwatchers the lowest. Similarly, waterfowl hunters ( $M=3.52$ ,  $SD=1.09$ ) and birdwatchers ( $M=3.26$ ,  $SD=0.95$ ) differed in their mean agreement scores for “Management currently benefits primarily hunters”. However, there were no differences between the four groups for agreement with the statement “Hunters’ opinions on wildlife management decisions are currently considered more by the WMA managers than non-hunters’ opinions” with all four groups having some agreement with the statement (range 3.27-3.43).

**Preference for Changes to Wildlife Habitat and Species Management.** There were differences found between the four survey groups in their preferences for changes to wildlife habitat and species management at the WMA that they are most knowledgeable about (Table 7). Waterfowl hunters preferred fewer changes to the number of different wildlife habitat types ( $M=3.50$ ,  $SD=0.72$ ) and were different than birdwatchers ( $M=3.89$ ,  $SD=0.73$ ) and anglers ( $M=3.75$ ,  $SD=0.75$ ). When asked about effort toward management of game species, birdwatchers ( $M=2.86$ ,  $SD=0.77$ ) were different from the other groups and had the lowest mean score. Birdwatchers ( $M=4.04$ ,  $SD=0.75$ ) had the highest mean score for efforts for non-game species management and scores for this group were higher than anglers ( $M=3.53$ ,  $SD=0.79$ ) and waterfowl hunters ( $M=3.15$ ,  $SD=0.76$ ), who had the lowest mean score. When asked if active wetland management (e.g., use of pumps, water control structures, etc.) should change, waterfowl hunters ( $M=3.76$ ,  $SD=0.81$ ) and birdwatchers ( $M=3.40$ ,  $SD=0.75$ ) were the only groups that differed with waterfowl hunters having the highest mean score and birdwatchers the

lowest. All four groups indicated that invasive plant species management should increase with mean scores ranging from 4.09 (waterfowl hunters) to 4.41 (community members).

**Preferences for Changes to Recreation Management.** Differences were detected between groups for eight of the nine statements about preferred changes to recreation management (Table 7). Groups did not differ in their preference for changes to the amount of vehicle road access. However, waterfowl hunters ( $M=3.09$ ,  $SD=0.55$ ) had a lower mean score for the number of hiking trails to access areas of the WMA as compared to the other three groups. When asked about changes to the amount of bicycle access, waterfowl hunters ( $M=2.95$ ,  $SD=0.65$ ) had the lowest mean score and were different from birdwatchers ( $M=3.28$ ,  $SD=0.72$ ) and anglers ( $M=3.44$ ,  $SD=0.81$ ). Anglers ( $M=3.43$ ,  $SD=0.62$ ) and community members ( $M=3.62$ ,  $SD=0.67$ ) had higher mean scores than birdwatchers ( $M=3.25$ ,  $SD=0.56$ ) and waterfowl hunters ( $M=3.21$ ,  $SD=0.50$ ) when asked about the number of parking lots. Anglers ( $M=3.55$ ,  $SD=0.76$ ) had the highest mean scores when asked about the number of boat launches to access areas of the WMAs and differed from birdwatchers ( $M=2.94$ ,  $SD=0.53$ ) and waterfowl hunters ( $M=3.29$ ,  $SD=0.60$ ). Birdwatchers ( $M=3.81$ ,  $SD=0.72$ ) indicated a preference for increased access for non-hunting recreation with the highest mean scores, and birdwatcher scores were higher than waterfowl hunters ( $M=2.98$ ,  $SD=0.56$ ) and anglers ( $M=3.41$ ,  $SD=0.74$ ), with waterfowl hunters having lower scores than the other three groups. Birdwatchers ( $M=2.51$ ,  $SD=0.79$ ) indicated a preference for decreased number of days that waterfowl hunting is allowed on the WMA in the fall and had lower mean scores than the other three groups. Similarly, birdwatchers ( $M=2.75$ ,  $SD=0.77$ ) had lower mean scores compared to waterfowl hunters and anglers when asked about changes to seasonal closures to avoid conflicts between different types of recreation. Waterfowl hunters ( $M=3.15$ ,  $SD=0.65$ ) had lower mean scores than birdwatchers

( $M=3.45$ ,  $SD=0.77$ ) and anglers ( $M=3.54$ ,  $SD=0.82$ ) when asked about preferred changes to wildlife resting areas that are closed to public access. Waterfowl hunters had the lowest mean scores for five of the nine statements about preferred changes to current WMA management (hiking trails, bicycle access, parking lots, access for non-hunting recreation, and wildlife resting areas closed to public access).

## **Discussion**

Results of this study provide knowledge about the attitudes and preferences of a diversity of stakeholders associated with WMAs. Understanding similarities and differences of stakeholders is useful to inform strategies to increase and diversify outdoor recreation on WMAs. This is the first study known to make direct comparisons of waterfowl hunters, birdwatchers, anglers, and community members—key stakeholder groups for the WMAs I studied. Few studies have examined specific management actions at WMAs intensively managed for waterfowl and waterfowl hunting and that also provide a diversity of other outdoor recreation and wildlife benefits. My results yield insights into efforts to grow the numbers of stakeholders that use WMAs and actively support, politically and financially, wildlife management. I found differences between WMA stakeholders, especially between waterfowl hunters and birdwatchers, for a number of variables of interest. These differences may indicate potential points of conflict for WMA managers to consider when making management decisions. In contrast, similarities found between stakeholder groups may illustrate complementarity of activities or common ground to potentially bring stakeholder groups together with the collective goal of supporting WMAs.

The socio-demographic differences of respondents were similar to the findings of previous research. Birdwatchers were older (Adams et al., 1997; Cooper et al., 2015; Cornell

Lab of Ornithology, 2020; Patton, 2021a), more educated (Adams et al., 1997; Daigle et al., 2002; Cooper et al., 2015; Cornell Lab of Ornithology, 2020; Patton, 2021a), and lived in more urban communities (Adams et al., 1997) than the other groups. Similar to other studies, there was little racial or ethnic diversity in respondents (Adams et al., 1997; Patton, 2021a; Patton, 2021b) and few female respondents in the waterfowl hunter and angler groups (Adams et al., 1997; Cooper et al., 2015). In contrast, the majority (60.7%) of respondents in the birdwatcher group were female.

I found that specialization measures differed significantly between groups, specifically that waterfowl hunters and birdwatchers tend to be more highly specialized than anglers in terms of centrality of their recreational activity and their identity as waterfowl hunters and birdwatchers. Centrality of activity was the highest for waterfowl hunters, consistent with previous research that found centrality of waterfowl hunting to be high among more avid types of waterfowl hunters (Schroeder et al., 2013). My results demonstrate strong identification as conservationists for both waterfowl hunters and birdwatchers, similar to previous studies (Patton, 2021a; Patton, 2021b). This isn't surprising as hunting has been tied to the history of conservation in North America (Heffelfinger et al., 2013; Mahoney & Jackson, 2013) and birdwatchers are actively engaged and interested in conservation (McFarlane & Boxall, 1996; Scott & Thigpen, 2003; Glowinski, 2013; Cooper et al., 2015).

Membership in conservation and environmental organizations is another measure of recreation specialization (Sorice et al., 2009) and has been used to predict conservation behavior (Fielding et al., 2008; Schroeder et al., 2020; Henderson, 2021). Membership represents a personal and behavioral commitment to an activity and these investments in personal time can be difficult to stop as it may lead to loss of social identity (Scott & Shafer, 2001). Birdwatchers

(McFarlane & Boxall, 1996; Adams et al., 1997; Glowinski, 2013; Scott, 2013) and hunters (Benson, 2010) often are active members of organizations related to conservation. Waterfowl hunters and birdwatchers in my study were indeed much more apt to be members of a conservation or environmental organization as compared to anglers and community members, providing further evidence that these two groups are more specialized, committed, and willing to devote personal time to conservation-related activities. Anglers were unlikely to be members in any organization (29%), including fishing-related organizations. This result appears to be consistent with Schuett et al. (2014) who found 31% of Texas anglers belonged to a conservation organization.

I found large differences between birdwatchers and waterfowl hunters in the type of land that they use for recreation. In contrast to previous research that found migratory bird hunters use private lands more than public lands and wildlife watchers used public lands much more than private lands (USFWS, 2016a), waterfowl hunters in my study were much more dependent on public lands than birdwatchers. Changes to public land access may therefore have serious implications for some stakeholder groups more so than others. A dependence on public lands by waterfowl hunters may also partially explain why waterfowl hunters were more knowledgeable about WMAs than the other groups in my study. The WMAs of interest all include specific management objectives related to waterfowl habitat and hunting opportunities and all provide managed waterfowl hunting opportunities, so it is logical that waterfowl hunters would be more familiar with these areas. Knowledge and use of WMAs were surprisingly high for all four groups, however. Even most of the community members who may be perceived as less engaged had heard of at least one WMA and half of those respondents had visited a WMA in the past 12

months. This is encouraging for SWAs and may be evidence that past communication and outreach campaigns have been successful or that these WMAs are a recognized community asset.

Results suggest differences between WMA stakeholders, especially waterfowl hunters and birdwatchers, in their attitudes about wildlife species and habitat management and recreation management and their preferences for changes in management. Not surprisingly, waterfowl hunters place more importance on game species management and hunting recreation management and birdwatchers more importance on non-game species management and non-hunting recreation management. Waterfowl hunters generally had the highest scores for more traditional (and current) management practices and thought that waterfowl management should be prioritized over other management. In contrast, birdwatchers placed much more importance on management for threatened and endangered and habitat management for a large diversity of wildlife species.

Waterfowl hunters generally had the highest mean scores for recreation-related objectives, and birdwatchers scored the hunting-related objectives the lowest of all groups. Generally, birdwatchers indicated a desire for more non-hunting recreational opportunities and their low scores for accessing the areas they want to at the time they want to, accessing the areas they want to without much trouble, and controlled water levels let them access the areas they want to in the fall suggest that they desire more access to WMAs. This stands to reason because current water level management at the WMAs in this study are timed to maximize waterfowl use and waterfowl hunting opportunities, with some areas of WMAs closed to non-hunting recreation during waterfowl hunting seasons.

Regarding preferences for changes to management practices, there were distinct differences between waterfowl hunters and birdwatchers, primarily that waterfowl hunters

preferred current management practices or status quo (e.g., waterfowl hunting should be prioritized over other wildlife-related recreation, a diversity of habitats is not important to enjoy waterfowl hunting, and an appropriate balance of hunting and non-hunting recreation already exists). Waterfowl hunters also had the lowest scores for changes to non-game species management efforts, potentially indicating additional resistance to change as compared to the other groups. Birdwatchers' scores, in comparison, were the highest of all groups for increasing management for non-game species and increasing different wildlife habitat types. Overall, waterfowl hunters in my study expressed less preference for increasing access for other recreation (e.g., hiking trail access, bicycle access, and access for non-hunting recreation to the WMA). In contrast, birdwatchers preferred more access for non-hunting recreation, fewer days of waterfowl hunting in the fall, and fewer seasonal closures on WMAs to manage for conflicts between different types of recreation. It is likely that birdwatchers desire access to WMA areas that are closed to non-hunting recreation during the fall, as these areas provide viewing opportunities for large concentrations of migrating waterfowl.

These attitudinal and preferential differences may suggest potential points of conflict and tradeoffs for multi-use management at WMAs that recreation management strategies could address. For example, one strategy to provide birdwatchers more access to WMAs during the waterfowl hunting season is zonation (e.g., allowing waterfowl hunting activities in certain zones and birdwatching in other zones). If such a management strategy is feasible, especially during the fall waterfowl migration, it could result in birdwatchers increased access to viewing areas (a win) while potentially reducing the amount of waterfowl hunting available (a loss). However, there is likely another alternative approach to identify supplementary and complementary interactions that would “expand the pie” instead of “competing for the pieces of the pie”.

Exploring the use of a non-conflict-based recreation interaction model (Scott et al., 2005; Marcouiller et al., 2008) would be advantageous.

Although differences in attitudes and preferences are notable, there were several important similarities that I found between waterfowl hunters and birdwatchers. For example, waterfowl hunters and birdwatchers were similar in the high importance they both placed on wildlife-related objectives (e.g., providing migrating and nesting habitat for waterfowl, providing refuge areas for waterfowl, managing wetlands for a diversity of wildlife, and protecting wetlands). Glowinski (2013) also discovered that birdwatchers placed high importance on protecting bird breeding, migration, and wintering habitat. Two management changes that waterfowl hunters and birdwatchers agreed should increase were providing refuge areas for wildlife and increasing invasive plant species management. Somewhat surprisingly, I did not detect any differences in agreement with the statement “Hunters’ opinions on wildlife management decisions are currently considered more by the WMA managers than non-hunters’ opinions” and birdwatchers did not have strong agreement that “management currently benefits primarily hunters”. This suggests that, unlike previous studies that indicated birdwatchers didn’t perceive the SWA as being concerned about their interests and that management benefited hunting (Adams et al., 1997), birdwatchers at these WMAs may recognize and accept the dedicated efforts towards providing waterfowl habitat and hunting opportunities at these intensively managed areas.

Similarities between waterfowl hunters and birdwatchers may represent common ground between the two stakeholder groups and provide opportunities for SWAs to engage both to help meet conservation goals. Additionally, anglers and community members scored wildlife habitat and wetland protection objectives high, so framing management activities in this context could



garner support from a diversity of WMA stakeholders. All four groups also scored the recreation-related objectives (providing hunting, trapping, and other wildlife-related recreation) lower than the wildlife-related objectives. There may be opportunities for SWAs to communicate about management in the context of wildlife and habitat to reach a diversity of stakeholders and potentially to build support for WMAs (e.g., wetland habitat restoration projects and habitat projects that focus on invasive plant species management).

My results can be used to inform strategies that engage a diversity of stakeholders, however they suggest that focusing on birdwatchers may be easier and most effective to increase use and build broad support for WMA management because of birdwatchers' high levels of commitment and membership in conservation organizations, strong social identity as conservationists, and high support for wildlife-related management actions. Birdwatchers have high potential to contribute to conservation, especially specialized and committed birdwatchers (McFarlane & Boxall, 1996; Hvenegaard, 2002; Scott & Thigpen, 2003; Glowinski, 2013; Cooper et al., 2015).

SWAs already largely engage with hunters, and in my study area, SWAs currently engage heavily with waterfowl hunters. Information from this study will help WMA managers better understand not only waterfowl hunters, but other key stakeholders and the potential conflicts and complementariness of broadening management actions to serve a more diverse set of users. SWAs also need to consider how their actions may potentially alienate existing supporters and allies like waterfowl hunters (AFWA & WMI, 2019). It will likely be more difficult to engage with anglers or community members unless site-specific strategies can be developed that target a particular niche. For example, one of the communities associated with a WMA in my study has an annual spring fishing tournament that partially takes place on the

WMA. A specific event such as this could provide WMA managers an opportunity to increase engagement and build local relationships with anglers. Strategies should be tailored to consider the uniqueness of each WMA and the local communities.

SWAs would benefit from implementing strategies to engage with a diversity of stakeholders and to continue to increase understanding of their similarities and differences. Continued stakeholder engagement will be critical as agencies move through the process of identifying and implementing changes to management strategies and managing potential points of conflict and complementarity. One strategy that some NWRs have implemented is “Friends Groups” consisting of volunteers that support the refuge. NWRs benefit from Friends Groups by forming a connection between the NWR and the community, enhancing trust of stakeholders, increasing financial contributions, coordinating volunteer efforts to assist management, and increasing advocacy (Jenson, 2003; Payton et al., 2005). These groups may also be valuable in building relationships with and between a diversity of stakeholders.

### ***Limitations and Future Research***

Several limitations affect the generalizability of the research results. The birdwatcher sample drawn from registered eBird users may not be representative of most birdwatchers that use WMAs because eBird users may be more avid, thereby under-representing more casual birdwatchers. My study investigated stakeholders at six WMAs in southeast Michigan that are intensively managed for waterfowl. As such, these areas have hunting stakeholders that may be more avid in their hunting participation and more invested in the WMAs than other waterfowl hunters. The nature of these WMAs may also bias birdwatcher responses if they perceive the intensity of management as a reflection of SWA priorities. There were very likely overlaps in the four groups that were compared. For example, birdwatchers from the birdwatcher sample

may also hunt waterfowl, fish, and reside in the local communities of interest. However, appropriate survey research methods were used, and I checked for nonresponse bias to increase generalizability of the results. Regarding measurement invariance of my latent variable centrality, I demonstrated configural and weak measurement invariance. With configural and weak measurement invariance, items can be used to measure the latent construct across groups and the relationship between the latent factor and external variables can be compared across groups, however the factor means should not be compared if strong invariance is not demonstrated (Dimitriov, 2010).

Future research should explore similarities and differences between WMA stakeholders in a broader context such as including additional stakeholder groups that use WMAs. While not measured in this study, differences between waterfowl hunters and birdwatchers may be partially explained by wildlife value orientations, or the beliefs associated with the relationships between people and wildlife (Fulton et al., 1996; Manfredo et al., 2018), where hunters tend to be more traditionalist or domination oriented (e.g., wildlife use) and wildlife watchers more mutualist orientation (e.g., wildlife rights) (Fulton et al., 1996; Manfredo et al., 2003, 2018; Teel & Manfredo, 2010). Including other important constructs such as motivations (McFarlane, 1994; Sali et al., 2008; Glowinski & Moore, 2014), place attachment and sense of place (Stedman, 2002; Walker & Chapman, 2003; Halpenny, 2010), and trust in SWAs (Schroeder et al., 2021) may help further the comparisons of stakeholders. Studies should expand to WMAs that are not intensively managed for waterfowl habitat and waterfowl hunting to determine if stakeholders are similar in their specialization, knowledge and use of the areas, and attitudes and preferences for management. Broadening this context would be beneficial for SWAs to effectively target and implement communication, outreach, and programs to a diversity of recreationists.

### ***Management Implications***

Considering and incorporating attitudes and preferences of key WMA stakeholders can improve SWA management decisions about wildlife-related recreational opportunities that will benefit a diversity of hunting and non-hunting recreational users. My results assist WMA managers in understanding how management objectives and decisions may or may not be supported by stakeholders, anticipate potential conflicts between recreational users, consider tradeoffs associated with changes in management, and develop strategies to resolve conflicts and facilitate positive interactions between stakeholders. For example, to increase wildlife watching opportunities on WMAs, the similarities and differences that I found between waterfowl hunters and birdwatchers are especially useful for identifying where supplementary and complementary interactions can be maximized while minimizing antagonistic and competitive interactions. Instead of closing an area to hunting in autumn to increase birdwatching activity, one example of a complementary approach might be installing a birding observation platform in a refuge area where there is no reduction in hunting area, birders have additional opportunities to view large concentrations of waterfowl, and hunters can also observe abundance and diversity of waterfowl using the area. Another example of a complementary approach is restoring wetlands in agricultural areas of the WMA which would result in both increased birdwatching and waterfowl hunting opportunities by providing habitat for a diversity of birds. This approach also addresses the management objectives that both waterfowl hunters and birdwatchers identified as the most important.

I recommend that SWAs explore planning for potential recreation conflicts with this complementary mindset instead of traditional means of managing interactions (e.g., temporal and spatial zonation). To meet goals to broaden and diversify stakeholders and gain their support

without alienating traditional allies, SWAs will need to commit to and employ new and innovative strategies. Borrowing from interest-based negotiation theory, it is important to identify common interests and stay away from win-lose mindsets and when interests differ, seek management options that are complementary or compatible with each other (Fisher et al., 2011). Shifting the framing of multi-use management in this way (e.g., expanding the pie for everyone) may be a useful way to realize positive outcomes. In addition, SWAs may be successful in building support and relevancy by framing their communication and outreach about management actions to focus on common ground perspectives (e.g., importance of wildlife habitat and refuge areas, management for a diversity of wildlife species, and protecting wetlands). My research results provide insights to a more complementary approach, however SWAs will need to engage with stakeholders to identify tradeoffs and specific management actions that will benefit a diversity of wildlife-related recreation.

## Tables

**Table 1**

*Socio-demographic data of survey respondents. Age is reported as mean year of birth with standard deviation in parentheses and superscripts with different letters indicate between-group differences in the one-way ANOVA with a Bonferroni correction and Tukey post-hoc tests of pairwise differences in means were significant at  $p < 0.05$ . All other socio-demographic variables are reported as frequencies (%) and Chi-Square results reported. An asterisk (\*) indicates a Chi-Square test was significant at  $p < 0.05$ .*

<b>Socio-demographics</b>	<b>Birdwatcher</b>	<b>Waterfowl Hunter</b>	<b>Angler</b>	<b>Community Member</b>	<b><math>\chi^2</math></b>	<b>df</b>
<b>Age (year of birth)</b>	1961.57(14.31) <sup>a</sup>	1970.14(16.15) <sup>b</sup>	1971.10(13.02) <sup>b</sup>	1963.72(17.75) <sup>a</sup>		
<b>Gender (male)</b>	39.3	96.2	75.4	58.2	404.94*	3
<b>Education</b>					243.33*	12
Some high school or less	0.2	1.4	3.2	0.0		
High school diploma or GED	3.4	13.6	19.4	16.0		
Some college (no degree)	13.9	26.4	27.8	11.1		
Associate's degree or bachelor's degree	39.1	40.6	35.5	46.9		
Graduate or professional school	43.4	18.0	14.1	25.9		
<b>Race</b>						
American Indian or Native Alaskan	1.1	1.4	3.4	4.9	11.97*	3
Asian	0.8	0.3	1.3	3.7	9.0*	3
Black or African American	0.9	0.3	1.3	4.9	14.52*	3
Native Hawaiian or other Pacific Islander	0.0	0.0	0.0	0.0		
White	98.2	98.3	95.4	82.7	68.74*	3
Other	0.5	1.4	2.1	3.7	10.88*	3

**Table 1** (cont'd)

<b>Ethnicity (Hispanic/Latino)</b>	0.8	0.8	3.0	1.4	8.50*	3
<b>Community Size</b>					25.14*	12
Large urban area (>500,000)	8.3	7.9	10.1	11.4		
Medium urban area (50,000–500,000)	29.2	17.8	25.8	31.6		
Small city (10,000–50,000)	19.5	21.0	21.4	19.0		
Small town (2,000–10,000)	20.8	27.3	21.4	17.7		
Rural area (<2,000)	22.1	26.0	21.4	20.3		
<b>Income</b>					31.83	27
≤\$24,999	7.0	3.2	6.3	1.6		
\$25,000 to \$49,999	15.6	11.6	17.5	15.6		
\$50,000 to \$74,999	20.2	20.3	18.9	14.1		
\$75,000 to \$99,999	19.3	18.1	20.9	21.9		
\$100,000 to \$124,999	14.2	16.8	12.1	18.8		
\$125,000 to \$149,999	9.2	12.3	9.7	10.9		
\$150,000 to \$199,999	7.6	9.7	8.7	9.4		
\$200,000 to \$249,999	2.8	1.6	3.4	4.7		
\$250,000 to \$299,999	1.7	2.6	1.5	0.0		
≥\$300,000	2.5	3.9	1.0	3.1		

**Table 2**

*Results of categorical specialization measures (participation, membership) and land type, both reported as frequency (%), for all survey groups. Chi-Square tests all had 3 degrees of freedom and results were significant at  $p < 0.05$ . Land type was only measured for waterfowl hunters and birdwatchers.*

<b>Participation in Nature-Based Activities</b>	<b>Birdwatcher</b>	<b>Waterfowl Hunter</b>	<b>Angler</b>	<b>Community Member</b>	<b><math>\chi^2</math></b>
Viewing birds	99.0	48.8	40.1	61.0	728.33
Viewing wildlife, not including birds	89.7	46.1	42.8	70.7	419.68
Learning about nature away from home	70.1	28.0	29.2	41.5	287.39
Backyard/at home nature activities	92.5	67.7	73.5	87.8	160.95
Fishing	23.4	85.2	95.7	35.4	720.08
Hunting waterfowl (ducks and geese)	2.4	95.7	5.5	9.8	1.50E+03
Hunting other game species	7.7	80.9	33.1	18.3	778.33
Non-motorized outdoor recreation activities	75.7	66.9	63.0	64.6	24.77
Motorized outdoor recreation activities	17.9	61.5	54.1	30.5	306.97
Other nature-based activities (e.g., picnicking, relaxing in nature, camping)	76.2	63.9	61.9	62.2	37.78
Participated in at least one activity	99.9	98.7	99.2	95.1	31.02
<b>Membership</b>					
Birding	60.3	3.0	3.5	3.7	599.6
Hunting	6.3	69.7	14.5	12.2	701.3
Fishing	4.0	17.3	9.8	1.2	79.6
Environmental	41.7	5.7	5.9	17.1	261.2
Local/Regional Conservation	24.3	8.4	5.5	6.1	89.6
Membership in at least one organization	73.1	70.0	29.0	26.8	231.4
<b>Land Type</b>					79.40
Mostly public land	38.6	65.2	NA	NA	
Mostly private property	32.6	15.9	NA	NA	
Equal mix of public and private land	28.1	18.4	NA	NA	
I'm not sure	0.6	0.6	NA	NA	



**Table 3**

*Means and standard deviations of continuous specialization measures (trips, centrality) and identity. Superscripts with different letters indicate between-group differences in one-way ANOVA tests with a Bonferroni correction, and Tukey post-hoc tests of pairwise differences in means were significant at  $p < 0.05$ . No superscript letters means that the one-way ANOVA was not significant.*

	<b>Birdwatcher</b>			<b>Waterfowl Hunter</b>			<b>Angler</b>			<b>Community Member</b>		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
<b>Trips</b>	25.9	54.63	1132	13.8	13.90	365	17.00	29.15	251	NA	NA	NA
<b>Centrality<sup>1</sup></b>	3.15 <sup>a</sup>	0.89	1131	3.54 <sup>b</sup>	0.94	368	3.24 <sup>a</sup>	0.96	256	NA	NA	NA
<b>Identity<sup>2</sup></b>												
Birdwatcher	4.01 <sup>a</sup>	1.04	1126	2.16 <sup>b</sup>	1.05	342	2.37 <sup>b</sup>	1.21	234	2.51 <sup>b</sup>	1.18	76
Waterfowl Hunter	1.19 <sup>a</sup>	0.65	1048	4.12 <sup>b</sup>	1.00	366	1.31 <sup>ac</sup>	0.86	228	1.52 <sup>c</sup>	1.25	71
Angler	1.71 <sup>a</sup>	1.10	1055	3.61 <sup>b</sup>	1.20	357	3.26 <sup>c</sup>	1.32	256	2.14 <sup>d</sup>	1.45	70
Outdoor Enthusiast	3.67 <sup>a</sup>	1.19	1099	3.33 <sup>b</sup>	1.22	353	3.59 <sup>ab</sup>	1.18	244	3.27 <sup>b</sup>	1.12	77
Conservationist	4.08 <sup>a</sup>	1.00	1116	4.01 <sup>a</sup>	1.00	362	3.46 <sup>b</sup>	1.17	242	3.41 <sup>b</sup>	1.18	76
Preservationist	3.80 <sup>a</sup>	1.13	1112	3.46 <sup>b</sup>	1.17	354	3.21 <sup>b</sup>	1.16	236	3.29 <sup>b</sup>	1.18	76

<sup>1</sup>Items rated on scale: 1=strongly disagree, 2=somewhat disagree, 3=neither disagree nor agree, 4=somewhat agree, 5=strongly agree

<sup>2</sup>Items rated on scale: 1=not at all, 2=slightly, 3=moderately, 4=strongly, 5=very strongly

**Table 4**

*Knowledge and use of WMAs reported as frequency (%) for all survey groups. Chi-Square tests all had 3 degrees of freedom and results were significant at  $p < 0.05$ .*

	Birdwatcher %	Waterfowl Hunter %	Angler %	Community Member %	$X^2$
<b>Knowledge of WMA</b>					
Nayanquing Point	38.4	73.8	19.1	21.0	228.90
Fish Point	33.7	84.9	31.3	28.4	324.84
Shiawassee River	45.7	84.9	39.8	37.0	200.74
Shiawassee NWR	68.5	84.6	41.0	43.2	151.35
Harsens Island	41.3	78.9	35.2	34.6	184.67
Pointe Mouillee	57.0	75.4	24.6	29.6	180.64
At least one WMA	82.9	97.3	71.1	71.1	89.28
<b>Use of WMA</b>					
Nayanquing Point	19.5	31.6	7.4	4.9	51.76
Fish Point	13.0	41.6	12.0	19.5	140.87
Shiawassee River	9.0	30.5	13.1	25.0	97.55
Shiawassee NWR	26.9	17.9	11.4	17.1	27.55
Harsens Island	9.9	26.5	21.1	9.8	61.80
Pointe Mouillee	26.9	15.1	14.3	12.2	31.14
At least one WMA	54.1	84.0	53.7	50.0	105.56

**Table 5**

*Means and standard deviations of importance of WMA objectives for all survey groups. Superscripts with different letters indicate between-group differences in one-way ANOVA with a Bonferroni correction, and Tukey post-hoc tests of pairwise differences in means were significant at  $p < 0.05$ . No superscript letters means that the one-way ANOVA was not significant. Importance of objectives was measured on a 5-point scale (1=not at all important, 2=somewhat unimportant, 3=neither unimportant nor important, 4=somewhat important, 5=very important).*

Importance of Objectives	Birdwatcher			Waterfowl Hunter			Angler			Community Member		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Provide habitat for migrating waterfowl <sup>1</sup>	4.90 <sup>a</sup>	0.37	1125	4.92 <sup>a</sup>	0.39	370	4.40 <sup>b</sup>	0.93	253	4.60 <sup>b</sup>	0.79	80
Provide nesting habitat for waterfowl <sup>1</sup>	4.88 <sup>a</sup>	0.39	1123	4.88 <sup>a</sup>	0.45	370	4.42 <sup>b</sup>	0.91	253	4.58 <sup>b</sup>	0.79	81
Provide areas of no disturbance for waterfowl	4.73 <sup>a</sup>	0.56	1113	4.64 <sup>ab</sup>	0.71	364	4.25 <sup>c</sup>	0.92	251	4.44 <sup>bc</sup>	0.88	81
Manage wetlands for diversity of wetland wildlife species <sup>1</sup>	4.89 <sup>a</sup>	0.39	1110	4.82 <sup>a</sup>	0.48	370	4.45 <sup>b</sup>	0.89	253	4.56 <sup>b</sup>	0.88	81
Protect wetlands <sup>1</sup>	4.91 <sup>a</sup>	0.37	1112	4.84 <sup>ab</sup>	0.50	370	4.50 <sup>c</sup>	0.88	249	4.58 <sup>bc</sup>	0.91	80
Provide waterfowl hunting opportunities <sup>1</sup>	2.69 <sup>a</sup>	1.39	1104	4.88 <sup>b</sup>	0.46	370	3.86 <sup>c</sup>	1.17	251	3.36 <sup>d</sup>	1.23	80
Provide deer hunting opportunities	2.80 <sup>a</sup>	1.39	1103	4.02 <sup>b</sup>	1.1	367	4.04 <sup>b</sup>	1.21	248	3.36 <sup>d</sup>	1.41	76
Provide small game hunting opportunities	2.60 <sup>a</sup>	1.35	1103	4.10 <sup>b</sup>	1.03	367	3.98 <sup>b</sup>	1.18	250	3.29 <sup>c</sup>	1.47	76
Provide wildlife trapping opportunities	2.11 <sup>a</sup>	1.28	1102	3.83 <sup>b</sup>	1.14	366	3.38 <sup>c</sup>	1.37	247	3.33 <sup>c</sup>	1.47	76
Provide opportunities for diversity of wildlife-related recreational activities	4.18	1.02	1083	4.20	0.99	367	4.27	0.97	248	4.07	1.05	76

**Table 6**

*Means and standard deviations of agreement with statements about WMA wildlife and recreation management for all survey groups. Superscripts with different letters indicate between-group differences in one-way ANOVA with a Bonferroni correction, and Tukey post-hoc tests of pairwise differences in means were significant at  $p < 0.05$ . No superscript letters means that the one-way ANOVA was not significant. Agreement was measured on a 5-point scale (1=strongly disagree, 2=somewhat disagree, 3=neither disagree nor agree, 4=somewhat agree, 5=strongly agree).*

	<b>Birdwatcher</b>			<b>Waterfowl Hunter</b>			<b>Angler</b>			<b>Community Member</b>		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
<b>Wildlife Management</b>												
Waterfowl habitat should be prioritized over other species management	2.86 <sup>a</sup>	1.05	505	4.05 <sup>b</sup>	1.10	304	3.01 <sup>ac</sup>	1.08	92	3.48 <sup>bc</sup>	1.20	23
TE species should be prioritized over other species management	4.05 <sup>a</sup>	0.87	505	3.48 <sup>b</sup>	1.07	301	3.73 <sup>b</sup>	0.99	93	3.74 <sup>ab</sup>	1.21	23
A large variety of species should be prioritized over management for a few specific species	3.97 <sup>a</sup>	0.91	505	3.36 <sup>b</sup>	1.09	301	3.56 <sup>b</sup>	0.96	93	4.22 <sup>a</sup>	0.85	23
Current management primarily benefits game species	3.34 <sup>a</sup>	0.91	500	3.56 <sup>b</sup>	0.97	299	3.4 <sup>ab</sup>	0.73	91	3.7 <sup>ab</sup>	0.88	23
Wetlands are currently managed sufficiently to provide wildlife habitat	3.52 <sup>a</sup>	0.96	506	3.78 <sup>b</sup>	1.04	300	3.43 <sup>a</sup>	0.98	93	3.78 <sup>ab</sup>	0.90	23
Areas closed to public access are necessary to provide resting areas for wildlife	4.31 <sup>a</sup>	0.90	505	4.47 <sup>a</sup>	0.88	302	3.86 <sup>b</sup>	1.04	93	4.35 <sup>ab</sup>	0.88	23
<b>Recreation Management</b>												
I can access the areas that I want to at the time of year I want	3.42 <sup>a</sup>	1.25	505	4.00 <sup>b</sup>	1.03	303	3.83 <sup>b</sup>	0.94	93	3.57 <sup>ab</sup>	1.12	23
I can access the areas that I want to for my recreational activity without much trouble	3.66 <sup>a</sup>	1.02	505	4.02 <sup>b</sup>	1.00	303	3.85 <sup>ab</sup>	0.82	93	3.87 <sup>ab</sup>	0.92	23
Controlled water levels allow me to access the areas that I want to in the fall	3.30 <sup>a</sup>	0.89	503	4.21 <sup>b</sup>	0.89	303	3.42 <sup>a</sup>	0.92	93	3.43 <sup>a</sup>	0.95	23

**Table 6** (cont'd)

I experience little disturbance from other recreational users	3.76 <sup>a</sup>	0.98	505	3.49 <sup>b</sup>	1.21	304	3.43 <sup>b</sup>	1.03	92	3.48 <sup>ab</sup>	0.90	23
I feel safe and secure when I participate in wildlife-related recreation there	4.25 <sup>ac</sup>	0.85	505	4.29 <sup>ab</sup>	0.89	304	4.00 <sup>ac</sup>	0.92	90	4.13 <sup>abc</sup>	0.87	23
Current management provides a diversity of opportunities for wildlife-related recreation	3.80 <sup>a</sup>	0.87	504	4.03 <sup>b</sup>	0.86	304	3.92 <sup>ab</sup>	0.80	92	3.83 <sup>ab</sup>	0.83	23
Waterfowl hunting management should be prioritized over the management for other wildlife-related recreation	2.04 <sup>a</sup>	1.00	506	3.94 <sup>b</sup>	1.15	304	2.82 <sup>c</sup>	1.07	92	3.00 <sup>c</sup>	0.95	23
Having a variety of wildlife habitats is important for me to enjoy my recreational activities	4.44 <sup>a</sup>	0.74	505	3.89 <sup>b</sup>	1.02	304	4.15 <sup>bc</sup>	0.74	92	4.39 <sup>ac</sup>	0.66	23
Providing wildlife habitat is more important than providing wildlife-related recreational opportunities	4.20 <sup>a</sup>	0.89	506	3.53 <sup>b</sup>	1.07	304	3.66 <sup>b</sup>	0.87	92	3.83 <sup>ab</sup>	0.94	23
An appropriate balance currently exists between management for hunting and non-hunting recreational opportunities	3.19 <sup>a</sup>	0.96	504	3.72 <sup>b</sup>	0.94	304	3.46 <sup>ab</sup>	0.93	93	3.26 <sup>ab</sup>	0.81	23
Management currently benefits primarily hunters	3.26 <sup>a</sup>	0.95	503	3.52 <sup>b</sup>	1.09	304	3.25 <sup>ab</sup>	0.97	93	3.26 <sup>ab</sup>	1.01	23
Hunters' opinions on wildlife management decisions are currently considered more by the WMA managers than non-hunters' opinions	3.40	0.88	502	3.33	1.00	303	3.27	0.92	93	3.43	0.99	23

**Table 7**

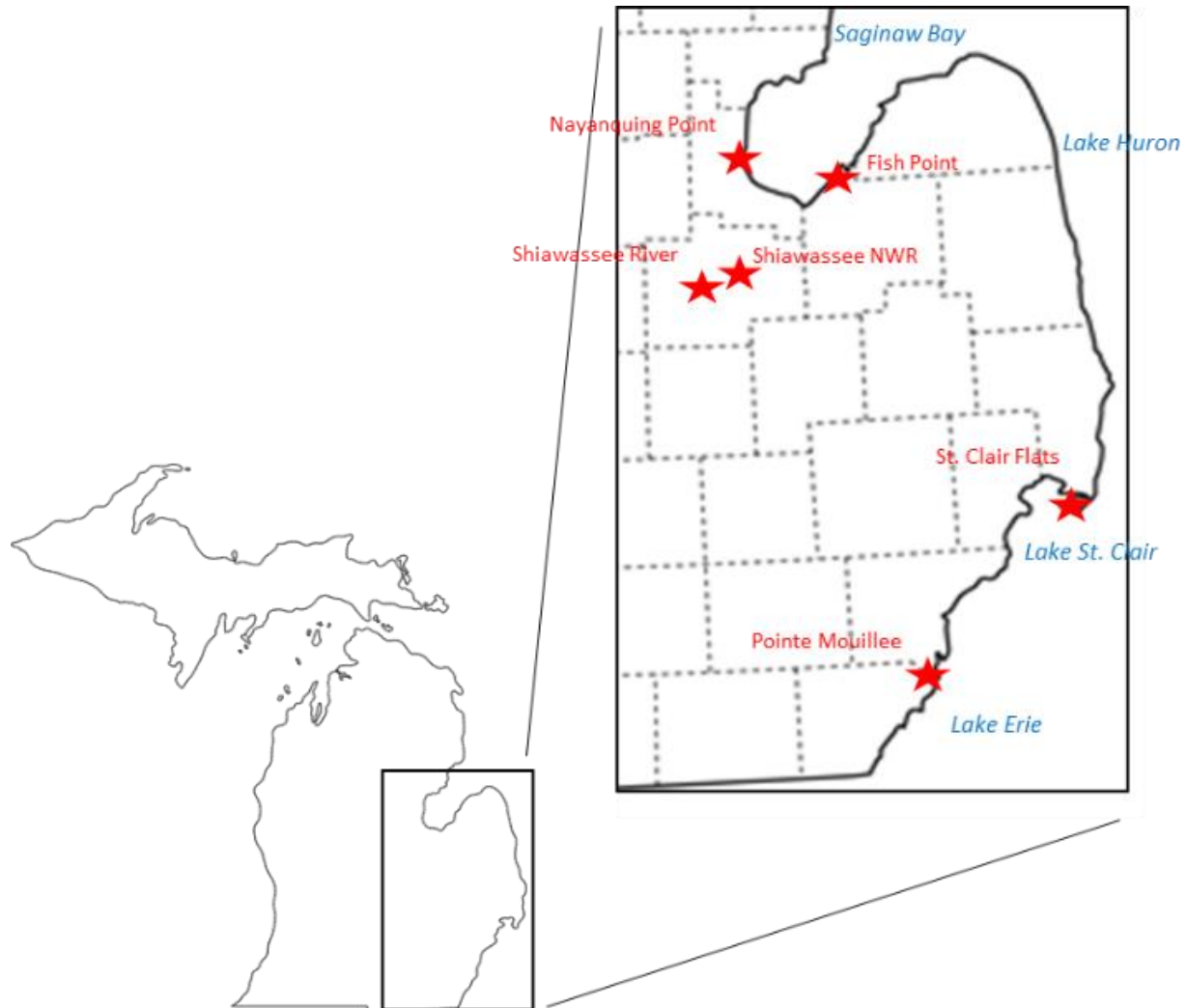
*Means and standard deviations of preferences for changes to statements about WMA wildlife and recreation management for all survey groups. Superscripts with different letters indicate between-group differences in one-way ANOVA with a Bonferroni correction, and Tukey post-hoc tests of pairwise differences in means were significant at  $p < 0.05$ . No superscript letters means that the one-way ANOVA was not significant. Preference for changes was measured on a 5-point scale (1=greatly decrease, 2=somewhat decrease, 3=stay about the same, 4=somewhat increase, 5=greatly increase).*

	<b>Birdwatcher</b>			<b>Waterfowl Hunter</b>			<b>Angler</b>			<b>Community Member</b>		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
<b>Wildlife Management Changes</b>												
Different wildlife habitat types	3.89 <sup>a</sup>	0.73	440	3.50 <sup>b</sup>	0.72	283	3.75 <sup>a</sup>	0.75	85	3.84 <sup>ab</sup>	0.69	19
Management for game species	2.86 <sup>a</sup>	0.77	413	3.78 <sup>b</sup>	0.76	295	3.63 <sup>b</sup>	0.75	87	3.62 <sup>b</sup>	0.86	21
Management for non-game species	4.04 <sup>a</sup>	0.75	440	3.15 <sup>b</sup>	0.76	288	3.53 <sup>c</sup>	0.79	87	3.70 <sup>ac</sup>	0.98	20
Active wetland management	3.40 <sup>a</sup>	0.75	362	3.76 <sup>b</sup>	0.81	288	3.65 <sup>ab</sup>	0.84	82	3.67 <sup>ab</sup>	0.91	18
Invasive plant species management	4.37 <sup>a</sup>	0.87	451	4.09 <sup>b</sup>	1.05	289	4.14 <sup>ab</sup>	1.05	84	4.41 <sup>ab</sup>	0.67	22
<b>Recreation Management Changes</b>												
Vehicle road access	3.17	0.75	464	3.08	0.50	298	3.20	0.70	88	3.05	0.67	21
Hiking trails to access areas	3.59 <sup>a</sup>	0.66	469	3.09 <sup>b</sup>	0.55	276	3.59 <sup>a</sup>	0.76	87	3.85 <sup>a</sup>	0.67	20
Bicycle access	3.28 <sup>a</sup>	0.72	436	2.95 <sup>b</sup>	0.65	263	3.44 <sup>ac</sup>	0.81	86	3.25 <sup>abc</sup>	0.97	20
Parking lots	3.25 <sup>a</sup>	0.56	453	3.21 <sup>a</sup>	0.50	297	3.43 <sup>b</sup>	0.62	88	3.62 <sup>b</sup>	0.67	21
Boat launches to access areas	2.94 <sup>a</sup>	0.53	360	3.29 <sup>b</sup>	0.60	292	3.55 <sup>c</sup>	0.76	88	3.30 <sup>bc</sup>	0.57	20
Access for non-hunting recreational opportunities	3.81 <sup>a</sup>	0.72	458	2.98 <sup>b</sup>	0.56	282	3.41 <sup>c</sup>	0.74	87	3.48 <sup>ac</sup>	0.75	21
Number of days that waterfowl hunting is allowed	2.51 <sup>a</sup>	0.79	397	3.45 <sup>b</sup>	0.76	297	3.13 <sup>c</sup>	0.94	77	3.50 <sup>bc</sup>	0.92	18
Seasonal closures to avoid conflicts	2.75 <sup>a</sup>	0.77	391	3.02 <sup>b</sup>	0.58	282	3.19 <sup>b</sup>	0.65	84	2.82 <sup>ab</sup>	0.64	17
Wildlife resting areas that are closed to public access	3.45 <sup>a</sup>	0.77	433	3.15 <sup>b</sup>	0.65	298	3.54 <sup>ac</sup>	0.82	85	3.2 <sup>abc</sup>	0.70	20

## Figures

**Figure 1**

*Study area including five state-owned and one federally-owned coastal Wildlife Management Areas in southeastern Michigan, USA.*



### **Chapter 3: Stakeholder Perceptions of Ecosystem Services Provided by Wildlife Management Areas**

#### **Abstract**

Coastal wildlife management areas (WMAs) are managed primarily for wetland wildlife habitat and recreational opportunities but also provide additional ecosystem services (ES) that are often unrecognized by recreationists and local communities. Understanding the ES that are most salient to the public can improve policy and management decisions by wildlife managers and potentially increase public support for wildlife management. Objectives of this study were to understand and compare coastal wetland WMA stakeholders' perceptions of ES and assess and compare their attitudes about the ES provided by WMAs. I used internet and mail surveys to collect data from waterfowl hunters ( $n = 316$ ), birdwatchers ( $n = 1,133$ ), anglers ( $n = 254$ ), and community members ( $n = 84$ ) in 2019 at six coastal wetland WMAs in southeastern Michigan, USA that are intensively managed for waterfowl habitat and waterfowl hunting opportunities. One-way ANOVA tests followed by post-hoc pairwise comparisons were used to compare the four stakeholder groups' importance placed on ES provided by natural places, and attitudes about the ES that are provided by WMA management. I found all stakeholder groups placed importance on all ES included in the study, with cultural (e.g., places for future generations to know and experience nature) and provisioning (e.g., places for abundant wildlife, fish, and plants) ES highest in importance. There were differences between the four stakeholder groups, especially between birdwatchers and waterfowl hunters. A majority of respondents reported somewhat or strong agreement that most ES were provided by current management at WMAs and there was the most agreement that WMAs provide public access to nature; abundant wildlife, fish, and plants; and non-consumptive recreation opportunities. My results inform wildlife policy and management decisions so that WMAs are managed to provide ecological benefits to



society while still meeting wetland wildlife habitat and wildlife-related recreation goals. I provide recommendations for wildlife managers to incorporate a suite of ES into planning and management, evaluate trade-offs of potential management actions that result in maximum ES benefits, and communicate the importance of ES and the connection to quality of life and the ES that are provided by WMAs. This may provide an opportunity to build support for WMA management and wetland conservation by highlighting the benefits of these habitats to human well-being. Results of this study can also be used to inform local community land use and economic development planning efforts that result in increased quality of life for citizens and visitors of these communities.

## **Introduction**

Ecosystem services (ES) are “the benefits people obtain from ecosystems” (MEA, 2005:27). Kline et al. (2013:146) provide an additional definition of ES in the context of natural resource management: “ES are beneficial outcomes that derive from landscape conditions and ecological processes as they are altered by both natural disturbance and management activities”. Federal and state wildlife agencies (SWAs) are tasked with managing public lands such as WMAs to provide wildlife habitat and wildlife-related recreation, but these areas also provide a suite of other ES. Kline et al. (2013) described national forest landscapes as natural capital that produced ES and where management decisions and actions influenced forest conditions that then affected the availability of ES. WMAs can be thought of similarly with wildlife management actions having direct and indirect influence on the supply of ES. There are several WMAs throughout the Great Lakes that contain coastal wetland habitat known to provide a broad range of ES such as biogeochemical processes; hydrologic processes; water quality; sediment control; flood water storage; erosion control; carbon storage; habitat for wildlife, fish, invertebrates and

plants; human food supplies; and consumptive and non-consumptive recreational opportunities (Environment Canada, 2002; MEA, 2005; Euliss et al., 2013). The ES that wetlands in general provide have been well documented (de Groot et al., 2012; Scholte et al., 2016; Wilkins et al., 2019; Mushet et al., 2022). Coastal wetland WMAs likely have objectives such as managing impounded wetlands to provide habitat for breeding and migrating waterfowl and other wetland wildlife and to provide waterfowl hunting, birdwatching, and other wildlife-related recreation. However, less visible benefits are potentially present including flood and erosion protection for local communities, improved water quality, and carbon sequestration (Villamagna et al., 2014; Mushet et al., 2022). While wildlife-related recreationists and local communities may easily recognize the wildlife habitat and wildlife-related recreation benefits from these WMAs, other ES benefits related to human well-being are often overlooked.

There is a robust literature documenting the economic values of coastal wetland ES (Barbier, 2019). In a WMA context, Ingraham & Foster (2008) estimated the value of ES (e.g., atmospheric gas regulation; water quality; nutrient regulation; and habitat) provided by National Wildlife Refuges (NWRs) at nearly \$27 billion annually and noted that wetland ecosystems on these WMAs largely provided the most value (nearly \$23 billion annually). While NWRs are managed primarily for wildlife, fish, and recreational benefits, the value of regulating ES (e.g., carbon storage, chemical processes, and flood protection) produced by management actions are much more valuable (Ingraham & Foster, 2008). Quantifying only economic values of ES greatly underestimates the true values which also include social and cultural values (Cole et al., 2015; Ruckelshaus et al., 2015; Annis et al., 2017). Understanding public perceptions and social values of ES in addition to ecological and economic values is required for comprehensive ecosystem management (deGroot et al., 2002). Social metrics have included economic indicators

(e.g., jobs and gross domestic product), but these do not measure the cultural ES benefits that people receive (e.g., aesthetics, educational, traditions, historic values, peace and quiet, spiritual renewal) (Biedenweg et al., 2017; Clarke et al., 2021). Fish et al. (2016:330) define cultural ES as “the contributions that ecosystems make to human well-being in terms of the identities they help frame, the experiences they help enable and the capabilities they help equip”. Cultural ES often have intangible attributes and are more difficult to quantify (Clarke et al., 2021). Assessing a suite of ES including cultural ES can improve conservation efforts by making better policy and management decisions (Cole et al., 2015), increasing public support by highlighting human well-being benefits (Annis et al., 2017), improving policy compliance (Asah et al., 2014), and motivating conservation behavior (Asah et al., 2014; Clarke et al., 2021).

Beyond wildlife conservation benefits, there is also value in understanding the public’s social values of ES for local community planning efforts (e.g., land use planning, economic growth and development planning, recreation planning) that can result in sustainable development and improved quality of life for residents and visitors (Niemela et al. 2010; Cortinovis and Geneletti 2018). Multiple benefits of including ES concepts in community plans have been recognized including educating and engaging citizens in environmental stewardship (Rall et al., 2015; Cortinovis & Geneletti, 2018), communicating environmental goals (Wilkinson et al., 2013; Rall et al., 2015), assessing impacts of planning decisions (Rall et al., 2015; Cortinovis & Geneletti, 2018), assisting with mitigation of environmental impacts (Hansen et al., 2015); and improving community resilience (Hansen et al., 2015).

Public perceptions of ES also have potential implications for wildlife conservation funding. Funding for management of federal and state coastal wetland WMAs relies primarily on hunter participation (through excise tax on firearms and ammunition and waterfowl hunting

licenses) (USDOJ, 2020; Duda et al., 2021). Therefore, declining trends in hunting participation (Cordell, 2012; Winkler & Warnke, 2013; USFWS, 2016a) are especially concerning for the sustainability of wetland conservation (Vrtiska et al., 2013) and WMA management. At the national scale, there are urgent calls for federal and SWAs to engage with a broader set of stakeholders to build a community of support for wildlife conservation (AFWA & WMI, 2019). Similarly, the waterfowl management community has a goal to increase and broaden the citizens that enjoy and support waterfowl and wetland conservation (NAWMP, 2018). To build greater public support for conservation, there are recommendations for agencies to communicate and connect the public to the diversity of societal benefits that result from wildlife and wetland conservation, specifically those ES that the public needs and cares about most (Scholte et al., 2016; NAWMP, 2018; AFWA & WMI, 2019). However, building broad support for conservation will take more than just communicating the wildlife-related benefits of management actions (Euliss et al., 2010; Mattsson et al., 2020; Mushet et al., 2022). For example, providing diverse wildlife-related recreational opportunities can lead to increased recreation participation, increased ES awareness, and subsequently increased behaviors that support wildlife conservation because the recreational pursuits rely on healthy wildlife habitat (Wilkins and Miller, 2018; Rutter et al., 2022).

Social science research can provide a broader understanding of how the public perceives a full suite of ES and the relationship between wildlife conservation actions and resulting ES (Asah et al., 2014; AFWA & WMI, 2019). This knowledge can inform federal and SWAs' application of an ES approach to policy and management decisions that result in meeting wildlife conservation goals, broadening support for wildlife conservation, and providing for the well-being of the public. Because people perceive ES differently across spatial scales (Hein et al.,

2006), it is important to consider social values of ES at a WMA scale to improve management decisions at the appropriate level that will positively impact a diversity of stakeholders that know and use the local resources and that receive direct benefits. To my knowledge, there is a gap in previous research about how the public perceives ES at a WMA scale or if they perceive that the WMAs are providing societal benefits. Therefore, my study seeks to fill this knowledge gap of the perceived importance that key coastal wetland WMA stakeholders place on ES in general and their attitudes about WMAs providing these benefits. My results can inform federal and SWA policy and management decisions so that WMAs are managed to provide ecological benefits to society while still meeting wetland wildlife habitat and wildlife-related recreation goals. Results can also be used by agencies to highlight the broad benefits of WMA management to human well-being and build support for local wildlife conservation. Information from this study is also important for informing local community land use and economic development planning efforts that result in increased quality of life for citizens and visitors of these communities.

### ***Applying an ES Approach to Wildlife Conservation***

Recognizing, managing for, and communicating the ES benefits that are important to the public is one step that agencies can take to advance support for wildlife conservation. Applying an ES approach to wildlife conservation can result in improved policy and decisions, increased support from a broader audience, and expanded agency relevancy. Such an approach relies on public perceptions of ES that can be incorporated into planning and decisions that address what is most important to people (Cole et al., 2015; Clarke et al., 2021). When managers have a robust understanding of the value of a suite of ES that WMAs provide, they are better suited to communicate these benefits (Mushet et al., 2022) and justify conservation funding (Noe et al., 2017) to the public. For example, Kline et al. (2013) posit that an ES approach to national forest

management will help the United States Forest Service communicate the societal benefits that result from management actions, increase support for management decisions, and increase diverse partnerships to reach forest conservation goals. Using an ES approach to conservation emphasizes the complete suite of ES that conservation lands provide and recognizes human well-being as a goal (Noe et al., 2017). In this way, policy and decision makers can better predict and plan for long-term impacts that management actions may have on public well-being (Metz & Weigel, 2010; Adams et al., 2014).

Management actions have direct effects on the flow of ES. An ES approach allows agencies to identify a set of management actions and then assess each one in terms of trade-offs with available ES, which ultimately can lead to decisions about which actions will result in the greatest public benefit (Kline et al., 2013; Adams et al., 2014; Darvill & Lindo, 2016). To evaluate tradeoffs, agencies must consider the different ways in which a diversity of stakeholders perceive and value ES (Darvill & Lindo, 2016). An ES approach also allows for communication and outreach to raise awareness and inform the public about benefits provided by wildlife conservation efforts (Scholte et al., 2016). For example, developing messages that explain how wildlife management efforts provide the ES that the public is most concerned about will likely help federal and SWAs meet their goal of garnering broader public support for WMAs.

### ***Public Perceptions of ES***

The public largely values nature and recognizes its importance for physical and mental well-being (Kellert et al., 2017). Scholars have explored the public's awareness, perception, and social value of ES and found that southern USA landowners value most ES (Adhikari et al., 2021), U.S. voters recognize benefits from nature and place high importance on most ES (Metz & Weigel, 2010), and the majority of the public is concerned about the loss of wetlands and

subsequent loss of ES in their community (Wilkins et al., 2019). Understanding the factors that influence perceptions and how different stakeholders compare is needed for federal and SWAs to consider strategies to increase and broaden support for wildlife conservation.

ES are categorized into provisioning (i.e., provide direct benefits such as food, fuel, and water), regulating (i.e., regulate benefits such as natural processes, flooding, and climate), cultural (e.g., spiritual renewal, recreation, and aesthetic benefits), and supporting services (i.e., processes that support the other ES) (MEA, 2005). The importance that the public places on ES can differ by the type of ES, and cultural and provisioning ES are often socially valued more than regulating ES. In studies that did not measure cultural ES, regulating (clean air and water, erosion and flood protection) and provisioning (wildlife habitat, food, medicine) ES were most important (Metz & Weigel, 2010; Adhikari et al., 2021). When exploring regulating, provisioning, and cultural ES, Scholte et al. (2016) found that provisioning and cultural ES were most valued, and that cultural ES were important across all of the stakeholder groups they studied. Similarly, Asah et al. (2014) found that tribal members placed higher importance on provisioning and cultural ES than regulating ES. Darvill & Lindo (2016) found that cultural ES (e.g., aesthetic, recreation) were more important across all of the stakeholder groups they studied than provisioning ES. However, Wilkins & Miller (2018) found that loss of provisioning ES (clean air and water, wildlife and pollinator habitat) elicited the most concern and cultural ES (hunting opportunities and scenic places for inspiration or spiritual renewal) had the least concern. Overall, it appears that cultural ES are often more important to the public than other ES which poses a challenge for policy and decision makers as cultural ES can be difficult to measure (Clarke et al., 2021).

Stakeholder groups can differ in the importance they place on ES and contextual factors can influence these differences. Scholte et al. (2016) found that stakeholder groups differed in the importance they placed on wetland ES with farmers valuing biodiversity more and anglers valuing provision of food and materials more. Considering different recreation types, hunters place more importance on hunting opportunities as an ES than non-hunting recreationists (Holsman & Peyton, 2003; Wilkins and Miller, 2018). Wilkins & Miller (2018) also found that wildlife viewers placed more importance on wildlife viewing opportunities than other stakeholder groups and wildlife viewers and anglers perceived greater importance of ES provided by wetlands more than hunters, but all groups placed great importance on clean water and clean air. Adams et al. (2014) reported that cultural and biodiversity human well-being domains were more important to indigenous people and commercial domains more important to farmers. Differences in public perceptions of ES have also been reported in the size of a community that people live in with rural residents generally placing lower importance on wetland ES than urban residents and urban residents valuing regulating (flood protection, climate regulation, clean water) and provisioning (habitat for pollinators) ES more than rural residents (Wilkins & Miller, 2018).

Additionally, the importance stakeholders place on ES can be dependent on spatial scales. Darvill & Lindo (2016) reported increased importance of provisioning and cultural ES at a local community scale and increased importance of regulating and supporting ES at a much larger scale (e.g., regional, continental, global). Similarly, Hein et al. (2006) found provisioning and cultural (e.g., recreation) ES to be more important at local scales and cautioned that management plans that focus on benefits to stakeholders at one scale very well may not be acceptable to stakeholders at another scale.



Outdoor recreation participation can also impact ES perceptions. Knowledge and visitation of wetlands and participation in wildlife-related recreation increased concern over losing ES provided by wetlands as well as conservation behavior (Wilkins et al., 2019) and participation in waterfowl hunting and wildlife viewing increased awareness of wetland ES (Rutter et al., 2022). Similarly, Wilkins & Miller (2018) found that respondents that didn't participate in wildlife-related recreation had the lowest concern for loss of ES.

### ***Purpose of Study and Objectives***

Coastal WMAs provide important ES related to human well-being (e.g., flood protection; filtration of nutrients, pollutants, and sediments; wildlife habitat; places to recreate). My study addresses a gap in the knowledge of how ES resulting from WMAs are perceived by the public at a local scale. By focusing on WMAs, my study will elucidate the salient ES of stakeholders and provide insights for federal and SWAs to improve policy and management decisions (e.g., evaluating management tradeoffs and maximizing ES) and develop communication and outreach tools to increase support for wildlife conservation on WMAs. Stakeholder perceptions of ES are also important for local coastal community land use and economic development planning efforts around WMAs. Local community planners can use this information to incorporate the ES most important to the public into land use planning to increase quality of life (Adams et al., 2014; Annis et al., 2017) while promoting sustainable development (Niemela et al., 2010; Cortinovis & Geneletti, 2018) and maintaining ecosystems. My specific objectives were to 1) understand and compare the importance placed on ES by key WMA stakeholders and 2) assess and compare key stakeholders' attitudes about ES provided by WMAs.

## **Methods**

### ***Study Area***

This project focused on five state WMAs and one federal NWR in southeastern Michigan, USA with coastal wetland habitat intensively managed to provide waterfowl habitat and waterfowl hunting opportunities. The wetlands resulting from intensive management provide habitat for a large diversity of wildlife and provide ample opportunities for other non-hunting recreation such as birdwatching, paddle sports, and fishing. The NWR also carries out intensive wetland habitat management with a primary objective to provide a wildlife refuge for migratory birds and secondary objectives to provide hunting and non-hunting opportunities. To meet their management objectives, federal and SWAs have made significant financial investments in the WMAs in terms of wetland management infrastructure and habitat management. This intensive management of coastal habitats and recreation provides a unique opportunity to compare key stakeholders on their perceptions of ES. For a complete description of the study area, see the Study Area section of Chapter 2 and Figure 1.

### ***Sampling and Data Collection***

I constructed and administered web-based and mail-back surveys to measure and compare perceptions and attitudes about ES provided by natural places and resulting from WMA management among four key stakeholder groups: waterfowl hunters, birdwatchers, anglers, and community members. Surveys followed a modified version of the Tailored Design Method (Dillman et al. 2014) and survey instruments and data collection protocols were approved by Michigan State University Institutional Review Board on August 9, 2019 (Project 00003031). Data was collected between August 2019 and March 2020 for the four surveys. Birdwatchers received only web-based surveys, waterfowl hunters and anglers received a combination of web-

based and mail-back surveys, and community members only received mail-back surveys. After accounting for undeliverable invitations and refusals to participate, response rates were 24.0% for birdwatchers (1,133 completed surveys), 14.8% for waterfowl hunters (316 completed surveys), 10.2% for anglers (254 completed surveys), and 2.8% for community members (84 completed surveys). Although response rates are low, they are comparable to recent social science studies in the natural resources (Stedman et al. 2019). Non-response bias was examined via a shortened questionnaires mailed to a random sample of each group with response rates of 25.9% (117 responses) for birdwatchers, 39.6% (198 responses) for waterfowl hunters, 9.6% (48 responses) for anglers, and 2.6% (13 responses) for community members. Because only slight differences were detected between respondents in the original and non-response samples, I chose not to weight data. See the Sampling and Data Collection section of Chapter 2 for a complete description of survey sampling frames, data collection, and assessment of non-response bias.

### ***Variables Measured***

**ES Provided by Natural Places.** To measure importance that stakeholders place on ES provided by natural places, respondents were asked to indicate the importance of 19 provisioning, regulating, and cultural ES that were adapted from the MEA (2005) classification of ES, human well-being domains (Smith et al., 2012; Adams et al., 2014; Scholte et al., 2016), and a social value of ES typology (Cole et al., 2015). Provisioning ES included providing abundant wildlife, fish, and plants; jobs and income for the local economy; a source of food; and human health (e.g., clean air and clean water). Regulating ES included providing natural processes which support life (e.g., climate regulation and storage of greenhouse gasses); and safety to communities (e.g., flood and erosion protection). Cultural ES included places for enjoyable scenery, sights, and/or sounds; passing down culture, knowledge, and traditions; future

generations to know and experience nature; natural and/or human history; a sense of community and belonging; educational value; hunting, fishing, or trapping opportunities; wildlife watching, hiking camping, paddling, or similar outdoor opportunities; spiritual renewal; peace, quiet, and stress relief; value in just knowing they are there; public access to nature; and a place free from human development where there is minimal human impact. To avoid respondent confusion and unfamiliarity with the term “ecosystem services”, “benefits that people get from nature” was used in the survey questionnaire (Metz & Weigel, 2010; Thompson et al., 2016). Respondents were given the following direction, “Listed below are some benefits to people that could be provided by natural places (not just WMAs, but any natural place). Please tell us how important each benefit is to you personally.” Importance of ES was measured on a 5-point scale (1 = not at all important, 2 = somewhat important, 3 = neither unimportant nor important, 4 = somewhat important, 5 = very important). Respondents were then asked to indicate the one ES that was the most important to them personally.

**ES Provided by WMA Management.** To measure perceptions about the ES that WMAs provide, respondents were asked to indicate their agreement on a 5-point scale (1 = strongly disagree, 2 = somewhat disagree, 3 = neither disagree nor agree, 4 = somewhat agree, 5 = strongly agree) that the same 19 ES in the importance of ES question were provided by WMA management. Specifically, respondents were asked “To what extent do you agree or disagree that current WMA management provides these benefits”?

**Socio-Demographics.** Gender, year of birth, race, ethnicity, education level, household income, zip code of primary residence, and type of residence (large urban, medium urban, small city, small town, or rural area) were collected from respondents.

## ***Data Analysis***

Data from the birdwatcher, waterfowl hunter, angler, and community member surveys were merged for analysis. Data were analyzed for missingness and listwise deletion was used for all variables during data analysis because all variables had < 5% of data missing. The four survey samples (birdwatchers, waterfowl hunters, anglers, and community members) were treated as distinct groups (i.e., there were no duplicate individuals sampled in each group) to make comparisons. To compare mean group scores, one-way ANOVA tests with a Bonferroni correction and Tukey post-hoc tests of pairwise differences in means were used to identify differences between birdwatchers, waterfowl hunters, anglers, and community members. Stata (Version 15.1) was used to perform all analyses. Descriptive statistics are also presented to characterize differences between groups. Differences were considered statistically significant at  $p < 0.05$ .

## **Results**

### ***Socio-Demographics***

Table 1 displays the socio-demographic results for each group. The mean year of birth for birdwatchers ( $M=1961.57$ ,  $SD=14.3$ ) and community members ( $M=1963.72$ ,  $SD=17.75$ ) indicated that they were significantly older than waterfowl hunters ( $M=1970.14$ ,  $SD=16.15$ ) and anglers ( $M=1971.10$ ,  $SD=13.02$ ). Gender differed between groups ( $\chi^2(3) = 404.94$ ,  $p < .001$ ) with male respondents making up 96.2% of waterfowl hunters, 75.4% of anglers, 58.2% of community members, and 39.3% of birdwatchers. Most waterfowl hunters (98.3%), birdwatchers (98.2%), anglers (95.4%), and community members (82.7%) were white, and there were differences between groups for each race category. Most survey respondents were also not Hispanic or Latino, although there were differences between groups ( $\chi^2(3) = 8.50$ ,  $p < .05$ ).

Anglers (3.0%) had the most Hispanic or Latino respondents, followed by community members (1.4%), waterfowl hunters (0.8%), and birdwatchers (0.8%). There were differences in education levels between groups ( $\chi^2(12) = 243.33$ ,  $p < .001$ ) and more than 82% of birdwatchers had at least an associate or bachelor's degree compared to 72.8% of community members, 58.6% of waterfowl hunters, and 49.6% of anglers. There were also differences between groups in the size of the communities that respondents lived in at the time of the survey ( $\chi^2(12) = 25.14$ ,  $p = 0.01$ ) and waterfowl hunters had the most rural residence of the four groups, with 26.0% from rural areas (population < 2,000) and 27.3% from small towns (population 2,000–10,000), followed by birdwatchers, anglers, and community members. Frequency of income categories did not differ between groups ( $\chi^2(27) = 31.83$ ,  $p = 0.24$ ), however waterfowl hunters and community members had 46.9% of respondents with income > \$100,000, followed by birdwatchers (38.0%) and anglers (36.4%). Similarly, anglers (23.8%) and birdwatchers (22.6%) reported income < \$50,000 more than community members (17.2%) and waterfowl hunters (14.8%).

### ***Importance of ES***

Across all respondents, mean scores of importance were relatively high across all 19 ES (Figure 2). All but three ES had a mean score >4.0 indicating the ES were at least somewhat important. The three ES with lower mean importance scores were places for spiritual renewal; that provide hunting, fishing, or trapping opportunities; and that provide a source of food for humans, however all three of these had over 52% of respondents reporting they were either somewhat or very important. Cultural and provisioning ES scored the highest in mean importance. Places for future generations to know and experience nature had the highest mean score ( $M=4.78$ ,  $SD=0.49$ ) followed by places for abundant wildlife, fish, and plants ( $M=4.77$ ,  $SD=0.53$ ); places that provide public access to nature ( $M=4.66$ ,  $SD=0.61$ ); places free from

development where there is minimal human impact ( $M=4.65$ ,  $SD=0.69$ ); places that provide for human health ( $M=4.61$ ,  $SD=0.72$ ); places that provide wildlife watching, hiking, camping, paddling, or other similar outdoor opportunities ( $M=4.61$ ,  $SD=0.64$ ); and places that provide enjoyable scenery, sights, or sounds ( $M=4.61$ ,  $SD=0.70$ ).

There were differences detected between the four groups in the importance they place on 18 of the 19 ES (Table 8). Only one ES, places for sense of community and belonging, did not differ between groups ( $F(3, 1823) = 0.87$ ,  $p = 0.91$ ). Birdwatchers had higher mean scores of importance than the other three groups for seven of the ES (places for enjoyable scenery, sights, or sounds; abundant wildlife, fish, and plants; future generations to know and experience nature; value just knowing that they are there; educational value; natural processes which support life; and peace, quiet, and stress relief). Notably, birdwatchers had a lower mean score for places that provide hunting, fishing, or trapping opportunities ( $M=3.05$ ,  $SD=1.32$ ) and it was the lowest score of any of the ES across all groups. Birdwatchers also scored places that provide a source of food for humans lower than the other groups ( $M=3.21$ ,  $SD=1.25$ ). Waterfowl hunters had higher mean scores for places that provide hunting, fishing, or trapping opportunities ( $M=4.79$ ,  $SD=0.43$ ) than the other three groups and lower mean scores for places that provide enjoyable scenery, sights, or sounds and natural processes which support life. Differences were especially prevalent between birdwatchers and waterfowl hunters with differences found between the two groups for 18 ES. Birdwatchers also differed from anglers on 14 ES and from community members on 10 ES. Waterfowl hunters and community members only differed on four ES: places that provide enjoyable scenery, sights, or sounds; natural processes which support life; hunting, fishing, and/or trapping opportunities; and safety to communities. Waterfowl hunters and anglers differed on six ES: places that provide enjoyable scenery, sights, or sounds; natural

processes which support life; hunting, fishing, or trapping opportunities; wildlife watching, hiking, camping, paddling, or similar outdoor opportunities; peace, quiet, and stress relief; and human health. Anglers and community members only differed on places that provide hunting, fishing, or trapping opportunities with higher mean importance scores for anglers.

Figure 3 displays the ES that had at least 5% of the responses by survey group for the most important ES. Birdwatchers' highest responses were places for abundant wildlife, fish, and plants (29%), future generations to know and experience nature (14%), and wildlife watching, hiking, camping, paddling, or other similar outdoor opportunities (13%). In contrast, the majority of waterfowl hunters (51%) indicated that places for hunting, fishing, or trapping opportunities was the most important ES followed by places for abundant wildlife, fish, and plants (20%). Anglers were similar to waterfowl hunters with their top two responses of places for hunting, fishing, or trapping (22%) and abundant wildlife, fish, and plants (18%). Community members were more dispersed in their responses for the most important ES with places for future generations to know and experience nature as the top response (17%) followed by wildlife watching, hiking, camping, paddling, or other similar outdoor opportunities (12%).

#### ***Agreement That WMA Management Provides ES***

Across all respondents, mean scores of agreement that WMA management provides ES were lower than mean scores of importance of ES except for places that provide hunting, fishing, or trapping. The largest differences between mean importance scores and mean agreement scores were for places that provide for human health (difference=0.73) and free from development where there is minimal human impact (difference=0.71). All mean scores of agreement were  $\geq 3.37$  indicating at least some agreement that WMA management provides ES for all items (Figure 4). The ES with the highest mean scores of agreement were places that



provide public access to nature (M=4.29, SD=0.78); abundant wildlife, fish, and plants (M=4.28, 0.77); wildlife watching, hiking, camping, paddling, or other similar outdoor opportunities (M=4.21, SD=0.80); enjoyable scenery, sights, or sounds (M=4.17, SD=0.79); for future generations to know and experience nature (M=4.13, SD=0.82); and peace, quiet, and stress relief (M=4.02, SD=0.88). The ES with the lowest mean scores of agreement and that had less than 50% of the respondents reporting that they somewhat or strongly agreed that WMA management provided these benefits were places that provide a source of food for humans (M=3.37, SD=0.99); jobs and income for local economy (M=3.49, SD=0.84); for spiritual renewal (M=3.54, SD=0.98); and a sense of community and belonging (M=3.57, SD=0.87).

Differences were detected between groups in their agreement that current WMA management provides ES for 12 of the 19 ES (Table 9). Waterfowl hunters had higher agreement for places that provide hunting, fishing, or trapping opportunities (M=4.61, SD=0.66) than the other three groups and this was the highest mean score of agreement of any of the ES. Birdwatchers had lower agreement for places that provide jobs and income for the local economy (M=3.35, SD=0.77) and source of food for humans (M=3.16, SD=0.91) than the other three groups. Similar to importance of ES, birdwatchers and waterfowl hunters appeared to differ the most in their agreement that WMA management provides ES with differences in 10 ES.

## **Discussion**

Results from my study contribute to a growing scholarship about the public's perceived benefits of ES that has implications for improved wildlife conservation and land use planning efforts. This study focused on ES at a WMA scale which is relevant to federal and SWAs interested in applying the ES concept to policy and management decisions at a local scale. Local coastal communities can also incorporate these results into land use and economic development

plans that recognize the benefits from natural places that are most important to their residents and visitors.

My results indicate that WMA stakeholders perceive that there are benefits they receive from natural places as shown by the high importance they placed on most of the ES. These results are encouraging for federal and SWAs that oversee WMAs and provide a potential opportunity to connect WMAs with societal benefits most important to stakeholders (NAWMP, 2018; AFWA & WMI, 2019). My findings are consistent with previous studies that found the public placed high value on benefits from nature (Metz & Weigel, 2010; Wilkins et al., 2019; Adhikari et al., 2021). Similar to other studies (Asah et al., 2014; Scholte et al., 2016), I found that cultural ES (e.g., places for future generations to know and experience nature; public access to nature; places free from development with minimal human impact; for non-consumptive wildlife recreation; and that provide enjoyable scenery, sights, and sounds) and provisioning ES (e.g., places that provide abundant wildlife, fish, and plants and places that provide for human health) were more important to respondents than regulating ES. Unlike Darvill & Lindo (2016) that found cultural ES were valued more than provisioning ES, I found cultural and provisioning ES to be similar in importance across all stakeholder groups. Regulating ES were not frequently included in the top responses to the most important ES, however over 84% of respondents in my study found the two regulating ES to be somewhat or very important. Additionally, community members ranked places that provide natural processes which support life third in the most important ES and birdwatchers ranked it fifth. Scholte et al. (2016) suggest that the public may place lower importance on regulating ES because they are less tangible. The relatively high importance scores I report for regulating ES may be because I provided context to these benefits in the questionnaire such as flood and erosion protection being part of providing safety to

communities. Poor policy compliance and ineffective communication can result if policy and decision makers focus primarily on regulating and provisioning ES when the public perceives cultural ES to be equally or more important (Asah et al., 2014).

I found differences between stakeholder groups in the importance they placed on ES. However, importance scores were relatively high for most ES across all stakeholder groups. Waterfowl hunters clearly placed more importance on places for hunting, fishing, or trapping opportunities than the other three groups (waterfowl hunters scored this ES the highest of all 19 ES) which is not surprising and consistent with other research (Patton, 2021b). Conversely, waterfowl hunters had the lowest importance scores across all stakeholders for places that provide natural processes which support life (e.g., climate regulation, storage of greenhouse gases) which is also consistent with Patton (2021b). Birdwatcher's highest importance on places for abundant wildlife, fish, and plants and lowest importance on places that provide hunting, fishing, or trapping opportunity are similar to Patton (2021a). Differences were especially prevalent between waterfowl hunters and birdwatchers in the importance placed on ES. Birdwatchers scored cultural ES higher than waterfowl hunters except for places that provide hunting, fishing, or trapping opportunities and places for passing down culture, knowledge, and traditions. However, birdwatchers still scored places for passing down culture, knowledge, and traditions high. Birdwatchers scored 10 of the cultural ES higher than waterfowl hunters however waterfowl hunters still placed importance on these, just not as great as birdwatchers (except for places for spiritual renewal). Patton (2021b) also found low levels of concern in waterfowl hunters for places for spiritual renewal. Birdwatchers in my study also assigned a lower importance to spiritual renewal than the other cultural ES. For provisioning ES, waterfowl hunters placed significantly higher importance on places that provide a source of food for

humans than birdwatchers, however waterfowl hunters scored this ES lower than the other provisioning ES. Even though waterfowl hunters' importance scores for places that provide jobs and income for the local economy were higher than birdwatchers, the magnitude of difference is small.

Overall, the differences detected between birdwatchers and waterfowl hunters may not be that remarkable since both groups clearly value most ES and it doesn't appear that they are that polarized except for places for hunting, fishing, or trapping opportunities. This suggests that efforts are not urgently needed to educate these groups on the importance of benefits from natural places. There is opportunity for agencies to highlight the multiple ES that all stakeholder groups find important and that can potentially be used as common ground for engaging a diversity of stakeholders (Holsman & Peyton, 2003).

At a local scale, my results provide insight to how key WMA stakeholders perceive the benefits provided by management at coastal wetland WMAs. Generally, respondents' mean scores of agreement about ES benefits from WMAs were less than the importance they placed on ES. Most ES had at least a majority of respondents either somewhat or strongly agreeing that WMA management provided them which is encouraging for agencies considering policy and management at the WMA scale. The ES 'places that provide for human health (clean air and clean water)' had the largest difference in scores between importance of ES and agreement that WMA management provides this ES, suggesting that the public may not make a connection between coastal wetland WMAs and human health benefits. Thus, federal and SWAs could develop communication strategies to target this message to WMA stakeholders, especially for the clean water benefits that coastal wetlands provide. Respondents indicated that the top three ES that WMAs provided were places that provide public access to nature; abundant wildlife,

fish, and plants; and wildlife watching, hiking, camping, paddling, or other similar outdoor opportunities. This is not surprising because these WMAs are open to the public, are intensively managed for wildlife, and are well known locations for outdoor recreation. What is surprising is that, although about 68% of respondents either somewhat or strongly agreed that WMA management provides hunting, fishing, or trapping opportunities, this ES did not rank higher because all of the WMAs in this study provide these opportunities and hunting is the most popular and intensively managed activity on the five state WMAs.

### ***Limitations and Future Research***

Several limitations affect the generalizability of my results. The birdwatcher sample was drawn from registered eBird users that may not be representative of most birdwatchers that use WMAs because eBird users may be more avid, thereby under-representing more casual birdwatchers. The coastal wetland WMAs included in this study are intensively managed for waterfowl habitat and waterfowl hunting opportunities and are likely not representative of most WMAs. There were very likely overlaps in the four stakeholder groups that were compared. For example, birdwatchers from the birdwatcher sample may also hunt waterfowl, fish, and reside in the local communities of interest. However, appropriate survey research methods were used, and I checked for nonresponse bias (see the Sampling and Data Collection section of Chapter 2) to increase generalizability of the results.

Additional data from my stakeholder surveys could be used to develop models to predict importance of ES and to build on previous work exploring how social values are shaped (e.g., the influences of recreation participation and specialization, knowledge and visitation of recreational areas, and frequency of conservation behaviors) (Scholte et al., 2016; Rutter et al., 2022). Additionally, future research could explore the relationship between social values placed on ES

and attitudes about WMA management. The concepts of place attachment and sense of place and their relationships with public perceptions and value of ES, especially at local scales, is an important consideration for future research (Asah et al., 2014; Darvill & Lindo, 2016). While the management of coastal wetlands and resulting ES provide an informative case study for ES perceptions, research should be expanded to additional WMAs.

### ***Management Implications***

Federal and SWAs that desire to implement an ES approach to wildlife management could identify, incorporate, and measure a suite of ES indicators (including human well-being indicators) into their planning and management and explicitly make human well-being a goal (Noe et al., 2017). Similarly, Mushet et al. (2022) call for a change in the way agencies think about and plan for wildlife conservation and management from habitat and species outcomes to a holistic vision where wildlife conservation efforts provide a suite of ES that are important to human well-being as well as providing wildlife habitat. My results help to understand which measures may be most salient to different groups of WMA stakeholders.

After ES have been identified, agencies could use a suite of ES to evaluate trade-offs of multiple management options and make decisions that attempt to maximize ES benefits. The challenge will be deciding tradeoffs when stakeholders value ES benefits differently. However, these considerations will provide better plans for long-term well-being impacts of different management actions (Metz & Weigel, 2010; Kline et al., 2013; Adams et al., 2014; Darvill & Lindo, 2016). Asah et al., (2014) suggest that considering a full suite of ES can result in better policy compliance, improved stakeholder experiences with nature, and increased stewardship and conservation behaviors. Specifically, results from my study help agencies consider how different management decisions may affect key stakeholders' obtainment of the ES that are most salient to

them (Adams et al., 2014; Asah et al., 2014; Darvill & Lindo, 2016), what potential conflicts to anticipate between stakeholder groups, and if support for or concern about management actions can be expected (Ruckelshaus et al., 2015; Mushet et al., 2022). Management actions taken without considering this information may result in outcomes that do not address the ES that are most important to key stakeholders (Darvill & Lindo, 2016).

My results provide a local scale understanding of the ES most salient to stakeholders. This information can be built into communication, outreach, and marketing strategies to educate the public about the importance of ES provided by WMAs and the connection to quality of life. A national study for The Nature Conservancy provided several pragmatic suggestions for agency communications including using local examples when explaining broad benefits received from conservation actions; focusing on the ES that the public cares about the most; and including clear and easy to understand descriptions of trade-offs and long-term impacts of management actions (Metz & Weigel, 2010). Others have recommended that communications clearly make linkages between different types of ES (Villamagna et al., 2014). For example, explaining how improvements to coastal wetland habitat for waterfowl habitat is also valuable for water quality, carbon sequestration, and flood protection and vice versa. Because stakeholder groups in my study were largely similar in the high importance they placed on ES, broad messaging may be effective for some ES that had shared importance across groups. However, the differences I detected between waterfowl hunters and birdwatchers may warrant separate and targeted communications for these stakeholder groups. For example, messaging could acknowledge the importance of consumptive use for waterfowl hunters and conversely, the importance of non-consumptive use for birdwatchers and the trade-offs associated with different management decisions.

## Tables

**Table 8**

*Means and standard deviations for importance of ecosystem services (ES) for all survey groups. Superscripts with different letters indicate between-group differences in one-way ANOVA with a Bonferroni correction, and Tukey post-hoc tests of pairwise differences in means were significant at  $p < 0.05$ . No superscript letters means that the one-way ANOVA was not significant.*

Importance of ES <sup>1</sup> “Places for...”	Birdwatcher			Waterfowl Hunter			Angler			Community Member		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Enjoyable scenery, sights, and/or sounds	4.78 <sup>a</sup>	0.48	1130	4.21 <sup>b</sup>	0.93	370	4.45 <sup>c</sup>	0.81	254	4.47 <sup>c</sup>	0.73	81
Abundant wildlife, fish, and plants	4.89 <sup>a</sup>	0.37	1131	4.57 <sup>b</sup>	0.68	369	4.61 <sup>b</sup>	0.70	254	4.57 <sup>b</sup>	0.69	81
Passing down culture, knowledge, and traditions	4.25 <sup>a</sup>	0.88	1129	4.40 <sup>b</sup>	0.77	368	4.32 <sup>ab</sup>	0.85	253	4.23 <sup>ab</sup>	0.97	81
Jobs and income for the local economy	3.99 <sup>a</sup>	0.92	1131	4.15 <sup>b</sup>	0.89	369	4.25 <sup>b</sup>	0.9	253	4.11 <sup>ab</sup>	1.10	81
Future generations to know and experience nature	4.85 <sup>a</sup>	0.41	1128	4.67 <sup>b</sup>	0.57	368	4.69 <sup>b</sup>	0.61	253	4.69 <sup>b</sup>	0.59	80
Natural and/or human history	4.42 <sup>a</sup>	0.76	1130	4.15 <sup>b</sup>	0.87	368	4.29 <sup>ab</sup>	0.85	253	4.30 <sup>ab</sup>	0.93	81
Sense of community and belonging	4.10	0.96	1127	3.98	0.94	368	4.07	0.96	251	4.07	1.00	81
Value just knowing they are there	4.40 <sup>a</sup>	0.78	1127	4.13 <sup>b</sup>	0.84	367	4.15 <sup>b</sup>	0.92	252	4.10 <sup>b</sup>	1.03	80
Educational value	4.52 <sup>a</sup>	0.64	1130	4.31 <sup>b</sup>	0.72	368	4.31 <sup>b</sup>	0.75	253	4.26 <sup>b</sup>	0.95	81
Natural processes which support life	4.57 <sup>a</sup>	0.82	1129	3.93 <sup>b</sup>	1.08	369	4.17 <sup>c</sup>	1.01	251	4.28 <sup>c</sup>	1.04	81
Hunting, fishing, and/or trapping opportunities	3.05 <sup>a</sup>	1.32	1125	4.79 <sup>b</sup>	0.43	368	4.47 <sup>c</sup>	0.87	253	3.56 <sup>d</sup>	1.36	80
Wildlife watching, hiking, camping, paddling, etc.	4.68 <sup>a</sup>	0.59	1129	4.42 <sup>b</sup>	0.73	368	4.62 <sup>ac</sup>	0.63	253	4.47 <sup>bc</sup>	0.69	81
Spiritual renewal	3.82 <sup>a</sup>	1.17	1124	3.32 <sup>b</sup>	1.25	366	3.56 <sup>b</sup>	1.27	251	3.64 <sup>ab</sup>	1.21	81
Source of food for humans	3.21 <sup>a</sup>	1.25	1123	3.82 <sup>b</sup>	1.14	365	3.94 <sup>b</sup>	1.08	252	3.77 <sup>b</sup>	1.29	81
Peace, quiet, and stress relief	4.60 <sup>a</sup>	0.67	1129	4.07 <sup>b</sup>	1.02	367	4.37 <sup>c</sup>	0.87	254	4.28 <sup>bc</sup>	0.88	81



**Table 8** (cont'd)

Free from development where there is minimal human impact	4.74 <sup>a</sup>	0.57	1130	4.45 <sup>b</sup>	0.85	367	4.51 <sup>b</sup>	0.83	254	4.63 <sup>ab</sup>	0.62	80
Safety to communities	4.43 <sup>a</sup>	0.76	1129	4.18 <sup>b</sup>	0.95	368	4.28 <sup>bc</sup>	0.87	251	4.51 <sup>ac</sup>	0.67	80
Human health	4.68 <sup>a</sup>	0.65	1129	4.38 <sup>b</sup>	0.89	369	4.65 <sup>a</sup>	0.65	251	4.59 <sup>ab</sup>	0.71	80
Public access to nature	4.72 <sup>a</sup>	0.55	1128	4.55 <sup>b</sup>	0.69	369	4.61 <sup>b</sup>	0.7	252	4.54 <sup>ab</sup>	0.67	80

<sup>1</sup> Importance scale: 1 = not at all important, 2 = somewhat important, 3 = neither unimportant nor important, 4 = somewhat important, 5 = very important

**Table 9**

*Means and standard deviations for agreement that current WMA management provides ecosystem service (ES) for all survey groups. Superscripts with different letters indicate between-group differences in one-way ANOVA with a Bonferroni correction, and Tukey post-hoc tests of pairwise differences in means were significant at  $p < 0.05$ . No superscript letters means that the one-way ANOVA was not significant.*

<b>Agreement that WMA management provides ES<sup>1</sup> “Places for...”</b>	<b>Birdwatcher</b>			<b>Waterfowl Hunter</b>			<b>Angler</b>			<b>Community Member</b>		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Enjoyable scenery, sights, and/or sounds	4.21	0.77	1098	4.13	0.81	360	4.07	0.86	238	4.14	0.81	69
Abundant wildlife, fish, and plants	4.27 <sup>a</sup>	0.77	1095	4.42 <sup>b</sup>	0.67	360	4.17 <sup>a</sup>	0.85	238	4.25 <sup>ab</sup>	0.79	69
Passing down culture, knowledge, and traditions	3.57 <sup>a</sup>	0.84	1094	4.05 <sup>b</sup>	0.89	360	3.86 <sup>c</sup>	0.90	237	3.83 <sup>abc</sup>	0.80	69
Jobs and income for the local economy	3.35 <sup>a</sup>	0.77	1094	3.74 <sup>b</sup>	0.90	360	3.73 <sup>b</sup>	0.91	237	3.64 <sup>b</sup>	0.94	69
Future generations to know and experience nature	4.10 <sup>a</sup>	0.82	1094	4.27 <sup>b</sup>	0.74	362	4.06 <sup>a</sup>	0.90	236	4.13 <sup>ab</sup>	0.82	69
Natural and/or human history	3.66	0.84	1090	3.74	0.87	359	3.81	0.92	237	3.80	0.87	69
Sense of community and belonging <sup>2</sup>	3.52	0.85	1090	3.65	0.90	359	3.66	0.93	237	3.60	0.88	68
Value just knowing they are there	4.03	0.87	1095	3.99	0.87	360	3.87	0.92	237	3.87	0.84	69
Educational value	3.96	0.80	1091	4.03	0.78	360	3.96	0.87	236	3.90	0.77	69
Natural processes which support life	3.92 <sup>a</sup>	0.93	1092	3.75 <sup>b</sup>	0.98	362	3.82 <sup>ab</sup>	0.98	236	3.83 <sup>ab</sup>	1.04	69
Hunting, fishing, and/or trapping opportunities	3.75 <sup>a</sup>	0.98	1091	4.61 <sup>b</sup>	0.66	363	4.12 <sup>c</sup>	0.89	237	3.87 <sup>ac</sup>	0.95	69
Wildlife watching, hiking, camping, paddling, etc.	4.21	0.81	1091	4.22	0.74	361	4.21	0.82	236	4.12	0.82	68
Spiritual renewal	3.59 <sup>a</sup>	0.94	1090	3.36 <sup>b</sup>	1.06	360	3.59 <sup>a</sup>	1.02	236	3.59 <sup>ab</sup>	0.96	69
Source of food for humans	3.16 <sup>a</sup>	0.91	1085	3.74 <sup>b</sup>	1.02	358	3.69 <sup>b</sup>	1.01	236	3.53 <sup>b</sup>	1.01	68
Peace, quiet, and stress relief	4.08 <sup>a</sup>	0.86	1092	3.90 <sup>b</sup>	0.92	361	3.96 <sup>ab</sup>	0.92	237	3.91 <sup>ab</sup>	0.79	68

**Table 9** (cont'd)

Free from development where there is minimal human impact	3.91 <sup>a</sup>	0.96	1089	4.06 <sup>b</sup>	0.91	358	3.89 <sup>ab</sup>	1.00	237	3.97 <sup>ab</sup>	0.87	69
Safety to communities	3.73	0.86	1086	3.83	0.92	357	3.81	0.94	236	3.84	0.87	69
Human health	3.85	0.89	1086	3.91	0.92	359	3.95	0.96	237	3.94	0.87	69
Public access to nature	4.30 <sup>a</sup>	0.78	1084	4.36 <sup>a</sup>	0.71	358	4.14 <sup>b</sup>	0.83	236	4.22 <sup>ab</sup>	0.84	69

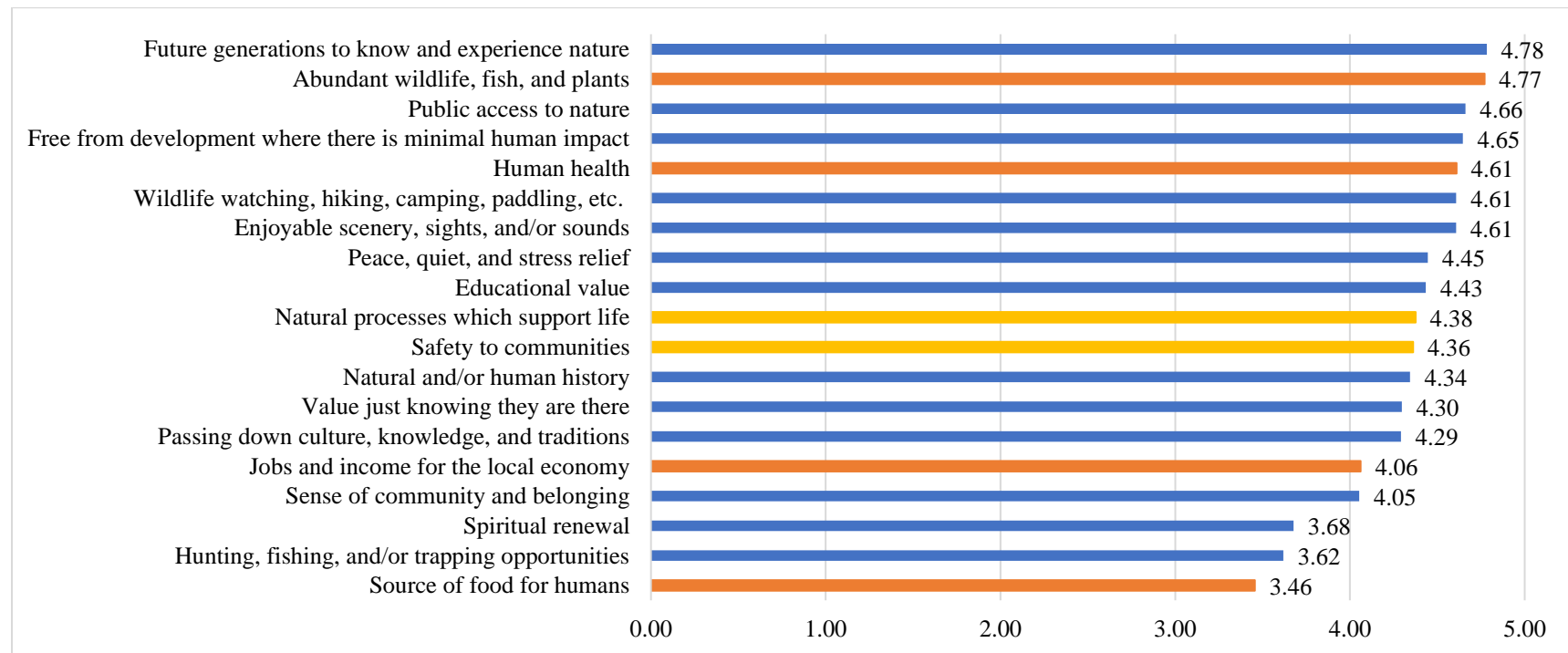
<sup>1</sup> Agreement scale: 1 = strongly disagree, 2 = somewhat disagree, 3 = neither disagree nor agree, 4 = somewhat agree, 5 = strongly agree

<sup>2</sup> ANOVA significant ( $F(3,1750) = 2.84, p=0.037$ )) however Tukey post-hoc tests of pairwise differences not significant.

## Figures

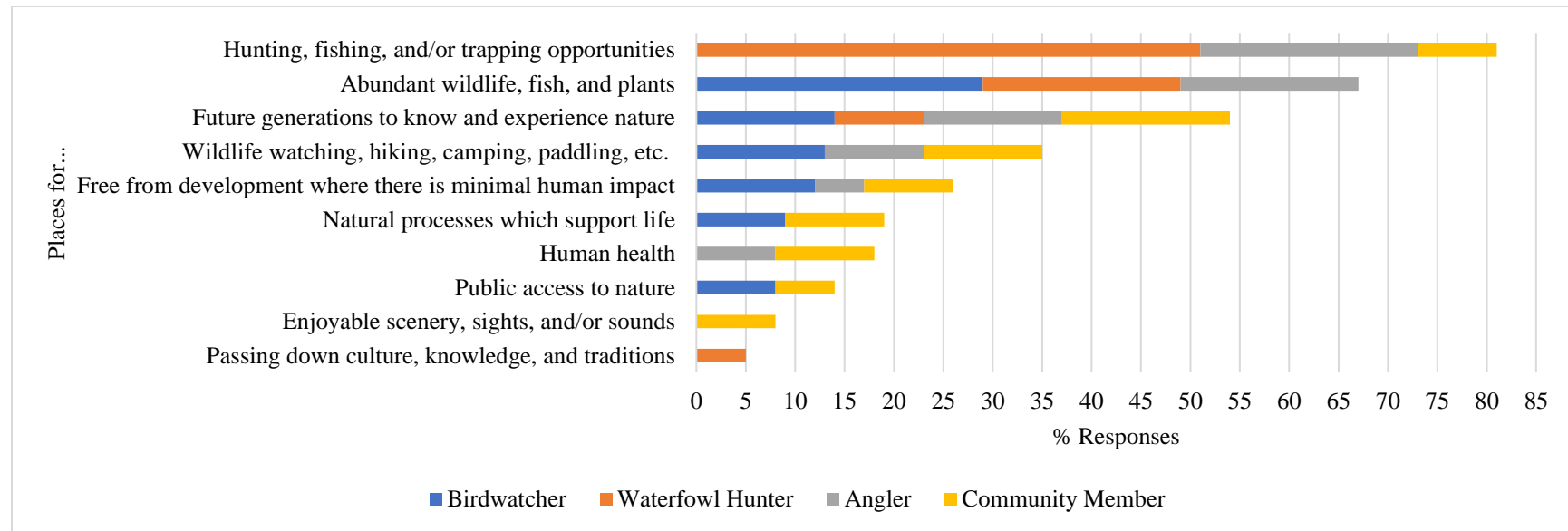
**Figure 2**

*Mean scores of importance of ecosystem services across all survey respondents (n = 1,786). Importance scale: 1 = not at all important, 2 = somewhat important, 3 = neither unimportant nor important, 4 = somewhat important, 5 = very important. Blue bars indicate cultural ecosystem services, orange bars are provisioning ecosystem services, and yellow bars are regulating ecosystem services.*



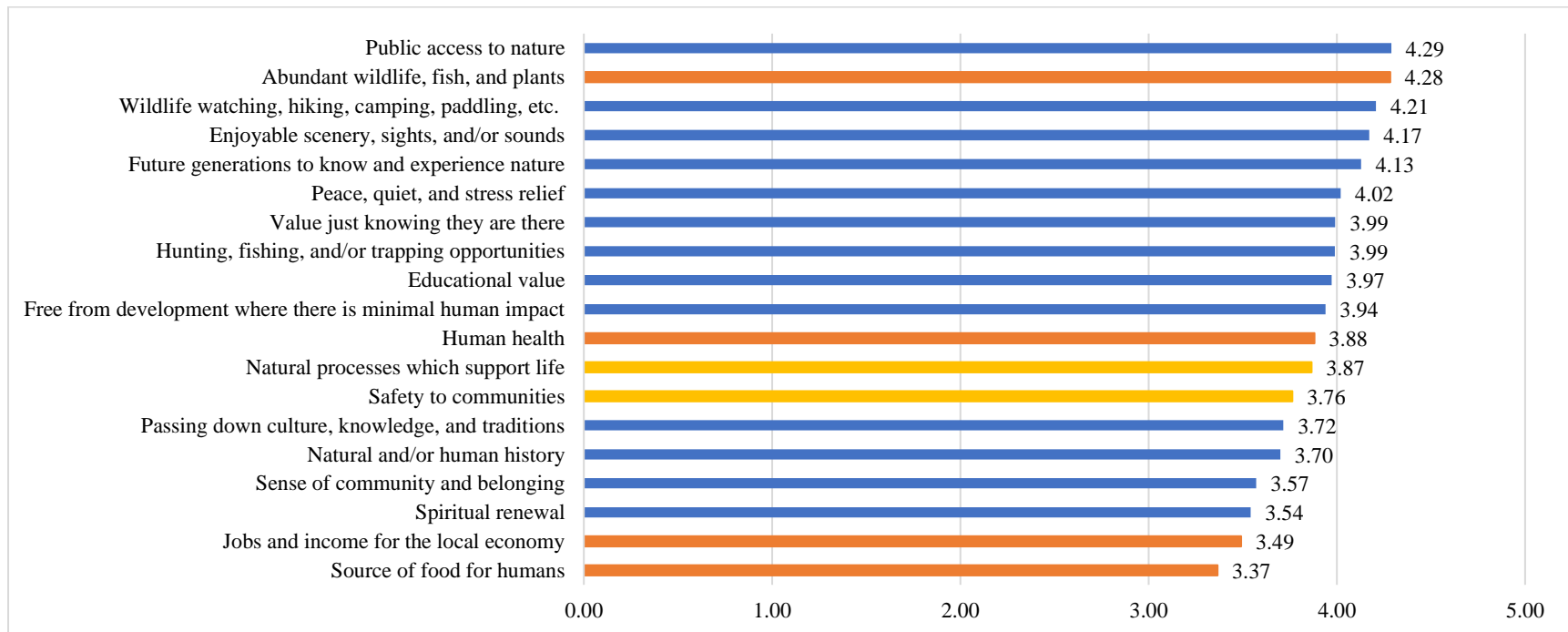
**Figure 3**

*Frequency of responses for most important ecosystem services. Only ecosystem services that had responses > 5% for at least one stakeholder group are included in table.*



**Figure 4**

*Mean scores of agreement that WMA management provides ecosystem services across all survey respondents (n = 1,697). Agreement scale: 1 = strongly disagree, 2 = somewhat disagree, 3 = neither disagree nor agree, 4 = somewhat agree, 5 = strongly agree. Blue bars indicate cultural ecosystem services, orange bars are provisioning ecosystem services, and yellow bars are regulating ecosystem services.*



## **Chapter 4: Predicting Conservation Behavior of Wildlife Management Area Stakeholders**

### **Abstract**

Trends in changing socio-demographics, wildlife value orientations, and wildlife-related recreation participation have implications for the sustainability of wildlife conservation in the United States. As such, State Wildlife Agencies (SWAs) seek to broaden support, both politically and financially, for wildlife management. A diversity of recreation experiences on wildlife management areas (WMAs) provides opportunities for agencies to engage with stakeholders and facilitate stewardship at a local scale. To understand stewardship potential, I sought to examine factors that influence conservation behaviors of key WMA stakeholders. I hypothesized that increased recreation participation and increased salience as an outdoor recreationist (birdwatcher, waterfowl hunter, angler), general outdoor enthusiast, and conservationist would positively predict frequency of conservation behavior. I used hierarchical regression models to test hypotheses using data collected from birdwatcher, waterfowl hunter, and angler stakeholder surveys ( $n = 1,759$ ) from six southeastern Michigan, USA WMAs that are intensively managed for waterfowl and waterfowl hunting. Results indicated that two participation variables (centrality of activity and membership in an environmental or conservation organization) and three identity salience variables (waterfowl hunter, outdoor enthusiast, and conservationist) predicted frequency of conservation behavior. My results inform communication, engagement, and programming strategies that SWAs can use to facilitate the development of stewards committed to supporting local WMA management as well broader conservation goals. Strategies are recommended that appeal to conservationist identities and that provide opportunities for social connections to build and foster group identity and group norms that include conservation behaviors and WMA stewardship. Engagement with existing

environmental or conservation organizations may also help to strengthen group norms and increase conservation behaviors. My results also increase knowledge of the relationship between multiple identity salience and frequency of conservation behaviors.

## **Introduction**

As the United States becomes more ethnically diverse, more urbanized, and more mutualistic in wildlife value orientations, it is unclear how these changing demographics will affect the sustainability of wildlife conservation (Jacobson et al., 2010; Teel & Manfredi, 2010; Echols et al., 2019). The wildlife management community has made repeated calls for SWAs to broaden their engagement with stakeholders beyond traditional stakeholders such as hunters to increase relevancy of and support for wildlife management (Jacobson and Decker, 2006; Jacobson et al., 2010; Decker et al., 2016; AFWA & WMI, 2019). This has become increasingly important with decreasing trends in hunting participation and increasing trends in wildlife-related recreation such as birdwatching (USFWS, 2016a), and the potential impacts to current user-pay funding mechanisms for wildlife conservation (Jacobsen et al., 2010). SWAs would benefit from collaborative and stakeholder-engaged approaches that foster stewards and build support for habitat management on WMAs at a local scale. Dixon et al. (1995:42–43) defines stewardship as “the moral obligation to care for the environment and actions undertaken to provide that care”. Understanding the stewardship potential of WMA stakeholders is a first step to inform potential outreach, engagement, and programming to build a constituency of stakeholders that actively support WMAs and broader conservation efforts.

Examining pro-environmental behaviors (PEB) enables an approach to understanding stewardship potential. Cooper et al. (2015:446) define PEB as “actions that generate positive environmental impacts, promote environmental quality, and result in sustainable use of natural



resources”. PEB has been described with multiple domains including conservation lifestyle behaviors in the private sphere (e.g., recycling, energy conservation) to public sphere behaviors in environmental citizenship (e.g., voting for pro environmental policies, donating to support conservation), social environmentalism (e.g., participating in conservation organizations), and land stewardship (e.g., working to enhance wildlife habitat) (Larson et al., 2015). However, some domains may be less useful to SWAs interested in stewardship potential of their stakeholders. PEB of particular interest to SWAs are conservation behaviors that would result in increased support for wildlife conservation and management (Cooper et al., 2015). Previous studies have called for an increased understanding of the influence of user characteristics, recreational participation, and social and psychological constructs (e.g., motivations, values, self-identity, and place attachment) on PEB that can be used to inform the development of stewardship opportunities that support wildlife conservation (Cooper et al., 2015; Landon et al., 2018; Larson et al., 2018; Henderson, 2021).

Participation in outdoor recreation and general nature-based activities have been found to be important factors in predicting and promoting PEB and environmental stewardship (Theodori et al., 1998; Tarrant and Green, 1999; Tiesl & O’Brien, 2003; Manfredi, 2008; Zaradic et al., 2009; Cooper et al., 2015; Doyle-Capitman et al., 2017; Ghasemi & Kyle, 2021). Positive experiences in nature may result in people caring more about natural resources, especially resources on those places in which they are the most familiar (Henderson, 2021), and ultimately in increased support for conservation actions related to wildlife (Zaradic et al., 2009). In the context of wildlife-related recreation, it is thought that participants have a vested interest in conserving habitats and populations because those activities directly impact their recreational pursuits (Cooper et al., 2015). For example, Cooper et al. (2015) found a positive link between

participation in wildlife-related recreation and public and private land wildlife habitat activities. Public lands, such as WMAs, provide important access for nature-based activities and have been found to “promote interest in and social capacity to conserve valued natural resources” (Doyle-Capitman et al., 2017:22). WMAs provide natural spaces embedded in local communities that provide a diversity of benefits including opportunities for outdoor recreation. Therefore, promoting and providing a diversity of hunting and non-hunting wildlife-related recreation on WMAs that result in increased recreational participation is likely to result in significant gains in conservation stewardship (Cooper et al., 2015; Ghasemi & Kyle, 2021).

There has been little research on the role that the psychological attribute of self-identity (e.g., as an outdoor recreationist or conservationist) has in predicting stewardship potential. Previous studies have examined the influence of certain identities (e.g., angler, hunter, waterfowl hunter, wildlife steward, environmentalist) on PEB and behavioral intentions (Landon et al., 2018; Schroeder et al., 2020; Ghasemi & Kyle, 2021). However, a person can identify as multiple types of recreationists and there is a need for understanding the salience of identity as one outdoor recreationist type relative to other identities a person holds (Schroeder et al., 2013). Self-identification with outdoor recreational activities may be an important antecedent for the internalization of beliefs about stewardship and ultimately stewardship behaviors that conserve the resources that support their recreational activity (Landon et al., 2018). Additionally, the more salient a person’s identity as an outdoor recreationist is, the more influence it will have on their cognition and behavior towards natural resources and on what they perceive as normative behavior for that type of outdoor recreationist (Landon et al., 2018). Using anglers as an example, Landon et al., (2018:581) argued that “If individuals associate stewardship with their identity as an angler, it will be reflected in an obligation to act as a steward and engage in

stewardship behaviors to the extent that those individuals' identity as an angler is salient". Understanding how stakeholders identify with different wildlife-related activities also has practical application for SWAs to inform their communication, outreach, and engagement efforts. For example, Landon et al., (2020) recommended directed communication that appeals to stakeholder's identity as a wildlife steward.

### ***Predicting PEBs***

Understanding the variables that best predict PEB, and specifically conservation behavior, enables the development of strategies to increase stewards that support wildlife conservation and management. There is a large body of research exploring constructs and frameworks that explain PEB including outdoor recreation participation and recreation specialization, motivations, wildlife value orientations, place attachment, and identity.

**Outdoor Recreation Participation and Recreation Specialization.** There is evidence that participation in outdoor recreational activities positively influences environmental concern and behaviors in hunters and birdwatchers (Cooper et al., 2015; Wilkins & Miller, 2018), forest recreationists (Teisl and O'Brien, 2003), refuge volunteers (Doyle-Capitman et al., 2017), and residents of agricultural communities (Theodori et al., 1998). The literature is mixed on the effects that various types of outdoor recreation have on PEB. Theodori et al. (1998) found that light resource utilization recreational activities (e.g., camping, birdwatching, hiking, mountain biking) were similar in predicting PEB as moderate-to-intensive resource utilization activities (e.g., fishing, hunting, ORV riding). Some research indicates an association between non-consumptive recreation (e.g., hiking, camping, wildlife viewing) and conservation behavior (Tarrant and Green, 1999; Teisl and O'Brien, 2003; Larson et al., 2018; Wilkins et al., 2019), except that Glowinski & Moore (2014) found participation in birdwatching was not influential to

environmental concern. The results are also mixed for consumptive recreation (e.g., hunting, fishing). Theodori et al. (1998) found that hunting was positively associated with environmental concerns and Cooper et al. (2015) found that hunters and birdwatchers are more likely to engage in conservation behaviors (e.g., donating to local conservation efforts, enhancing wildlife habitat, advocating for wildlife management, and engaging with local environmental groups) than non-recreationists, and those that both hunted and birdwatched even more so. Similarly, others reported that hunting participation and experience predicted PEB and specifically conservation behaviors (Larson et al., 2018; Wilkins & Miller, 2018; Schroeder et al., 2020). However, Zaradic et al. (2009) detected a negative correlation between fishing participation and NGO donations.

Beyond examining participation in outdoor recreation independently, several researchers have used a recreation specialization construct to predict PEB. In these cases, participation is typically included as a behavioral dimension of recreation specialization. Recreational specialization has been defined as “a continuum of behavior from the general to the particular, reflected by equipment and other skills used in the sport and activity setting preferences” (Bryan 1977:175). Dimensions of recreation specialization such as participation, commitment, centrality to lifestyle, and skill have been used to examine birdwatchers (McFarlane, 1994; Hvenegaard, 2002; Scott & Thigpen, 2003; Scott et al., 2005; Harshaw et al., 2020), hunters (Kuentzel & Heberlein, 1992; Schroeder et al., 2013), and anglers (Schroeder et al., 2006a). While researchers have conceptualized recreation specialization in several ways, Jun et al. (2015) reviewed the literature and found three general dimensions of the construct: behavioral (experience and participation), cognitive (skill and knowledge), and affective (enjoyment, importance, commitment, centrality). As outdoor recreationists move along the recreation

specialization continuum, their concern, support, and advocacy for the conservation of natural resources that support their recreational activity increases (Bryan, 2000). Several researchers have found a positive effect of recreation specialization on conservation attitudes and behaviors (Hvenegaard, 2002; Scott et al., 2005; Lessard et al., 2018; Shipley et al., 2019; Harshaw et al., 2020; Schroeder et al., 2020; Henderson, 2021) as well as a willingness to pay for resource protection (Oh & Ditton, 2008). Generally, the more specialized a recreationist is along the continuum, the more likely they are to take conservation behaviors.

Membership in environmental or conservation organizations has been used both as a measure of the behavioral dimension of recreation specialization (Schroeder et al., 2006a; Sorice et al., 2009; Schroeder et al., 2020) and as an individual predictor of PEB and support for resource management (Henderson, 2021). Membership in these organizations may represent a personal behavioral commitment that includes an investment in time and sometimes money. This personal investment may make cessation of the membership difficult because it could lead to the loss of a strongly held identity, social connections, and resources to pursue their preferred activity (Scott & Shafer, 2001).

**Motivations, Wildlife Value Orientations, and Place Attachment.** Researchers have explored the influence of motivations, wildlife value orientations, and place attachment on PEB. Motivations can influence participation in outdoor activities (Sali et al., 2008), thereby having a positive impact on PEB. Achievement, social, and conservation-oriented motivations have predicted levels of concern for the environment and conservation behaviors in birdwatchers (McFarlane, 1994; and Glowinski & Moore, 2014). Similarly, Henderson (2021) found that social and nature-oriented motivations were related to PEB in nature-based recreationists.

Some researchers have examined wildlife value orientations as predictors of PEB. Wildlife value orientations are “the pattern of direction and intensity among a set of basic beliefs regarding wildlife” (Fulton et al., 1996:28) and typically are classified along a continuum from domination (use of wildlife to benefit humans) to mutualism (wildlife have rights) (Fulton et al., 1996; Manfredo et al., 2003; Manfredo et al., 2020). Wildlife value orientations influence PEB and environmental intentions with a domination value orientation negatively associated with PEB (Ghasemi & Kyle, 2021). Wildlife value orientations also have been determined to indirectly affect PEB through their influence on motivations (Henderson, 2021).

Sense of place can be defined as “a collection of symbolic meanings, attachment, and satisfaction with a spatial setting held by an individual or group” (Stedman, 2002: 563) and place attachment as “an emotional, cognitive, and functional bond with a place” (Halpenny, 2010:409). Outdoor recreation at a certain place may form a sense of place and place attachment and positively influence an individual’s stewardship potential toward that place that is important to them (Halpenny, 2010). Place attachment and sense of place can predict PEB (Larson et al., 2018; Henderson, 2021) and have strong associations with place-specific PEB (Stedman, 2002; Walker & Chapman, 2003; Halpenny, 2010). Doyle-Capitman et al., (2017) also reported local participation in activities on a National Wildlife Refuge increased stewardship potential within the refuge, but not as much off the refuge. Additionally, as Halpenny (2010) states, “As individuals build increased awareness, understanding, and attachments to nature-based contexts, which may form and confirm their sense of identity associated with these places, their attachment to natural settings may convert to a commitment to the environment in general”.

**Demographics.** Several demographics also influence PEB. Education has a positive association with PEB (Theodori et al., 1998; Theodori & Luloff, 2002; Schroeder et al., 2020)

and conservation involvement (Wilkins et al., 2019). Other researchers have reported that PEB increases with income (Theodori & Luloff, 2002; Schroeder et al., 2020) and decreases with age (Theodori & Luloff, 2002). Larson et al. (2011) found that, while demographics (e.g., income, education, gender, and race) didn't directly predict PEB, they all had a mediating effect through value orientations.

### ***Identity Theory***

Whereas some researchers have used identity as a dimension of recreation specialization (Jun et al. 2015; Landon et al. 2018) or as a predictor of specialization (Schroeder et al., 2013), others have examined identity independently as a predictor of PEB. Burke and Stets (2009:3) defined identity as “the set of meanings that define who one is when one is an occupant of a particular role in society.” Identity theory postulates that people take on societal roles and then construct and internalize identities related to those roles (Stryker & Burke, 2000). Additionally, when the salience of an identity increases, the likelihood of behaving in a manner consistent with the role also increases (Fielding et al., 2008). In a natural resources stewardship context, the stronger an individual identifies as specific type of outdoor recreationist (e.g., hunter, angler, birdwatcher), the greater their internalization of beliefs about how they should act in that role, and subsequently the greater the likelihood of taking actions that protect or conserve the natural resources that sustain their recreational pursuits. For example, hunter or birdwatcher are social roles with “socially constructed expectations that proscribe what it means to be” a hunter or birdwatcher (Landon et al., 2020:4). Hunters and birdwatchers would then feel obligated to take conservation behaviors that reflect the norms of their roles (Schroeder et al., 2020). Identity, therefore, is a primary driver of attitudes and behavior.

Identity has been found to predict PEB. For example, several researchers found environmental self-identity predicted PEB and pro-environmental intentions (Stets & Biga, 2003; Fielding et al., 2008; Ghasemi & Kyle, 2021) and Landon et al. (2020) found that identity as a wildlife steward affected sense of responsibility to manage deer. Landon et al. (2018) not only found a positive association between angler identity and stewardship, but also that as salience of identity increased, the obligation to act as stewards of fisheries and aquatic resources and to more frequently engage in stewardship behaviors also increased. Therefore, identity alone isn't necessarily enough to impact behavior; people also need to internalize an obligation to act in a certain way.

People have multiple identities related to their multiple societal roles. These identities have differing salience, priority, and commitment to the role (Burke and Stets 2009). Exploring multiple identities related to social roles provides an opportunity to investigate whether decisions to engage in PEBs differ by identity (Fielding et al., 2008). Research is lacking to understand the salience of multiple identities relative to each other (Schroeder et al., 2013).

### ***Purpose of Study and Hypotheses***

My research sought to explore the stewardship potential of key WMA stakeholders by examining factors that influence their conservation behaviors. As such, this study adds to the understanding of PEB and its associated domains, especially at a local scale. My study also takes a novel approach in exploring the relationship between multiple WMA stakeholder identities and conservation behaviors. SWAs can use these insights to develop stewards committed to supporting WMA management as well as helping to achieve broader conservation goals. Knowledge about recreation participation and self-identity effects on conservation behaviors have direct implications for SWA policy and practice. For example, this information



can help inform outreach, engagement, and programming strategies that promote stewardship and support for WMAs.

Based on past research, I hypothesized:

- H<sub>1</sub>: Increased recreation participation will positively predict frequency of conservation behavior (Theodori et al., 1998; Tarrant & Green, 1999; Teisl & O'Brien, 2003; Cooper et al., 2015; Larson et al., 2018; Schroeder et al., 2020).
- H<sub>2</sub>: Increased salience or strength of identity as an outdoor recreationist (birdwatcher, waterfowl hunter, angler), general outdoor enthusiast, and conservationist will positively predict frequency of conservation behavior (Landon et al., 2018; Landon et al., 2020).

## **Methods**

### ***Study Area***

My project explored WMA stakeholders at five state and one federally owned and managed coastal wetland WMAs located in Michigan, USA from Lake Huron's Saginaw Bay region south to western Lake Erie. There is intensive management of both coastal wetland habitat and recreational use at these six WMAs. While managed primarily for waterfowl, the wetland habitats resulting from intensive management attract abundant and diverse bird species that in turn provides abundant birdwatching opportunities as well as ample opportunity for other non-hunting recreation such as paddle sports, fishing, and hiking. For a complete description of the study area, see the Study Area section of Chapter 2 and Figure 1.

### ***Sampling and Data Collection***

To test hypotheses, I constructed quantitative survey instruments administered to a random selection of participants in three groups—waterfowl hunters, birdwatchers, and

anglers—following a modified version of the Tailored Design Method (Dillman et al., 2014).

The survey instruments and data collection protocols were approved by Michigan State University Institutional Review Board on August 9, 2019 (Project 00003031). Data was collected between August 2019 and March 2020 for the three surveys. After accounting for undeliverable invitations and refusals to participate, response rates were 24.0% for birdwatchers (1,133 completed surveys), 14.8% for waterfowl hunters (316 completed surveys), and 10.2% for anglers (254 completed surveys). The low response rates are comparable to recent social science studies in the natural resources (Stedman et al. 2019).

To assess potential non-response bias, I randomly selected non-respondents from each of the samples that were mailed a shortened version of the questionnaire and I received 117 birdwatcher responses (25.9% response rate), 198 waterfowl hunter responses (39.6% response rate), and 48 angler responses (9.6% response rate). Chi-square and t-tests with significance at  $p \leq 0.05$  were used to compare respondents and non-respondents (Appendix G). Socio-demographics and participation rates were comparable for the three survey groups. Waterfowl hunter non-respondents had slightly lower scores for centrality of waterfowl hunting and identity as a waterfowl hunter, suggesting that non-respondents may be less avid waterfowl hunters. Given there were only slight differences between respondents in the original and non-response samples, I chose not to weight data for non-response bias. See the Sampling and Data Collection section of Chapter 2 for a complete description of survey sampling frames, data collection, and assessment of non-response bias.

### ***Variables Measured***

**Recreation Participation.** Items for participation in nature-based activities were adapted from previous survey efforts (USFWS, 2016a; Harshaw, 2018a; Harshaw, 2018b; Wilkins &

Miller, 2018; Patton, 2021a; Patton, 2021b). Respondents were asked to select from a list of 10 nature-based activities that they had participated in during the past 12 months. This variable was recoded as a binary variable where 1 = participated in at least one activity and 0 = did not participate in any activities. To measure amount of participation, respondents were asked to report the number of trips taken for their recreational activity during the past year. For birdwatchers, this was defined as trips at least one mile from their home (Cooper et al., 2015; USFWS, 2016a). It should be noted that trips are not directly comparable across the three samples because birdwatchers are not limited by the number of days they can recreate as waterfowl hunters and anglers are by the number of days in the legal hunting and fishing seasons.

Centrality of recreation type was measured by asking agreement with five statements about personal participation in their recreational activity (Table 12) (Schroeder et al., 2013; Harshaw, 2018a; Harshaw, 2018b; Patton, 2021a; Patton, 2021b). Respondents rated their agreement on the following scale: 1 = strongly disagree, 2 = somewhat disagree, 3 = neither disagree nor agree, 4 = somewhat agree, and 5 = strongly agree. Exploratory factor analysis (EFA) was initially conducted to identify factor structure in the data, followed by confirmatory factor analysis (CFA) to assess the construct validity of centrality based on the five statements with no error covariance specified in the model. The following model fit indices were used: comparative fit index (CFI), root mean square error of approximation (RMSEA), the Tucker-Lewis index (TLI), and standardized root mean square residual (SRMR). CFI and TLI values  $\geq .09$  and RMSEA and SRMR values  $\leq .08$  suggest an acceptable model fit. Then, Cronbach's alpha was used to assess the internal consistency reliability of the latent construct. Cronbach's alpha values  $\geq .70$  suggest high internal consistency (Brown 2015). CFA results suggest an

acceptable model fit for the latent centrality construct (CFI = .98, RMSEA = 0.09, TLI = .96, SRMR = .02) and Cronbach's alpha results (.81) indicate acceptable reliability (Table 12).

Respondents were asked about their membership in the past 12 months for the following types of organizations: birdwatching/bird conservation; hunting/game species conservation, fishing/fish conservation, national/international environmental or conservation, and local/regional conservation. This variable was recoded as a binary variable where 1 = member of at least one organization and 0 = not a member of any organization.

**Identity.** Identity variables were adapted from previous surveys (Harshaw, 2018a; Harshaw, 2018b; Patton, 2021a; Patton, 2021b) and measured the salience or strength of identification as a birdwatcher, waterfowl hunter, angler, outdoor enthusiast, and conservationist with responses on a 5-point scale (1 = not at all, 2 = slightly, 3 = moderately, 4 = strongly, and 5 = very strongly).

**Conservation Behaviors.** Ten conservation behaviors were adapted from previous scales (Cooper et al., 2015; Harshaw, 2018a; Harshaw, 2018b; Patton, 2021a; Patton, 2021b).

Respondents were asked how often they participated in each activity in the past 12 months with responses on a 5-point scale to determine frequency of participation. An initial EFA to identify factor structure in the data suggested that conservation behavior data loaded best onto one factor. I then conducted a CFA on the ten activities to establish construct validity, with error covariances specified in the model after examination of modification indices. CFA results suggested an acceptable model fit for a one-dimensional latent conservation behavior construct (CFI = .97, RMSEA = 0.08, TLI = .94, SRMR = .04) and Cronbach's alpha results (.89) indicate acceptable reliability (Table 12). While PEB has been described by some researchers as a multi-dimensional (Larson et al., 2015) construct, my EFA and CFA resulted in a one-dimensional

scale that best fit my conservation behavior data, similar to others (Theodori et al., 1998; Henderson, 2021).

**Respondent Characteristics.** Gender, age (measured as year of birth), education level, household income, community size (large urban, medium urban, small city, small town, or rural area), and WMA visitation were collected from respondents. Age, education level, income, and community size were treated as continuous variables and gender a binary variable. To measure WMA visitation, respondents were asked to report which of the six WMAs they had visited in the last 12 months. This variable was recoded to a binary variable of have visited at least one WMA (1) or have not visited any WMAs (0). This variable was included to explore the potential relationship between a WMA-specific behavior (visiting at least one WMA) and the frequency of conservation behaviors.

### ***Data Analysis***

To test hypotheses, data from the birdwatcher, waterfowl hunter, and angler surveys were merged for analysis. Data were analyzed for missingness and listwise deletion was used for all variables during data analysis because all variables had  $\leq 7\%$  missing data. For variables where missing data was  $>5\%$ , investigations of missing data patterns indicated that data were missing completely at random. Merging samples and listwise deletion resulted in an effective sample size of 1,759 respondents. Stata (Version 15.1) was used to perform all analyses. Differences were considered statistically significant at  $p \leq 0.05$ .

Hierarchical multiple regression was used to examine the relationship between frequency of conservation behavior and independent variables and to evaluate how much the independent variables of interest explain the amount of variance in frequency of conservation behavior. This method is beneficial to understand the influence of blocks of independent variables as they are

added in sequence to determine if there is an improvement in the amount of variance that is explained by the model ( $R^2$ ) (Cohen et al., 2015). The first block of variables typically includes covariates such as demographics or respondent characteristics, followed by a block of variables known to be important from previous research, followed by a block of variables of interest to the current study (Kim, 2016). Therefore, I included three blocks of independent variables and entered them sequentially into regression models in the following order: 1) respondent characteristics (gender, age, education, community size, income, WMA visitation), 2) recreation participation (participation, trips, centrality, membership), and 3) identity salience (strength of identity as birdwatcher, waterfowl hunter, angler, outdoor enthusiast, and conservationist). Wald's tests were used to determine if addition of blocks of variables significantly improved  $R^2$ . Only survey responses that included data for all of the independent variables were used in the analyses. Multicollinearity among independent variables was inspected using Variance Inflation Factor (VIF) values.

## **Results**

### ***Summary of Respondents***

Descriptive statistics for all variables used in the hierarchical regression model are displayed in Table 10 and Table 11. The mean year of birth of respondents was 1964, and there were more male respondents (56.4%) compared to female respondents (43.6%). Survey respondents were well educated with more than 72% with at least an associate or bachelor's degree and mean education score of 3.97. The size of the communities that respondents lived in at the time of the survey varied with 34.8% from large or medium urban areas, 42.4% from small cities or towns, and 22.8% from rural areas. Household income varied with 21.1% reporting income <\$50,000, 39.3% with income between \$50,000–\$100,000, 32.6% with income between

\$100,000–\$200,000, and 7.0% with income >\$200,000. Most respondents (61.4%) reported visiting at least one of the six WMA in the past 12 months.

Respondents were generally quite specialized in their recreation activity, with nearly all respondents (99.6%) reporting that they participated in at least one nature-based activity in the past 12 months and taking just over 22 trips in the past 12 months. Mean scores for each individual centrality item and for the latent centrality factor ( $M=3.25$ ,  $SD=0.92$ ) are found in Table 12. Most respondents were also members of a conservation or environmental organization (66.0%).

Respondents identified most strongly as a conservationist ( $M=3.98$ ,  $SD=1.05$ ), followed by outdoor enthusiast ( $M=3.59$ ,  $SD=1.20$ ), and birdwatcher ( $M=3.41$ ,  $SD=1.36$ ). There were the lowest mean scores for identification as an angler ( $M=2.35$ ,  $SD=1.44$ ) and waterfowl hunter ( $M=1.86$ ,  $SD=1.44$ ).

For the ten conservation behavior items, respondents reported most often making their yard or land more desirable to wildlife ( $M=3.99$ ,  $SD=1.13$ ), voting to support a policy or regulation that supports conservation ( $M=3.66$ ,  $SD=1.30$ ), talking to others about conservation issues ( $M=3.39$ ,  $SD=1.23$ ), and contributing money to support local conservation causes ( $M=3.11$ ,  $SD=1.27$ ) (Table 12). The activities participated in least often were attending meetings about conservation issues ( $M=2.28$ ,  $SD=1.31$ ), volunteering personal time and effort for habitat improvement projects on public land in my community ( $M=2.26$ ,  $SD=1.21$ ), and contacting elected officials or government agencies about conservation issues ( $M=2.18$ ,  $SD=1.27$ ). The mean score for the latent conservation behavior factor was 2.94 (Table 12).

### ***Modeling Frequency of Conservation Behavior***

Three blocks of independent variables were analyzed sequentially, beginning with respondent characteristic variables in Block 1, followed by recreation participation variables in Block 2, and lastly identity variables in Block 3. No VIF value exceeded 2.13, and therefore there was no evidence of multicollinearity in the model. Respondent characteristics alone poorly predicted frequency of conservation behaviors ( $R^2 = 0.090$ ), and the amount of variance in frequency of conservation behavior explained was significantly improved when the recreation participation model ( $R^2 = 0.292$ ,  $p \leq 0.001$ ) and identity model ( $R^2 = 0.403$ ,  $p \leq 0.001$ ) were sequentially included (Table 13). Therefore, the third model that included all three blocks had the best predictive ability.

With attention to the third model (Respondent Characteristics + Recreation Participation + Identity), four respondent characteristic variables (gender, age, education, and WMA visitation), two recreation participation variables (centrality and membership), and three identity variables (waterfowl hunter, outdoor enthusiast, and conservationist) predicted frequency of conservation behaviors (Table 13). Education had a positive effect on frequency of conservation behaviors in all three models with more educated respondents having higher frequency of conservation behaviors. Gender had an effect in the second and third models and age in the third model with less frequency of conservation behaviors in men and a negligible negative effect of age. Visitation of at least one WMA had a positive influence on frequency of conservation behavior in all three models. Centrality's positive effect on frequency of conservation behavior indicates that as an outdoor activity is increasingly important to a person's life, they are more likely to increase their conservation behaviors. Likewise, membership in an environmental or conservation organization predicted increased frequency of conservation behaviors. Being a



member in an environmental or conservation organization had the largest magnitude of effect of any of the independent variables and was the strongest predictor of frequency of conservation behavior. Identity as a waterfowl hunter, outdoor enthusiast, and conservationist all positively affected frequency of conservation behavior. As strength of identity increased, so did the frequency of conservation behavior, with identity as a conservationist having the largest effect. All other independent variables were not significant in any of the three hierarchical models.

## **Discussion**

WMA visitation was a positive predictor of conservation behaviors in my model. Place-based constructs have been found to have a positive relationship with PEB (Larson et al., 2018; Henderson, 2021), and it may be that visiting a WMA increases place attachment. Behavior (visiting a WMA) may also have a stronger influence on conservation behaviors than attitudes or behavioral intentions. An individual makes an investment in time and resources to visit a WMA which could increase the positive experiences they have in nature, and in turn foster a greater concern for conserving the natural resources related to their type of recreation. Subsequently, this could result in increased likelihood of conservation behaviors (Zaradic et al., 2009). SWA efforts to increase visitation and usage of WMAs may therefore have broader impacts beyond the scale of the WMA.

Participation in outdoor recreation's link to PEB has been extensively examined as discussed above (Theodori et al., 1998; Tarrant & Green, 1999; Teisl & O'Brien, 2003; Cooper et al., 2015; Larson et al., 2018; Wilkins & Miller, 2018; Schroeder et al., 2020). I found that two of my recreation participation variables (centrality and membership) positively affected the frequency of conservation behaviors. Therefore, my hypothesis that increased recreation participation will positively predict frequency of conservation behavior ( $H_1$ ) was somewhat

supported as participation in at least one nature-based activity and number of trips taken (for birdwatching, waterfowl hunting, or fishing) did not have an effect. Centrality of a recreation type to one's lifestyle is often treated as a dimension of recreation specialization in PEB predictive models (Schroeder et al., 2006a; Schroeder et al., 2013; June et al., 2015; Harshaw et al., 2020), so there are few examples for direct comparison to my results. McFarlane & Boxall (1996) found that a higher centrality score related to increased spending for wildlife habitat and Schroeder et al. (2020) found centrality was positively associated with volunteering to improve wildlife habitat. Unlike other studies that found a relationship between PEB and participation (Theodori et al., 1998; Teisl & O'Brien, 2003; Larson et al., 2018; Schroeder et al., 2020) and days of recreation (Schroeder et al., 2020), my study did not detect an influence of these variables.

I found that membership in an environmental or conservation organization had the largest effect on increasing frequency of conservation behavior. This result is supported by previous research that reported correlations between membership in environmental and conservation organizations and monetary donations to wildlife conservation organizations (Schroeder et al., 2020) and environmental activism intentions (Fielding et al., 2008). It's important to note, however, that being a member of an organization is not the same as being an *active* member. For example, even though most respondents reported being a member of an environmental or conservation organization, they had relatively low mean frequency scores for attending meetings about conservation issues and participating as an active member in a conservation group. Because outdoor recreationists such as birdwatchers (McFarlane & Boxall, 1996; Scott, 2013) and hunters (Benson, 2010) are often members of conservation organizations, SWAs that engage with existing organizations and develop outreach and programming that appeal to members may

realize results such as a broader set of stakeholders that are involved in stewardship activities. Similarly, recreational, volunteer, and other stewardship opportunities could be marketed to existing members of local and regional conservation organizations.

My hypothesis that increased salience or strength of identity as an outdoor recreationist (birdwatcher, waterfowl hunter, angler), general outdoor enthusiast, and conservationist will positively predict frequency of conservation behavior ( $H_2$ ) was partially supported. Identification as a waterfowl hunter, outdoor enthusiast, and conservationist were positive predictors of conservation behaviors, however identification as a birdwatcher and angler were not. Because waterfowl hunters have high levels of self-identification (Schroeder et al., 2013), it may not be surprising that identity salience as a waterfowl hunter positively influenced frequency of conservation behavior. Respondents that identified as a waterfowl hunter likely have invested resources (time, financial, social) into their recreation that increases their salience as waterfowl hunters. It was unexpected that birdwatcher self-identity did not influence conservation behavior because other researchers have reported similarities between birdwatchers and hunters in their conservation behaviors (Cooper et al., 2015) and support for conservation funding policies (Henderson, 2021).

Identity as a conservationist had the largest effect on frequency of conservation behavior of any of the identities. If recreationists associate conservation behaviors with their self-identity, it is likely to be internalized as an obligation to act as a conservationist, and subsequently engage in conservation behaviors (Landon et al., 2018). Similarly, as an individual internalizes an identity as a conservationist, they are likely to seek out social opportunities that support the conservation of wildlife (Landon et al., 2018). When individuals self-identify as conservationists and engage in conservation behaviors, it affirms and strengthens their identity (Fielding et al.,

2008). Similar to the recommendation from Landon et al., (2020) that targeted communication that appeals to a person's identity as a wildlife steward can be successful, SWAs could use strategies that appeal to a conservationist self-identity. Communication strategies could use this as a unifying factor (e.g., "calling all conservationists") as it has the potential to bring together both hunting and non-hunting recreationists that identify as conservationists. Therefore, communication targeted to conservationists could emphasize how stewardship efforts on WMAs relate to being a good conservationist. Additionally, SWAs could provide opportunities to build social connections and social bonding (e.g., volunteer activities and mentoring programs) with those that share identities to build and foster group identity that leads to norms which include conservation behaviors. Additional research is still needed to address how to appeal to certain self-identities, what actions could help to increase certain identity salience, and how to facilitate identity as a conservationist across both hunting and non-hunting recreationists.

It is possible that normative support for conservation behaviors is built through memberships and self-identities. Group norms influence behavior, so the stronger one identifies with a group (e.g., conservationists), the more likely they are to take actions supported by the norms (e.g., conservation behaviors) (Fielding et al., 2008; Lute & Gore, 2014; Schroeder et al., 2021). Members of environmental or conservation organizations are likely to receive messages from the organization encouraging members to participate in actions that protect or conserve the environment, which in turn communicates group norms and potentially motivates behavior (Fielding et al., 2008). This further emphasizes the potential benefits of strategic SWA-conservation organization partnerships.

As other researchers have noted, conservation behaviors can have impacts at multiple scales (Lute & Gore, 2014; Cooper et al., 2015). For example, volunteering for local habitat

improvement projects, contributing money to local conservation causes, and making private property more desirable to wildlife have impacts on a local scale. Participating in a conservation group or organization, recruiting others to participate in wildlife-related recreation, and talking to others about conservation issues are forms of social environmentalism (Larson et al., 2015) that strengthen and enforce social norms related to conservation and can have impacts larger than a local scale. Some environmental citizenship actions such as voting to support policies or regulations that support conservation, contributing money to conservation organizations, and contacting decision and policy-makers about conservation issues can have important impacts at a larger scale (e.g., state, regional, national) and longer time (e.g., future generations). In my study, the social environmentalism behaviors were some of the most frequent conservation behaviors, suggesting that SWAs should consider social opportunities when planning engagement efforts. Providing these social interactions may also strengthen group identities and group norms including conservation actions as expected behavior.

### ***Limitations and Future Research***

This study is limited by the generalizability of results to the sample population of stakeholders of intensively managed WMAs in southeast Michigan which may not be representative of broader populations. Of note, registered eBird users that reported bird sightings in the area of interest and that resided in Michigan were used as the sample for birdwatchers. This sample may under-represent casual birdwatchers that do not report their bird sightings on eBird or travel far to view birds and may over-represent more specialized birdwatchers. During data analysis, I was able to demonstrate configural invariance for the latent conservation behavior variable, however more rigorous measurement invariance was not demonstrated. For the latent centrality variable, I was able to demonstrate weak measurement invariance. With

configural and weak measurement invariance, items can be used to measure the latent construct across groups and the relationship between the latent factor and external variables can be compared across groups, however the factor means should not be compared if strong invariance is not demonstrated (Dimitriov, 2010).

Future research that explores conservation behavior of WMA stakeholders beyond intensively managed WMAs would provide a better understanding of stewardship potential at a greater scale. Including recreation types other than waterfowl hunting, birdwatching, and fishing may also be beneficial. My full model (with all three blocks of variables) explained a good amount of variance in frequency of conservation behaviors, however there are likely other important factors missing. Whereas I included several recreation participation variables, future models that include a robust recreation specialization construct with behavioral, cognitive, and affective dimensions (Jun et al., 2015) may have stronger predictive ability. Likewise, models to predict conservation behaviors may be improved by including recreation specialization variables such as experience and skill, motivations, wildlife value orientations, and place attachment (Schroeder et al., 2013; Glowinski & Moore, 2014; Larson et al., 2018; Harshaw et al., 2020; Ghasemi & Kyle, 2021; Henderson, 2021). A more robust statistical approach could use structured equation modeling to test the relationships between latent predictor variables and potential mediating effects of variables (Halpenny, 2010; Larson et al., 2015; Landon et al., 2018; Larson et al., 2018; Ghasemi & Kyle, 2021).

This is the first research that I know of to measure and use multiple identities as independent variables to predict conservation behaviors. When exploring the relationship between identity and PEB, past researchers have measured identity salience as a single type (e.g., waterfowl hunter, environmentalist, hiker, angler, etc.) using statements such as “being a/an...is

an important part of who I am”, “ I think of myself as a/an...”, and “I would be at a loss if I were forced to give up...” (Schroeder et al., 2013; Lute & Gore, 2014; Jun et al., 2015; Landon et al., 2018). The inclusion of multiple recreational identities could be an approach to improve the predictive ability of PEB models. Future research could thus explore the potential linkages between different identities and use statistical approaches that address respondents that identify with multiple identities (e.g., strongly identify as both a birdwatcher and waterfowl hunter) or lack strong identification with any identity. Similar to Cooper et al. (2015) discovering that birder-hunters have increased conservation behaviors more so than birders or hunters alone, it may be that multiple strong identities lead to greater frequency of conservation behaviors.

### ***Management Implications***

My results have direct implications for informing SWA outreach, engagement, and programs that may help to build a cadre of stewards that are invested in actions to support wildlife and the habitats that sustain them and their outdoor recreational pursuits. My results suggest that WMA visitation, centrality, membership, and strength of certain identities positively impact the conservation behaviors of WMA stakeholders. Strategies that SWAs can employ to increase these factors will help to develop normative beliefs about stewardship that in turn result in behaviors that help achieve wildlife conservation goals at multiple scales. Specifically, communication, outreach, and engagement strategies that appeal to a conservationist self-identity may be effective. Examples are framing desired behaviors (e.g., volunteer habitat management efforts, following WMA rules and regulations, mentoring other outdoor recreationists) as behaviors that conservationists take or communicating about wildlife management efforts in a conservation context.

Additionally, providing social opportunities for a diversity of stakeholders that identify as conservationists will help build group norms related to stewardship. Because membership was such a strong predictor of conservation behavior, SWAs could target outreach and programming to existing members of environmental and conservation organizations as an approach to building support for wildlife conservation. Similarly, developing partnerships with these organizations may also facilitate stewardship opportunities. Because visitation of WMAs influenced conservation behavior, promoting the use of these areas and other recreational lands may increase use and produce more supporters of wildlife conservation at both the local WMA scale and more broadly.



## Tables

**Table 10**

*Survey respondent frequency and percentages for independent variables included in a hierarchical regression model.*

<b>Variable</b>	<b><i>n</i></b>	<b>%</b>
<b>Gender (male)</b>	977	56.44
<b>Education</b>		
Some high school or less	15	0.86
High school diploma or GED	136	7.83
Some college (no degree)	322	18.54
Associate's degree or bachelor's degree	676	38.92
Graduate or professional school	588	33.85
<b>Community Size</b>		
Large urban area	148	8.51
Medium urban area	458	26.32
Small city	350	20.11
Small town	387	22.24
Rural area	397	22.82
<b>Income</b>		
≤\$24,999	91	6.10
\$25,000 to \$49,999	224	15.01
\$50,000 to \$74,999	299	20.04
\$75,000 to \$99,999	287	19.24
\$100,000 to \$124,999	216	14.48
\$125,000 to \$149,999	148	9.92
\$150,000 to \$199,999	122	8.18
\$200,000 to \$249,999	39	2.61
\$250,000 to \$299,999	28	1.88
≥\$300,000	38	2.55
<b>Visited WMA</b>	904	61.37
<b>Participation</b>	1,752	99.55
<b>Membership</b>	1,160	66.02

**Table 11**

*Survey respondent mean values and standard deviations for independent and dependent (conservation behavior) variables in a hierarchical regression model.*

<b>Variable</b>	<b>Mean</b>	<b>SD</b>	<b>n</b>
<b>Age</b> (year of birth)	1964.79	15.16	1,699
<b>Education</b> <sup>a</sup>	3.97	0.96	1,737
<b>Community Size</b> <sup>b</sup>	3.25	1.30	1,740
<b>Income</b> <sup>c</sup>	4.26	2.09	1,492
<b>Trips</b>	22.10	46.06	1,748
<b>Centrality</b> <sup>d</sup>	3.25	0.92	1,755
<b>Identity</b> <sup>e</sup>			
Birdwatcher	3.41	1.36	1,702
Waterfowl Hunter	1.86	1.44	1,642
Angler	2.35	1.44	1,668
Outdoor Enthusiast	3.59	1.20	1,696
Conservationist	3.98	1.05	1,720
<b>Conservation Behavior</b> <sup>f</sup>	2.94	0.91	1,746

<sup>a</sup> Education scale: 1=some high school or less, 2=high school diploma or GED, 3=some college (no degree), 4=associate's degree or bachelor's degree, 5=Graduate or professional school

<sup>b</sup> Community size scale: 1=large urban area (population  $\geq$  500,000), 2=medium urban area (population 50,000–500,000), 3=small city (population 10,000–50,000), 4=small town (population 2,000–10,000), 5=rural area (population < 2,000)

<sup>c</sup> Income scale: 1= $\leq$ \$24,999, 2=\$25,000–\$49,999, 3=\$50,000–\$74,999, 4=\$75,000–\$99,999, 5=\$100,000–\$124,999, 6=\$125,000–\$149,999, 7=\$150,000–\$199,999, 8=\$200,000–\$249,999, 9=\$250,000–\$299,999, 10= $\geq$ \$300,000

<sup>d</sup> Centrality scale: 1=strongly disagree, 2=somewhat disagree, 3=neither disagree nor agree, 4=somewhat agree, 5=strongly agree

<sup>e</sup> Identity scale: 1=not at all, 2=slightly, 3=moderately, 4=strongly, 5=very strongly

<sup>f</sup> Conservation Behavior scale: 1=never, 2=rarely, 3=occasionally, 4=often, 5=very often

**Table 12**

*Item means, standard deviations, factor loadings ( $\lambda$ ), and reliability (Cronbach's  $\alpha$ ) for centrality and conservation behavior latent factors.*

	<b>M(SD)</b>	<b><math>\lambda</math></b>	<b><math>\alpha</math></b>
<b>Centrality<sup>a</sup></b>	<b>3.25(0.92)</b>		<b>0.81</b>
Birdwatching/waterfowl hunting/fishing is one of the most enjoyable activities I do.	4.31(0.99)	0.60	
Birdwatching/waterfowl hunting/fishing has a central role in my life.	3.61(1.24)	0.82	
A lot of my life is organized around birdwatching/waterfowl hunting/fishing.	3.05(1.30)	0.82	
Most of my friends go birdwatching/waterfowl hunting/fishing.	2.66(1.23)	0.45	
If I couldn't go birdwatching/waterfowl hunting/fishing I am not sure what I would do instead.	2.61(1.32)	0.66	
<b>Conservation Behavior<sup>b</sup></b>	<b>2.94(0.91)</b>		<b>0.89</b>
Made my yard or my land more desirable to wildlife	3.99(1.13)	0.34	
Voted to support a policy or regulation	3.66(1.30)	0.57	
Talked to others	3.39(1.23)	0.72	
Contributed money to local conservation	3.11(1.27)	0.78	
Recruited others to participate in wildlife-related recreational activities	3.04(1.36)	0.60	
Contributed money to a conservation organization	3.03(1.34)	0.80	
Participated as an active member in a conservation group	2.47(1.42)	0.80	
Attended meetings	2.28(1.31)	0.78	
Volunteered for habitat improvement projects on public land	2.26(1.21)	0.66	
Contacted elected officials or government agencies	2.18(1.27)	0.63	

<sup>a</sup>Items rated on scale: 1=strongly disagree, 2=somewhat disagree, 3=neither disagree nor agree, 4=somewhat agree, 5=strongly agree

<sup>b</sup>Items rated on scale: 1=never, 2=rarely, 3=occasionally, 4=often, 5=very often

**Table 13**

*Hierarchical multiple regression analyses predicting frequency of conservation behavior.*

	<b>Respondent Characteristics</b>	<b>Respondent Characteristics + Recreation Participation</b>	<b>Respondent Characteristics + Recreation Participation + Identity</b>
	b	b	b
<b>Block 1</b>			
Gender	-0.095	-0.108*	-0.156**
Age	-0.001	-0.001	-0.003*
Education	0.202***	0.108***	0.074**
Community Size	0.030	0.024	0.014
Income	0.022	0.017	0.014
Visited WMA	0.389***	0.221***	0.177***
<b>Block 2</b>			
Participation		0.135	0.266
Trips		0.000	0.000
Centrality		0.172***	0.106***
Membership		0.765***	0.610***
<b>Block 3</b>			
ID-Birdwatcher			0.013
ID-Waterfowl Hunter			0.063**
ID-Angler			0.024
ID-Outdoor Enthusiast			0.056**
ID-Conservationist			0.269***
R <sup>2</sup>	0.090	0.292***	0.403***
D R <sup>2</sup>		0.202	0.111

N = 1,098, \*\*\*p ≤ .001, \*\*p ≤ .01, \*p ≤ .05. Cell entries are final unstandardized regression coefficients for all three models. Gender (male=1), visited WMA (visited at least one WMA=1), participation (yes=1), membership (member=1).

## **Chapter 5: Predicting Support and a Typology for Wildlife Management Area Funding**

### **Abstract**

The current model for funding wildlife conservation in the United States is in jeopardy as hunting participation, which the model relies on, continues to decline. State wildlife agencies (SWAs) also primarily rely on hunter-related funds to pay for wildlife and habitat management at wildlife management areas (WMAs). Therefore, many have called for broad-based funding that isn't reliant on a single set of users and a greater understanding of stakeholder support for a diversity of funding mechanisms for WMAs and wildlife conservation more broadly. I used web-based and mail back surveys of four key stakeholder groups at six intensively managed WMAs in southeastern Michigan, USA to explore support for funding mechanisms: birdwatchers ( $n=1,133$ ), waterfowl hunters ( $n=316$ ), anglers ( $n=254$ ), and community members ( $n=84$ ). Objectives of the study were to 1) compare stakeholders on their support for WMA funding options; 2) explore predictors of support for WMA funding options; and 3) develop a typology of WMA stakeholders based on support for WMA funding options. By measuring the likelihood of taking actions to support WMA management, I found support for a broader suite of funding mechanisms. There were differences detected among birdwatchers, waterfowl hunters, anglers, and community members in their support for all WMA funding mechanisms included in the survey. Multiple regression results revealed that factors influencing support for funding varied by the type of funding mechanism (purchasing a duck stamp, purchasing a songbird stamp, contributing directly to WMAs, and paying increased tax). Frequency of conservation behavior positively predicted likelihood of taking actions in the next 12 months to support WMA management for all four funding options. Strength of identity as a birdwatcher had a positive effect in three of the models (purchasing a duck stamp, contributing directly to WMAs, and

paying increased tax), and strength of identity as a waterfowl hunter was significant across all four models, positively predicting likelihood of purchasing a duck stamp and contributing directly to WMAs, and negatively predicting purchasing a songbird stamp and paying increased taxes. A k-means cluster analysis to group respondents on their patterns of responses about WMA funding options resulted in a typology of five groups: ‘opposed’, ‘traditional support’, ‘traditional + songbird’, ‘new funding’, and ‘strong universal support’ that differed in all variables of interest. My results inform marketing, communication, and engagement strategies to build support for WMA management and funding and suggest that these strategies need to be tailored to the group of interest. Birdwatchers appear to hold good potential for supporting WMAs as they are willing to contribute to WMA management, however not necessarily in traditional ways. SWAs should seek to develop a diversified portfolio of traditional and new funding mechanisms that are supported by a wide range of stakeholders. Future research is needed to compare the scale, feasibility, and sustainability of a diversity of funding mechanisms to ensure that current and projected funding needs are met.

## **Introduction**

The wildlife conservation community is having to reevaluate its current funding model which relies largely on hunters through an excise tax on firearms and ammunition as well as revenue from hunting licenses (Jacobson et al., 2010; AFWA, 2016; Echols et al., 2019; Duda et al., 2021). This current model for funding wildlife management activities is not sustainable because of a declining trend in hunting participation in the United States (Cordell, 2012; Winkler & Warnke, 2013; USFWS, 2016a). The great majority of funds that SWAs use for wildlife management are from these user-based funds (AFWA & Arizona Game and Fish Department, 2017; USDOI 2020; Duda et al., 2021). Compounding the problem, as SWAs are experiencing a

decline in the number of hunters, there is a concurrent trend of increasing costs for wildlife management (Jacobson et al., 2007). The loss of hunters does not just trigger a funding concern, but also the loss of an important ally that has a stake in wildlife resources and has actively worked to conserve them (Heffelfinger et al., 2013; Landon et al., 2018). Many in the wildlife conservation community have sounded the alarm about this potential funding dilemma and have called for broad-based funding that isn't reliant on a small set of users (Jacobson et al., 2010). Indeed, SWAs have identified securing alternative long-term funding solutions as a priority (Jacobson et al. 2007).

Addressing changing outdoor recreation trends is an additional benefit of a broad-based funding model. While hunting participation has been declining, participation in activities such as wildlife watching have been steadily increasing (USFWS, 2016a). Although this chapter addresses funding of wildlife management at a local scale, specifically the scale of state WMAs, it is embedded in a framework of changing global and continental trends such as increasing human population, land development, agricultural land and farming intensity, and changing demographics and wildlife value orientations that are impacting the ability of agencies to meet wildlife conservation goals (AFWA & WMI, 2019; Echols et al., 2019). As demographics change (e.g., more ethnically diverse and more urbanized) in the United States along with shifting wildlife value orientations (e.g., more mutualistic), the relevancy of SWAs is also in danger (Jacobson et al., 2010; Teel & Manfredo, 2010). Under the Public Trust Doctrine, wildlife is public property and SWAs are tasked with managing wildlife resources for all beneficiaries. Some argue that the current user-based funding mechanism has left SWAs in a position that favors hunters (McKinney et al., 2005; Dalrymple et al., 2012; Decker et al., 2016; Duda et al., 2021) and management of game species over non-game species (Jacobson et al.,

2007; AFWA, 2016; Nkansah et al., 2021). Therefore, broad-based funding for wildlife conservation could potentially increase SWA relevancy by facilitating a more inclusive and responsive approach with a broader set of constituents (Jacobson et al., 2010). Arguments have been made that wildlife conservation should be publicly funded because of the broad benefits realized beyond wildlife species and outdoor recreation opportunities (Jacobson et al., 2010). For example, wildlife management actions often contribute to important outcomes for human well-being (e.g., clean air, clean water, climate regulation, spiritual connections, and contributions to economy) (AFWA, 2016; Pohl & Lawson, 2017). Kellert et al. (2017:297) suggest that broad-based funding for wildlife conservation “will be achieved when various sectors effectively link nature, wildlife, and the outdoors to the public's self-interest in health, productivity, and quality of life—which...is already intuitive to the vast majority of Americans.”

An initial step to identify and develop broad-based funding mechanisms for wildlife management is to understand constituents' support for a diversity of funding options (AFWA & WMI, 2019; Nkansah et al., 2021). Nkansah et al. (2021) report that it is necessary to understand attitudes about and preferences for funding policies so that SWAs can tailor their communication and outreach. Several researchers have studied constituent support for potential funding for wildlife conservation from a diversity of options including alternative user-based excise taxes, public taxes, natural resource extraction fees, and reallocation of existing public taxes and existing funds from various sources (e.g., lottery sales) (Dalrymple et al., 2012; Manfredo et al., 2017; Manfredo et al., 2018; Henderson et al., 2021; Larson et al. 2021; Nkansah et al., 2021). Results of this research have generally indicated that the public is supportive of broad-based funding (Manfredo et al., 2018; Larson et al., 2021; Henderson et al., 2021; Nkansah et al., 2021). However, even with public support, implementing these potential funding mechanisms



can be extremely difficult as SWAs often face significant political constraints (Jacobson et al. 2007; Larson et al., 2021).

Previous studies that have explored potential funding policies have been at national and state levels but, to my knowledge, none have explored funding mechanisms that would directly benefit wildlife management at a local WMA level (e.g., access fees, donations, fundraisers, etc.). The Michigan Department of Natural Resources (MDNR) has noted concerns about declining hunter numbers and impacts to funding wildlife management in the state (Matheny, 2018; B. Frawley, personal communication, November 16, 2022). More specifically, they have expressed interest in additional funding sources and broadened stakeholder support for WMAs that are intensively managed for waterfowl, primarily because the management and infrastructure maintenance costs are typically higher at these areas (R. Mason, personal communication, September 30, 2015). The waterfowl management at these areas results in high-quality wetland habitat that attracts a diversity of wildlife and fish species, which in turn provides abundant non-hunting recreational opportunities (e.g., wildlife watching, fishing, paddling sports). Because of a historic emphasis on waterfowl and waterfowl hunting management, these areas have developed a very focused waterfowl hunting clientele that may be less supportive of broadening the use and support of these areas. My study explores funding support for WMA-level management from key stakeholders as well as contributes to the overall understanding of support for wildlife conservation funding at a larger scale.

### ***Funding for Wildlife Conservation***

In the United States, wildlife conservation has largely been funded by hunters through purchases of hunting equipment and licenses. Under this model, the majority of funds are derived from excise taxes under the Federal Aid in Wildlife Restoration Act. This act, also

known as the Pittman-Robertson Act (P-R), was passed in 1937 and it established an 11% excise tax on firearms and ammunition. Since, the act has been amended to include archery equipment and has generated almost \$19 billion for wildlife conservation (USFWS, 2020; Duda et al., 2021) by funding federal and SWA habitat conservation, law enforcement, monitoring and management of wildlife species, agency infrastructure, research, hunter education programs, and communication and outreach programs (Heffelfinger et. al, 2013). P-R funds, combined with hunting license revenue, make up the great majority of SWA funding (AFWA & Arizona Game and Fish Department, 2017; USDOJ, 2020; Larson et al., 2021). While this funding model has been successful (Geist et al., 2001; Heffelfinger et al., 2013; Mahoney & Jackson, 2013), declining trends in hunting participation threaten its continued sustainability (Jacobson et al., 2010; Decker et al., 2016). Duda et al. (2021) notes an additional threat to the P-R funding mechanism is a growing number of non-hunters (recreational shooting sports) are now contributing more than hunters. Southwick Associates (2017) estimates that 78% of firearm and ammunition sales are for non-hunting purposes. The impacts of this shifting investment in wildlife conservation are largely unknown, however these non-hunters may not be as personally vested in wildlife conservation nor as willing to continue to support it (Duda et al., 2021).

In addition to P-R funds and hunting license sales, federal and SWAs also benefit from additional funds for wildlife conservation from waterfowl hunters through purchases of Federal Migratory Bird Hunting Conservation Stamps (i.e., federal duck stamp) that are required for hunting waterfowl. Revenue from the federal duck stamp is used for the purchase or lease of waterfowl habitat on National Wildlife Refuges (NWRs) and has provided over \$850 million (USD) for the protection of over six million acres (Madison, 2016; USFWS, 2016b). Vrtiska et al. (2013) voiced concern that as waterfowl hunting participation declines, there could be serious

losses in future funding for wetland habitat conservation that benefits waterfowl, other wildlife species, and human well-being. The waterfowl management community has prioritized growing the numbers of non-hunting recreationists that use and actively support waterfowl and wetlands conservation to mitigate these potential future wetland losses (NAWMP, 2018).

Birdwatchers appear to be committed to and supportive of wildlife conservation (McFarlane & Boxall, 1996; Hvenegaard, 2002; Cooper et al., 2015), and there have been efforts to market the purchase of federal duck stamps to birdwatchers for their contribution to migratory bird and wetland conservation (ABA, n.d.). However, Shipley et al. (2019) found that few birdwatchers purchased federal duck stamps unless they were also waterfowl hunters. Considering this, the American Bird Association is exploring the potential for a new songbird conservation stamp (ABA, 2020) that would be modeled after the federal duck stamp and provide funding for songbird conservation nationally. Audubon Great Lakes has also expressed interest in the development of a songbird conservation stamp on a regional level that would contribute funds for wildlife management at several of MDNR's WMAs (E. Rowan Ford, personal communication, July 25, 2019). To my knowledge, there have not been any studies that have explored support of a songbird conservation stamp.

Some states have additional funding sources from purchases of state waterfowl hunting licenses and state duck stamp programs for WMAs with wetland habitat. For example, 75% of the revenue from sales of Michigan's Waterfowl Hunting License are invested in wetland protection and habitat restoration activities that benefit waterfowl, with an additional 16% directly earmarked for WMAs that benefit waterfowl (Michigan Natural Resources and Environmental Protection Act, 2017). Several states also have state duck stamp programs that are either associated with a waterfowl hunting license or available as a voluntary purchase to

hunters, wildlife enthusiasts, and wildlife art collectors. In Michigan, a Michigan Waterfowl Stamp can be purchased voluntarily with proceeds used for wetland conservation, including WMA management (MDNR, n.d.).

Some states find success in establishing broad-based funding such as conservation taxes (i.e., miniscule increases in sales tax) in Missouri and Arkansas, lottery revenues in Arizona and Colorado, outdoor gear sales tax in Virginia, and natural resources extraction fees in Nevada (McKinney et al., 2005). Other alternative wildlife conservation funding options that have been explored or implemented include income tax check offs, state general funds, alcohol taxes, industry taxes, vehicle license plate fees, trust funds, and contributions from federal, for profit, and nonprofit partners (McKinney et al., 2005; Jacobson et al., 2010; Pohl & Lawson, 2017). While many of these alternative funding mechanisms gain revenue from a broader set of constituents, they still may not disperse contributions across all constituents. Truly public funded wildlife conservation is difficult to implement because the funds directly compete with other statewide funding priorities (Pohl & Lawson, 2017).

SWAs often have a primary focus on game species management largely because of the current user-pay funding mechanism (Jacobson et al., 2007; Nkansah et al., 2021) which has resulted in inadequate funding for non-game programs (McKinney et al., 2005; Dalrymple et al., 2012; Duda et al., 2021). There have been unsuccessful attempts to establish broad-base funding mechanisms at the federal level such as non-hunting user-based taxes (e.g., tax on outdoor gear) and few states have found success in building the level of financial support needed to implement diverse wildlife conservation programs (Pohl & Lawson, 2017; Echols et al., 2019; Duda et al., 2021). In 2001, the federal State Wildlife Grants program was approved and implemented, providing funding that requires a 50% match from SWAs to implement State Wildlife Action

Plans (McKinney et al., 2005). While this program has been helpful, it still does not come close to meeting the financial needs of SWAs to carry out conservation of species of greatest conservation need outlined in State Wildlife Action Plans. So, to address the deficit in non-game conservation funding, there was a recommendation to reallocate federal revenue from development of energy and mineral resources on federal lands and waters to the Wildlife Conservation Restoration Program to better enable states to implement their State Wildlife Action Plans (AFWA, 2016). More recently, this recommendation has evolved into the Recovering America's Wildlife Act (RAWA), except that current legislation calls for funds to be reallocated from general treasury revenue (Duda et al., 2021). It is estimated that RAWA would provide nearly \$1.3 billion annually to SWAs for wildlife conservation and, as of this writing, there is strong bipartisan support for RAWA, and it has been passed by the U.S. House of Representatives (TWS, 2022).

The body of knowledge about broadening wildlife conservation funding suggests that there is not a 'one-size-fits-all' or 'silver bullet' for solutions. SWAs will need to explore a suite of funding mechanisms that will appeal to a diversity of constituents and that are most feasible and cost-effective for individual states to implement (Jacobson et al., 2007; Duda et al., 2021; Henderson et al., 2021; Larson et al., 2021). Experts caution that broadening financial support for wildlife conservation may come at a cost of alienating traditional stakeholders such as hunters as they see SWAs being more responsive to new stakeholders (Jacobson et al., 2007; Jacobson et al., 2010; Manfredo et al., 2017).

### ***Exploring Support for Conservation***

Several studies have explored support for a diversity of funding mechanisms for wildlife conservation such as state taxes (Dalrymple et al., 2012; Manfredo et al., 2017; Henderson et al.,

2021; Larson et al., 2021; Nkansah et al., 2021), lottery proceeds (Henderson et al., 2021; Larson et al., 2021), natural resource extraction fees (Henderson et al., 2021; Larson et al., 2021), user-based tax on outdoor gear (Dalrymple et al., 2012; Henderson et al., 2021; Larson et al., 2021), increased hunting license fees (Manfredo et al., 2017; Larson et al., 2021; Nkansah et al., 2021), and WMA access fees (Nkansah et al., 2021) and results are mixed. Overall, support has been demonstrated for natural resource extraction fees (Henderson et al., 2021; Larson et al., 2021), and there appears to be moderate to strong support for various forms of public taxes (Dalrymple et al., 2012; Henderson et al., 2021; Larson et al., 2021; Nkansah et al., 2021). Researchers report mixed results for support of a non-hunting user-pay option (e.g., tax on outdoor gear) with most studies indicating weak support (Pohl & Lawson, 2017; Henderson et al., 2021; Larson et al., 2021) and one finding strong support (Dalrymple et al., 2012). Others report moderate support for increased hunting license fees, lottery proceeds, and conservation bonds (Henderson et al., 2021; Larson et al., 2021; Nkansah et al., 2021) and low support for WMA access fees (Nkansah et al., 2021). Notably, Manfredo et al. (2018) found a preference for wildlife funding that was split equally between public taxes and hunting license fees. There is scarce information about WMA level funding mechanisms (Nkansah et al., 2021) and a need to explore a diversity of funding options that differ in complexity and feasibility of implementation (AFWA & WMI, 2019; Henderson et al., 2021).

Differing support can be expected for a range of funding options because support can be linked to the social, psychological, and demographic characteristics of constituents (Stern, 2000) and cognitively, value orientations, attitudes and norms, and behavioral intentions influence behavior (Manfredo, 2008). Participation in outdoor recreation has been found to influence support for wildlife funding (Dalrymple et al., 2012; Larson et al., 2021), likely because

participants can realize the direct impact of wildlife conservation efforts to their recreational pursuits (Cooper et al., 2015; Nkansah et al., 2021). van Eeden et al. (2020) used a social identity approach to measure support for wildlife management actions and found that salience of certain social identities shaped attitudes. This is reasonable because the more salient a person's identity is, the more influence it has on their cognition and behavior and what they perceive as normative behavior for the group they are identifying with (Landon et al., 2018; van Eeden et al., 2020). In other words, if people think of wildlife conservation as part of their identity, it will be internalized as an obligation to take actions such as funding wildlife conservation. Past behavior, such as frequency of conservation behaviors can also predict support for funding options (Henderson et al., 2021).

Other cognitive and psychological factors that have been found to influence support for funding policies include wildlife value orientations (with mutualistic orientations more supportive than domination orientations) (Manfredo et al., 2017; Henderson et al., 2021), place attachment (Henderson et al., 2021), and trust in SWAs (Manfredo et al., 2017). Socio-demographics are often included as covariates in models that explore support for wildlife conservation funding. For a variety of funding mechanisms, studies have shown a positive effect of education (Dalrymple et al., 2012), negative effect of age (Dalrymple et al., 2012; Henderson et al., 2021), and a negative effect of rural residence (Kellert et al., 2017; Nkansah et al., 2021). In one study, the influence of gender differed depending on the type of funding policy (Henderson et al., 2021).

### ***Purpose of Study and Objectives***

This study recognizes the need for SWAs to understand constituent support for a variety of wildlife funding mechanisms (AFWA, 2019), as well as addresses MDNR's specific questions

about support for funding for WMAs that are intensively managed for waterfowl. Information about how key stakeholders compare and the factors that influence support will allow SWAs to consider a diversity of funding mechanisms, develop targeted communication and engagement strategies to build support, and develop and implement new sustainable funding policies that results in a group of diverse constituents that support WMAs, both politically and financially. Therefore, I sought to explore support for a diversity of WMA funding options (e.g., at national, state, and WMA levels) among key WMA stakeholders and create a typology of stakeholders based on that support. Typologies are an effective way for SWAs to understand the heterogeneity of respondents and can be particularly useful for SWA decision and policy makers. This study included several funding mechanisms for which there is little information about support (e.g., songbird conservation stamp and WMA-specific mechanisms such as access permits, donations, and fundraising events). Overall, this study contributes to the growing body of research that seeks to better understand the likelihood of constituents actively supporting funding for wildlife conservation.

Objectives of my study were to 1) compare key WMA stakeholders on their support for WMA funding options; 2) explore variables that influence support for WMA funding options by predicting likelihood of taking actions in the next 12 months to support WMA management; and 3) develop a typology of WMA stakeholders that groups respondents on their support for WMA funding options.

## **Methods**

### ***Study Area***

I focused on five MDNR and one NWR intensively managed coastal wetland WMAs located in southeastern Michigan, USA. The five MDNR WMAs are managed waterfowl



hunting areas with a primary objective to provide waterfowl habitat and waterfowl hunting opportunities, however the wetland habitats resulting from intensive management provide habitat for a large diversity of wildlife and provide ample opportunities for other non-hunting recreation such as birdwatching, paddle sports, and fishing. The NWR also carries out intensive wetland habitat management with a primary objective to provide a wildlife refuge for migratory birds and secondary objectives to provide hunting and non-hunting opportunities. To meet their management objectives, federal and SWAs have made significant financial investments in the WMAs in terms of wetland management infrastructure and habitat management. This intensive management of coastal habitats and recreation provides a unique opportunity to compare key stakeholders on their support for WMA funding. For a complete description of the study area, see the Study Area section of Chapter 2 and Figure 1.

### ***Sampling and Data Collection***

I constructed and administered web-based and mail-back surveys to measure and predict the likelihood of contributing to WMA funding among four key stakeholder groups—waterfowl hunters, birdwatchers, anglers, and community members—following a modified version of the Tailored Design Method (Dillman et al. 2014). Survey instruments and data collection protocols were approved by Michigan State University Institutional Review Board on August 9, 2019 (Project 00003031) and data was collected between August 2019 and March 2020 for the four surveys. After accounting for undeliverable invitations and refusals to participate, response rates were 24.0% for birdwatchers (1,133 completed surveys), 14.8% for waterfowl hunters (316 completed surveys), 10.2% for anglers (254 completed surveys), and 2.8% for community members (84 completed surveys). Although response rates are low, they are comparable to recent social science studies in the natural resources (Stedman et al. 2019). Non-response bias

was examined via shortened questionnaires mailed to a random sample of each group with response rates of 25.9% (117 responses) for birdwatchers, 39.6% (198 responses) for waterfowl hunters, 9.6% (48 responses) for anglers, and 2.6% (13 responses) for community members. Because only slight differences were detected between respondents in the original and non-response samples, I chose not to weight data. See the Sampling and Data Collection section of Chapter 2 for a complete description of survey sampling frames, data collection, and assessment of non-response bias.

### ***Variables Measured***

**Likelihood of Contributing to WMA Funding.** The dependent variable in my analyses was support of WMA funding options and was measured by eight items that asked respondents about the likelihood of taking actions in the next 12 months that would help support funding for WMA management. Both real (i.e., already existing) and hypothetical (i.e., currently not available) actions were explored. Responses were on a 5-point scale (1 = not at all likely, 2 = somewhat unlikely, 3 = neither unlikely nor likely, 4 = somewhat likely, and 5 = very likely). These items were selected based on previous studies (Halpenny, 2010; Patton, 2021a), a review of policies that have been used or discussed in other states, and engagement with MDNR and Audubon Great Lakes administrators and managers. Items included a diversity of funding options at national, state, and WMA levels. The eight WMA funding items are listed below:

1. Purchasing a Federal Migratory Bird Hunting and Conservation Stamp (real)
2. Purchasing a Michigan Waterfowl Stamp (real)
3. Donating money to WMA management (real)
4. Participating in WMA fundraising events (real)
5. Purchasing a Songbird Conservation Stamp (hypothetical)
6. Purchasing a WMA access permit (hypothetical)
7. Paying a small increase in Michigan State Income Tax (hypothetical)

8. Paying a small increase in Michigan Gas Tax (hypothetical)

To reduce the funding options into fewer categories, I conducted an exploratory factor analysis (EFA) on the eight WMA funding items. The EFA (a principal component analysis with orthogonal varimax rotation) suggested that items loaded onto three factors with acceptable measurement reliability: 1. ‘purchase a duck stamp’ factor including purchasing a federal or state waterfowl stamp (Cronbach’s  $\alpha = 0.92$ ); 2. ‘contribute directly to WMAs’ factor including donating money to WMAs, participating in WMA fundraising events, and purchasing a WMA access permit (Cronbach’s  $\alpha = 0.76$ ); and 3. ‘pay increased tax’ factor including paying small increases in Michigan State Income and Gas Taxes (Cronbach’s  $\alpha = 0.84$ ) (Table 14).

Cronbach’s alpha values  $\geq .70$  suggest high internal consistency (Brown 2015). One item, purchasing a Songbird Conservation Stamp loaded onto both factors one and two, but not well onto either one. Therefore, I chose to use ‘purchase a songbird stamp’ as an individual observed dependent variable in the analysis, resulting in a total of four WMA funding options for analysis.

**Recreation Participation.** Items for participation in nature-based activities were adapted from previous survey efforts (USFWS, 2016a; Harshaw, 2018a; Harshaw, 2018b; Wilkins & Miller, 2018; Patton, 2021a; Patton, 2021b). Respondents were asked to select from a list of 10 nature-based activities that they had participated in during the past 12 months. This variable was recoded as a binary variable where 1 = participated in at least one activity and 0 = did not participate in any activities.

**Membership.** Respondents were asked about their membership in the past 12 months for the following types of organizations: birdwatching/bird conservation; hunting/game species conservation, fishing/fish conservation, national/international environmental or conservation, and local/regional conservation. This variable was recoded as a binary variable where 1 = member of at least one organization and 0 = not a member of any organization.

**Conservation Behavior.** Ten conservation behaviors were adapted from previous scales (Cooper et al. 2015; Harshaw 2018a; Harshaw 2018b; Patton 2021a; Patton 2021b).

Respondents were asked how often they participated in each activity in the past 12 months with responses on a 5-point scale to determine frequency of participation. I used an EFA (a principal components analysis with an orthogonal varimax rotation) to explore reduction of conservation behavior items and Cronbach's alpha to assess measurement reliability. Results suggested a unidimensional scale that included all 10 items (Cronbach's  $\alpha = 0.89$ ) to measure the frequency with which respondents participated in conservation behaviors. Therefore, a new continuous latent variable, conservation behavior, was generated and used in subsequent analyses.

**Identity.** Identity variables were adapted from previous surveys (Harshaw 2018a; Harshaw 2018b; Patton 2021a; Patton 2021b) and measured the salience or strength of identification as a birdwatcher, waterfowl hunter, angler, outdoor enthusiast, and conservationist with responses on a 5-point scale (1 = not at all, 2 = slightly, 3 = moderately, 4 = strongly, and 5 = very strongly).

**Respondent Characteristics and Contextual Variables.** Gender, age (measured as year of birth), education level, household income, community size (large urban, medium urban, small city, small town, or rural area), and knowledge of WMAs and WMA funding were collected from respondents. Age, education level, income, and community size were treated as continuous variables and gender a binary variable. Knowledge of WMAs and awareness of current WMA funding were included as contextual variables. Respondents were asked to report if they had heard about each of the six WMAs before taking the survey to measure knowledge of WMAs. This variable was recoded to create a binary variable of have heard of at least one WMA (1) or have not heard of any WMAs (0). To measure knowledge of WMA funding, I presented the

statement, “Please tell us what you think is the primary source of funds for wildlife management on WMAs” with the following response categories: funds from the sale of hunting licenses and equipment, funds from state taxes, access permits or fees, or other. I then recoded this to create a binary variable where they either correctly identified the source of WMA funding as funds from the sale of hunting licenses and equipment (1) or incorrectly identified the source of WMA funding (0).

### ***Data Analysis***

Data were analyzed for missingness and listwise deletion was used for all variables during data analysis because all variables had  $\leq 7\%$  missing data. For variables where missing data was  $> 5\%$ , investigations of missing data patterns indicated that data were missing completely at random. Stata (Version 15.1) was used to perform all analyses. Differences were considered statistically significant at  $p \leq 0.05$ . Descriptive statistics were calculated for variables of interest. Chi-square tests were used to compare knowledge of WMA funding among the four survey groups and one-way ANOVA tests with a Bonferroni correction and Tukey post-hoc tests of pairwise differences in means were used to compare mean group scores of likelihood of contributing to WMA funding and to identify differences between birdwatchers, waterfowl hunters, anglers, and community members.

Next, data from the birdwatcher, waterfowl hunter, angler, and community member surveys were merged to conduct four multiple regression models using each WMA funding option as a dependent variable to determine the influence of covariates on the likelihood of taking actions in the next 12 months to support WMA management. Covariates in the regression model included sociodemographic variables, contextual variables, participation in nature-based activities, membership in an environmental/conservation organization, frequency of conservation

behaviors, and identities as a birdwatcher, waterfowl hunter, angler, outdoor enthusiast, and conservationist. After merging samples and using only survey responses that included data for all the independent variables, there were usable sample sizes ranging from 1,354–1,360 for the four regression models. Multicollinearity among independent variables was inspected using Variance Inflation Factor (VIF) values (VIF values  $\leq 1.38$ ).

Lastly, k-means cluster analysis was conducted to group all respondents on their patterns of responses to the four WMA funding options. Hierarchical cluster analysis is useful for developing typologies of interest to SWAs, in this case of WMA stakeholders on their likelihood of supporting WMA funding options. To make comparisons among clusters, Chi-square tests (for binomial and categorical variables) and one-way ANOVA (for continuous variables) were used.

## **Results**

### ***Independent Variables***

**Respondent Characteristics and Contextual Variables.** For all respondents combined, descriptive statistics for variables used in the multiple regression models are displayed in Table 15 (binomial and categorical variables) and Table 16 (continuous variables). There were more male survey respondents (56%) than female respondents (44%) and the average year of birth of respondents was 1964.79 (SD=15.16). Respondents were generally well educated, with over 72% having an associate's, bachelors, or graduate degree. The size of the communities that respondents lived in at the time of the survey varied with 35% from large or medium urban areas, 42% from small cities or towns, and 23% from rural areas. Household income was also variable with 21% reporting income <\$50,000, 39% with income between \$50,000–\$100,000, 33% with income between \$100,000–\$200,000, and 7% with income >\$200,000. Most respondents (84%)

reported having knowledge of at least one of the six WMAs prior to the survey. Overall, most respondents correctly identified the source of WMA funding (63%).

I found differences between the four stakeholder groups when comparing their knowledge and understanding of the primary source of current WMA funding ( $\chi^2(9) = 91.17$ ,  $p < .001$ ) (Table 17). Waterfowl hunters correctly identified funds from the sale of hunting licenses and equipment as the primary funding source for WMA management more frequently (82%) than anglers (66%), birdwatchers (58%) or community members (52%).

**Recreation Participation, Membership, Conservation Behavior, and Identity.** Nearly every respondent reported participating in at least one nature-based activity in the past 12 months (99.6%) and over 66% of respondents were members of an environmental/conservation organization at the time of the survey (Table 15). Scores of the frequency of conservation behaviors were fairly low across all respondents ( $M=2.97$ ,  $SD=0.91$ ), suggesting that they only occasionally or rarely engaged in these behaviors. For identity measures, respondents identified most strongly as conservationists ( $M=3.98$ ,  $SD=1.05$ ), followed by outdoor enthusiasts ( $M=3.59$ ,  $SD=1.20$ ) and birdwatchers ( $M=3.41$ ,  $SD=1.36$ ). There were the lowest mean scores for identification as anglers ( $M=2.35$ ,  $SD=1.44$ ) and waterfowl hunters ( $M=1.86$ ,  $SD=1.44$ ) (Table 16).

***Dependent Variable—Likelihood to Contribute to WMAs***

Prior to the EFA, the individual funding option with the highest mean score across all respondents was purchasing a WMA access permit ( $M=3.24$ ,  $SD=1.37$ ), followed by purchasing a state duck stamp ( $M=3.15$ ,  $SD=1.62$ ), purchasing a songbird conservation stamp ( $M=3.14$ ,  $SD=1.52$ ), paying a small increase in state income tax ( $M=3.09$ ,  $SD=1.46$ ), and purchasing a federal duck stamp ( $M=3.04$ ,  $SD=1.66$ ) (Table 14). When examining responses across all survey

groups for the four WMA funding options resulting from the EFA and used in the regression models, purchasing a songbird conservation stamp had the highest mean score among all respondents ( $M=3.14$ ,  $SD=1.52$ ), followed by purchasing a duck stamp ( $M=3.10$ ,  $SD=1.58$ ), contributing directly to WMAs ( $M=2.93$ ,  $SD=1.04$ ), and paying increased tax ( $M=2.82$ ,  $SD=1.38$ ).

Differences were detected between the four groups in the likelihood of taking actions in the next 12 months that would help to secure funds for WMA management (Table 18). Waterfowl hunters were more likely to purchase a state duck stamp ( $M=4.66$ ,  $SD=0.78$ ) and purchase a federal duck stamp ( $M=4.83$ ,  $SD=0.56$ ) than the other three groups. In contrast, birdwatchers ( $M=3.72$ ,  $SD=1.36$ ) were more likely to purchase a hypothetical songbird conservation stamp than the other three groups. Waterfowl hunters were more likely to purchase a WMA access permit ( $M=3.58$ ,  $SD=1.39$ ), donate money to WMA management ( $M=3.15$ ,  $SD=1.24$ ), and participate in a WMA fundraising event ( $M=3.34$ ,  $SD=1.18$ ) than the other three groups. Anglers ( $M=2.72$ ,  $SD=1.36$ ;  $M=2.41$ ,  $SD=1.18$ ) and community members ( $M=2.54$ ,  $SD=1.38$ ;  $M=2.29$ ,  $SD=1.16$ ) were least likely to purchase a WMA access permit or donate money to WMA management. There was little support across the groups for an increase in taxes to help support WMA management, yet birdwatchers had higher mean scores for paying a small increase in state income tax ( $M=3.49$ ,  $SD=1.34$ ) and paying a small increase in state gas tax ( $M=2.94$ ,  $SD=1.50$ ) as compared to the other three groups. Anglers and community members indicated low likelihood to take any of the potential WMA funding actions with mean scores  $\leq 2.72$  for all actions.

Results of the ‘purchase a duck stamp’ regression model indicated that income, knowledge of WMAs, correct knowledge of WMA funding, frequency of conservation



behaviors, and strength of identity as a waterfowl hunter all had positive effects on the likelihood of purchasing a duck stamp (Table 19). Gender and community size both had a negative effect on likelihood of purchasing a duck stamp with men less likely than woman to purchase a duck stamp and rural residents less likely than urban residents to purchase a duck stamp. For my ‘purchase a songbird stamp’ model, membership in an environmental/conservation organization, frequency of conservation behaviors, and strength of identity as a birdwatcher all positively predicted likelihood of purchasing a songbird conservation stamp. However, identity as a waterfowl hunter, identity as an angler, gender, and community size had negative effects, with men less likely than women and rural residents less likely than urban to purchase a songbird stamp. Results of the ‘contribute directly to WMAs’ model indicated that knowledge of WMAs, frequency of conservation behaviors, strength of identity as a birdwatcher, and strength of identity as a waterfowl hunter all had positive associations with likelihood of contributing directly to WMAs. In this model, gender and community size had negative associations with the likelihood of contributing directly to WMAs. For my last model, ‘pay increased tax’, age, education, membership in an environmental/conservation organization, frequency of conservation behaviors, strength of identity as a birdwatcher, and strength of identity as a conservationist positively predicted the likelihood of paying increased taxes while community size and identities as waterfowl hunters, anglers, and outdoor enthusiasts had negative effects. As in the other three models, rural residents were less likely than urban residents to pay increased taxes, although effects are small.

Frequency of conservation behavior was a positive predictor across all four models and gender a negative predictor in three of the models. Strength of identity as a birdwatcher showed a positive effect in three of the models (all but ‘purchase a duck stamp’). Strength of identity as

a waterfowl hunter was significant across all four models, positively predicting likelihood of purchasing a duck stamp and contributing directly to WMAs, and negatively predicting purchasing a songbird stamp and paying increased taxes. The ‘purchase a duck stamp’ model explained the most variance in predicting the likelihood to contribute to WMAs ( $R^2 = 0.35$ ) followed by ‘purchase a songbird stamp’ ( $R^2 = 0.30$ ), ‘pay increased tax’ ( $R^2 = 0.25$ ), and ‘contribute directly to WMAs’ ( $R^2 = 0.22$ ).

### ***Cluster Analysis***

I explored the number of clusters to use in the k-means cluster analysis by examining a Ward’s linkage dendrogram, the Calinski-Harabasz pseudo-F statistic index, and the Duda-Hart  $Je(2)/Je(1)$  index (StataCorp, 2017). These assessments identified five as the optimum number of clusters to use in the k-means cluster analysis to group respondents into clusters based on their patterns of responses to likelihood of contributing to WMAs, where respondents in one cluster are more similar to each other than to respondents in other clusters. The k-means cluster analysis produced five distinct groups of respondents that were distributed similarly and that I labeled ‘opposed’ (n=379), ‘traditional support’ (n=307), ‘traditional + songbird’ (n=363), ‘new funding’ (n=358), and ‘strong universal support’ (n=387) (Figure 5). The ‘opposed’ group generally held the lowest mean scores across all four of the WMA funding options. The ‘traditional support’ group had the highest mean score for purchasing duck stamps as well as a high score for contributing directly to WMAs, both current and traditional funding mechanisms. In contrast, this group had low mean scores for purchasing a songbird stamp and paying increased taxes. The ‘traditional + songbird’ group suggested that they would support current traditional funding options (high mean scores for purchasing a duck stamp and contributing directly to WMAs) as well as purchasing a songbird conservation stamp. The ‘new funding’ group was characterized

by some of the highest mean scores for purchasing a songbird stamp and paying increased taxes, both currently unavailable funding options, and suggesting that this group would be supportive of new funding mechanisms. Lastly, the ‘strong universal support’ group held high mean scores across all four of the funding options suggesting that they would be supportive of any of the proposed funding options.

Chi-square and one-way ANOVA tests resulted in differences among the five typology groups for all variables of interest (Table 20). The ‘opposed’ group was mostly male (59%), younger ( $M=1964.66$ ,  $SD=15.31$ ) and had the lowest mean score for household income ( $M=3.93$ ,  $SD=1.95$ ). This group also had the least knowledge of WMAs although most had heard of at least one of the WMAs (73%) and most (62%) correctly identified the source of current WMA funding. Respondents in the ‘opposed’ cluster had the lowest membership in an environmental/conservation organization (38%), the lowest mean score for frequency of conservation behavior ( $M=2.39$ ,  $SD=0.85$ ), and generally low strength of identity scores for all identities. However, mean scores for strength of identity as an outdoor enthusiast ( $M=3.36$ ,  $SD=1.23$ ) and conservationist ( $M=3.43$ ,  $SD=1.15$ ) were moderate.

The ‘traditional support’ group respondents were more male (95%), the youngest ( $M=1969.60$ ,  $SD=15.86$ ), had lower mean education scores ( $M=3.62$ ,  $SD=0.99$ ), had higher mean community size scores meaning that they resided in more rural areas ( $M=3.48$ ,  $SD=1.27$ ), and had a higher household income ( $M=4.66$ ,  $SD=2.18$ ) than the other four groups. They had much more knowledge of WMAs (98%) and the source of WMA funding (85%). A large proportion of respondents reported being members of an environmental/conservation organization (70%). For strength of identities, ‘traditional support’ respondents had higher mean scores for waterfowl hunter ( $M=4.00$ ,  $SD=1.12$ ) and angler ( $M=3.57$ ,  $SD=1.22$ ) than the other

four groups. Indeed, the other four groups had very low mean scores for waterfowl hunter and only slightly identified as an angler by comparison. ‘Traditional support’ represented the lowest mean score for strength of identity as a birdwatcher ( $M=2.16$ ,  $SD=1.06$ ) but scored relatively high for conservationist ( $M=3.99$ ,  $SD=1.03$ ).

The ‘traditional + songbird’ group was about 51% male and most had knowledge of WMAs (82%). Most respondents were members of an environmental/conservation organization (58%) but ranked the second lowest of all five groups for this variable. This cluster had the second lowest mean score for frequency of conservation behavior ( $M=2.77$ ,  $SD=0.89$ ).

‘Traditional + songbird’ identified at least moderately as a birdwatcher ( $M=3.57$ ,  $SD=1.30$ ), outdoor enthusiast ( $M=3.57$ ,  $SD=1.20$ ), and conservationist ( $M=3.73$ ,  $SD=1.08$ ).

The ‘new funding’ group was characterized as the oldest ( $M=1962.85$ ,  $SD=14.71$ ) and had higher mean education scores ( $M=4.31$ ,  $SD=0.80$ ). This group had the least knowledge of the source of WMA funding of all five groups (53%). Nearly 76% of ‘new funding’ respondents reported being current members of an environmental/conservation organization and they had the second highest mean score for frequency of conservation behavior ( $M=3.16$ ,  $SD=0.80$ ) of all groups. This cluster held the highest mean scores for strength of identity as a birdwatcher ( $M=4.01$ ,  $SD=1.09$ ) and the second highest scores for conservationist ( $M=4.28$ ,  $SD=0.88$ ).

The ‘strong universal support’ group had the most females (59%), a high mean education score ( $M=4.20$ ,  $SD=0.82$ ), and the lowest mean community size score meaning they were the most urban ( $M=3.05$ ,  $SD=1.26$ ) of all groups. Respondents in this group were the most likely to be members of an environmental/conservation organization (81%) and had the highest mean scores for frequency of conservation behavior ( $M=3.30$ ,  $SD=0.81$ ). For strength of identities, the

‘strong universal support’ cluster scored highest for identity as a conservationist ( $M=4.32$ ,  $SD=0.88$ ) and second highest for identity as a birdwatcher ( $M=3.97$ ,  $SD=1.13$ ).

## **Discussion**

Results from my study indicated that WMA stakeholder support for funding options is dependent on the type of funding mechanism and the type of respondent group. Similar to other studies (Manfredo et al., 2018; Larson et al., 2021; Henderson et al., 2021; Nkansah et al., 2021), I found overall support for a broader suite of funding mechanisms. Factors that influenced funding support varied by type of funding mechanism and the respondent typology revealed heterogeneity in all variables of interest (respondent characteristics, contextual variables, participation, membership in environmental/conservation organizations, conservation behavior, and identity variables). My results inform the understanding of stakeholder attitudes and preferences for a diversity of funding options that SWAs can use to develop strategies towards implementing new broad-based funding for wildlife conservation.

Investigating respondent characteristics, I found results similar to Larson et al. (2021) that males were less supportive of most of the funding policies. A possible explanation for this is that women are more mutualism-oriented in their wildlife value orientations and have been found to support wildlife management in non-traditional ways (Vaske et al., 2001; Schroeder et al., 2006a; Teel et al., 2010). This could also be because more waterfowl hunters are men and therefore may feel that they are already contributing sufficiently to WMA management through their hunting license and federal duck stamp purchases. Rural residents were also less likely to support any of the funding options which is consistent with past research (Kellert et al., 2017; Nkansah et al., 2021).

It was not surprising that the contextual variable, previous knowledge of WMAs, was a significant predictor of the likelihood to take actions to fund WMAs. People who know and use WMAs have personal knowledge and experience with wildlife management activities and may be more likely to contribute directly to them through access fees, donations, and fundraising events. SWAs could take advantage of this to communicate opportunities for funding contributions to current users of the areas.

Similar to Henderson et al. (2021), I found that frequency of conservation behavior was associated with support for all four funding options. This is likely because engagement in conservation behaviors (e.g., participating in wildlife habitat projects, voting for conservation policies, contributing money to local conservation projects) may lead to more familiarity and understanding of wildlife conservation issues and increased interest in financial support (Zaradic et al., 2009; Cooper et al., 2015).

Salience of identity as a birdwatcher and a waterfowl hunter both influenced likelihood to support actions that support WMAs. This is likely because both of these outdoor recreation types are popular at the WMAs. Strength of identity as a birdwatcher was associated with increased support for purchasing a songbird stamp, contributing directly to WMAs, and paying increased taxes suggesting that SWAs could develop outreach and engagement strategies that appealed to this identity. Notably, identity as a conservationist strongly influenced support for paying increased state taxes and respondents' most salient identity was conservationist. This suggests that, if SWAs decide to pursue this funding option, communication strategies could be framed such that financial support of WMAs is a behavioral norm of conservationists. If stakeholders associate this behavior with their conservationist identity, they are likely to

internalize the behavior as an obligation and seek opportunities to take action (Fielding et al., 2008; Landon et al., 2018).

The four stakeholder groups differed in their likelihood to take actions that would help fund and support WMA management. Unsurprisingly, waterfowl hunters were more likely to purchase state and federal duck stamps as these are required for migratory bird hunting. Federal and state duck stamps are also available for purchase by collectors, art enthusiasts, and others, and federal duck stamps also give the purchaser free entry into NWRs. Few birdwatchers indicated that they were likely to purchase a federal duck stamp, and some of these respondents could also be waterfowl hunters. These results are similar to others and suggest that marketing efforts targeted at birdwatchers in recent years may not be effective at encouraging the purchase federal duck stamps to contribute to migratory bird and wetland conservation (Shipley et al., 2019; Patton, 2021a).

However, my results indicate that birdwatchers are likely willing and interested in contributing to WMAs, but not necessarily in traditional ways. Birdwatchers' highest score for purchasing a songbird conservation stamp may indicate a new funding source that birdwatchers would be keen to contribute to. Additionally, strength of identity as a birdwatcher was positively associated with likelihood to purchase a songbird stamp, contribute directly to WMAs, and pay an increased tax and is more evidence that birdwatchers are good candidates for increased financial support of WMAs. McFarlane & Boxall (1996) argued that birdwatchers are interested in supporting conservation funding but that there are few mechanisms in place for them to make meaningful contributions and challenged SWAs to develop novel funding mechanisms that would appeal to birdwatchers.

Waterfowl hunters indicated that they were more likely to purchase a WMA access permit, donate money to WMA management, and participate in a WMA fundraising event than the other three groups. This is likely because waterfowl hunters are the most knowledgeable about WMAs, use them more often, and are often members of state and local hunting organizations where fundraising events and donations are common. However, birdwatchers scored purchasing a WMA access fee third highest, indicating that they may be willing to contribute to WMA management directly through that mechanism. This is consistent with previous studies that found willingness to pay for entrance and user fees at outdoor recreation locations (Dalrymple et al., 2012; Patton, 2021a).

Waterfowl hunters and birdwatchers appear to be the stakeholder groups with the most potential for WMA management funding support as anglers and community members indicated low likelihood to contribute to any of the options listed. More engagement is needed with these groups to identify barriers to contributions to WMA management and to develop other potential funding sources. Because participation in birdwatching is increasing (USFWS, 2016), engaging with this group may have the biggest impact on increasing funds for wildlife conservation. Focusing on a group with large numbers of participants and predicted increases of participants in the future suggests a more sustainable approach.

The comparison of survey groups revealed differences in knowledge of current WMA funding. Not surprisingly, waterfowl hunters had the most knowledge of WMA funding, followed by anglers. These two groups are legally required to purchase hunting and fishing licenses for their recreational activities and are likely more familiar with how the funds from those license sales are used than birdwatchers or community members. Indeed, birdwatchers and community members had much lower knowledge of the current primary source of WMA



funding. An initial step in building financial support for WMA management is for stakeholders to recognize that there is not already broad public funding for wildlife management (e.g., from state taxes). Stakeholders may be more likely to support new funding mechanisms if they understand current funding sources, recreational trends, and the inability of current funds to cover wildlife management costs. Therefore, SWAs could consider developing communication strategies that aim to educate birdwatchers and the general public on how wildlife management is currently funded.

My cluster analysis provides a typology that can inform decisions about funding mechanisms for SWAs to pursue, how those mechanisms might appeal to certain groups, and communication, outreach, and engagement strategies. Membership in environmental/conservation organizations was high across all types of respondents and may provide an existing audience for SWAs to recruit WMA supporters (Kellert et al., 2017). As discussed above, birdwatchers are a stakeholder group with potential for increased WMA support. More evidence for this is the high strength of identity as a birdwatcher that respondents had in the ‘new funding’ and ‘strong universal support’ groups.

My typology results also suggest that SWAs may need to prioritize communication and outreach to the ‘traditional’ group, including waterfowl hunters, to provide justification for increased and diverse WMA funding based on their low support for new funding initiatives. Domination-oriented respondents (of which hunters often are) can be less supportive of broad-based wildlife governance models and there is potential for backlash from this group (Manfredo et al., 2017). SWAs may need to consider this and other effects, such as decreased trust in SWAs, that more inclusive and diverse funding for WMAs may have on traditional users (Manfredo et al., 2018). The challenge will be navigating a process to broaden and increase

funding and support without alienating these stakeholders (Jacobson et al., 2007; Jacobson et al., 2010).

### ***Limitations and Future Research***

The generalizability of my results is limited to stakeholders in southeast Michigan associated with WMAs that are intensively managed for waterfowl and waterfowl hunting. I suggest future research includes a broader set of WMA stakeholders to develop more comprehensive models of support for WMA funding. Registered eBird users that reported bird sightings in the area of interest and that resided in Michigan were used as the sample for birdwatchers and may under-represent casual birdwatchers that may not use eBird. I also suggest exploring a wider set of potential funding mechanisms as new and innovative strategies are continuously being identified. For example, I did not include reallocation of taxes and other public funds, other types of public taxes (e.g., sales tax), or non-hunting user-pay taxes or fees.

My research combined options for funding WMA management at multiple levels. Whereas these increase understanding of public support for a diversity of funding mechanisms, future studies could seek to make comparisons of support for funding options at differing levels (e.g., at local, state, and national levels). A limitation of my study is that the feasibility and long-term sustainability of these funding mechanisms were not explored, and the scale of impact is not consistent. For example, making a donation or participating in a fundraising event may only be done once or infrequently whereas purchasing an access permit or paying increased taxes may be done much more frequently and have a significantly larger financial impact. Future research that estimates financial gains and projects long-term funding (e.g., through projected numbers of people in stakeholder groups) would be beneficial to inform SWAs of funding options to pursue.

There was potential for survey respondents in one group to be associated with other survey groups (e.g., birdwatchers from the birdwatcher sample may also hunt waterfowl, fish, and reside in the local community), however to address these limitations, I used appropriate survey research methods and assessed nonresponse bias to increase generalizability of the results. My research could be improved with additional and more sophisticated statistical analyses of my data. For example, because I detected differences between the four survey groups, separate models could be constructed for each group instead of combining respondents.

While my models had acceptable explanatory power ( $R^2$  range 0.22–0.35), including social and psychological covariates such as wildlife value orientations, place attachment, and trust in SWAs (Manfredo et al., 2017; Henderson et al., 2021) may increase the amount of variance explained in support for funding mechanisms. In addition, I treated identities as individual independent variables but as van Eeden et al. (2020) notes, identity theory suggests that the most salient identities have the most effect on behavior so recording and using respondent's most salient identity may improve data analysis.

### ***Management Implications***

My findings add to the body of evidence that the public largely supports broader wildlife conservation funding, including public-based funding (Manfredo et al., 2018; Larson et al., 2021; Henderson et al., 2021; Nkansah et al., 2021). The challenges for SWAs to implement broad-based funding are likely political (AFWA & WMI, 2019; Jacobson et al., 2007; Larson et al., 2021). Efforts to educate policy makers about the wildlife conservation funding dilemma and WMAs' role in delivering wildlife conservation may help to build political acceptance and support for broad-based funding.

SWAs seek outcomes of broad-based funding including sustainable wildlife management, broadened political and public support, and increased relevancy. However, as my results suggest, there is no ‘silver bullet’ or one single solution for increasing the public’s support for wildlife conservation and what works for one group of constituents will not work for all groups (Kellert et al., 2017). SWAs that explore a number of potential funding mechanisms and develop a diversified portfolio of traditional and novel funding sources may find increased success in garnering support by a wide range of constituents (Duda et al., 2021; Larson et al., 2021) and meeting funding needs. Potential strategies that SWAs could employ towards development and implementation of new funding mechanisms include targeted messaging based on known support from research, building partnerships, demonstrating a need for increased funding, and finding local champions (McKinney et al., 2005). SWA partnerships that help build capacity in marketing and communication may be effective for developing new funding mechanisms (Jacobson et al., 2007; Pohl & Lawson, 2017). My typology of respondents’ support for WMA funding is useful for developing marketing and communication strategies that resonate best with groups and that address their unique concerns. For example, SWAs could market different funding options in a diversified portfolio to different groups based on my typology.

WMAs facilitate wildlife conservation at local levels and as operations and management costs increase, SWAs are interested in potential funding sources that could be used directly on these areas. Because of the moderate to high likelihood of purchasing a WMA access permit, SWAs such as MDNR may want to consider this funding mechanism. Michigan residents may be familiar with a similar fee (i.e., an annual license plate pass) for access to state parks, recreation areas, and boat launches. This program has been widely successful and has seen annual increases in numbers of sales and revenue with proceeds earmarked for the operations and

maintenance of Michigan state parks and for local recreation grants (MTGA, 2019). While sales of WMA access permits would likely be insufficient to cover all operation and maintenance costs of WMAs, it could be one strategy that SWAs pursue to help build a broader and more diverse funding source for these areas and because this is another user-pay mechanism, there may be less political resistance in implementation. However, a potential challenge is that non-hunters paying a new access fee may have increased expectations for WMA management that directly benefits them, and this could have direct conflicts with WMA objectives for game species and hunting opportunities.

## Tables

**Table 14**

*Results of exploratory factor analysis of WMA funding options (likelihood of taking action) with orthogonal varimax rotation suggesting four factors of WMA funding options (n = 1,749). Only factor loadings > 0.3 are displayed.*

Factor (with items <sup>a</sup> )	Mean	SD	1	2	3
<b>1. Purchase a Duck Stamp (2 items, <math>\alpha = 0.92</math>)</b>	<b>3.10</b>	<b>1.58</b>			
Purchasing a Federal "Duck" Stamp	3.04	1.66	<b>0.93</b>		
Purchasing a Michigan "Duck" Stamp	3.15	1.62	<b>0.94</b>		
<b>2. Contribute directly to WMAs (3 items, <math>\alpha = 0.76</math>)</b>	<b>2.93</b>	<b>1.04</b>			
Donating money to WMA management	2.85	1.19		<b>0.84</b>	
Participating in WMA fundraising events	2.69	1.23		<b>0.83</b>	
Purchasing a WMA access permit	3.24	1.37		<b>0.68</b>	
<b>3. Pay increased tax (2 items, <math>\alpha = 0.84</math>)</b>	<b>2.82</b>	<b>1.38</b>			
Paying a small increase in Michigan State Income Tax	3.09	1.46			<b>0.88</b>
Paying a small increase in Michigan Gas Tax	2.55	1.51			<b>0.89</b>
<b>Purchase a Songbird Stamp</b>	<b>3.14</b>	<b>1.52</b>	<b>0.37</b>	<b>0.56</b>	

<sup>a</sup>Items rated on scale 1 = not at all likely, 2 = somewhat unlikely, 3 = neither unlikely nor likely, 4 = somewhat likely, and 5 = very likely

**Table 15**

*Survey respondent frequency and percentages for independent variables included in regression models.*

<b>Variable</b>	<b><i>n</i></b>	<b>%</b>
<b>Gender (male)</b>	977	56.44
<b>Education</b>		
Some high school or less	15	0.86
High school diploma or GED	136	7.83
Some college (no degree)	322	18.54
Associate's degree or Bachelor's degree	676	38.92
Graduate or professional school	588	33.85
<b>Community Size</b>		
Large urban area	148	8.51
Medium urban area	458	26.32
Small city	350	20.11
Small town	387	22.24
Rural area	397	22.82
<b>Income</b>		
≤\$24,999	91	6.10
\$25,000 to \$49,999	224	15.01
\$50,000 to \$74,999	299	20.04
\$75,000 to \$99,999	287	19.24
\$100,000 to \$124,999	216	14.48
\$125,000 to \$149,999	148	9.92
\$150,000 to \$199,999	122	8.18
\$200,000 to \$249,999	39	2.61
\$250,000 to \$299,999	28	1.88
≥\$300,000	38	2.55
<b>Knowledge of WMAs</b>	1,533	83.68
<b>Knowledge of WMA Funding</b>	1,162	63.08
<b>Participation</b>	1,752	99.55
<b>Membership</b>	1,160	66.02

**Table 16**

*Survey respondents mean values and standard deviations for independent variables in regression models.*

<b>Variable</b>	<b>Mean</b>	<b>SD</b>	<b><i>n</i></b>
<b>Age</b> (year of birth)	1964.79	15.16	1,699
<b>Education</b> <sup>a</sup>	3.97	0.96	1,737
<b>Community Size</b> <sup>b</sup>	3.25	1.30	1,740
<b>Income</b> <sup>c</sup>	4.26	2.09	1,492
<b>Conservation Behavior</b> <sup>d</sup>	2.97	0.91	1,746
<b>Identity</b> <sup>e</sup>			
Birdwatcher	3.41	1.36	1,702
Waterfowl Hunter	1.86	1.44	1,642
Angler	2.35	1.44	1,668
Outdoor Enthusiast	3.59	1.20	1,696
Conservationist	3.98	1.05	1,720

<sup>a</sup> Education scale: 1=some high school or less, 2=high school diploma or GED, 3=some college (no degree), 4=Associate's degree or Bachelor's degree, 5=Graduate or professional school

<sup>b</sup> Community size scale: 1=large urban area (population  $\geq$  500,000), 2=medium urban are (population 50,000–500,000), 3=small city (population 10,000–50,000), 4=small town (population 2,000–10,000), 5=rural area (population < 2,000)

<sup>c</sup> Income scale: 1= $\leq$ \$24,999, 2=\$25,000–\$49,999, 3=\$50,000–\$74,999, 4=\$75,000–\$99,999, 5=\$100,000–\$124,999, 6=\$125,000–\$149,999, 7=\$150,000–\$199,999, 8=\$200,000–\$249,999, 9=\$250,000–\$299,999, 10= $\geq$ \$300,000

<sup>d</sup> Conservation Behavior scale: 1=never, 2=rarely, 3=occasionally, 4=often, 5=very often

<sup>e</sup> Identity scale: 1=not at all, 2=slightly, 3=moderately, 4=strongly, 5=very strongly



**Table 17**

*Knowledge of current WMA funding by all survey groups reported as frequency (%). Chi-Square test had 9 degrees of freedom and results were significant at  $p < 0.05$ .*

	<b>Birdwatcher %</b>	<b>Waterfowl Hunter %</b>	<b>Angler %</b>	<b>Community Member %</b>	<b><math>X^2</math></b>
<b>Knowledge of WMA funding</b>					91.17
Hunting licenses and equipment	57.9	82.3	65.7	51.9	
Funds from state taxes	22.7	9.0	13.6	21.0	
Access permits or fees	15.3	6.3	16.3	22.2	
Other	4.1	2.5	4.4	4.9	

**Table 18**

*Means and standard deviations of likelihood of taking actions in the next 12 months to support WMA management for all survey groups. Superscripts with different letters indicate between-group differences in one-way ANOVA with a Bonferroni correction, and Tukey post-hoc tests of pairwise differences in means were significant at  $p < 0.05$ . Likelihood of taking action was measured on a 5-point scale (1=not at all likely, 2=somewhat likely, 3=neither unlikely nor likely, 4=somewhat likely, 5=very likely).*

Likelihood of taking action	Birdwatcher			Waterfowl Hunter			Angler			Community Member		
	Mean	SD	n	Mean	SD	n	Mean	SD	n	Mean	SD	n
Purchase a Michigan Waterfowl Stamp	2.94 <sup>a</sup>	1.56	1110	4.66 <sup>b</sup>	0.78	368	2.01 <sup>c</sup>	1.25	251	2.56 <sup>a</sup>	1.51	79
Purchase a Federal Migratory Bird Hunting and Conservation Stamp	2.71 <sup>a</sup>	1.57	1104	4.83 <sup>b</sup>	0.56	369	2.08 <sup>c</sup>	1.26	252	2.48 <sup>ac</sup>	1.54	79
Purchase a Migratory Songbird Conservation Stamp	3.72 <sup>a</sup>	1.36	1119	2.20 <sup>bc</sup>	1.26	362	2.12 <sup>c</sup>	1.23	252	2.56 <sup>b</sup>	1.47	80
Purchase a WMA access permit	3.29 <sup>a</sup>	1.31	1105	3.58 <sup>b</sup>	1.39	366	2.72 <sup>c</sup>	1.36	249	2.54 <sup>c</sup>	1.38	79
Donate money to WMA management	2.89 <sup>a</sup>	1.13	1117	3.15 <sup>b</sup>	1.24	366	2.41 <sup>c</sup>	1.18	249	2.29 <sup>c</sup>	1.16	77
Participate in WMA fundraising event	2.57 <sup>a</sup>	1.17	1107	3.34 <sup>b</sup>	1.18	364	2.40 <sup>a</sup>	1.23	250	2.27 <sup>a</sup>	1.28	79
Pay a small increase in Michigan State income tax	3.49 <sup>a</sup>	1.34	1124	2.50 <sup>b</sup>	1.44	367	2.38 <sup>b</sup>	1.41	251	2.44 <sup>b</sup>	1.47	81
Pay a small increase in Michigan gas taxes	2.94 <sup>a</sup>	1.50	1118	1.90 <sup>b</sup>	1.27	365	1.90 <sup>b</sup>	1.28	251	2.06 <sup>b</sup>	1.36	80

**Table 19**

*Regression coefficients and standard errors from multiple linear regression analyses predicting likelihood of taking four actions in the next 12 months to support WMA management. Likelihood of taking actions was measured on a 5-point scale (1=not at all likely, 2=somewhat likely, 3=neither unlikely nor likely, 4=somewhat likely, 5=very likely).*

	$\beta$ (SE)			
	Purchase Duck Stamp (N=1,357)	Purchase Songbird Stamp (N=1,354)	Contribute Directly to WMAs (N=1,359)	Pay increased Tax (N=1,360)
Gender	-0.31 (0.08)***	-0.39 (0.08)***	-0.17 (0.06)**	-0.03 (0.08)
Age	0.00 (0.00)	-0.00 (0.00)	0.00 (0.00)	0.00 (0.00)*
Education	-0.00 (0.04)	0.02 (0.04)	-0.02 (0.03)	0.19 (0.04)***
Community Size	-0.08 (0.03)**	-0.06 (0.03)*	-0.04 (0.02)*	-0.08 (0.03)**
Income	0.05 (0.02)**	0.03 (0.02)	0.01 (0.01)	0.00 (0.02)
Knowledge of WMAs	0.21 (0.10)*	0.04 (0.10)	0.25 (0.07)***	-0.05 (0.10)
Knowledge of WMA Funding	0.16 (0.08)*	-0.06 (0.08)	0.00 (0.05)	-0.10 (0.07)
Participation	0.02 (0.75)	0.23 (0.75)	0.31 (0.54)	0.69 (0.69)
Membership	0.15 (0.09)	0.20 (0.09)*	0.07 (0.06)	0.18 (0.08)*
Conservation Behaviors	0.22 (0.05)***	0.25 (0.05)***	0.35 (0.04)***	0.29 (0.05)***
ID-Birdwatcher	0.05 (0.03)	0.36 (0.03)***	0.05 (0.02)*	0.07 (0.03)*
ID-Waterfowl Hunter	0.63 (0.03)***	-0.08 (0.03)*	0.17 (0.02)***	-0.15 (0.03)***
ID-Angler	-0.05 (0.03)	-0.11 (0.03)***	-0.01 (0.02)	-0.14 (0.03)***
ID-Outdoor Enthusiast	-0.02 (0.03)	-0.02 (0.03)	0.00 (0.02)	-0.08 (0.03)**
ID-Conservationist	0.02 (0.04)	0.05 (0.04)	0.03 (0.03)	0.23 (0.04)***
$R^2$	0.35	0.30	0.22	0.25

\*\*\*p < .001, \*\*p < .01, \*p < .05. Cell entries are final unstandardized regression coefficients. Gender (male=1), participation (yes=1), membership (member=1), knowledge of WMAs (have knowledge=1), knowledge of WMA funding (correct knowledge=1).

**Table 20**

*Results of Chi-square and one-way ANOVA tests comparing five clusters of respondents based on their likelihood of taking actions to support WMA management. Categorical variables are reported as frequency (%) and continuous variables as mean values.*

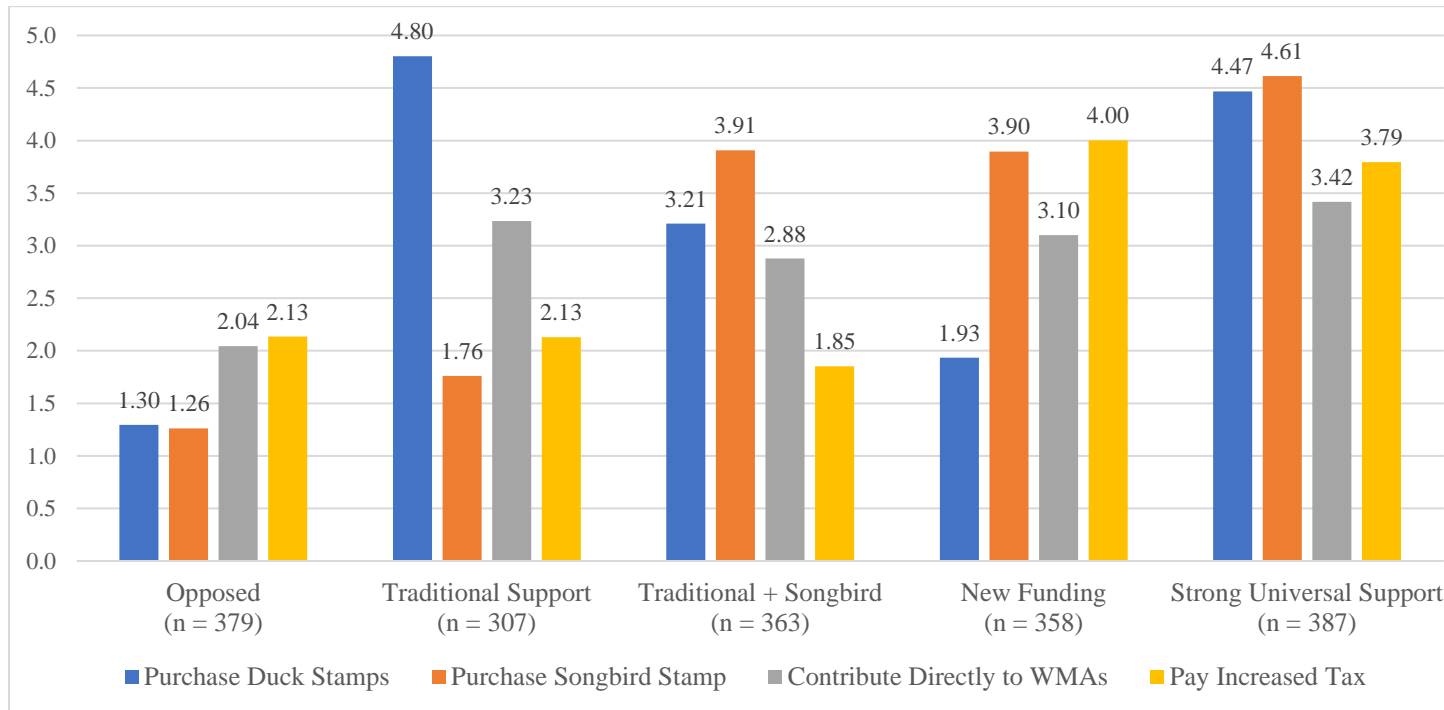
<b>Variable</b>	<b>Opposed</b>	<b>Traditional Support</b>	<b>Traditional + Songbird</b>	<b>New Funding</b>	<b>Strong Universal Support</b>
<b>Respondent characteristics</b>					
Gender (% Male)***	59.12	94.75	50.70	43.54	40.78
Age (year of birth)***	1964.66	1969.60	1963.73	1962.85	1963.75
Education (1–5 scale)***	3.73	3.62	3.89	4.31	4.20
Community Size (1–5 scale)***	3.29	3.48	3.23	3.19	3.05
Income (1–10 scale)***	3.93	4.66	4.11	4.36	4.32
<b>Contextual variables (%)</b>					
Knowledge of WMAs***	73.26	98.05	82.32	83.43	84.97
Knowledge of WMA Funding***	62.20	84.59	60.94	53.37	61.92
<b>Participation (%)*</b>	99.47	98.70	98.35	100.00	100.00
<b>Membership (%)***</b>	37.83	70.26	58.40	75.98	80.62
<b>Conservation Behavior (1–5 scale)***</b>	2.39	3.12	2.77	3.16	3.30
<b>Identity (1–5 scale)</b>					
Birdwatcher***	2.87	2.16	3.57	4.01	3.97
Waterfowl Hunter***	1.24	4.00	1.57	1.12	1.52
Angler***	2.46	3.57	2.22	1.69	1.98
Outdoor Enthusiast***	3.36	3.32	3.57	3.77	3.83
Conservationist***	3.43	3.99	3.73	4.28	4.32

\*\*\*p ≤ .001, \*\*p ≤ .01, \*p ≤ .05.

## Figures

**Figure 5**

*Mean likelihood to contribute to WMA funding by cluster (mean). Likelihood of taking actions was measured on a 5-point scale (1=not at all likely, 2=somewhat likely, 3=neither unlikely nor likely, 4=somewhat likely, 5=very likely).*



## **Chapter 6: Conclusion and Recommendations**

The primary goal of my dissertation research was to explore stakeholder support for and stewardship potential of WMAs. A secondary goal was to provide pragmatic recommendations to federal and SWAs to achieve sustainable wildlife conservation through broader political and financial support for WMAs. The specific objectives of this study were to 1) assess stakeholder attitudes about and preferences for management objectives and actions at WMAs; 2) investigate stakeholder perceptions of ES and their attitudes about ES resulting from WMAs; 3) explore key variables that influence conservation behaviors; 4) explore support for a diversity of funding options among WMA stakeholders; and 5) suggest recommendations for federal and SWAs to facilitate stewardship opportunities to build support for wildlife conservation on WMAs. My research was novel in the focus on coastal WMAs (i.e., local scale), including examining key WMA stakeholder groups and wildlife habitat and recreation management actions on these areas. Using this approach, I was able to make targeted recommendations to agencies, especially the MDNR, to aid policy makers and practitioners in identifying, developing, and implementing actions to increase stakeholder support for and stewardship of coastal WMAs as well as increasing relevancy to the public. Below, I summarize the key findings, contributions, and recommendations for each chapter of my dissertation, present overarching themes and key recommendations and best practices, and end with suggestions for future research.

In Chapter 2, I compared key stakeholders' (waterfowl hunters, birdwatchers, anglers, and community members) attitudes and preferences for WMA management to inform management strategies that will complement a diversity of recreation. My findings suggest that there are important differences among WMA stakeholders, especially waterfowl hunters and birdwatchers, in their attitudes and preferences for wildlife and recreation management.

Waterfowl hunters tended to place more importance on game species management and recreation management for hunting than birdwatchers and may be resistant to changes in the direction of management objectives. Birdwatchers indicated a desire for more non-hunting recreation opportunities and access to WMAs. However, birdwatchers and waterfowl hunters were similar in that both placed high importance on wildlife management objectives (e.g., habitat for nesting and migrating waterfowl, areas of no disturbance for waterfowl, managing wetlands for a diversity of wildlife species, and protecting wetlands), were more specialized and committed in their recreation, held strong personal identities with their recreation, and were more apt to belong to environmental/conservation organizations than the other stakeholder groups. These attitudinal similarities and differences have implications for agencies to understand how management actions may or may not be supported by stakeholders, identify potential points of conflict or points of complementariness for recreational activities, consider trade-offs for management actions, and make improved decisions that serve a broader set of stakeholders. I provided recommendations that agencies leverage the commonalities among stakeholders to build common ground, facilitate positive interactions between stakeholders, and to pursue a complementary non-conflict approach to provide a diversity of recreational opportunities.

I found that coastal WMA stakeholders largely valued the importance of ES, with cultural and provisioning ES highest in importance, however there were differences between stakeholder groups (Chapter 3). Most respondents indicated that WMAs were providing key ES, especially public access to nature; abundant wildlife, fish, and plants; and non-consumptive recreation opportunities. I recommended that agencies leverage this information and link their management actions to the societal benefits that are most important to their stakeholders. These findings contribute to policy and practice if agencies use a suite of ES to evaluate trade-offs of multiple

management options and make improved decisions that result in maximized human well-being benefits, support of WMAs, and improved relevancy while still meeting wildlife and recreation goals. I also provided recommendations for agencies to implement communication, outreach, and marketing strategies that educate the public about the ES benefits that result from WMAs (especially those most important to stakeholders) and provide local examples that link multiple ES. The increased understanding of the ES that are most important to WMA stakeholders also has implications for improved local community planning efforts that result in increased quality of life for citizens and visitors. More broadly, my results contribute to the theoretical understanding of the perceived social values of ES.

Chapter 4 indicated that recreation participation and certain identities were important predictors of conservation behavior, making important contributions to the conceptualization of conservation behaviors and PEB in general. I provided suggestions for agencies to prioritize communications, engagement, and stewardship opportunities with members of existing organizations because membership in an environmental/conservation organization was associated with increased frequency of conservation behavior. Engagement with existing environmental/conservation organizations may also help to strengthen group norms and increase conservation behaviors. Strength of identity as a conservationist had a strong positive relationship with frequency of conservation behavior. If WMA stakeholders associate conservation behaviors with a conservationist identity that they hold, they will likely internalize an obligation to behave a certain way and seek out opportunities that support conservation, further affirming and strengthening their identity (Fielding et al., 2008; Landon et al., 2018). Therefore, I offered recommendations related to communication (e.g., framing desired behaviors as conservationist behavior) and engagement strategies that appeal to this identity and facilitate



positive relationships between hunting and non-hunting stakeholders that identify similarly as conservationists. Additionally, identity can be strengthened through group norms (Fielding et al., 2008; Lute & Gore, 2014; Schroeder et al., 2021). Therefore, agencies could facilitate opportunities (e.g., volunteer activities, mentoring programs) for stakeholders with a shared conservationist identity to socially connect and build and foster group identity that builds norms including conservation behaviors and potentially increased WMA stewardship.

My exploration of WMA stakeholder support for funding mechanisms largely indicated support for a broader suite of funding policies for WMAs, although stakeholder groups differed in their support (Chapter 5). Key variables that influenced support for WMA funding options were frequency of conservation behavior; identity salience as a birdwatcher, waterfowl hunter, and conservationist; and membership in an environmental/conservation organization. My findings contribute to the increased understanding of public support for wildlife conservation funding and the important concepts related to support. The typology of stakeholders presented in Chapter 5 is based on support for WMA funding options and has direct implications for SWAs in making predictions about how different options might appeal to certain groups, making decisions about which funding mechanisms to pursue, and informing communication and marketing strategies that are tailored to the groups of interest. I recommended that agencies seek to develop a diversified portfolio of traditional and new funding mechanisms that could be supported by a wide range of stakeholders. I suggested that future research compares the scale, feasibility, and sustainability of a diversity of funding mechanisms to ensure that current and projected funding needs are met.

Membership in an environmental/conservation organization stood out as an important variable across chapters and informed specific recommendations that agencies engage with

existing organizations to potentially increase support for coastal WMAs. Membership in an environmental/conservation organization was an important predictor of both conservation behavior and support for several WMA funding options. Membership and participation in an organization may play a part in strengthening conservation-related identities, building social bonding, and strengthening norms related to conservation. Group norms may be communicated through messages delivered from the organizations about conservation and that encourage actions that protect or conserve the environment (Fielding et al., 2008). By using targeted communication, outreach, and engagement to existing organizations, agencies may be able to secure local champions for increased support of WMAs. For example, recreational, volunteer, and other stewardship opportunities could be developed and marketed to existing members of local and regional conservation organizations. Fostering strategic partnerships with existing organizations may also be fruitful for agencies to build positive relationships. One example that has been successful in building support for NWRs is the establishment of ‘Friend Groups’ made up of volunteers. SWAs could consider a similar strategy to build ‘Friend Groups’ to build relationships with stakeholders and the local community, build trust with stakeholders, increase financial contributions, coordinate volunteer efforts to assist management, and increase advocacy (Jenson, 2003; Payton et al., 2005). These groups may also be particularly valuable in building relationships with and between a diversity of hunting and non-hunting stakeholders.

Agency efforts to increase visitation and use of WMAs as discussed in Chapter 2 may be effective for several reasons. My results and others have shown that visitation (e.g., to WMAs and to wetlands) has been associated with increased concern over losing ES and increased conservation behavior (Wilkins et al., 2019). When individuals invest their time and effort into visiting and recreating at a WMA and have positive experiences there, it can result in increased

concern for the place and its resources. Subsequently, this can lead to increased support for that area to sustain the resources important to their recreational activity. Agency efforts to increase use of WMAs may not only lead to increased support of local WMAs, but also support for wildlife conservation and the ES provided at a larger scale (e.g., regional or national policies). Agencies could therefore seek strategies to promote WMAs and the recreational opportunities available. The challenge will be diversifying and increasing these opportunities while minimizing negative interactions between different users and minimizing ecological harm to wildlife and wildlife habitats. Because I found support across all respondents for purchase of a WMA access permit, increased visitation and use of WMAs may also provide one potential funding mechanism that partially addresses the need for diversified funding for WMA management.

My research findings suggest that birdwatchers hold great potential for increased support of WMAs because of their high levels of commitment to birding, strong identification as birdwatchers and conservationists, high value placed on WMA wildlife management objectives, and their knowledge and use of these coastal WMAs. In addition, I found that birdwatchers are largely willing and interested in contributing financially to WMA management and supporting a variety of funding mechanisms, however not necessarily in current or traditional ways. For example, this group indicated strong support for purchasing a songbird conservation stamp (which doesn't currently exist) and may present a new funding source that birdwatchers would contribute to. Conversely, birdwatchers were not very likely to purchase duck stamps and current efforts to market these wetland conservation stamps to birdwatchers may not be effective (Shipley et al., 2019). The typology I presented in Chapter 5 indicated that the 'new funding' and 'strong universal support' groups had strong identities as birdwatchers, further suggesting

that engagement with birdwatchers may lead to increased policy and funding support for WMAs. Some strategies, such as birding tours, open houses, and partnerships with birding groups on WMA projects are likely easy to implement because these areas are already popular destinations for birdwatching.

My results suggest that broadening support for WMAs is a complex issue and that there is not a ‘silver bullet’ or easy quick solution. Furthermore, strategies that might work for one set of stakeholders may not work for others because stakeholders are not a homogenous group. An integrated and adaptive approach is needed such as targeted communication, outreach, and engagement and a diversified portfolio of traditional and novel funding mechanisms that are supported by a range of stakeholders. Potentially a significant challenge facing agencies is balancing the engagement with a broader set of stakeholders with continued engagement with hunters. My results suggest that waterfowl hunters prefer the status quo in recreation management on WMAs and there is precedent for distrust and backlash from hunters (Manfredo et al., 2018). With declining hunting participation, they may perceive that they are on a trajectory to lose power and influence over wildlife management. Compounding this is the uncertainty of what management expectations a broader set of supporters may have in return for their contributions. Agencies should be aware of potential effects of being more inclusive and of actions that could unintentionally alienate or even polarize hunters while outreaching to non-hunting recreationists such as birdwatchers. It will take innovative and thoughtful strategies to shift hunters’ mindset to collaboration and illustrate how sharing power will benefit them through long-term sustainable funding for wildlife management. Targeted outreach and engagement that provide sound explanation and need for increased and diverse WMA funding may be one effective strategy to address this challenge.

An important consideration for agencies striving to diversify their stakeholders is the commonalities that stakeholder groups have, especially waterfowl hunters and birdwatchers. Leveraging this common ground (e.g., value of WMA wildlife management objectives, perceived values of ES, and strong identification as conservationists) through communication, outreach, and engagement may be an effective approach to facilitating new engagement among stakeholders. Agencies may find success in building support and increasing relevancy for coastal WMAs by framing messages to focus on common perspectives (e.g., importance of waterfowl habitat management, management for a diversity of wildlife species, and protecting wetlands) and that appeal to both waterfowl hunters and birdwatchers. Because waterfowl hunters and birdwatchers both identified strongly as conservationists, another strategy is to build positive relationships between these two groups by facilitating social opportunities that bring hunting and non-hunting stakeholders together with a focus on conservation efforts (e.g., wildlife habitat projects). In this way, group norms can be strengthened related to conservation and conceivably lead to WMA stewardship. In addition, agencies should avoid a win-lose mindset when engaging with hunting and non-hunting stakeholders about increasing and diversifying recreation and seek management options that are compatible or complementary. Shifting the framing of multi-use recreation management in this way (i.e., expanding the pie for everyone instead of competing for pieces of the existing pie) may be a viable way to realize outcomes for diverse political and financial support for WMAs.

The challenges of achieving broad and sustainable support for wildlife conservation may seem daunting for federal and SWAs to tackle alone. It is likely that agencies will need assistance with engagement with current and new stakeholders. Partners, such as local community partners, NGOs, or public health agencies (to communicate linkages between WMA

management and human well-being) may have more trust built with stakeholders that agencies have traditionally had little engagement with. Additionally, if hunters distrust agencies' intentions to broaden and diversify stakeholders, it may be beneficial for non-agency partners (e.g., hunting industry partners, conservation NGO partners, and local/regional conservation organizations) to facilitate outreach and engagement between hunters and agency personnel.

A suggestion for future research to inform stakeholder support for and potential stewardship of coastal WMAs is to measure place attachment. Place attachment, or the “emotional, cognitive, and functional bond with a place” (Halpenny, 2010:409), could be explored as a potential antecedent to WMA support. Others have found that place attachment influences stewardship potential at a place as well as PEB specific to a place (Stedman, 2002; Walker & Chapman, 2003; Halpenny, 2010; Larson et al., 2018). Therefore, exploring place attachment and its relationship to knowledge and use of WMAs and its influence on conservation behaviors and support for funding policies may be especially important for examining stewardship potential at a local WMA scale.

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## APPENDIX A: SPRING AND SUMMER 2018 COASTAL WILDLIFE MANAGEMENT AREA VISITOR USE SURVEY PRELIMINARY RESULTS

(A Preliminary Report of Phase I of Project: A Stakeholder-Engaged Framework for Great Lakes Coastal Wildlife Management Areas for Waterfowl Hunting, Bird Watching, and Community Development)

**Figure 6**

*Photos of Spring and Summer 2018 Visitor Use Surveys at: a) Harsens Island, b) Harsens Island, c) Shiawassee River, and d) Fish Point.*



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### **Visitor Use Survey Objectives:**

Phase I of the research project titled “A Stakeholder-Engaged Framework for Great Lakes Coastal Wildlife Management Areas for Waterfowl Hunting, Bird Watching, and Community Development” includes preliminary on-site recreational use surveys. These surveys are being conducted during spring, summer, and fall 2018 at six coastal wildlife management areas (WMAs) to explore the relative amount and type of recreation occurring at each site. This preliminary step is important to identify key recreational users of the WMAs and to inform survey questionnaires that will be developed for each of the five stakeholder groups (waterfowl hunters, bird watchers, other key recreational users, local community leaders, and local community residents) during Phase II of the research. The objectives of the preliminary visitor surveys are to:

- Determine the scope of recreation occurring on WMAs
- Understand and characterize visits and visitors of WMAs during spring, summer, and fall
- Determine economic impacts of visitor uses of WMAs

### **Methods Review:**

Surveys take place at six state and federally owned and managed aquatic-based coastal wetland sites from Lake Huron’s Saginaw Bay to western Lake Erie. Michigan Department of Natural Resources (MDNR) lands include five managed waterfowl hunting areas: Nayanquing Point State Wildlife Area (SWA), Fish Point SWA, Shiawassee River State Game Area (SGA), St. Clair Flats SWA-Harsens Island Unit, and Pointe Mouillee SGA. U.S. Fish and Wildlife Service (USFWS) lands will include the Shiawassee National Wildlife Refuge.

The visitor use survey design and methodology is largely based on the USGS National Wildlife Refuge Visitor Survey (Sexton et al. 2012). WMA managers were interviewed to identify potential survey periods in each of three seasons (spring, summer, and fall) that best represented the visitation patterns and diversity of use on the WMA. These manager-selected time frames were used to develop a calendar of sampling periods for each WMA. A stratified design with strata by season (spring, summer, fall), WMA, and day of week (weekend day or weekday) is used for improved precision, benefits to scheduling survey teams, and estimates that can be calculated by strata. Seven weeks per season were selected based on the input from WMA managers. The seven-week sampling period per season allows for each WMA to be surveyed two weekdays and two weekend days per period. Surveys conducted on weekdays alternate by sampling week between Monday/Wednesday and Tuesday/Thursday to improve representativeness and for ease of scheduling survey teams. Simple random sampling is used to select the days (two weekdays and two weekend days) each WMA is surveyed within the WMA manager selected time frames. Survey back up dates are scheduled as close to the randomly selected survey date as possible to replace selected survey dates in cases of inclement weather or other unforeseen events that prohibit the visitor use survey from taking place. Visitors are intercepted by a survey team as they are leaving the WMA, and surveys are administered using tablets equipped with Qualtrics survey software. One member of the survey team is responsible



for tallying the total number of visitors leaving the sampling site. On the selected days, surveys are conducted in two sampling shifts 3 hours long; one in the morning (8:00–11:00) and the other in the afternoon (1:00–4:00). Survey teams attempt to conduct 20 surveys per area per day sampled (10 in the morning shift and 10 in the afternoon shift), for a total of 80 surveys per season per area. All seasons combined, this would provide a total of 240 surveys per WMA.

In addition to sampling periods, WMA managers were also asked to identify all potential locations for surveys. Simple random sampling is used to select locations for visitor use surveys on each selected day. Because of low visitation rates during spring and summer 2018, all survey locations at each area were used for sampling. A small token of appreciation for completing the survey is offered at the conclusion of the survey.

The survey instrument is a brief questionnaire of approximately 20 questions asking about the participant's visit to the WMA, trip expenditures, demographics, and the potential for future visits. Questions were pre-tested by three MSU graduate students and seven MDNR Wildlife Division professionals for validity. The visitor use survey was approved by MSU IRB (STUDY00000435) prior to conducting surveys.

This preliminary report includes summary statistics for survey participation, trip and visitor characteristics, primary recreational activities, social media use and provision of emails, residence, and demographics. A summary of two open-ended questions is also included. A final report including statistical analysis will be made available after the conclusion of the fall surveys. The trip expenditure data from the surveys will be used for an economic impact analysis and will be included in a future report.

## **Preliminary Results:**

### ***Survey Participation***

Spring surveys began March 26, 2018 and ran through May 27, 2018. A total of 225 surveys were conducted at all six WMAs (Table 21), with 122 weekday surveys and 103 weekend surveys. Summer surveys began June 11, 2018 and ran through August 19, 2018. A total of 193 surveys were conducted during the summer (Table 22), with 67 weekday surveys and 126 weekend surveys. The total number of surveys differed by area during both seasons and ranged from 15 to 69 during spring, with Shiawassee River SGA having the least number of surveys and Pte. Mouillee having the greatest number of surveys. During summer, the total number of surveys ranged from 21 to 57, with Fish Point having the least number of surveys and Pte. Mouillee having the greatest number of surveys. The percentage of visitors surveyed ranged from 24–42% during spring and 16–37% during summer. Survey teams only approached visitors that parked and exited their vehicle. Teams noted that it is common for people drive through parking lots or down roads on the WMAs but don't actually stop and get out. Teams attempted to count all of these vehicles as total visitors on the area, and felt generally confident that most visitors were accounted for because all survey locations were visited at each area each day. All survey locations were visited because of the small number of visitors encountered during the spring and summer. Overall, the visitor use of WMAs during spring and summer 2018 was very low and teams had difficulty finding visitors. Only one survey date achieved the goal of 20

surveys, and eleven survey dates had less than four surveys during spring and summer. The cold early spring weather could have contributed to reduced visitation at the WMAs during that period.

### ***Trip and Visitor Characteristics***

For the spring surveys, visitors reported spending an average of 2.47 hours at WMAs per trip, ranging from a low of 1.68 hours at Nayanquing Point to a high of 4.91 hours at Harsens Island. Most respondents (80%) were returning visitors that had been to the WMA in the last 12 months. This ranged from a low of 58% at Shiawassee NWR to a high of 95% at Harsens Island. The average number of days visited in the last 12 months for these returning visitors ranged from 26 (Fish Point) to 79 (Harsens Island). The higher number at Harsens Island is likely because a small number of respondents reported coming to the area nearly daily because they lived nearby and walked their dog daily on the WMA. For the summer surveys, visitors reported spending an average of 2.28 hours at WMAs per trip, ranging from a low of 1.14 hours at Fish Point to a high of 3.39 hours at Harsens Island. Most respondents (74%) were returning visitors that had been to the WMA in the last 12 months. This ranged from a low of 60% at Shiawassee NWR to a high of 86% at Shiawassee River SGA. The average number of days visited in the last 12 months for these returning visitors ranged from 14 (Nayanquing Point) to 52 (Shiawassee River SGA).

Survey participants were also asked about how many total outdoor recreation trips they've taken in the last 12 months at least one mile from their home. Spring survey responses ranged from an average of 59.74 (Fish Point) to 95.64 (Harsens Island), and summer survey responses ranged from 56.09 (Harsens Island) to 74.56 (Shiawassee River SGA).

### ***Primary Recreational Activity***

Early spring fishing seems to be an important activity with nearly 62% of spring survey participants responding that fishing was their primary activity (Table 23). This was followed by bird watching (12.5%), hiking/walking (9.8%), and wildlife observation (4.0%). Other activities noted by spring respondents included photography, paddling sports, dog training, biking, and mushrooming. The trends in primary activities were quite similar across the state-owned and managed WMAs in the spring, with fishing being the most frequent use across all areas but one (Table 24). Hiking/walking was the most prevalent use at Shiawassee NWR, with only three respondents reporting fishing as their primary activity (bird watching, wildlife observation, and photography were all more prevalent than fishing). Surprisingly, despite the WMAs being known as important spring birding destinations, survey teams encountered few bird watchers.

Although it was not as prominent as it was in the spring, fishing was the most frequent primary activity reported during the summer (45%) (Table 25). This was followed by wildlife observation (14.1%), bird watching (12.4 %), and hiking/walking (9.7%). Other activities noted by summer respondents included paddling sports, motorized boating, biking, photography, dog training, auto tour route, a special event, and other. The trends in primary activities were quite similar across the state-owned and managed WMAs in the summer, with fishing being the most frequent use across all areas but two (Table 26). Wildlife observation was more prevalent than fishing at Nayanquing point and bird watching was more prevalent than fishing at Shiawassee NWR.

Shiawassee NWR is the only WMA with an auto tour route. Surprisingly there was only one response that the auto tour was the primary activity, however 20 respondents reported the auto tour route as a secondary activity.

### ***Social Media Use and Emails***

Visitors were asked about their social media use. Spring respondents reported using Facebook most (58%), followed by Instagram (20%), Snapchat (17%), and Twitter (12%). Thirty-one percent reported that they did not use social media. Summer respondents showed very similar trends in social media use with Facebook being the most prominent (64%), followed by Instagram (23%), Snapchat (13%), and Twitter (11%). Thirty-one percent of summer respondents reported that they did not use social media. We also asked participants about their use of eBird because we have an interest in using eBird to draw a sample of bird watchers. During spring, of the 28 participants that reported bird watching as their primary activity, 50% of them reported using eBird. During summer, 43% of the 23 participants that reported bird watching as their primary activity also reported using eBird.

Respondents were asked to provide an email address for a potential follow-up survey regarding their recreational use of the WMA. In the spring, the percentage of respondents that provided an email address ranged from 43% (Harsens Island) to 75% (Shiawassee NWR) (Table 21), with a total of 131 participants providing an email address. For summer surveys, the percentage of respondents that provided an email address ranged from 51.92% (Pointe Mouillee) to 69.7% (Shiawassee NWR), with a total of 115 participants providing an email address.

### ***Demographics***

Table 27 (spring) and Table 28 (summer) summarize the demographics of survey respondents. The average year of birth for respondents was 1969 for spring surveys and 1968 for summer surveys. Males made up the majority of respondents during spring (85.3%) and summer (75.7%) surveys. 14.7% (spring) and 24.3% (summer) of respondents were female. 48.4% (spring) and 51.1% (summer) respondents reported completing a college degree, technical school degree, graduate degree, or professional school degree; 49.3% (spring) and 47.3% (summer) respondents reported completing a high school degree; and 2.2% (spring) and 1.7% (summer) reported completing elementary or middle school. Participants were asked about their race and ethnicity and most were White for both the spring (82.2%) and summer (84.8%) surveys. Spring survey participants also included 7.6% Black/African American, 2.2% American Indian, 2.2% Multiracial, and 1.8% Hispanic/Latino. 3.6% of spring participants either refused to answer the race and ethnicity question or didn't know. Summer survey participants also included 6.5% Black/African American, 3.3% Multiracial, 1.6% Hispanic/Latino, and 0.5% American Indian. 3.3% of summer participants either refused to answer the race and ethnicity question or didn't know. Participants were also asked if their household income in the last year before taxes and other deductions was above or below \$57,000, the mean for U.S. households in 2016 (Guzman 2017). 53.3% (spring) and 51.4% (summer) reported that their income was >\$57,000, and 41.8% (spring) and 43.2% (summer) reported that it was <\$57,000. 4.9% (spring) and 5.4% (summer) either refused to answer this question or didn't know.

## ***Residence***

Visitors were asked if they reside within 50 miles of the WMA to determine if they were a local resident or not. The percentage of spring respondents that lived within 50 miles are as follows: 61% at Shiawassee NWR, 68% at Nayanquing Point, 78% at Harsens Island, 82% at Fish Point, 85% at Pointe Mouillee, and 87% at Shiawassee River SGA. The percentage of summer respondents that lived within 50 miles are as follows: 42% at Shiawassee NWR, 62% at Nayanquing Point, 64% at Harsens Island, 67% at Fish Point, 87% at Pointe Mouillee, and 96% at Shiawassee River SGA. Visitors were also asked for the zip code of their residence. Figures 6–11 display the zip codes of residence for spring and summer survey participants for each WMA.

## ***Open-Ended Questions***

Participants were asked two open-ended questions about what the MDNR or USFWS could do to improve their visits and what they loved most about the area they were visiting. Responses were grouped into categories and are summarized in Tables 29 and 30 (spring) and 31 and 32 (summer). The most frequent categories for improving visits during spring for all areas combined were clean up garbage/provide garbage cans (41 responses), provide more or better access to area (24 responses), improve or install toilets (21 responses), improve or maintain roads (9 responses), improve or increase trails (7 responses), improve signage or provide more information (7 responses), improve or increase parking (7 responses), and provide benches/tables (7 responses). The most frequent categories for improving visits during summer surveys were provide more or better access to the area (40 responses), improve or install toilets (16 responses), clean up garbage/provide garbage cans (13 responses), improve or maintain roads (12 responses), and improve signage or provide more information (8 responses).

Survey participants reported what they loved most about the area they were visiting and responses were similar for both spring and summer survey periods. The most frequent responses for all areas combined (for spring and summer, respectively) were quiet/peaceful/relaxing (86, 66), wildlife/nature/being outdoors (67, 50), hunting/fishing opportunities (47, 37), location/access (25, 34), and bird watching opportunities (18, 16).

## **Discussion:**

Overall, results indicated that there were few visitors to the WMAs during the spring and summer surveys. On only one day was the desired number of surveys met, and on all other survey dates, survey teams had to visit all of the survey locations on a WMA to find visitors.

Fishing was the predominant recreational activity during both the spring and summer and the survey team noted that if it weren't for early spring fishing, it would have been difficult to find any visitors on certain survey dates. Only 12–13% of visitors reported that birdwatching was their primary recreational activity. This was surprising as three of the six WMAs (Pte. Mouillee SGA, Shiawassee NWR, and Nayanquing Point SWA) are recognized as several of the top birding areas in Michigan (White, 2016). The WMAs were similar in the predominant types of recreational activities that visitors reported with the exception of Shiawassee NWR and Nayanquing Point (during summer). After fall surveys are completed, I plan to test for

differences between WMAs. The spring and summer visitor use surveys were informative in the types of recreation occurring at the WMAs and will help identify the key recreational users for future stakeholder surveys. For example, based on the spring and summer survey efforts, anglers would be an important stakeholder group to consider.

When visitors were asked what the MDNR could do to improve their visit to state owned WMAs, several response categories included a desire for amenities that would typically be found in a park or recreation area (e.g., improving or installing toilets, providing tables and benches, and improving access for non-hunting recreation). This suggests that there may be a lack of understanding by visitors of the funding mechanism and management objectives of state game and wildlife areas (i.e., Pittman-Robertson funds from hunters are used to purchase many state game and wildlife areas and are managed primarily to provide wildlife habitat and hunting opportunities).

The spring and summer surveys will provide an interesting contrast to the upcoming fall surveys in the types of recreation occurring. Hunting and trapping activities begin in September and it is expected that use will increase during the fall season.

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## Tables

**Table 21**

*Summary of spring 2018 Coastal WMA Visitor Use Surveys.*

	<b>Fish Pt.</b>	<b>Harsens Island</b>	<b>Nayanquing Pt.</b>	<b>Pte. Mouillee</b>	<b>Shiawassee River</b>	<b>Shiawassee NWR</b>
<b># surveys completed</b> (weekday/weekend)	38 (23/15)	37 (17/20)	31 (14/17)	69 (41/28)	15 (7/8)	37 (21/16)
<b>% visitors surveyed</b>	29.46	42.53	24.22	24.29	25.00	28.35
<b>Ave. hours spent at WMA</b>	2.78	4.91	1.68	2.78	2.72	1.94
<b>% returning visitors</b>	65.79	94.59	80.65	88.24	86.67	58.33
<b>Ave. # days visited in the last 12 months</b>	26.33	79.50	39.92	30.55	55.85	30.43
<b>% providing email addresses</b>	68.42	43.24	58.06	54.41	46.67	75.00

**Table 22**

*Summary of summer 2018 Coastal WMA Visitor Use Surveys.*

	<b>Fish Pt.</b>	<b>Harsens Island</b>	<b>Nayanquing Pt.</b>	<b>Pte. Mouillee</b>	<b>Shiawassee River</b>	<b>Shiawassee NWR</b>
<b># surveys completed</b> (weekday/weekend)	21 (5/16)	23 (8/15)	34 (12/22)	57 (21/36)	24 (5/19)	34 (16/18)
<b>% visitors surveyed</b>	35.0	31.08	28.33	37.01	29.63	16.83
<b>Ave. hours spent at WMA</b>	1.14	3.39	1.79	2.64	2.48	2.21
<b>% returning visitors</b>	66.67	86.36	64.71	80.77	86.96	60.61
<b>Ave. # days visited in the last 12 months</b>	35.21	38.58	14.32	31.21	52.05	16.55
<b>% providing email addresses</b>	66.67	59.09	67.65	51.92	65.22	69.70



**Table 23**

*Primary recreational activities reported by Coastal WMA Visitor Use Survey respondents during spring 2018, across all WMAs.*

<b>Primary Activity</b>	<b># Responses</b>	<b>% of Responses</b>
Fishing	138	61.60
Bird Watching	28	12.50
Hiking/Walking	22	9.80
Wildlife Observation	9	4.00
Photography	8	3.60
Other	7	3.10
Paddling Sports	6	2.70
Dog Training	4	1.80
Biking	1	0.40
Mushrooming	1	0.40

**Table 24**

*Primary recreational activities reported by Coastal WMA Visitor Use Survey respondents during spring 2018, by individual WMA.*

<b>Primary Activity (# responses)</b>	<b>Fish Pt.</b>	<b>Harsens Island</b>	<b>Nayanquing Pt.</b>	<b>Pte. Mouillee</b>	<b>Shiawassee River</b>	<b>Shiawassee NWR</b>
Fishing	29	28	12	55	11	3
Bird Watching	6	1	11	3	0	7
Hiking/Walking	1	4	2	3	0	12
Wildlife Observation	1	0	3	0	0	5
Photography	1	0	0	2	0	5
Other	0	2	0	2	0	3
Paddling Sports	0	1	1	1	4	0
Dog Training	0	1	1	2	0	0
Biking	0	0	0	0	0	1
Mushrooming	0	0	1	0	0	0

**Table 25**

*Primary recreational activities reported by Coastal WMA Visitor Use Survey respondents during summer 2018, across all WMAs.*

<b>Primary Activity</b>	<b># Responses</b>	<b>% of Responses</b>
Fishing	84	45.41
Wildlife Observation	26	14.05
Bird Watching	23	12.43
Hiking/Walking	18	9.73
Paddling Sports	8	4.32
Motorized Boating	6	3.24
Other	6	3.24
Photography	5	2.70
Biking	5	2.70
Dog Training	2	1.08
Auto Tour Route	1	0.54
Special Event	1	0.54

**Table 26**

*Primary recreational activities reported by Coastal WMA Visitor Use Survey respondents during summer 2018, by individual WMA.*

<b>Primary Activity (# responses)</b>	<b>Fish Pt.</b>	<b>Harsens Island</b>	<b>Nayanquing Pt.</b>	<b>Pte. Mouillee</b>	<b>Shiawassee River</b>	<b>Shiawassee NWR</b>
Fishing	6	20	9	29	15	5
Bird Watching	3	0	8	2	0	10
Hiking/Walking	2	1	3	6	1	5
Wildlife Observation	4	0	10	2	1	9
Photography	1	0	0	1	1	2
Other	2	0	2	1	1	0
Paddling Sports	0	1	1	5	1	0
Dog Training	1	0	0	0	1	0
Biking	2	0	0	2	0	1
Auto Tour Route	0	0	0	0	0	1
Motorized Boating	0	0	0	4	2	0
Special Event	0	0	1	0	0	0

**Table 27***Demographics of spring 2018 Visitor Use Survey respondents.*

	<b>Fish Pt.</b>	<b>Harsens Island</b>	<b>Nayanquing Pt.</b>	<b>Pte. Mouillee</b>	<b>Shiawassee River</b>	<b>Shiawassee NWR</b>	<b>All Areas</b>
Average Year of Birth	1961	1967	1968	1971	1977	1971	1969
% Female	13.16 (5)	8.11 (3)	12.9 (4)	14.71 (10)	13.33 (2)	25 (9)	14.67 (33)
% Male	86.84 (33)	91.89 (34)	87.1 (27)	85.29 (58)	86.67 (13)	75 (27)	85.33 (192)
% Elementary Grads	2.63	0.00	6.45	0.00	0.00	2.78	2.22
% High School Grads	68.42	58.33	25.81	54.41	40.00	41.67	49.33
% College/Technical School Grads	15.89	33.33	54.84	3.24	53.33	47.22	39.11
% Graduate/Professional School Grads	13.16	8.33	12.90	7.35	6.67	8.33	9.33
% White, non Hispanic	94.73 (36)	75.68 (28)	83.87 (26)	75 (51)	86.67 (13)	86.11 (31)	82.22 (185)
% Hispanic/Latino/Spanish	2.63 (1)	0 (0)	0 (0)	4.41 (3)	0 (0)	0 (0)	1.78 (4)
% Black/African American	0 (0)	21.63 (8)	0 (0)	10.29 (7)	0 (0)	5.56 (2)	7.56 (17)
% American Indian	0 (0)	0 (0)	0 (0)	4.41 (3)	13.33 (2)	0 (0)	2.22 (5)
% American/Pacific Islander	2.63 (1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.44 (1)
% Multiracial	0 (0)	0 (0)	6.45 (2)	1.47 (1)	0 (0)	5.56 (2)	2.22 (5)
% Didn't Know/Refused to Answer	0 (0)	2.70 (1)	9.68 (3)	4.41 (3)	0 (0)	2.78 (1)	3.56 (8)
% > \$57,000 Household Income	42.11	56.76	48.49	61.77	46.67	52.78	53.33
% < \$57,000 Household Income	55.26	40.54	38.71	33.82	53.33	41.67	41.78
% Didn't Know/Refused to Answer	2.63	2.70	12.90	4.41	0.00	5.56	4.89

**Table 28***Demographics of summer 2018 Visitor Use Survey respondents.*

	<b>Fish Pt.</b>	<b>Harsens Island</b>	<b>Nayanquing Pt.</b>	<b>Pte. Mouillee</b>	<b>Shiawassee River</b>	<b>Shiawassee NWR</b>	<b>All Areas</b>
Average Year of Birth	1967	1967	1965	1968	1975	1966	1968
% Female	28.57 (6)	31.82 (7)	26.47 (9)	17.31 (9)	17.39 (4)	30.30 (10)	24.32 (45)
% Male	71.43 (15)	68.18(15)	73.53 (25)	82.69 (43)	82.61 (19)	69.70 (23)	75.68 (140)
% Elementary Grads	0	0	0	2.04	4.35	3.03	1.65
% High School Grads	66.67	63.64	44.12	51.02	43.48	24.24	47.25
% College/Technical School Grads	28.57	36.36	41.18	34.69	43.48	48.49	39.01
% Graduate/Professional School Grads	4.76	0	14.70	12.25	8.69	24.24	12.09
% White, non Hispanic	95.24 (20)	54.54 (12)	94.12 (32)	80.39 (41)	95.65 (22)	87.88 (29)	84.78 (156)
% Hispanic/Latino/Spanish	0 (0)	0 (0)	0 (0)	1.97 (1)	4.35 (1)	3.03 (1)	1.63 (3)
% Black/African American	0 (0)	31.82 (7)	0 (0)	9.80 (5)	0 (0)	0 (0)	6.52 (12)
% American Indian	0 (0)	0 (0)	2.94 (1)	0 (0)	0 (0)	0 (0)	0.54 (1)
% American/Pacific Islander	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (1)
% Multiracial	0 (0)	13.64 (3)	0 (0)	3.92 (2)	0 (0)	3.03 (1)	3.26 (6)
% Didn't Know/Refused to Answer	4.76 (1)	0 (0)	2.94 (1)	3.92 (2)	0 (0)	6.06 (2)	3.26 (6)
% > \$57,000 Household Income	47.62	59.09	52.94	57.69	34.78	48.49	51.35
% < \$57,000 Household Income	47.62	40.91	38.24	36.54	60.87	45.45	43.24
% Didn't Know/Refused to Answer	4.76	0	8.82	5.77	4.35	6.06	5.41

**Table 29**

*A summary of the categories of responses to the question, “Is there anything that the Michigan DNR or U.S. Fish and Wildlife Service could do to improve your visit to this WMA?” for the Spring 2018 Coastal WMA Visitor Use Survey.*

<b>Suggested Improvements</b>	<b>Fish Pt.</b>	<b>Harsens Island</b>	<b>Nayanquing Pt.</b>	<b>Pte. Mouillee</b>	<b>Shiawassee River</b>	<b>Shiawassee NWR</b>	<b>All Areas</b>
Clean up garbage/provide garbage cans	1	14	3	21	2	3	41
Provide more or better access to area	3	4	3	5	3	6	24
Improve or install toilets	3	2	5	7	2	2	21
Improve or maintain roads	-	-	4	3	2	-	9
Improve or increase trails	1	2	-	1	-	3	7
Improve signage or provide more information	1	-	1	-	-	5	7
Improve or increase parking lots	6	-	1	-	-	-	7
Provide benches/tables	2	1	-	3	1	-	7
Improve fishing	1	-	-	3	-	1	5
Increase law enforcement presence	-	-	3	1	-	-	4
Maintain or increase observation towers	1	1	1	-	-	-	3
Reduce cost of fishing licenses	-	2	-	-	-	-	2
Increase pheasants	2	-	-	-	-	-	2
Remove Phragmites	-	2	-	-	-	-	2
More businesses/supplies nearby	-	1	-	-	1	-	2
Improve Field Office services	1	-	-	-	-	-	1
Improve food plots	1	-	-	-	-	-	1
Don't spray Round-Up	-	1	-	-	-	-	1
Provide guided tours	-	-	1	-	-	-	1
Legalize cormorant/swan hunting	-	-	1	-	-	-	1
Decrease insects	-	-	-	1	-	-	1
Provide off-road trails	-	-	-	1	-	-	1
Provide drinking fountains	-	-	-	-	-	1	1

**Table 29** (cont'd)

Ban dogs	-	-	-	-	-	1	1
More trees	-	-	-	1	-	-	1
Change deer hunting licenses	-	1	-	-	-	-	1



**Table 30**

*A summary of the categories of responses to the question, “What is one thing that you love about this WMA?” for the Spring 2018 Coastal WMA Visitor Use Survey.*

<b>What Respondents Love</b>	<b>Fish Pt.</b>	<b>Harsens Island</b>	<b>Nayanquing Pt.</b>	<b>Pte. Mouillee</b>	<b>Shiawassee River</b>	<b>Shiawassee NWR</b>	<b>All Areas</b>
Quiet/Peaceful/Relaxing	7	18	8	28	7	18	86
Wildlife/Nature/Being							67
Outdoors	14	8	9	18	4	14	
Hunting/Fishing Opportunities	12	9	3	18	5	-	47
Location/Access	8	4	3	4	2	4	25
Bird Watching Opportunities	6	-	8	1	-	3	18
Family Ties/Historic Meaning	-	1	-	4	1	-	6
Boating Opportunities	-	1	-	4	-	-	5
Hiking Opportunities	-	-	-	-	-	2	2
DNR Presence	-	2	-	-	-	-	2
Photography Opportunities	-	-	-	-	-	2	2
Well-Maintained	-	-	-	1	-	1	2
Special Events	-	-	-	1	-	-	1

**Table 31**

*A summary of the categories of responses to the question, “Is there anything that the Michigan DNR or U.S. Fish and Wildlife Service could do to improve your visit to this WMA?” for the Summer 2018 Coastal WMA Visitor Use Survey.*

<b>Suggested Improvements</b>	<b>Fish Pt.</b>	<b>Harsens Island</b>	<b>Nayanquing Pt.</b>	<b>Pte. Mouillee</b>	<b>Shiawassee River</b>	<b>Shiawassee NWR</b>	<b>All Areas</b>
Provide more or better access to area	1	12	4	6	10	7	40
Improve or install toilets	1	3	-	6	3	3	16
Clean up garbage/provide garbage cans	-	-	-	7	4	2	13
Improve or maintain roads	-	-	3	7	2	-	12
Improve signage or provide more information	1	-	-	2	1	4	8
Provide benches/tables	1	-	1	1	-	1	4
Reduce cost of fishing licenses/More Options	-	-	-	3	1	-	4
Improve fishing	-	1	-	1	-	-	2
Improve or increase parking lots	-	2	-	-	-	-	2
Improve or increase trails	-	-	2	-	-	-	2
Maintain or increase observation towers	-	-	2	-	-	-	2
Improve or increase crops	-	-	-	1	-	-	1
More businesses/supplies nearby	-	1	-	-	-	-	1
Decrease cost of car ferry	-	1	-	-	-	-	1
Clean up contamination in river	-	-	-	-	-	1	1

**Table 32**

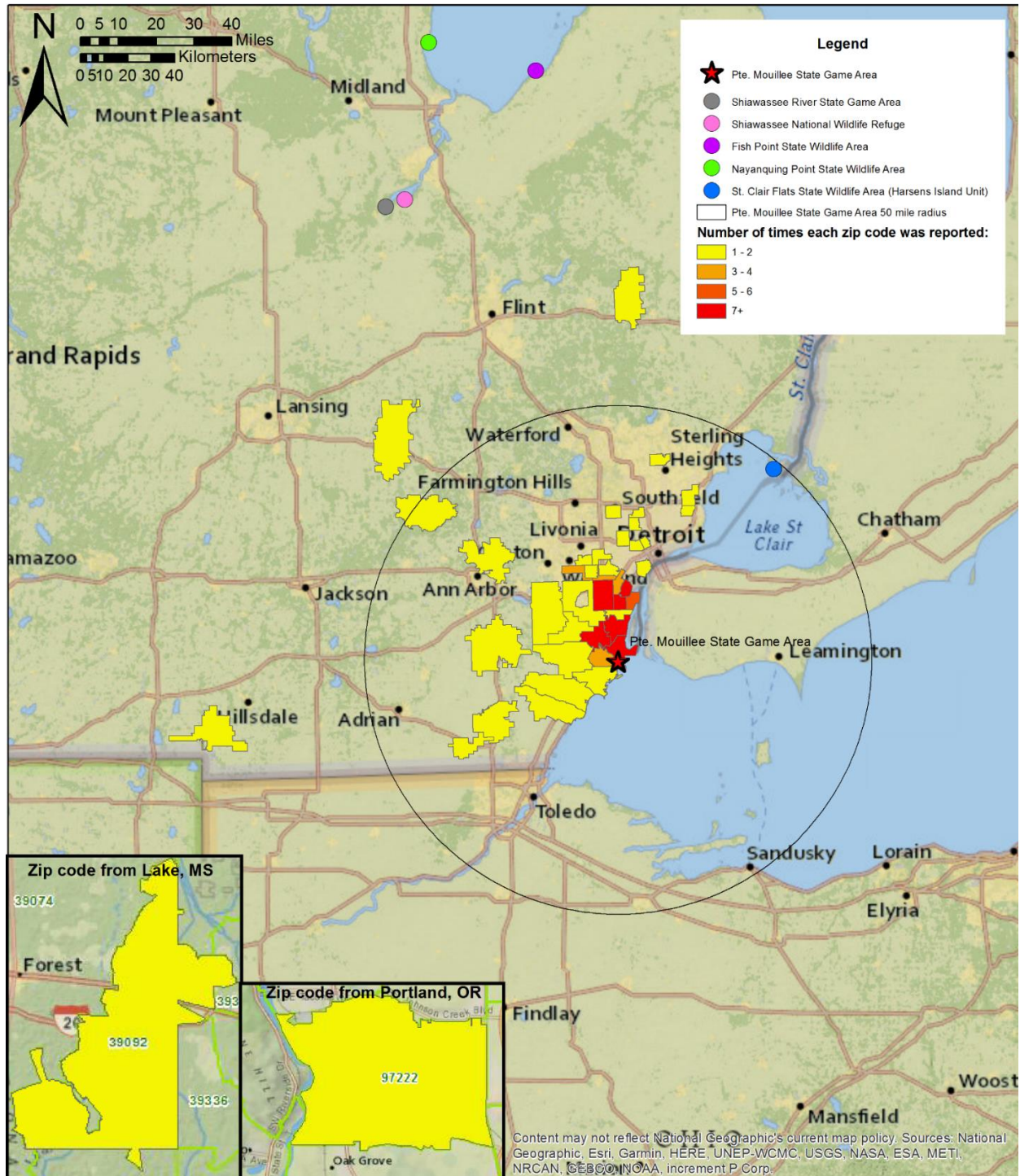
*A summary of the categories of responses to the question, “What is one thing that you love about this WMA?” for the Summer 2018 Coastal WMA Visitor Use Survey.*

<b>What Respondents Love</b>	<b>Fish Pt.</b>	<b>Harsens Island</b>	<b>Nayanquing Pt.</b>	<b>Pte. Mouillee</b>	<b>Shiawassee River</b>	<b>Shiawassee NWR</b>	<b>All Areas</b>
Quiet/Peaceful/Relaxing	10	11	11	17	8	9	66
Wildlife/Nature/Outdoors	2	7	9	11	3	18	50
Hunting/Fishing Opportunities	3	6	7	9	11	1	37
Location/Access	4	2	3	12	5	8	34
Bird Watching Opportunities	-	-	9	6	-	1	16
Family Ties/Historic Meaning	2	-	1	-	3	-	6
Boating Opportunities	-	1	-	1	-	-	2
Photography Opportunities	-	-	1	-	-	-	1
Well-Maintained	-	-	-	-	-	1	1

## Figures

**Figure 7**

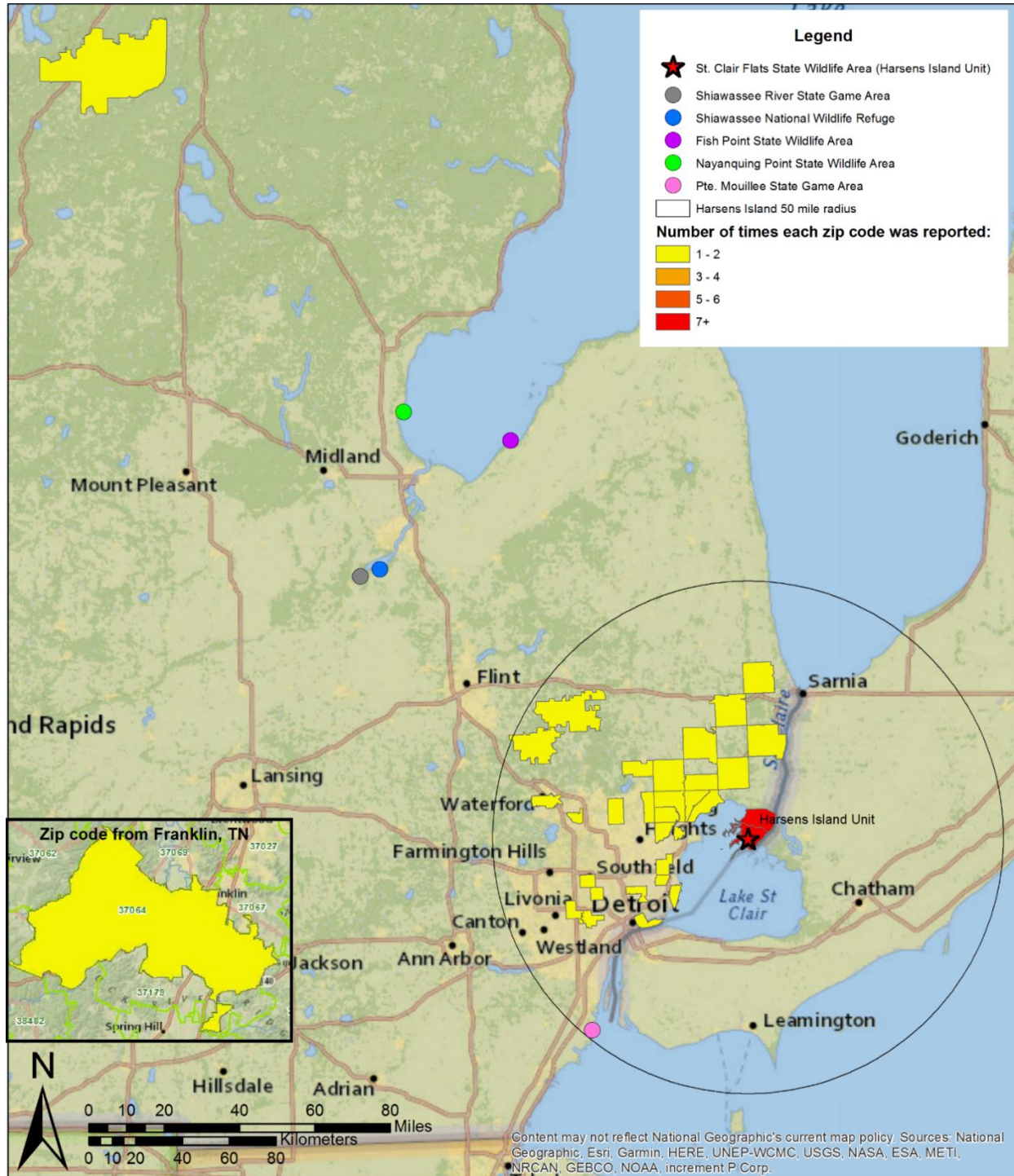
*Visitor use survey respondents' zip codes of residence for 2018 Spring and Summer surveys conducted at Pte. Mouillee State Game Area.*





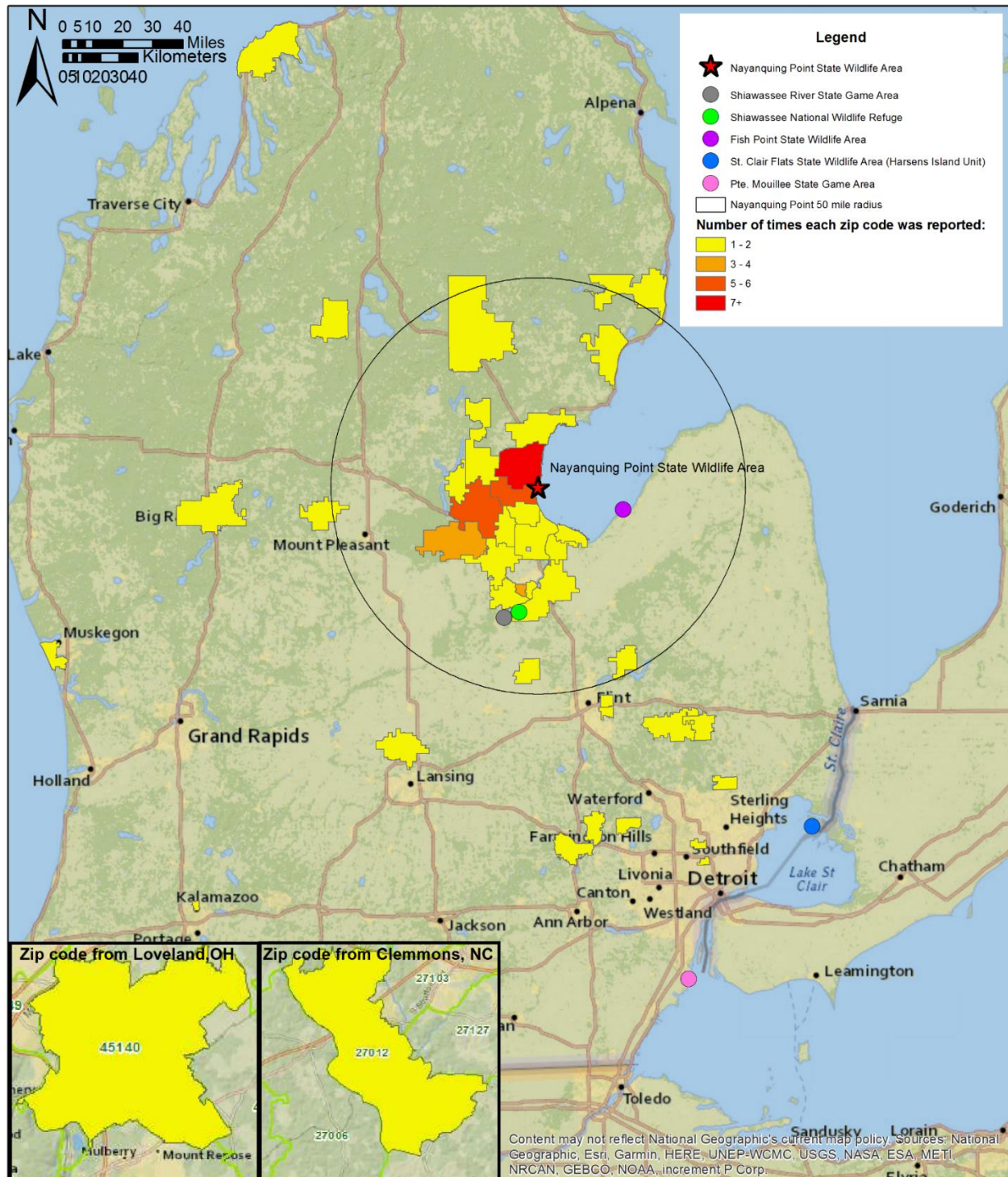
**Figure 8**

*Visitor use survey respondents' zip codes of residence for 2018 Spring and Summer surveys conducted at St. Clair Flats State Wildlife Area (Harsens Island Unit).*



**Figure 9**

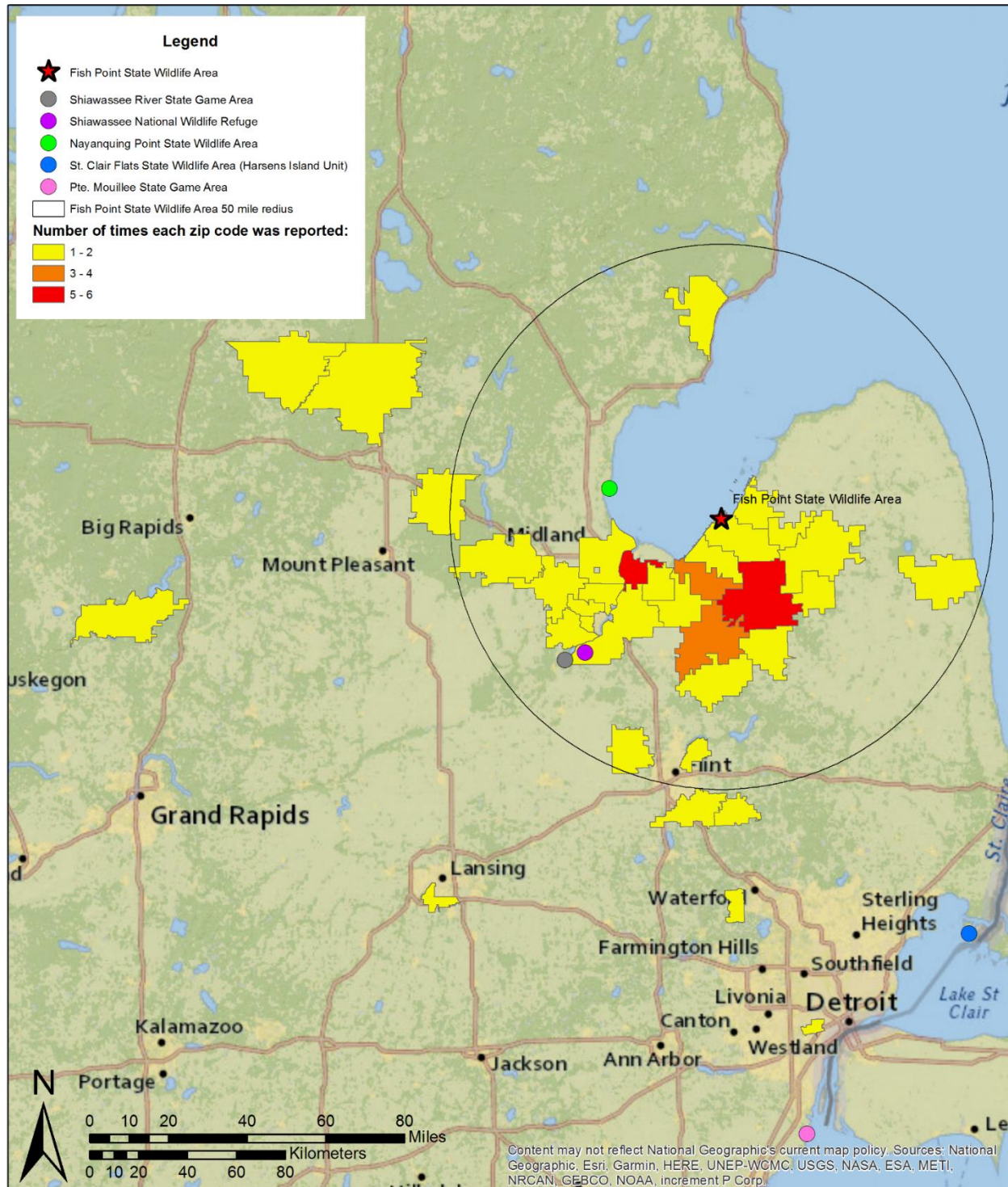
*Visitor use survey respondents' zip codes of residence for 2018 Spring and Summer surveys conducted at Nayanquing Point State Wildlife Area.*





**Figure 10**

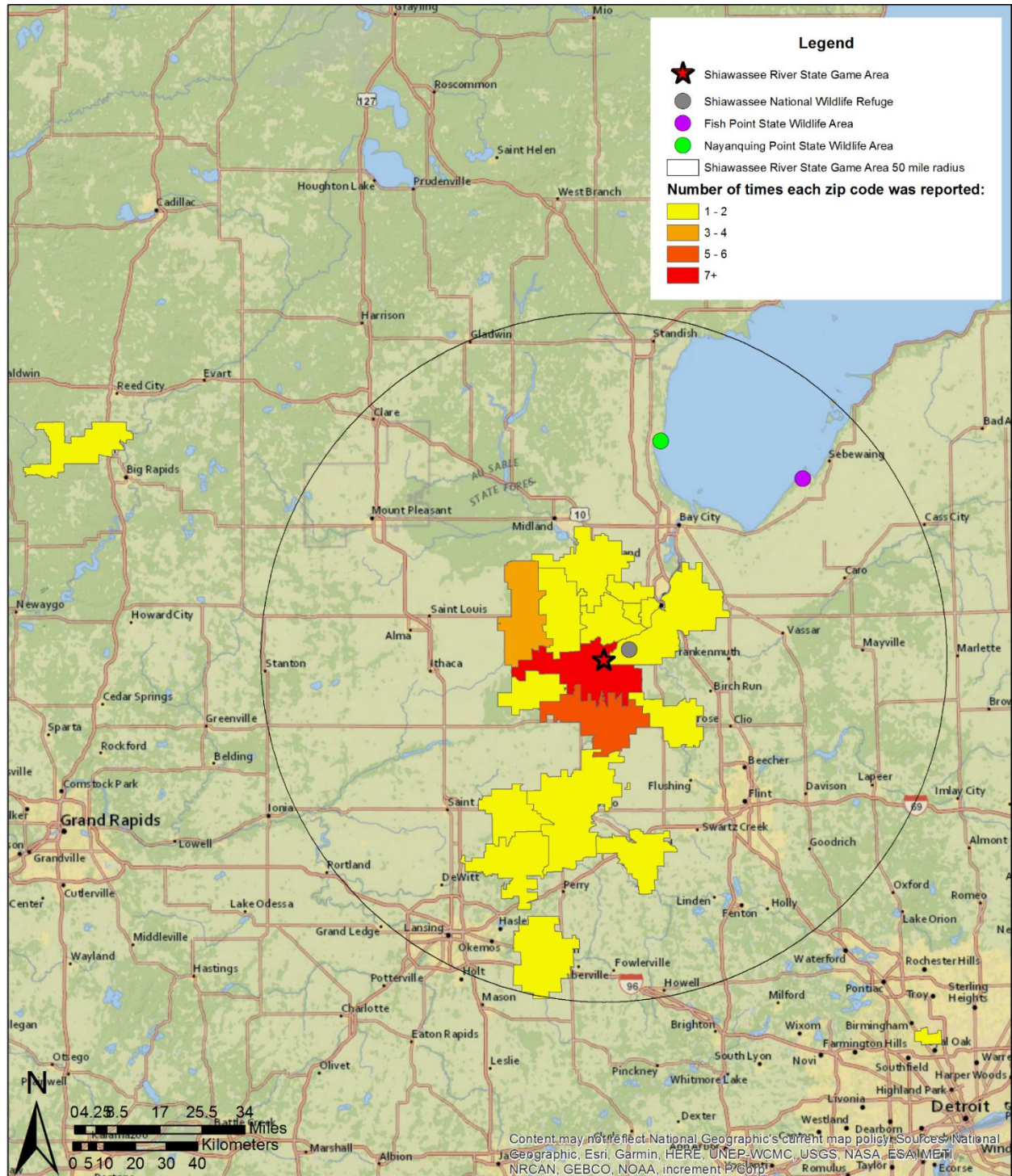
*Visitor use survey respondents' zip codes of residence for 2018 Spring and Summer surveys conducted at Fish Point State Wildlife Area.*





**Figure 11**

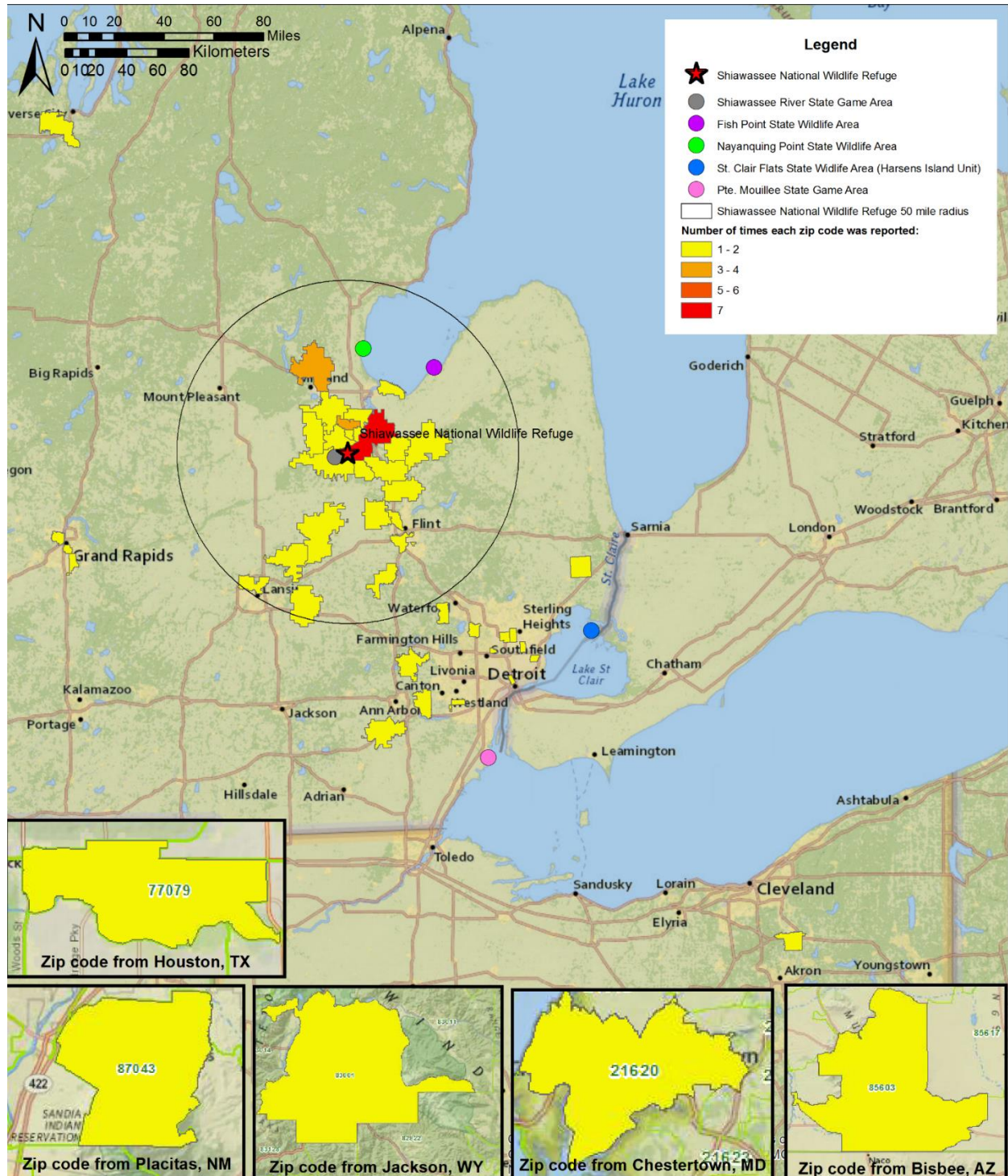
*Visitor use survey respondents' zip codes of residence for 2018 Spring and Summer surveys conducted at Shiawassee River State Game Area.*





**Figure 12**

*Visitor use survey respondents' zip codes of residence for 2018 Spring and Summer surveys conducted at Shiawassee National Wildlife Refuge.*



## APPENDIX B: FALL 2018 COASTAL WILDLIFE MANAGEMENT AREA VISITOR USE SURVEY PRELIMINARY RESULTS

(A Preliminary Report of Phase I of Project: A Stakeholder-Engaged Framework for Great Lakes Coastal Wildlife Management Areas for Waterfowl Hunting, Bird Watching, and Community Development)

**Figure 13**

*Photos of Fall 2018 Visitor Use Surveys at a) the Shiawassee River SGA check station, b) a Shiawassee River boat launch, c) outside the Shiawassee River SGA check station, and d) at a Shiawassee River boat launch.*



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## **Visitor Use Survey Objectives:**

Phase I of the research project titled “A Stakeholder-Engaged Framework for Great Lakes Coastal Wildlife Management Areas for Waterfowl Hunting, Bird Watching, and Community Development” included preliminary on-site recreational use surveys. These surveys were conducted during spring, summer, and fall 2018 at six coastal wildlife management areas (WMAs) to explore the relative amount and type of recreation occurring at each site. This preliminary step is important to identify key recreational users of the WMAs and to inform survey questionnaires that will be developed for each of the five stakeholder groups (waterfowl hunters, bird watchers, other key recreational users, local community leaders, and local community residents) during Phase II of the research. The objectives of the preliminary visitor surveys are to:

- Determine the scope of recreation occurring on WMAs
- Understand and characterize visits and visitors of WMAs during spring, summer, and fall
- Determine economic impacts of visitor uses of WMAs

## **Methods Review:**

Surveys took place at six state and federally owned and managed aquatic-based coastal wetland sites from Lake Huron’s Saginaw Bay to western Lake Erie. Michigan Department of Natural Resources (MDNR) lands include five managed waterfowl hunting areas: Nyanquing Point State Wildlife Area (SWA), Fish Point SWA, Shiawassee River State Game Area (SGA), St. Clair Flats SWA-Harsens Island Unit, and Pointe Mouillee SGA. U.S. Fish and Wildlife Service (USFWS) lands will include the Shiawassee National Wildlife Refuge.

The visitor use survey design and methodology was largely based on the USGS National Wildlife Refuge Visitor Survey (Sexton et al. 2012). WMA managers were interviewed to identify potential survey periods in each of three seasons (spring, summer, and fall) that best represented the visitation patterns and diversity of use on the WMA. These manager-selected time frames were used to develop a calendar of sampling periods for each WMA. A stratified design with strata by season (spring, summer, fall), WMA, and day of week (weekend day or weekday) was used for improved precision, benefits to scheduling survey teams, and estimates that can be calculated by strata. Seven weeks per season were selected based on the input from WMA managers. The seven-week sampling period per season allows for each WMA to be surveyed two weekdays and two weekend days per period. Surveys conducted on weekdays alternate by sampling week between Monday/Wednesday and Tuesday/Thursday to improve representativeness and for ease of scheduling survey teams. Simple random sampling was used to select the days (two weekdays and two weekend days) each WMA is surveyed within the WMA manager selected time frames. Survey back up dates were scheduled as close to the randomly selected survey date as possible to replace selected survey dates in cases of inclement weather or other unforeseen events that prohibit the visitor use survey from taking place. Visitors were intercepted by a survey team as they left the WMA, and surveys were administered using tablets equipped with Qualtrics survey software. One member of the survey team was responsible for tallying the total number of visitors leaving the sampling site. On the selected days, surveys were conducted in two sampling shifts 3 hours long; one in the morning (8:00–



11:00) and the other in the afternoon (1:00–4:00). Survey teams attempted to conduct 20 surveys per area per day sampled (10 in the morning shift and 10 in the afternoon shift), for a total of 80 surveys per season per area. All seasons combined, this would provide a total of 240 surveys per WMA.

In addition to sampling periods, WMA managers were also asked to identify all potential locations for surveys. Simple random sampling was used to select locations for visitor use surveys on each selected day. Because of low visitation rates, all survey locations at each area were used for sampling. A small token of appreciation for completing the survey was offered at the conclusion of the survey.

The survey instrument is a brief questionnaire of approximately 20 questions asking about the participant's visit to the WMA, trip expenditures, demographics, and the potential for future visits. Questions were pre-tested by three MSU graduate students and seven MDNR Wildlife Division professionals for validity. The visitor use survey was approved by MSU IRB (STUDY00000435) prior to conducting surveys.

This preliminary report includes summary statistics for fall 2018 surveys including participation, trip and visitor characteristics, primary recreational activities, social media use and provision of emails, residence, and demographics. A summary of two open-ended questions is also included. A separate preliminary report for spring and summer 2018 surveys was submitted to the MDNR on September 24, 2018. A final report including statistical analysis and comparisons of all WMAs and seasons will be made available at a later date. The trip expenditure data from the surveys will be used for an economic impact analysis and will be included in a future report.

## **Preliminary Results:**

### ***Survey Participation***

Fall surveys began September 4, 2018 and ran through November 24, 2018. A total of 283 surveys were conducted at all six WMAs, with 112 weekday surveys and 171 weekend surveys (Table 33). The total number of surveys differed by area during the fall and ranged from 22 to 69, with Shiawassee National Wildlife Refuge (NWR) having the least number of surveys and Harsens Island having the greatest number of surveys. The percentage of visitors surveyed ranged from 16–32% during the fall. Survey teams only approached visitors that parked and exited their vehicle. Teams noted that it is common for people to drive through parking lots or down roads on the WMAs but don't actually stop and get out. Teams attempted to count all of these vehicles as total visitors on the area and felt generally confident that most visitors were accounted for because all survey locations were visited at each area each day. We continued to survey all locations in the fall because of the small numbers of visitors encountered during the spring and summer surveys. On several occasions, there were numerous waterfowl hunters at a survey location at the same time (e.g., at the check station during a waterfowl hunt drawing or at a boat launch at the end of a waterfowl hunt period). In these situations, the survey team was only able to survey a small number of hunters but attempted to count all hunters that were leaving the area. Overall, the visitor use of WMAs during fall 2018 was very low prior to the opening day of the regular duck hunting season (October 14) and use picked up after the duck

hunting season opened. We found visitor use at Shiawassee NWR to be quite low throughout the fall despite the refuge providing managed duck hunts for the first time. Only five survey dates achieved the goal of 20 surveys, and 13 survey dates had less than 10 surveys during fall.

### ***Trip and Visitor Characteristics***

For the fall surveys, visitors reported spending an average of 4.1 hours at WMAs per trip, ranging from a low of 2.84 hours at Shiawassee NWR and a high of 4.8 hours at Harsens Island (Table 33). Most respondents (87%) were returning visitors that had been to the WMA in the last 12 months. This ranged from a low of 81% at Fish Point and a high of 97% at Harsens Island. The average number of days visited in the last 12 months for these returning visitors ranged from 8.4 at Shiawassee NWR to 42.5 at Harsens Island (Table 33).

Survey participants were also asked about how many total outdoor recreation trips they've taken in the last 12 months at least one mile from their home. The average number of trips was 66.6 across all areas and responses ranged from an average of 46.5 (Shiawassee NWR) to 91.1 (Harsens Island).

### ***Primary Recreational Activity***

In the fall, waterfowl hunting is an important activity with nearly 73% of fall survey participants responding that waterfowl hunting was their primary activity (Table 34). This was followed by fishing (5%), hiking/walking (4.3%), big game hunting (3.6%), and wildlife observation (3.2%). Other activities noted by fall respondents included small game hunting, trapping, dog training, bird watching, biking, auto tour route/driving, paddling sports, and other. The trends in primary activities were similar across the state-owned and managed WMAs in the fall, with waterfowl hunting being the most frequent use across all areas except for Shiawassee NWR (Table 35). Hiking/walking was the most prevalent use at Shiawassee NWR, with only 3 respondents reporting waterfowl hunting as their primary activity. Nayanquing Point had more visitors reporting small game hunting (6) and wildlife observation (6) as primary activities than the other WMAs. Harsens Island had more visitors reporting fishing (7) than the other WMAs.

### ***Social Media Use and Emails***

Visitors were asked about their social media use. Fall respondents reported using Facebook most (64%), followed by Instagram (25%), Snapchat (13%), and Twitter (10%). Thirty-three percent reported that they did not use social media. We also asked participants about their use of eBird because we have an interest in using eBird to draw a sample of bird watchers. During fall, of the 7 participants that reported bird watching as their primary activity, 4 of them reported using eBird (57%).

Respondents were asked to provide an email address for a potential follow-up survey regarding their recreational use of the WMA. Fifty-seven percent of the fall survey respondents provided an email address, ranging from a low of 48% at Nayanquing Point to a high of 72% at Pointe Mouillee (Table 33), with a total of 161 respondents providing an email address.

## ***Demographics***

Table 36 summarizes the demographics of survey respondents. The average year of birth for respondents was 1973. Males made up the majority of respondents during the fall surveys (95%). Fifty-two percent of respondents reported completing a college degree, technical school degree, graduate degree, or professional school degree; 47% of respondents reported completing a high school degree; and 1% respondents reported completing elementary or middle school. Participants were asked about their race and ethnicity and most (254 participants) were White for the fall surveys (90.4%), followed by 2.1% Black/African American (6 participants), 1.4% Hispanic/Latino/Spanish (4 participants), 1.1% Multiracial (3 participants), 0.7% American/Pacific Islander (2 participants), and 0.4% American Indian (1 participant). A few participants (3.9%) either refused to answer the race and ethnicity question or didn't know their race or ethnicity. Participants were also asked if their household income in the last year before taxes and other deductions was above or below \$57,000, the mean for U.S. households in 2016 (Guzman 2017). Most (73.9%) respondents reported their household income was greater than \$57,000 and 24.7% reported it was less than \$57,000. Another 1.4% either refused to answer this question or did not know.

## ***Residence***

Visitors were asked if they reside within 50 miles of the WMA to determine if they were a local resident or not. Based on this question, the percentage of fall respondents that said they lived within 50 miles of the WMA where they were surveyed are as follows: 40% at Fish Point, 62% at Nayanquing Point, 73% at Shiawassee NWR, 77% at Shiawassee River SGA, 81% at Pointe Mouillee, and 83% at Harsens Island. Visitors were also asked for their zip code of their residence so future analyses will determine local residency based on zip code data. Figures 12–17 display the zip codes of residence for fall survey participants for each WMA.

## ***Open-Ended Questions***

Participants were asked two open-ended questions about what the MDNR or USFWS could do to improve their visits and what they loved most about the area they were visiting. Responses were grouped into categories and are summarized in Tables 37 and 38. The most frequent categories for improving visits during fall for all areas combined with the number of responses in parentheses were clean up garbage/provide garbage cans (9), improve signage (9), improve or increase crops/cover (9), improve or maintain roads/parking (9), more enforcement of area (8), improve or maintain trails (8), and provide more or better access (8).

Some participants also reported what they loved most about the area they were visiting. The most frequent responses for all areas combined with the number of responses in parentheses were birds/wildlife/nature (81), recreation/hunting/fishing (74), easy access/close proximity/convenience (65), and peace/quiet/calm/beautiful (35).

## **Discussion:**

Overall, results indicated that there were few visitors to the WMAs during the fall surveys prior to the opening day of the regular duck hunting season (October 14). Visitor use appeared to increase after that except for the Shiawassee NWR. There were only five survey dates that achieved the goal of 20 surveys during the fall and on all other survey dates, survey teams visited all of the survey locations on a WMA to find visitors. However, on several occasions at the state WMAs, there were too many waterfowl hunters exiting the area at the same time for survey teams to meet the minimum number of surveys. This happened both at the check stations after a waterfowl hunt drawing completed and at boat launches at the end of a waterfowl hunt period. In these situations, the survey team was only able to survey a small number of hunters but attempted to count all hunters that were leaving the area.

Waterfowl hunting was the predominant recreational activity during the fall and the survey team noted that if it weren't for waterfowl hunting in the fall, it would have been difficult to find visitors on certain survey dates as there were very few visitors doing anything else. The WMAs were similar in the predominant types of recreational activities that visitors reported with the exception of Shiawassee NWR where the primary activity most frequently reported was hiking/walking. This was surprising because 2018 was the first year that the refuge allowed duck hunting and survey teams expected to find more waterfowl hunters. The spring, summer, and fall visitor use surveys were informative in the types of recreation occurring at the WMAs and have informed key stakeholder groups for stakeholder surveys being conducted in Phase II of the research project.

When visitors were asked what the MDNR could do to improve their visit to state owned WMAs, several response categories included actions that may be easy for WMA managers to implement such as cleaning up garbage and improving signage. Maintaining roads, parking lots, and trails may be more difficult for managers to address, and some items identified such as improving and increasing crops, increasing enforcement, and increasing access are even more difficult for managers to address.

The next steps for the visitor use survey data include statistical analyses and comparisons of all WMAs and seasons. These results will be made available in a future MDNR report. The trip expenditure data from the surveys is being used for an economic impact analysis that will also be a future MDNR report.



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## Tables

**Table 33**

*Summary of fall 2018 Coastal WMA Visitor Use Surveys.*

	<b>Fish Pt.</b>	<b>Harsens Island</b>	<b>Nayanquing Pt.</b>	<b>Pte. Mouillee</b>	<b>Shiawassee NWR</b>	<b>Shiawassee River</b>
<b># surveys completed</b> (weekday/weekend)	67 (16/51)	69 (27/42)	50 (29/21)	36 (22/14)	22 (5/17)	39 (13/26)
<b>% visitors surveyed</b>	67	69	50	36	22	39
<b>Ave. hours spent at WMA</b>	4.57	4.8	3.07	3.64	2.84	4.59
<b>% returning visitors</b>	80.60	97.10	82	88.89	81.82	87.18
<b>Ave. # days visited in the last 12 months</b>	18.61	42.48	28.98	28.09	8.44	39.26
<b>% providing email addresses</b>	56.72	57.97	48	72.22	63.64	48.72

**Table 34**

*Primary recreational activities reported by Coastal WMA Visitor Use Survey respondents during fall 2018, across all WMAs.*

<b>Primary Activity</b>	<b># Responses</b>	<b>% of Responses</b>
Waterfowl hunting	203	73.02
Fishing	14	5.04
Hiking/walking	12	4.32
Big game hunting	10	3.6
Wildlife observation	9	3.24
Other	9	3.24
Bird watching	7	2.52
Small game hunting	7	2.52
Auto tour route/driving	2	0.72
Biking	1	0.36
Trapping	1	0.36
Motorized boating	1	0.36
Paddling sports	1	0.36
Dog training	1	0.36

**Table 35**

*Primary recreational activities reported by Coastal WMA Visitor Use Survey respondents during fall 2018, by individual WMA.*

Primary Activity (# responses)	<b>Fish Point</b>	<b>Harsens Island</b>	<b>Nayanquing Point</b>	<b>Pointe Mouillee</b>	<b>Shiawassee NWR</b>	<b>Shiawassee River</b>
Waterfowl hunting	57	59	29	22	3	33
Fishing	1	7	1	3	1	1
Hiking/walking	2	0	1	2	7	0
Big game hunting	1	1	1	3	2	2
Wildlife observation	1	0	6	1	1	0
Other	2	0	1	3	0	3
Bird watching	0	0	3	0	4	0
Small game hunting	1	0	6	0	0	0
Auto tour route/driving	0	0	0	0	2	0
Biking	0	0	0	0	1	0
Trapping	0	0	0	0	1	0
Motorized boating	0	0	1	0	0	0
Paddling sports	0	1	0	0	0	0
Dog training	0	0	0	1	0	0

**Table 36***Demographics of fall 2018 Visitor Use Survey respondents.*

	<b>Fish Point</b>	<b>Harsens Island</b>	<b>Nayanquing Point</b>	<b>Pointe Mouillee</b>	<b>Shiawassee NWR</b>	<b>Shiawassee River</b>	<b>All Areas</b>
Average Year of Birth	1972	1974	1975	1978	1966	1972	1973
% Female	2.99 (2)	2.90 (2)	8 (4)	2.78 (1)	22.73 (5)	0 (0)	4.95 (14)
% Male	97.01 (65)	97.10 (67)	92 (46)	97.22 (35)	77.27 (17)	100 (39)	95.05 (269)
% Elementary Grads	4.55 (3)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1.06 (3)
% High School Grads	46.97 (31)	47.83 (33)	48 (24)	47.22 (17)	40.91 (9)	46.15 (18)	46.81 (132)
% College/Technical School Grads	40.91 (27)	46.38 (32)	46 (23)	52.78 (19)	50 (11)	46.15 (18)	46.10 (130)
% Graduate/Professional School Grads	7.58 (5)	5.80 (4)	6 (3)	0 (0)	9.10 (2)	7.69 (3)	6.03 (17)
% White, non Hispanic	91.04 (61)	84.06 (58)	94 (47)	85.71 (30)	90.48 (19)	100 (39)	90.39 (254)
% Hispanic/Latino/Spanish	2.99 (2)	0 (0)	2 (1)	2.86 (1)	0 (0)	0 (0)	1.42 (4)
% Black/African American	0 (0)	8.70 (6)	0 (0)	0 (0)	0 (0)	0 (0)	2.14 (6)
% American Indian	0 (0)	0 (0)	0 (0)	2.86 (1)	0 (0)	0 (0)	0.36 (1)
% American/Pacific Islander	1.49 (1)	0 (0)	0 (0)	2.86 (1)	0 (0)	0 (0)	0.71 (2)
% Multiracial	1.49 (1)	2.90 (2)	0 (0)	0 (0)	0 (0)	0 (0)	1.07 (3)
% Didn't Know/Refused to answer	2.99 (2)	4.35 (3)	4 (2)	5.71 (2)	9.52 (2)	0 (0)	3.91 (11)
% > \$57,000 Household Income	64.18 (43)	81.16 (56)	78 (39)	72.22 (26)	54.55 (12)	84.62 (33)	73.85 (209)
% < \$57,000 Household Income	34.33 (23)	18.84 (13)	22 (11)	25 (9)	36.36 (8)	15.38 (6)	24.73 (70)
% Didn't Know/Refused to answer	1.49 (1)	0 (0)	0 (0)	2.78 (1)	9.09 (2)	0 (0)	1.41 (4)

**Table 37**

*A summary of the categories of responses to the question, "Is there anything that the Michigan DNR or U.S. Fish and Wildlife Service could do to improve your visit to this WMA?" for the Fall 2018 Coastal WMA Visitor Use Survey.*

<b>Suggested Improvements</b>	<b>Fish Point</b>	<b>Harsens Island</b>	<b>Nayanquing Point</b>	<b>Pointe Mouillee</b>	<b>Shiawassee NWR</b>	<b>Shiawassee River</b>	<b>All Areas</b>
Clean up garbage/provide garbage cans	1	2	1	4	1	-	9
Improve or maintain roads/parking	1	-	1	5	1	1	9
Improve or increase crops/cover	2	3	1	1	1	1	9
Improve signage	3		2	1	1	2	9
Provide more or better access	1	1	1	3		2	8
Improve or maintain trails	-	-	3	-	4	1	8
More enforcement of area	-	3	4	-	-	1	8
Fix or maintain dikes/ditches	1	3	1	1	-	1	7
Improve or maintain restrooms	-	4	-	1	1	-	6
Longer hunting season/more birds	3	1	-	2	-		6
Improve or maintain boat launches	1	1	-	2	-	2	6
Remove weeds/phragmites/invasives	1	3	-	1	-	-	5
Funding/fees/free entrance	-	3	1	1	-	-	5
Hunter education/hunter mentoring	-	2	-	1	-	1	4
Change draws	1	3	-	-	-		4
Lower ferry prices	-	3	-	-	-	-	3
Water levels (more water)	2	-		1	-	-	3
More land	1	-	2	-	-	-	3
Improve corn strips	2	1					3
Flood earlier	1	1	1				3
Better/more staff	-	1	1	-	-		2
Improve/add campgrounds	1	-	-	-	-	1	2
Water levels (less water)	1						1

**Table 37** (cont'd)

Less hunting	-	-	-	-	1		1
More shoreline fishing spots	-	-	1		-	-	1
Harvest reports	-	-	1	-	-	-	1
Water testing reports	-	-	-	1	-	-	1
More nature center hours	-	-	-	-	1	-	1
Add shore bird habitat	-	-	-	-	1	-	1
Improve or maintain blinds	1						1
Allow pets					1		1
Stock fish						1	1
Ban chainsaw winches						1	1
Implement antler point restrictions						1	1

**Table 38**

*A summary of the categories of responses to the question, "What is one thing that you love about this WMA?" for the Fall 2018 Coastal WMA Visitor Use Survey.*

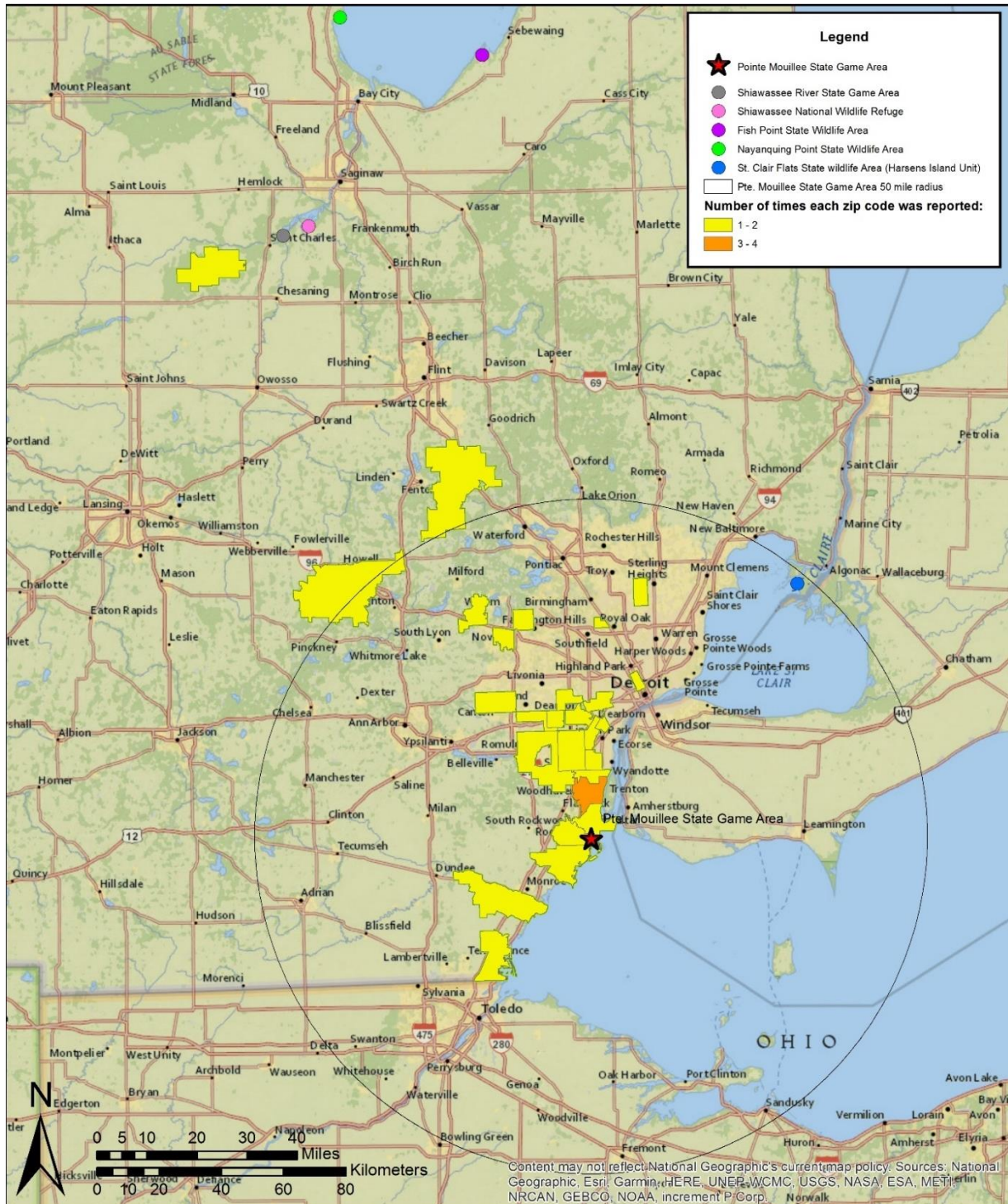
<b>What Respondents Love</b>	<b>Fish Point</b>	<b>Harsens Island</b>	<b>Nayanquing Point</b>	<b>Pointe Mouillee</b>	<b>Shiawassee NWR</b>	<b>Shiawassee River</b>	<b>All Areas</b>
Birds, Wildlife, Nature	20	21	17	5	10	8	81
Recreation—Hunting, Fishing	21	17	10	10	2	14	74
Easy access, close proximity, convenience etc.	14	10	13	14	3	11	65
Peace, Quiet, Calm, Beautiful	7	12	7	5	4	-	35
Staff	4	1	4	2	-	-	11
Heritage/Tradition	4	4	1	-	-	1	10
Not crowded	-	1	1	-	2	4	8
Diversity of recreation	-	1	-	2	2	-	5



## Figures

**Figure 14**

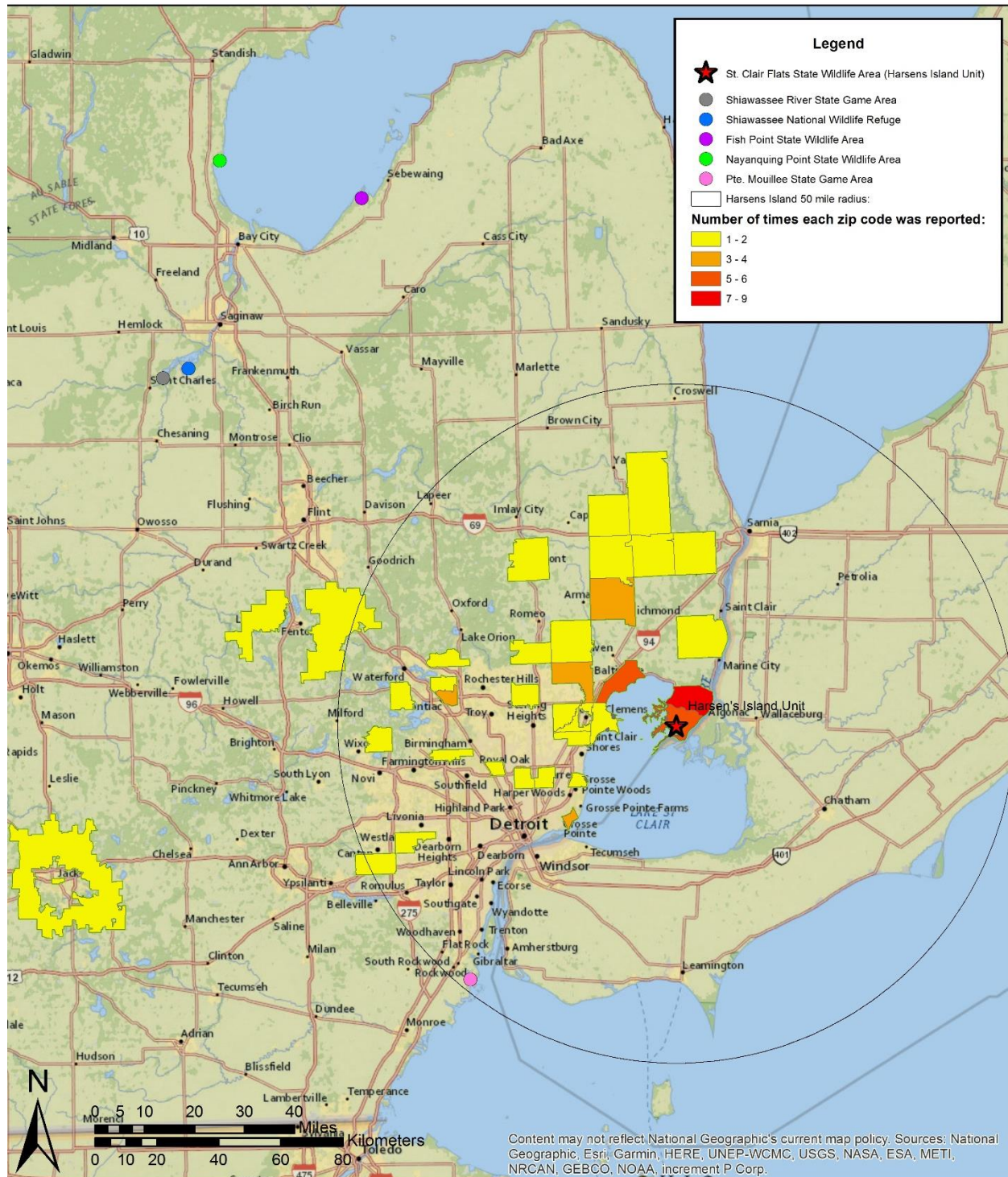
*Visitor use survey respondents' zip codes of residence for 2018 Fall surveys conducted at Pte. Mouillee State Game Area.*





**Figure 15**

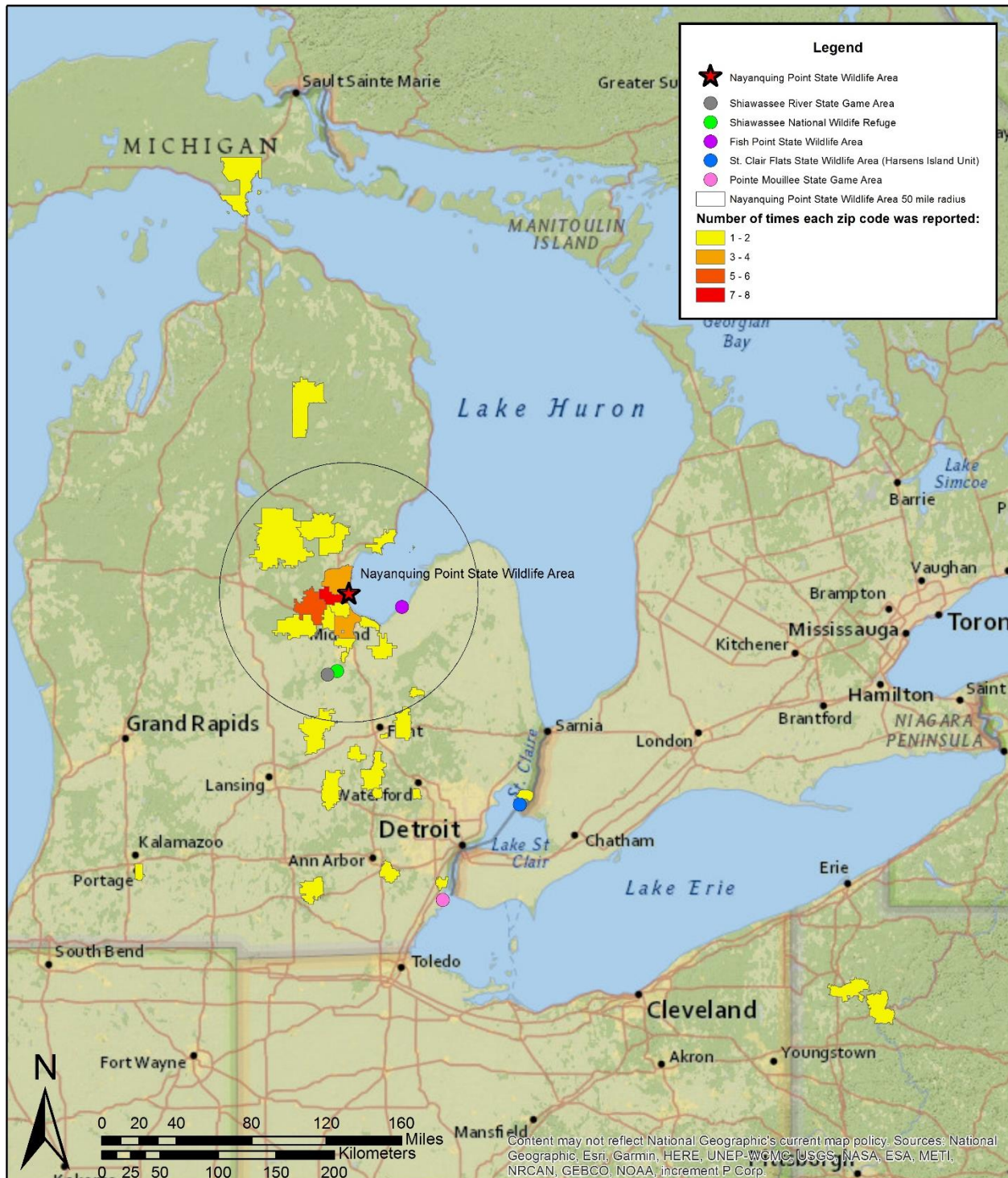
*Visitor use survey respondents' zip codes of residence for 2018 Fall surveys conducted at St. Clair Flats State Wildlife Area (Harsens Island Unit).*





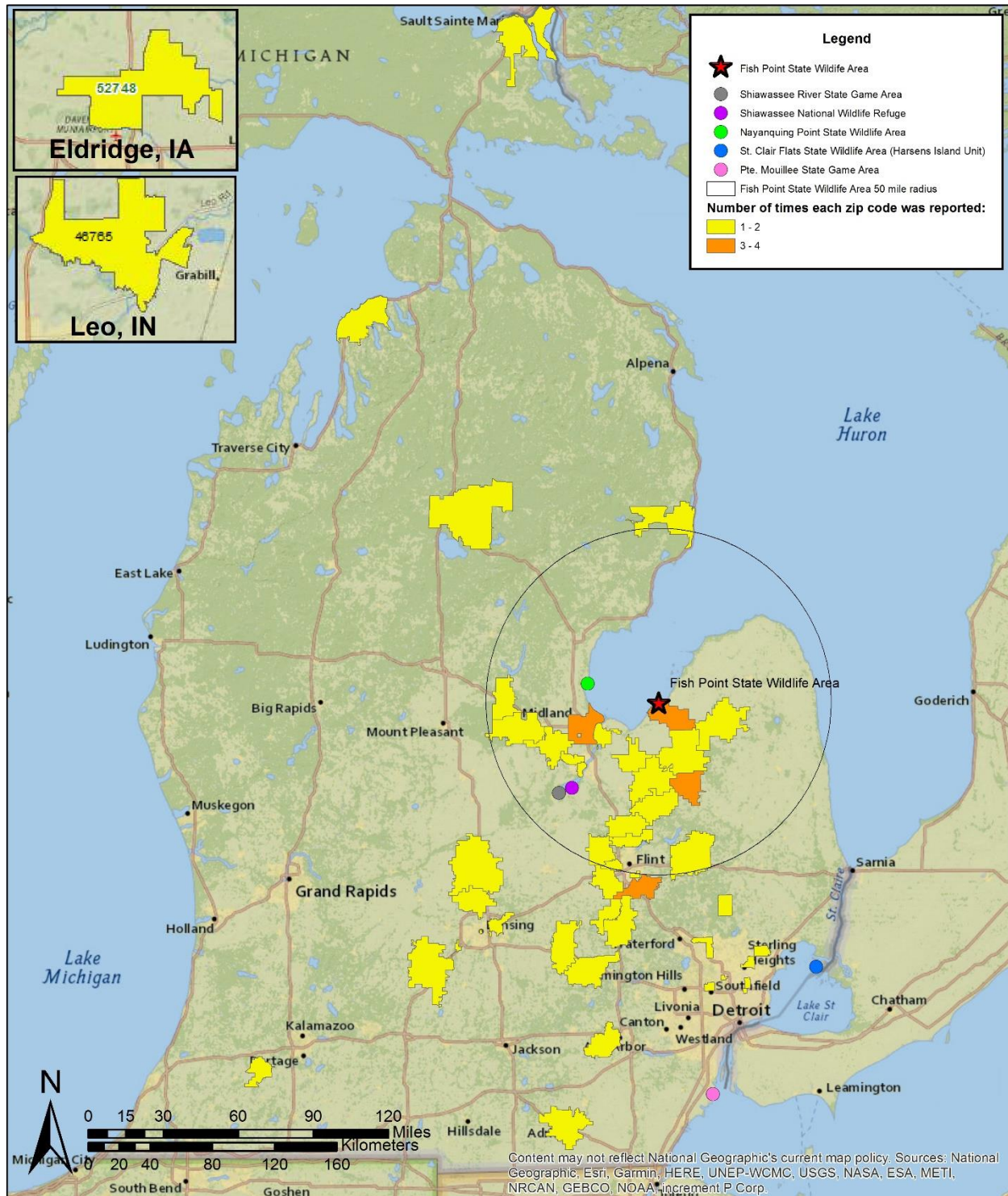
**Figure 16**

*Visitor use survey respondents' zip codes of residence for 2018 Fall surveys conducted at Nayanquing Point State Wildlife Area.*



**Figure 17**

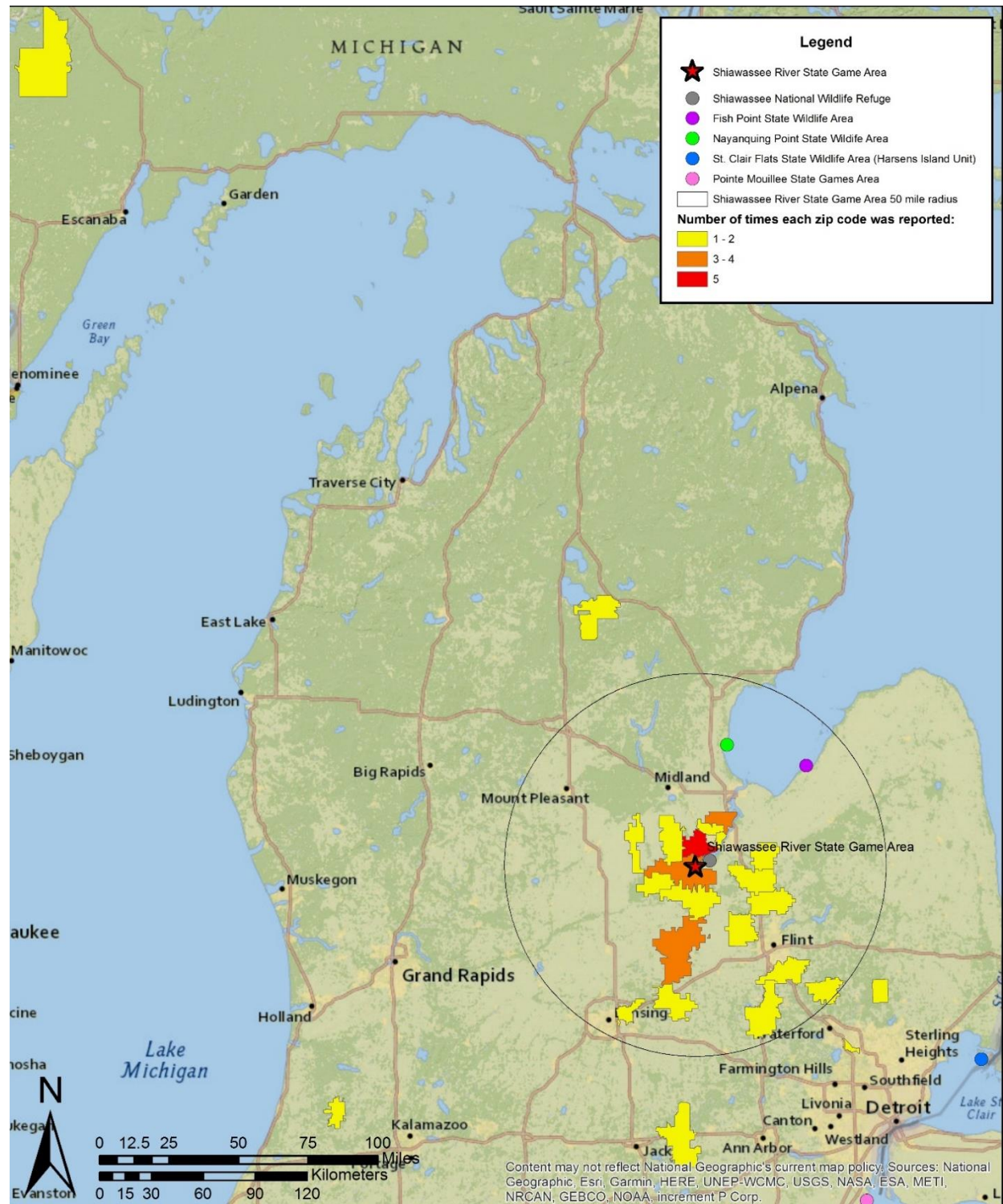
*Visitor use survey respondents' zip codes of residence for 2018 Fall surveys conducted at Fish Point State Wildlife Area.*





**Figure 18**

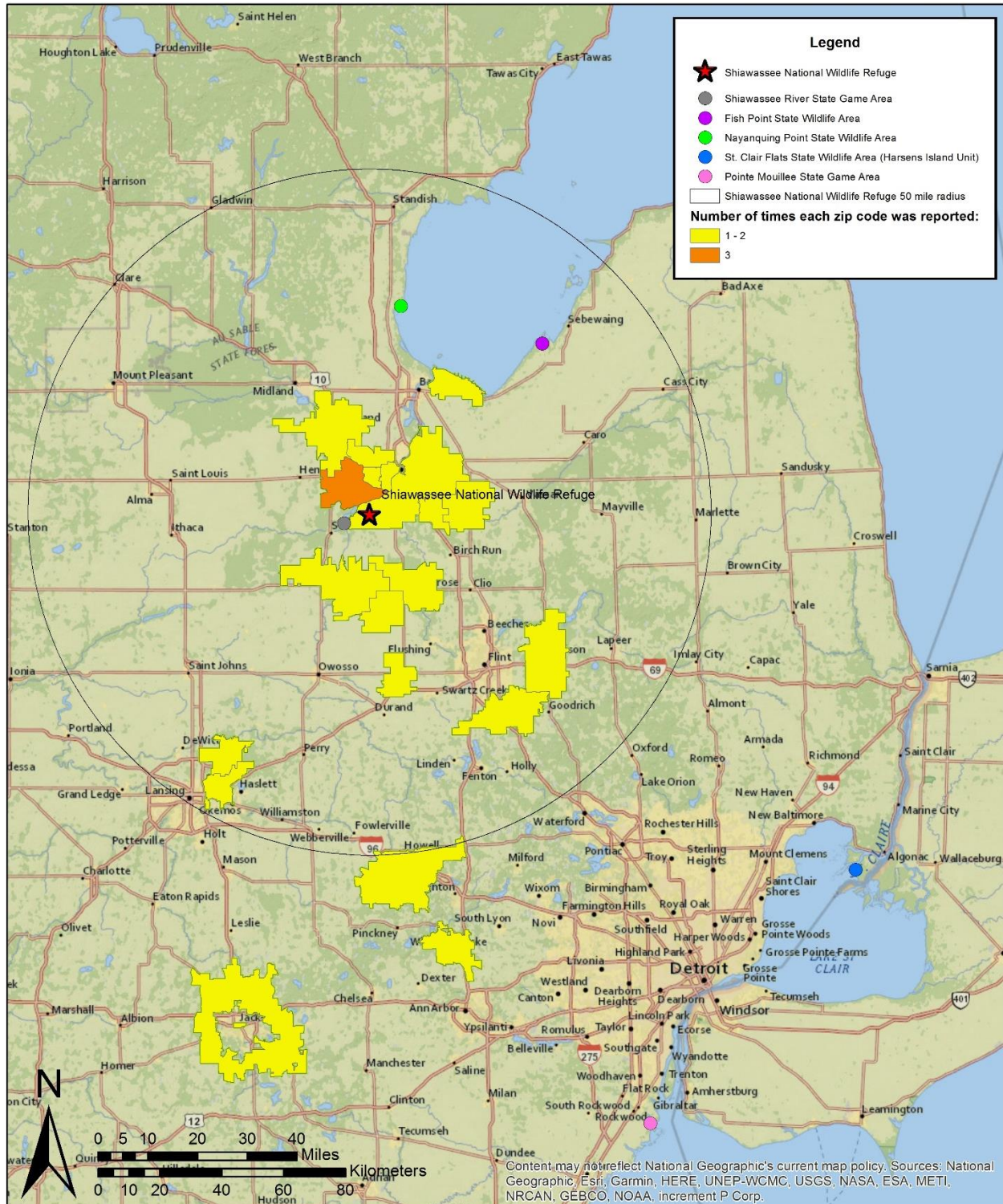
*Visitor use survey respondents' zip codes of residence for 2018 Fall surveys conducted at Shiawassee River State Game Area.*





**Figure 19**

*Visitor use survey respondents' zip codes of residence for 2018 Fall surveys conducted at Shiawassee National Wildlife Refuge.*



## APPENDIX C: MICHIGAN COASTAL WILDLIFE MANAGEMENT AREA ANGLER SURVEY



Thank you for participating in this study about Michigan's coastal Wildlife Management Areas (WMAs) and fishing. These areas are managed by state and federal fish and wildlife agencies to provide wildlife habitat and wildlife-related recreation, and also provide fishing opportunities. We are interested in the opinions and behaviors of everyone who spends time fishing. We are particularly interested in your fishing experiences, your experiences with WMAs, and your thoughts on ways to improve these WMAs for fishing. Even if you've only been fishing in Michigan once or have never visited a WMA, we want to hear from you!

Michigan State University researchers are working in collaboration the Michigan Department of Natural Resources and the U.S. Fish and Wildlife Service for this study. Your responses are important to this study and will be used to help improve the management of WMAs in the future. Please be assured that your participation in the study, and all of your responses, will be kept confidential and your participation is strictly voluntary. You may choose not to participate at all, or you may refuse to answer certain questions or discontinue your participation at any time without consequence. This survey should take about 20 minutes to complete. You must be 18 or older to participate. By completing this survey, you are voluntarily agreeing to participate in this research study.

**Thank you for your help!**

1. Please tell us **all** of the nature-based activities in which you have participated during **the past 12 months**.

(Please select **all that apply.**)

- ☐ Fishing
- ☐ Hunting waterfowl (e.g., ducks and geese)
- ☐ Hunting other game species
- ☐ Viewing birds (e.g., birdwatching, bird feeding)
- ☐ Viewing wildlife, not including birds (e.g., wildlife watching, wildlife photography)
- ☐ Learning about nature away from home (e.g., attending festivals or lectures, visiting a nature center)
- ☐ Backyard/at home nature activities (e.g., gardening, landscaping)
- ☐ Non-motorized outdoor recreation activities (e.g., hiking, backpacking, horseback riding, bicycling, skiing, swimming, canoeing and kayaking)
- ☐ Motorized outdoor recreation activities (e.g., motorized boating, riding ATVs, snowmobiling)
- ☐ Other nature-based activities (e.g., picnicking, relaxing in nature, camping)

2. **During 2018**, about how many **trips** did you take primarily for fishing, including outside of Michigan?

(Enter number)

NUMBER OF FISHING TRIPS IN 2018

3. We are interested in what **fishing means to you**. Please tell us how much you disagree or agree with the following statements about your **personal** participation in fishing.

(Circle **one** answer for each statement.)

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat agree	Strongly agree
Fishing is one of the most enjoyable activities I do.	1	2	3	4	5
Most of my friends go fishing.	1	2	3	4	5
Fishing has a central role in my life.	1	2	3	4	5
A lot of my life is organized around fishing.	1	2	3	4	5
If I couldn't go fishing, I am not sure what I would do instead.	1	2	3	4	5



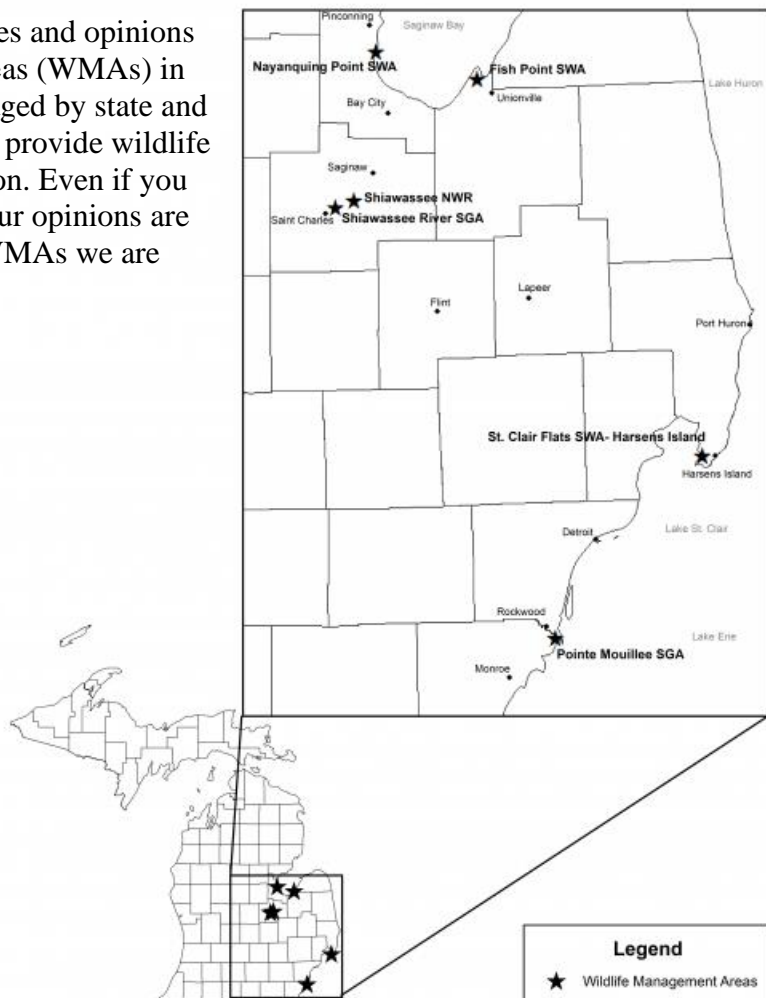
4. A person can participate in many different activities and can think of themselves in a variety of ways. Please tell us the extent to which you personally identify with each of the following.

(Circle **one** answer for each statement.)

I identify myself as a/an...	Not at all	Slightly	Moderately	Strongly	Very strongly
<b>Angler</b>	1	2	3	4	5
<b>Waterfowl (e.g., duck and goose)</b>					
<b>Hunter</b>	1	2	3	4	5
<b>Other Type of Hunter</b>	1	2	3	4	5
<b>Birdwatcher</b>	1	2	3	4	5
<b>Outdoor Enthusiast (e.g., hiking, bicycling, camping, paddling)</b>	1	2	3	4	5
<b>Conservationist</b>	1	2	3	4	5
<b>Preservationist</b>	1	2	3	4	5

We are interested in your experiences and opinions about six Wildlife Management Areas (WMAs) in southeast Michigan which are managed by state and federal fish and wildlife agencies to provide wildlife habitat and wildlife-related recreation. Even if you are not familiar with these areas, your opinions are still very important to us. The six WMAs we are most interested in are:

- Nayanquing Point State Wildlife Area, Pinconning
- Fish Point State Wildlife Area, Unionville
- Shiawassee River State Game Area, St. Charles
- Shiawassee National Wildlife Refuge, Saginaw
- St. Clair Flats State Wildlife Area-Harsens Island Unit, Harsens Island
- Pointe Mouillee State Game Area, Rockwood



5. Below are listed the current **management objectives** for the WMAs. Please tell us how important or unimportant these WMA management objectives are to **you personally**. Even if you have not visited a WMA, your opinions are important.

(Circle **one** answer for each objective.)

WMA Management Objective	Not at all important	Somewhat unimportant	Neither unimportant nor important	Somewhat important	Very important	Not sure
1. Provide habitat for migrating waterfowl (e.g., ducks and geese).	1	2	3	4	5	6
2. Provide nesting habitat for waterfowl.	1	2	3	4	5	6
3. Provide areas of no disturbance for waterfowl.	1	2	3	4	5	6
4. Manage wetlands (e.g., marshes, swamps) for a diversity of wetland wildlife species.	1	2	3	4	5	6
5. Protect wetlands (e.g., marshes, swamps).	1	2	3	4	5	6
6. Provide waterfowl (duck and goose) hunting opportunities.	1	2	3	4	5	6
7. Provide deer hunting opportunities.	1	2	3	4	5	6
8. Provide small game hunting opportunities.	1	2	3	4	5	6
9. Provide wildlife trapping opportunities.	1	2	3	4	5	6
10. Provide opportunities for a diversity of wildlife-related recreational activities.	1	2	3	4	5	6

6. Of the 10 WMA management objectives listed in Question 5 (above), which is the **one** objective that is the **most** important to you?

(Please indicate the number of the **one** objective in the box below.)

Objective number from Question 5 (1–10)

7. Please tell us if you have ever **heard about** the following WMAs prior to this survey, and whether you have **visited** them **in the past 12 months**.

(Circle YES or NO for each question.)

WMA and nearest city or town	I have heard about this WMA before.		I have visited this WMA in the past 12 months.	
Nayanquing Point State Wildlife Area, Pinconning	YES	NO	YES	NO
Fish Point State Wildlife Area, Unionville	YES	NO	YES	NO
Shiawassee River State Game Area State Game Area, St. Charles	YES	NO	YES	NO
Shiawassee National Wildlife Refuge, Saginaw	YES	NO	YES	NO
St. Clair Flats State Wildlife Area-Harsens Island Unit, Harsens Island	YES	NO	YES	NO
Pointe Mouillee State Game Area, Rockwood	YES	NO	YES	NO

*If you have **not** visited any of the WMAs listed above in the past 12 months, please continue to Question 15.*

8. For all of the WMAs that you visited **in the past 12 months**, please tell us your **main reason** for visiting them in the past 12 months. Select only **one** main reason for each area you visited in the past 12 months. Leave columns blank for those WMAs that you did **not** visit in the past 12 months.

(Circle only **one** main reason for each area you visited in the past 12 months.)

Main Reason for Visiting	Nayanquing Point SWA	Fish Point SWA	Shiawassee River SGA	Shiawassee NWR	St. Clair Flats SWA-Harsens Island	Pte. Mouillee SGA
Fishing on-site	1	1	1	1	1	1
Fishing off-site (use of boat access)	2	2	2	2	2	2
Waterfowl (duck and goose) hunting	3	3	3	3	3	3
Small game hunting	4	4	4	4	4	4
Big game (e.g., deer, turkey) hunting	5	5	5	5	5	5
Furbearer hunting or trapping	6	6	6	6	6	6
Birdwatching	7	7	7	7	7	7
Wildlife observation (other than birdwatching)	8	8	8	8	8	8
Photography	9	9	9	9	9	9
Hiking, walking, or running	10	10	10	10	10	10
Biking	11	11	11	11	11	11
Motorized boating	12	12	12	12	12	12
Paddling (e.g., canoeing, kayaking)	13	13	13	13	13	13
Dog training	14	14	14	14	14	14
Mushrooming, berry picking, or foraging for food	15	15	15	15	15	15
Outdoor/environmental education	16	16	16	16	16	16
Other (please describe) _____	17	17	17	17	17	17

*If you **did not** select “fishing on-site” or “fishing off-site (use of boat access)” for any of the WMAs in the previous question, continue to Question 10.*

9. Please tell us the fish species you were targeting on the WMA(s) where you were fishing on-site or fishing off-site (using a boat access). For example, if you were trying to catch panfish at Fish Point SWA and at Shiawassee River SGA, you would be an X in each of those columns for that fish species. Leave columns blank for those WMAs where you were not fishing on-site or off-site.

*(Mark all that apply with a X)*

Fish species targeted	Nayanquing Point SWA	Fish Point SWA	Shiawassee River SGA	Shiawassee NWR	St. Clair Flats SWA-Harsens Island	Pte. Mouillee SGA
Walleye						
Yellow Perch						
Panfish						
Bass						
Catfish						
Suckers						
Common Carp						
Other (please describe) _____						

The following questions ask your opinions about the management of wildlife habitat and recreation at the one WMA for which you are most knowledgeable about.

10. Of the WMAs you reported visiting in the past 12 months, which one are you most knowledgeable about? If you are equally knowledgeable about more than one, please select your favorite WMA.

*(Please select only one.)*

- ☐ <sub>1</sub> Nayanquing Point State Wildlife Area  
☐ <sub>2</sub> Fish Point State Wildlife Area  
☐ <sub>3</sub> Shiawassee River State Game Area  
☐ <sub>4</sub> Shiawassee National Wildlife Refuge  
☐ <sub>5</sub> St. Clair Flats State Wildlife Area - Harsens Island Unit  
☐ <sub>6</sub> Pte. Mouillee State Game Area

11. Please tell us how much you agree or disagree with the following statements about **wildlife and fish habitat and species management** at the one **WMA which you are most knowledgeable about**.

(Circle **one** answer for each statement.)

At the WMA I am most knowledgeable about...	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
Waterfowl (e.g., duck and goose) habitat management should be prioritized over <u>other wildlife species</u> management.	1	2	3	4	5
Waterfowl habitat management should be prioritized over <u>fish species</u> management.	1	2	3	4	5
Management for threatened and endangered species should be prioritized over other wildlife species management.	1	2	3	4	5
Management to provide habitats for a large variety of wildlife species should be prioritized over habitat management for a few specific wildlife species.	1	2	3	4	5
Current management benefits primarily game species.	1	2	3	4	5
Wetlands (e.g., marshes, swamps) are currently managed sufficiently to provide <u>wildlife</u> habitat.	1	2	3	4	5
Wetlands (e.g., marshes, swamps) are currently managed sufficiently to provide <u>fish</u> habitat.	1	2	3	4	5
Current controlled water levels allow for sufficient passage of migrating fish species.	1	2	3	4	5
Flooded agricultural fields are necessary to provide food for waterfowl (e.g., ducks and geese).	1	2	3	4	5
Areas closed to public access are necessary to provide resting areas for wildlife.	1	2	3	4	5

12. Please tell us how much you agree or disagree with the following statements about **management of recreational opportunities** at the one **WMA which you are most knowledgeable about.**

Circle **one** answer for each statement.)

At the WMA I am most knowledgeable about...	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
I can access the areas that I want to at the time of year I want.	1	2	3	4	5
I can access the areas that I want to for my recreational activity without much trouble.	1	2	3	4	5
Controlled water levels allow me to access the areas that I want to in the fall.	1	2	3	4	5
I experience little disturbance from other recreational users.	1	2	3	4	5
I feel safe and secure when I participate in wildlife-related recreation there.	1	2	3	4	5
Current management provides a diversity of opportunities for wildlife-related recreation.	1	2	3	4	5
Waterfowl (duck and goose) hunting management should be prioritized over the management for other wildlife-related recreation.	1	2	3	4	5
Having a variety of wildlife habitats is important for me to enjoy my recreational activity.	1	2	3	4	5
Providing wildlife habitat is more important than providing wildlife-related recreational opportunities.	1	2	3	4	5
An appropriate balance currently exists between management for hunting and non-hunting recreational opportunities.	1	2	3	4	5
Management currently benefits primarily hunters.	1	2	3	4	5
Hunters' opinions on wildlife management decisions are currently considered more by the WMA managers than non-hunters' opinions.	1	2	3	4	5

13. Please tell us if you would prefer **changes** to the following **wildlife and fish habitat and species management** activities at the one **WMA which you are most knowledgeable about.**

(Circle **one** answer for each statement.)

At the WMA I am most knowledgeable about...	Greatly decrease	Somewhat decrease	Stay about the same	Somewhat increase	Greatly increase	Not sure
The number of different wildlife habitat types should...	1	2	3	4	5	6
Efforts toward management for game species should...	1	2	3	4	5	6
Efforts toward management for non-game species should...	1	2	3	4	5	6
Efforts toward management for fish habitat should...	1	2	3	4	5	6
Active wetland management (e.g., use of pumps, water control structures, etc.) should...	1	2	3	4	5	6
The depth of managed water levels in the fall should...	1	2	3	4	5	6
The number of agricultural fields that are flooded in the fall should...	1	2	3	4	5	6
Invasive plant species management efforts should...	1	2	3	4	5	6
The number of water control structures that allow for fish passage should...	1	2	3	4	5	6
The amount of wetland area (e.g., marshes, swamps) available to fish for spawning habitat should...	1	2	3	4	5	6



14. Please tell us if you would prefer **changes** to the following **recreation management** activities at the one **WMA which you are most knowledgeable about**.

(Circle **one** answer for each statement.)

At the WMA I am most knowledgeable about...	Greatly decrease	Somewhat decrease	Stay about the same	Somewhat increase	Greatly increase	Not sure
The amount of vehicle road access to the WMA should...	1	2	3	4	5	6
The number of hiking trails to access areas of the WMA should...	1	2	3	4	5	6
The amount of bicycle access to the WMA should...	1	2	3	4	5	6
The number of parking lots should...	1	2	3	4	5	6
The number of boat launches to access areas of the WMA should...	1	2	3	4	5	6
The number of boat launches to access rivers and lakes should...	1	2	3	4	5	6
Access for non-hunting recreational activities should...	1	2	3	4	5	6
The number of days that waterfowl (duck and goose) hunting is allowed on the WMA in the fall should...	1	2	3	4	5	6
Seasonal closures to avoid conflicts between different types of recreation should...	1	2	3	4	5	6
Wildlife resting areas that are closed to public access should...	1	2	3	4	5	6

The next question asks for your thoughts about funding for WMA management.

15. Please tell us what you think is the **primary source of funds** for wildlife management on WMAs.

(Select only **one**.)

☐<sub>1</sub> Funds from the sale of hunting licenses and equipment

☐<sub>2</sub> Funds from state taxes

☐<sub>3</sub> Access permits or fees

☐<sub>4</sub> Other (please indicate) \_\_\_\_\_

16. Listed below are some actual actions that are currently available that help to secure funds for WMA management as well as some hypothetical actions that might be available in the future to help support WMA management. How likely is it that you would take the following actions **in the next 12 months**, if they were available, in order to help support WMA management?

(Circle **one** answer for each action.)

	Not at all likely	Somewhat unlikely	Neither unlikely nor likely	Somewhat likely	Very likely
Purchase a Michigan Waterfowl Stamp (Michigan Duck Stamp)	1	2	3	4	5
Purchase a Federal Migratory Bird Hunting and Conservation Stamp (Federal Duck Stamp)	1	2	3	4	5
Purchase a Migratory Songbird Conservation Stamp	1	2	3	4	5
Purchase a WMA access permit	1	2	3	4	5
Donate money to WMA management	1	2	3	4	5
Participate in a WMA fundraising event	1	2	3	4	5
Pay a small increase in Michigan state income tax (e.g., 0.375%)	1	2	3	4	5
Pay a small increase in Michigan gas taxes (e.g., \$0.15/gallon)	1	2	3	4	5

In the following questions, it is important to understand what you think about the benefits that people get from nature.

17. Listed below are some benefits to people that could be provided by natural places (not just WMAs, but **any** natural place). Please tell us how important each benefit is to you personally.

(Circle **one** answer for each benefit.)

Benefits provided by natural places	Not at all important	Somewhat unimportant	Neither unimportant nor important	Somewhat important	Very important
1. Places that provide enjoyable scenery, sights, and/or sounds.	1	2	3	4	5
2. Places for abundant wildlife, fish, and plants.	1	2	3	4	5
3. Places for passing down culture, knowledge, and traditions.	1	2	3	4	5
4. Places that provide jobs and income for the local economy.	1	2	3	4	5
5. Places for future generations to know and experience nature.	1	2	3	4	5
6. Places for natural and/or human history.	1	2	3	4	5
7. Places that provide a sense of community and belonging.	1	2	3	4	5
8. Places that have value in just knowing they are there.	1	2	3	4	5
9. Places that provide educational value.	1	2	3	4	5
10. Places that provide natural processes which support life (e.g., climate regulation, storage of greenhouse gasses).	1	2	3	4	5
11. Places that provide hunting, fishing, and/or trapping opportunities.	1	2	3	4	5
12. Places that provide wildlife watching, hiking, camping, paddling, and/or other similar outdoor opportunities.	1	2	3	4	5
13. Places for spiritual renewal.	1	2	3	4	5
14. Places that provide a source of food for humans.	1	2	3	4	5
15. Places for peace, quiet, and stress relief.	1	2	3	4	5
16. Places free from development where there is minimal human impact.	1	2	3	4	5

<b>17. Places that provide safety to communities (e.g., flood and erosion protection).</b>	1	2	3	4	5
<b>18. Places that provide for human health (e.g., clean air to breathe and clean water to drink).</b>	1	2	3	4	5
<b>19. Places that provide public access to nature.</b>	1	2	3	4	5

18. For the benefits to people provided by natural places listed above, please write the number that is next to the **one** benefit that is the **most** important to you personally.

Objective number from Question 17 (1–19)

19. Listed below are the same benefits to people that could be provided by natural places as Question 17. To what extent do you agree or disagree that **current WMA management provides these benefits?**

(Circle **one** answer for each benefit.)

Current WMA management provides...	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Places that provide enjoyable scenery, sights, and/or sounds.	1	2	3	4	5
Places for abundant wildlife, fish, and plants.	1	2	3	4	5
Places for passing down culture, knowledge, and traditions.	1	2	3	4	5
Places that provide jobs and income for the local economy.	1	2	3	4	5
Places for future generations to know and experience nature.	1	2	3	4	5
Places for natural and human history.	1	2	3	4	5
Places that provide a sense of community and belonging.	1	2	3	4	5
Places that have value in just knowing they are there.	1	2	3	4	5
Places that provide educational value.	1	2	3	4	5
Places that provide natural processes which support life (e.g., climate regulation, storage of greenhouse gasses).	1	2	3	4	5
Places that provide hunting, fishing, and/or trapping opportunities.	1	2	3	4	5
Places that provide wildlife watching, hiking, camping, paddling, and/or other similar outdoor opportunities.	1	2	3	4	5
Places for spiritual renewal.	1	2	3	4	5
Places that provide a source of food for humans.	1	2	3	4	5
Places for peace, quiet, and stress relief.	1	2	3	4	5
Places free from development where there is minimal human impact.	1	2	3	4	5
Places that provide safety to communities (e.g., flood and erosion protection).	1	2	3	4	5
Places that provide for human health (e.g., clean air to breathe and clean water to drink).	1	2	3	4	5
Places that provide public access to nature.	1	2	3	4	5

**In the following questions, you will be asked about your participation in conservation-related activities.**

20. Please tell us how often you participated in each of the following activities, if they were available, **in the past 12 months**.

(Circle **one** answer for each activity.)

	Never	Rarely	Occasionally	Often	Very Often
Made my yard or my land more desirable to wildlife.	1	2	3	4	5
Volunteered my personal time and effort for habitat improvement projects on public land in my community.	1	2	3	4	5
Voted to support a policy or regulation that supports conservation.	1	2	3	4	5
Contributed money to support local conservation causes.	1	2	3	4	5
Recruited others to participate in wildlife-related recreational activities.	1	2	3	4	5
Participated as an active member in a conservation group.	1	2	3	4	5
Contributed money to a conservation organization.	1	2	3	4	5
Attended meetings about conservation issues.	1	2	3	4	5
Contacted elected officials or government agencies about conservation issues.	1	2	3	4	5
Talked to others about conservation issues.	1	2	3	4	5

21. Are you or have you been a member of any of the following organizations **in the past 12 months**?

(Please select **all** that apply).

- ☐ Fishing or Fishing conservation organization (e.g., Trout Unlimited, Izzaak Walton League of American, Saginaw Bay Walleye Club)
- ☐ Hunting/conservation organization (e.g., Ducks Unlimited, National Wild Turkey Federation, Quality Deer Management Association, Michigan United Conservation Clubs, Michigan Duck Hunters Association)
- ☐ Birding, birdwatching, or bird conservation group (e.g., American Birding Association, National Audubon Society, American Bird Conservancy, Michigan Audubon, local Audubon chapter)
- ☐ National/international environmental or conservation organization (e.g., The Nature Conservancy, National Wildlife Federation, Sierra Club, World Wildlife Fund)
- ☐ Local/regional conservation organizations (e.g., Clinton River Watershed Council, Southeast Michigan Land Conservancy).

**The last set of questions asks about you.**

22. What is your gender? (*Please select one*)

- ☐<sub>1</sub> Female
- ☐<sub>2</sub> Male
- ☐<sub>3</sub> Other \_\_\_\_\_
- ☐<sub>4</sub> Prefer not to say

23. Enter zip code of primary residence in Michigan

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24. In what year were you born?

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25. What is the **highest** level of education you have **completed**? (*Select one*)

- ☐<sub>1</sub> Some high school or less
- ☐<sub>2</sub> High school diploma or GED
- ☐<sub>3</sub> Some college (no degree)
- ☐<sub>4</sub> Associate's degree or Bachelor's degree
- ☐<sub>5</sub> Graduate or professional school
- ☐<sub>6</sub> Prefer not to say

26. What ethnicity do you consider yourself? (*Select one.*)

- ☐<sub>1</sub> Hispanic or Latino
- ☐<sub>2</sub> Not Hispanic or Latino
- ☐<sub>3</sub> Prefer not to say

27. From what racial origin(s) do you consider yourself? (*Select all that apply.*)

- ☐<sub>1</sub> American Indian or Native Alaskan
- ☐<sub>1</sub> Asian
- ☐<sub>1</sub> Black or African American
- ☐<sub>1</sub> Native Hawaiian or other Pacific Islander
- ☐<sub>1</sub> White
- ☐<sub>1</sub> Other: \_\_\_\_\_
- ☐<sub>1</sub> Prefer not to say

**(OVER)**

28. Which of these categories best describes the place where you live now? (Select **one**)

- ☐<sub>1</sub> Large urban area (population 500,000 or more)
- ☐<sub>2</sub> Medium urban area (population between 50,000 and 500,000)
- ☐<sub>3</sub> Small city (population between 10,000 and 50,000)
- ☐<sub>4</sub> Small town (population between 2,000 and 10,000)
- ☐<sub>5</sub> Rural area (population less than 2,000)
- ☐<sub>6</sub> Prefer not to say

29. What was your household income last year (before taxes and other deductions)? (Select **one**)

- ☐<sub>1</sub> <\$24,999
- ☐<sub>2</sub> \$25,000 to \$49,999
- ☐<sub>3</sub> \$50,000 to \$74,999
- ☐<sub>4</sub> \$75,000 to \$99,999
- ☐<sub>5</sub> \$100,000 to \$124,999
- ☐<sub>6</sub> \$125,000 to \$149,999
- ☐<sub>7</sub> \$150,000 to \$199,999
- ☐<sub>8</sub> \$200,000 to \$249,999
- ☐<sub>9</sub> \$250,000 to \$299,999
- ☐<sub>10</sub> \$300,000 or more
- ☐<sub>11</sub> Prefer not to say

30. Thinking about the questions you have answered in this survey, do you have any additional thoughts or opinions that you'd like to share with the researchers?

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One of the next steps for Michigan State University researchers is to host WMA stakeholder workshops in 2019. Are you interested in potentially participating in one of these stakeholder workshops?

- ☐<sub>1</sub> Yes. Please provide your name, address, and email address below so that we may contact you:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Email address: \_\_\_\_\_

- ☐<sub>2</sub> No

**Thank you for your time and participation. Your responses are valuable for the success of this research project!**



**APPENDIX D: MICHIGAN COASTAL WILDLIFE MANAGEMENT AREA  
BIRDWATCHER SURVEY**



Thank you for your interest in this research study about Michigan’s coastal Wildlife Management Areas (WMAs) and waterfowl hunting. We are interested in the opinions and behaviors of everyone who spends time viewing birds. We also realize there are different levels of participation in birding and birdwatching. We use the term “birdwatching” to refer to both activities.

We are particularly interested in your birdwatching experiences, your experiences with WMAs, and your thoughts on ways to improve these WMAs for birdwatching. Even if you’ve only been birdwatching in Michigan once or have never visited a WMA, we want to hear from you!

We are working closely with the Cornell Lab of Ornithology, National Audubon Society, and your Michigan state and federal wildlife managers for this study. Your responses are important to this study and will be used to help improve the management of WMAs in the future. Please be assured that your participation in the study, and all of your responses, will be kept confidential and your participation is strictly voluntary. This survey should take about 20 minutes to complete. You must be 18 or older to participate.

**Thank you for your help!**

1. Please tell us **all** of the nature-based activities in which you have participated during the **past 12 months**. *(Please select all that apply).*

- ☐ Viewing birds (e.g., birdwatching, bird feeding)
- ☐ Viewing wildlife, not including birds (e.g., wildlife watching, wildlife photography)
- ☐ Learning about nature away from home (e.g., attending festivals or lectures, visiting a nature center)
- ☐ Backyard/at home nature activities (e.g., gardening, landscaping)
- ☐ Fishing
- ☐ Hunting waterfowl (ducks and geese)
- ☐ Hunting other game species
- ☐ Non-motorized outdoor recreation activities (e.g., hiking, backpacking, horseback riding, bicycling, skiing, swimming, canoeing and kayaking)
- ☐ Motorized outdoor recreation activities (e.g., motorized boating, riding ATVs, snowmobiling)
- ☐ Other nature-based activities (e.g., picnicking, relaxing in nature, camping)

2. In the past 12 months, did you take any trips at least 1 mile or more from your home **primarily** for birdwatching?

- ☐ Yes. Please continue to Question 3.
- ☐ No. Please continue to Question 4.

3. **In the past 12 months**, about how many **trips** at least 1 mile from your home did you take **primarily** for birdwatching? (Please estimate a number)

NUMBER OF BIRDWATCHING TRIPS IN THE LAST YEAR

4. Please tell us where you do **most** of your birdwatching. Please select only one response.

- ☐ Mostly public land or waters
- ☐ Mostly private property owned by you or your family
- ☐ Mostly private property owned by a friend or another landowner who gives you permission
- ☐ Mostly private property that is open to the public, such as nature conservancies or nature preserves
- ☐ Equal mix of public and private lands
- ☐ I'm not sure.

5. We are interested in what birdwatching means to you. Please tell us how much you disagree or agree with the following statements about your personal participation in birdwatching. Select one answer for each statement.

	<b>Strongly disagree</b>	<b>Somewhat disagree</b>	<b>Neither disagree nor agree</b>	<b>Somewhat agree</b>	<b>Strongly agree</b>
Birdwatching is one of the most enjoyable activities I do.					
Most of my friends go birdwatching.					
Birdwatching has a central role in my life.					
A lot of my life is organized around birdwatching.					
If I couldn't go birdwatching I am not sure what I would do instead.					

6. How would you rate your own ability to identify birds in the field on a scale of 1 to 7 where 1 is novice and 7 is expert? Please select only one response.

<b>1 Novice</b>	<b>2</b>	<b>3</b>	<b>4 Intermediate</b>	<b>5</b>	<b>6</b>	<b>7 Expert</b>

7. How often do you use the following equipment or techniques while birdwatching? Please select one answer for each item.

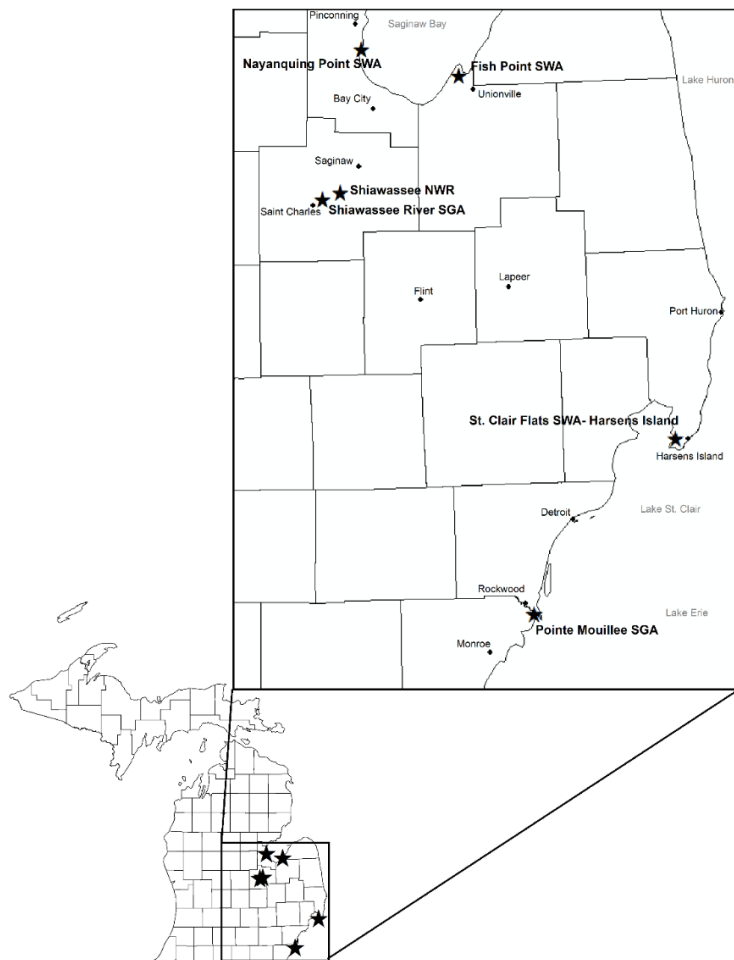
	<b>Never</b>	<b>Rarely</b>	<b>Occasionally</b>	<b>Often</b>	<b>Very Often</b>
Binoculars					
Scope					
Camera					
Digiscoping (using a digital camera and a spotting scope to take photos)					

8. A person can participate in many different activities and can think of themselves in a variety of ways. Please tell us the extent to which you personally identify with each of the following. Select one answer for each statement.

I identify myself as a/an...	Not at all	Slightly	Moderately	Strongly	Very strongly
Birdwatcher					
Waterfowl (e.g., duck and goose) Hunter					
Other Type of Hunter					
Angler					
Outdoor Enthusiast (e.g., hiking, bicycling, camping, paddling)					
Conservationist					
Preservationist					

We are interested in your experiences and opinions about six coastal Wildlife Management Areas (WMAs) in southeast Michigan (see map below). These areas are managed by state and federal fish and wildlife agencies to provide wildlife habitat and wildlife-related recreation. Even if you are not familiar with these areas, your opinions are important.

- Nayanquing Point State Wildlife Area (SWA), Pinconning
- Fish Point SWA, Unionville
- Shiawassee River State Game Area (SGA), St. Charles
- Shiawassee National Wildlife Refuge (NWR), Saginaw
- St. Clair Flats SWA-Harsens Island Unit, Harsens Island
- Pointe Mouillee SGA, Rockwood



9. Below are listed the current management objectives for the WMAs. Please tell us how important or unimportant these WMA management objectives are to you personally. Even if you have not visited a WMA, your opinions are important. Select one answer for each objective.

WMA Management Objective	Not at all important	Somewhat unimportant	Neither unimportant nor important	Somewhat important	Very important	Not sure
1. Provide habitat for migrating waterfowl (e.g., ducks and geese).						
2. Provide nesting habitat for waterfowl.						
3. Provide areas of no disturbance for waterfowl.						
4. Manage wetlands (e.g., marshes, swamps) for a diversity of wetland wildlife species.						
5. Protect wetlands (e.g., marshes, swamps).						
6. Provide waterfowl (duck and goose) hunting opportunities.						
7. Provide deer hunting opportunities.						
8. Provide small game hunting opportunities.						
9. Provide wildlife trapping opportunities.						
10. Provide opportunities for a diversity of wildlife-related recreational activities.						

10. Of the 10 WMA management objectives listed in Question 9, which is the **one** objective that is the **most** important to you? Please indicate the number of the objective in the box below.

Objective number from Question 9 (1–10)

11. Please tell us if you have ever heard about the following WMAs, and whether you have visited them **in the past 12 months**. Circle YES or NO for each question.

WMA and nearest city or town	I have heard about this WMA before.		I have visited this WMA <u>in the past 12 months</u> .	
Nayanquing Point State Wildlife Area (SWA), Pinconning	YES	NO	YES	NO
Fish Point SWA, Unionville	YES	NO	YES	NO
Shiawassee River State Game Area (SGA), St. Charles	YES	NO	YES	NO
Shiawassee National Wildlife Refuge (NWR), Saginaw	YES	NO	YES	NO
St. Clair Flats SWA-Harsens Island Unit, Harsens Island	YES	NO	YES	NO
Pointe Mouillee SGA, Rockwood	YES	NO	YES	NO

*If you have not visited any of the WMAs listed above in the past 12 months, please continue to Question 18.*

12. For the WMAs that you visited **in the past 12 months**, please tell us your **main reason** for visiting them in the past 12 months. Select only **one** main reason for each area you visited in the past 12 months.

Main Reason for Visiting	Nayanquing Point SWA	Fish Point SWA	Shiawassee River SGA	Shiawassee NWR	St. Clair Flats SWA-Harsens Island	Pte. Mouillee SGA
Birdwatching						
Wildlife observation (other than birdwatching)						
Photography						
Hiking, walking, or running						
Biking						
Motorized boating						
Paddling (e.g., canoeing, kayaking)						
Dog training						
Fishing						
Waterfowl (duck and goose) hunting						
Small game hunting						
Big game (e.g., deer, turkey) hunting						
Furbearer hunting or trapping						
Mushrooming, berry picking, or foraging for food						
Outdoor/environmental education						
Other (please describe) _____						

**The following questions ask your opinions about the management of wildlife habitat and recreation at the one WMA for which you are most knowledgeable about.**

13. Of the WMAs you reported visiting in the past 12 months, which **one** are you most knowledgeable about? If you are equally knowledgeable about more than one, please select your favorite WMA. Please select only **one**.

- |   |  |
|---|--|
| <input type="checkbox"/> Nayanquing Point SWA | <input type="checkbox"/> Shiawassee National Wildlife Refuge       |
| <input type="checkbox"/> Fish Point SWA       | <input type="checkbox"/> St. Clair Flats SWA - Harsens Island Unit |
| <input type="checkbox"/> Shiawassee River SGA | <input type="checkbox"/> Pte. Mouillee SGA                         |

14. Please tell us how much you agree or disagree with the following statements about **wildlife habitat and species management** at the one WMA which you are most knowledgeable about. Select one answer for each statement.

At the WMA I am most knowledgeable about...	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
Waterfowl (e.g., duck and goose) habitat management should be prioritized over other wildlife species management.					
Management for threatened and endangered species should be prioritized over other wildlife species management.					
Management to provide habitats for a large variety of wildlife species should be prioritized over habitat management for a few specific wildlife species.					
Current management primarily benefits game species.					
The current way habitat is managed provides the opportunity to see a lot of different bird species.					
Wetlands (e.g., marshes, swamps) are currently managed sufficiently to provide wildlife habitat.					
Flooded agricultural fields are necessary to provide food for waterfowl (e.g., ducks and geese).					
Areas closed to public access are necessary to provide resting areas for wildlife.					



15. Please tell us how much you agree or disagree with the following statements about **management of recreational opportunities** at the one WMA which you are most knowledgeable about. Select one answer for each statement.

At the WMA I am most knowledgeable about...	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
I can access the areas that I want to at the time of year I want.					
I can access the areas that I want to for my recreational activity without much trouble.					
Controlled water levels allow me to access the areas that I want to in the fall.					
I experience little disturbance from other recreational users.					
I feel safe and secure when I participate in wildlife-related recreation there.					
Current management provides a diversity of opportunities for wildlife-related recreation.					
Waterfowl (duck and goose) hunting management should be prioritized over the management for other wildlife-related recreation.					
Having a variety of wildlife habitats is important for me to enjoy my recreational activities.					
Providing wildlife habitat is more important than providing wildlife-related recreational opportunities.					
An appropriate balance currently exists between management for hunting and non-hunting recreational opportunities.					
Management currently benefits primarily hunters.					
Hunters' opinions on wildlife management decisions are currently considered more by the WMA managers than non-hunters' opinions.					

16. Please tell us if you would prefer **changes** to the following **wildlife habitat and species management** activities at the one WMA which you are most knowledgeable about. Select one answer for each statement.

At the WMA I am most knowledgeable about...	Greatly decrease	Somewhat decrease	Stay about the same	Somewhat increase	Greatly increase	Not sure
The number of different wildlife habitat types should...						
Efforts toward management for game species should...						
Efforts toward management for non-game species should...						
Active wetland management (e.g., use of pumps, water control structures, etc.) should...						
The depth of managed water levels in the fall should...						
The number of agricultural fields that are flooded in the fall should...						
Invasive plant species management efforts should...						

17. Please tell us if you would prefer **changes** to the following **recreation management** activities at the one WMA which you are most knowledgeable about. Select one answer for each statement.

<b>At the WMA I am most knowledgeable about...</b>	<b>Greatly decrease</b>	<b>Somewhat decrease</b>	<b>Stay about the same</b>	<b>Somewhat increase</b>	<b>Greatly increase</b>	<b>Not sure</b>
The amount of vehicle road access to the WMA should...						
The number of hiking trails to access areas of the WMA should...						
The amount of bicycle access to the WMA should...						
The number of parking lots should...						
The number of boat launches to access areas of the WMA should...						
Access for non-hunting recreational opportunities should...						
The number of days that waterfowl (duck and goose) hunting is allowed on the WMA in the fall should...						
Seasonal closures to avoid conflicts between different types of recreation should...						
Wildlife resting areas that are closed to public access should...						

The next set of questions asks for your thoughts about funding for WMA management.

18. Please tell us what you think is the **primary source of funds** for wildlife management on WMAs. Select only one.

- ☐ Funds from the sale of hunting licenses and equipment
- ☐ Funds from state taxes
- ☐ Access permits or fees
- ☐ Other (please indicate) \_\_\_\_\_

19. Listed below are some actual actions that are currently available that help to secure funds for WMA management as well as some hypothetical actions that might be available in the future to help support WMA management. How likely is it that you would take the following actions **in the next 12 months**, if they were available, in order to help support WMA management? Select one answer for each action.

Action	Not at all likely	Somewhat unlikely	Neither unlikely nor likely	Somewhat likely	Very likely
Purchase a Michigan Waterfowl Stamp (Michigan Duck Stamp)					
Purchase a Federal Migratory Bird Hunting and Conservation Stamp (Federal Duck Stamp)					
Purchase a Migratory Songbird Conservation Stamp					
Purchase a WMA access permit					
Donate money to WMA management					
Participate in a WMA fundraising event					
Pay a small increase in Michigan state income tax (e.g., 0.375%)					
Pay a small increase in Michigan gas taxes (e.g., \$0.15/gallon)					

**In the following questions, it is important to understand what you think about the benefits that people get from nature.**

20. Listed below are some benefits to people that could be provided by natural places (not just WMAs, but **any** natural place). Please tell us how important each benefit is to you personally. Select one answer for each benefit.

<b>Benefits provided by natural places</b>	<b>Not at all important</b>	<b>Somewhat unimportant</b>	<b>Neither unimportant nor important</b>	<b>Somewhat important</b>	<b>Very important</b>
1. Places that provide enjoyable scenery, sights, and/or sounds.					
2. Places for abundant wildlife, fish, and plants.					
3. Places for passing down culture, knowledge, and traditions.					
4. Places that provide jobs and income for the local economy.					
5. Places for future generations to know and experience nature.					
6. Places of natural and/or human history.					
7. Places that provide a sense of community and belonging.					
8. Places that have value in just knowing they are there.					
9. Places that provide educational value.					
10. Places that provide natural processes which support life (e.g., climate regulation, storage of greenhouse gasses).					
11. Places that provide hunting, fishing, and/or trapping opportunities.					
12. Places that provide wildlife watching, hiking, camping, paddling, and/or other similar outdoor opportunities.					
13. Places for spiritual renewal.					

14. Places that provide a source of food for humans.					
15. Places for peace, quiet, and stress relief.					
16. Places free from development where there is minimal human impact.					
17. Places that provide safety to communities (e.g., flood and erosion protection).					
18. Places that provide for human health (e.g., clean air to breathe and clean water to drink).					
19. Places that provide public access to nature.					

21. For the benefits to people provided by natural places listed above, please write the number that is next to the **one** benefit that is the **most** important to you personally.

Objective number from Question 20 (1-19)

22. Listed below are the same benefits to people that could be provided by natural places as Question 20. To what extent do you agree or disagree that **current WMA management provides these benefits?** Select one answer for each benefit.

Current WMA management provides...	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Places that provide enjoyable scenery, sights, and sounds.					
Places for abundant wildlife, fish, and plants.					
Places for preserving knowledge and traditions.					
Places that provide jobs and income for the local economy.					
Places for future generations to know and experience nature.					
Places for natural and human history.					
Places that provide a sense of place and belonging.					
Places that have value in just knowing they are there.					
Places that provide educational value.					
Places that provide natural processes which support life (e.g., climate regulation, storage of greenhouse gasses).					
Places that provide hunting, fishing, and trapping opportunities.					
Places that provide wildlife watching, hiking, camping, paddling, and other similar outdoor opportunities.					
Places for spiritual renewal.					
Places that provide a source of food for humans.					
Places for peace, quiet, and stress relief.					
Places free from development where there is minimal human impact.					
Places that provide safety to communities and reduce damage to infrastructure (e.g., flood and erosion protection).					
Places that provide for human health (e.g., clean air to breathe and clean water to drink).					
Places that provide public access to nature.					

**In the following questions, you will be asked about your participation in conservation-related activities.**

23. Please tell us how often you participated in each of the following activities, if they were available, **in the past 12 months**. Select one answer for each activity.

Activity	Never	Rarely	Occasionally	Often	Very often
Made my yard or my land more desirable to wildlife.					
Volunteered my personal time and effort for habitat improvement projects on public land in my community.					
Voted to support a policy or regulation that supports conservation.					
Contributed money to support local conservation causes.					
Recruited others to participate in wildlife-related recreational activities.					
Participated as an active member in a conservation group.					
Contributed money to a conservation organization.					
Attended meetings about conservation issues.					
Contacted elected officials or government agencies about conservation issues.					
Talked to others about conservation issues.					

24. Are you or have you been a member of any of the following organizations **in the past 12 months**? *(Please select all that apply).*

- ☐ National, state, or local birding or bird conservation group (e.g., American Birding Association, National Audubon Society, American Bird Conservancy, Michigan Audubon, local Audubon chapter)
- ☐ Fishing conservation organization (e.g., Trout Unlimited, Izzaak Walton)
- ☐ Hunting/conservation organization (e.g., Ducks Unlimited, National Wild Turkey Association, Quality Deer Management Association, Michigan United Conservation Clubs)
- ☐ National/international environmental or conservation organization (e.g., The Nature Conservancy, National Wildlife Federation, Sierra Club, World Wildlife Fund)
- ☐ Local/regional conservation organizations (e.g., Clinton River Watershed Council, Southeast Michigan Land Conservancy).



**eBird is a citizen science program and an online database of bird observations providing current and useful information to the birding community. The following set of questions ask about your participation in eBird and other citizen science programs.**

25. Have you used eBird?

- ☐ Yes.
- ☐ No.
- ☐ I'm not sure.

***If you have not used eBird, please continue to Question 28.***

26. How often did you report your birding trips (whether near or far) directly into the eBird database **in the past 12 months**? Please select only one response.

- ☐ Never
- ☐ Rarely
- ☐ Occasionally
- ☐ Often
- ☐ Very often

27. How important are the following factors in motivating you to participate in eBird?

	Not at all important	Somewhat unimportant	Neither unimportant nor important	Somewhat important	Very important
Belonging to the birding community.					
Competition with other birders.					
Learning more about birds.					
Concern for the well-being of birds.					
The recognition I receive from others.					
Gathering information on birds for science.					
Allowing me to keep track of what birds are in the area.					
Connecting with nature.					
Bringing me joy in seeing birds.					
The desire to contribute to bird conservation.					
Sharing experiences watching birds with others.					
Teaching others about birds.					

28. Public participation in scientific research is sometimes called citizen science. To what extent do you or have you participated in the following citizen science projects?

Citizen Science Project	I have never participated	I used to participate	I am a current participant	I plan to participate in the future
Project FeederWatch				
NestWatch				
Celebrate Urban Birds				
Bird Cams Lab				
Christmas Bird Count				
Great Backyard Bird Count				
iNaturalist				
Other (Please describe) _____				

**This last set of questions asks about you.**

29. What is your gender? Please select one.

- ☐ Female
- ☐ Male
- ☐ Other \_\_\_\_\_
- ☐ Prefer not to say

30. Enter your zip code of primary residence in Michigan:

31. In what year were you born?

32. What is the **highest** level of education you have **completed**? Select one.

- ☐ Some high school or less
- ☐ High school diploma or GED
- ☐ Some college (no degree)
- ☐ Associate's degree or Bachelor's degree
- ☐ Graduate or professional school
- ☐ Prefer not to say

33. What ethnicity do you consider yourself?

- ☐ Hispanic or Latino
- ☐ Not Hispanic or Latino
- ☐ Prefer not to say

34. From what racial origin(s) do you consider yourself? Select all that apply.

- ☐ American Indian or Native Alaskan
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or other Pacific Islander
- ☐ White
- ☐ Prefer not to say

35. Which of these categories best describes the place where you live now? Select one.

- ☐ Large urban area (population 500,000 or more)
- ☐ Medium urban area (population between 50,000 and 500,000)
- ☐ Small city (population between 10,000 and 50,000)
- ☐ Small town (population between 2,000 and 10,000)
- ☐ Rural area (population less than 2,000)
- ☐ Prefer not to say

36. What was your **household** income last year (before taxes and other deductions)?  
Select one.

- ☐ <\$24,999
- ☐ \$25,000 to \$49,999
- ☐ \$50,000 to \$74,999
- ☐ \$75,000 to \$99,999
- ☐ \$100,000 to \$124,999
- ☐ \$125,000 to \$149,999
- ☐ \$150,000 to \$199,999
- ☐ \$200,000 to \$249,999
- ☐ \$250,000 to \$299,999
- ☐ \$300,000 or more
- ☐ Prefer not to say

37. Thinking about the questions you have answered in this survey, do you have any additional thoughts or opinions that you'd like to share with the researchers? \_\_\_\_\_

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One of the next steps for Michigan State University researchers is to host WMA stakeholder workshops in 2019. Are you interested in potentially participating in one of these stakeholder workshops?

- ☐ Yes.

Please provide your name, address, and email address below so that we may contact you:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Email address: \_\_\_\_\_

- ☐ No

**Thank you for your time and participation. Your responses are valuable for the success of this research project!**

## APPENDIX E: MICHIGAN COASTAL WILDLIFE MANAGEMENT AREA COMMUNITY MEMBER SURVEY



Thank you for your interest in this research study about Michigan's coastal Wildlife Management Areas (WMAs) and the recreational opportunities they provide. These areas are managed by state and federal wildlife agencies to provide wildlife habitat and wildlife-related recreation. We are interested in the opinions and behaviors of everyone who lives near these WMAs. We are particularly interested in your experiences with WMAs and your thoughts on ways to improve these WMAs. Even if never visited a WMA, we want to hear from you!

Michigan State University researchers are working closely with the Michigan Department of Natural Resources and the U.S. Fish and Wildlife Service for this study. Your responses are important to this study and will be used to help improve the management of WMAs in the future. Please be assured that your participation in the study, and all of your responses, will be kept confidential. Participation is voluntary, you may choose not to participate at all, or you may refuse to answer certain questions or discontinue your participation at any time without consequence. This survey should take about 20 minutes to complete. You must be 18 or older to participate. By completing this survey, you are voluntarily agreeing to participate in this research study.

**Thank you for your help!**

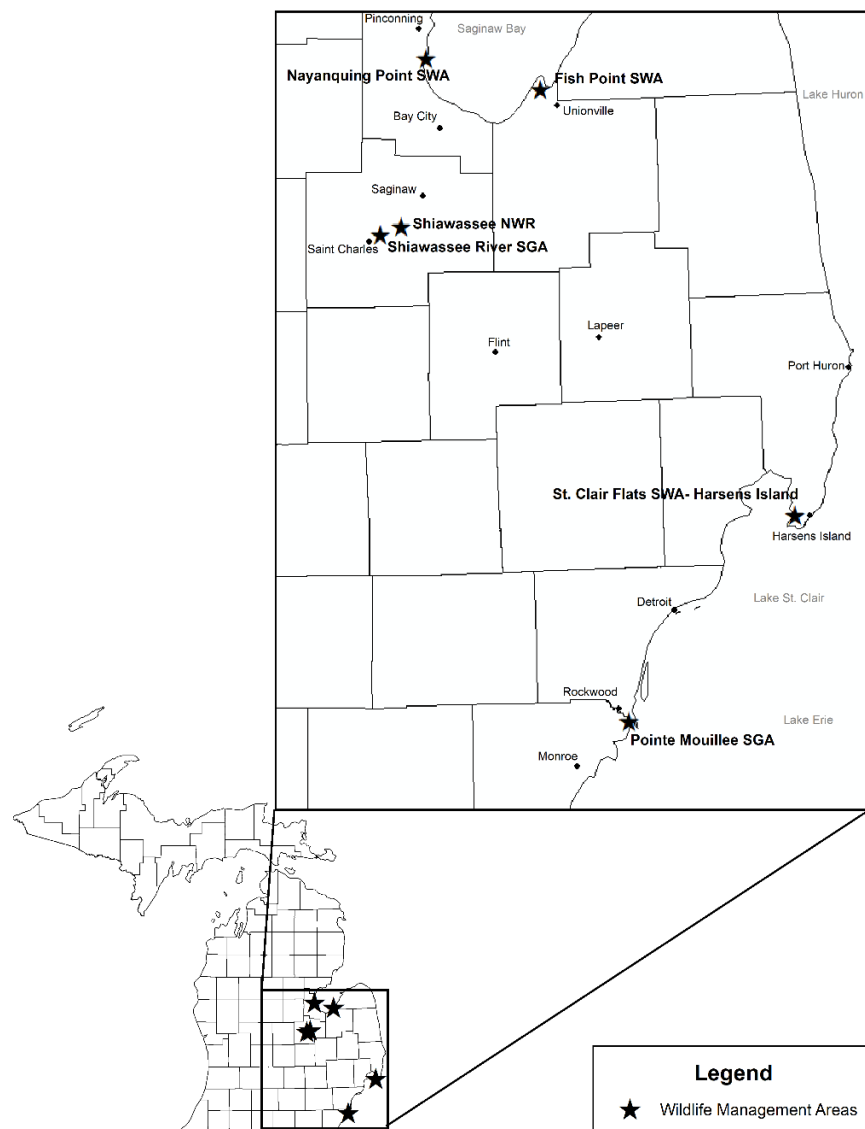
1. Please tell us **all** of the nature-based activities in which you have participated during **the past 12 months**. (Please select **all that apply**.)
  - ☐ Backyard/at home nature activities (e.g., gardening, landscaping)
  - ☐ Viewing birds (e.g., birdwatching, bird feeding)
  - ☐ Viewing wildlife, not including birds (e.g., wildlife watching, wildlife photography)
  - ☐ Learning about nature away from home (e.g., attending festivals or lectures, visiting a nature center)
  - ☐ Fishing
  - ☐ Hunting waterfowl (ducks and geese)
  - ☐ Hunting other game species
  - ☐ Non-motorized outdoor recreation activities (e.g., hiking, backpacking, horseback riding, bicycling, skiing, swimming, canoeing and kayaking)
  - ☐ Motorized outdoor recreation activities (e.g., motorized boating, riding ATVs, snowmobiling)
  - ☐ Other nature-based activities (e.g., picnicking, relaxing in nature, camping)
  
2. A person can participate in many different activities and can think of themselves in a variety of ways. Please tell us the extent to which you personally identify with each of the following.

(Circle **one** answer for each statement.)

I identify myself as a/an...	Not at all	Slightly	Moderately	Strongly	Very strongly
<b>Outdoor Enthusiast (e.g., hiking, bicycling, camping, paddling)</b>	1	2	3	4	5
<b>Birdwatcher</b>	1	2	3	4	5
<b>Angler</b>	1	2	3	4	5
<b>Waterfowl Hunter</b>	1	2	3	4	5
<b>Other Type of Hunter</b>	1	2	3	4	5
<b>Conservationist</b>	1	2	3	4	5
<b>Preservationist</b>	1	2	3	4	5

**We are interested in your experiences and opinions about six coastal Wildlife Management Areas (WMAs) in southeast Michigan which are managed by state and federal wildlife agencies to provide wildlife habitat and wildlife-related recreation. Even if you are not familiar with these areas, your opinions are important. The six WMAs we are most interested in are:**

- Nayanquing Point State Wildlife Area, Pinconning
- Fish Point State Wildlife Area, Unionville
- Shiawassee River State Game Area, St. Charles
- Shiawassee National Wildlife Refuge, Saginaw
- St. Clair Flats State Wildlife Area-Harsens Island Unit, Harsens Island
- Pointe Mouillee State Game Area, Rockwood



3. Below are listed the current management objectives for these six WMAs. Please tell us how important or unimportant these WMA management objectives are to you personally. Even if you have not visited one of the six WMAs, we still want to know what you think.

(Circle **one** answer for each objective.)

WMA Management Objective	Not at all important	Somewhat unimportant	Neither unimportant nor important	Somewhat important	Very important	Not sure
1. Provide habitat for migrating waterfowl (e.g., ducks and geese).	1	2	3	4	5	6
2. Provide nesting habitat for waterfowl.	1	2	3	4	5	6
3. Provide areas of no disturbance for waterfowl.	1	2	3	4	5	6
4. Manage wetlands (e.g., marshes, swamps) for a diversity of wetland wildlife species.	1	2	3	4	5	6
5. Protect wetlands (e.g., marshes, swamps).	1	2	3	4	5	6
6. Provide waterfowl (duck and goose) hunting opportunities.	1	2	3	4	5	6
7. Provide deer hunting opportunities.	1	2	3	4	5	6
8. Provide small game hunting opportunities.	1	2	3	4	5	6
9. Provide wildlife trapping opportunities.	1	2	3	4	5	6
10. Provide opportunities for a diversity of wildlife-related recreational activities.	1	2	3	4	5	6

4. Of the 10 WMA management objectives listed in Question 3 (above), which is the **one** objective that is the **most** important to you?  
(Please indicate the number of the **one** objective in the box below.)

Objective number from Question 3 (1–10)

5. Please tell us if you have ever heard about the following WMAs prior to this survey, and whether you have visited them **in the past 12 months.**

*(Circle YES or NO for each question.)*

WMA and nearest city or town	I have heard about this WMA before.		I have visited this WMA <u>in the past 12 months.</u>	
Nayanquing Point State Wildlife Area, Pinconning	YES	NO	YES	NO
Fish Point State Wildlife Area, Unionville	YES	NO	YES	NO
Shiawassee River State Game Area State Game Area, St. Charles	YES	NO	YES	NO
Shiawassee National Wildlife Refuge, Saginaw	YES	NO	YES	NO
St. Clair Flats State Wildlife Area-Harsens Island Unit, Harsens Island	YES	NO	YES	NO
Pointe Mouillee State Game Area, Rockwood	YES	NO	YES	NO

*If you have not visited any of the WMAs listed above in the past 12 months, please continue to Question 12.*



6. For all of the WMAs that you visited **in the past 12 months**, please tell us your **main reason** for visiting them in the past 12 months. Select only **one** main reason for each area you visited in the past 12 months. Leave columns blank for those WMAs that you did **not** visit in the past 12 months.

(Circle only **one** main reason for each area you visited in the past 12 months.)

Main Reason for Visiting	Nayanquing Point SWA	Fish Point SWA	Shiawassee River SGA	Shiawassee NWR	St. Clair Flats SWA-Harsens Island	Pte. Mouillee SGA
Waterfowl (duck and goose) hunting	1	1	1	1	1	1
Small game hunting	2	2	2	2	2	2
Big game (e.g., deer, turkey) hunting	3	3	3	3	3	3
Furbearer hunting or trapping	4	4	4	4	4	4
Fishing	5	5	5	5	5	5
Birdwatching	6	6	6	6	6	6
Wildlife observation (other than birdwatching)	7	7	7	7	7	7
Photography	8	8	8	8	8	8
Hiking, walking, or running	9	9	9	9	9	9
Biking	10	10	10	10	10	10
Motorized boating	11	11	11	11	11	11
Paddling (e.g., canoeing, kayaking)	12	12	12	12	12	12
Dog training	13	13	13	13	13	13
Mushrooming, berry picking, or foraging for food	14	14	14	14	14	14
Outdoor/environmental education	15	15	15	15	15	15
Other (please describe) _____	16	16	16	16	16	16

The following questions ask your opinions about the management of wildlife habitat and recreation at the one WMA for which you are most knowledgeable about.

7. Of the WMAs you reported visiting in the past 12 months, which one are you most knowledgeable about? If you are equally knowledgeable about more than one, please select your favorite WMA. *(Please select only one.)*

- ☐<sub>1</sub> Nayanquing Point State Wildlife Area  
☐<sub>2</sub> Fish Point State Wildlife Area  
☐<sub>3</sub> Shiawassee River State Game Area  
☐<sub>4</sub> Shiawassee National Wildlife Refuge  
☐<sub>5</sub> St. Clair Flats State Wildlife Area - Harsens Island Unit  
☐<sub>6</sub> Pte. Mouillee State Game Area

8. Please tell us how much you agree or disagree with the following statements about wildlife habitat and species management at the one WMA which you are most knowledgeable about.

*(Circle one answer for each statement.)*

At the WMA I am most knowledgeable about...	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
Waterfowl (e.g., duck and goose) habitat management should be prioritized over other wildlife species management.	1	2	3	4	5
Management for threatened and endangered species should be prioritized over other wildlife species management.	1	2	3	4	5
Management to provide habitats for a large variety of wildlife species should be prioritized over habitat management for a few specific wildlife species.	1	2	3	4	5
Current management benefits primarily game species.	1	2	3	4	5
Wetlands (e.g., marshes, swamps) are currently managed sufficiently to provide wildlife habitat.	1	2	3	4	5
Flooded agricultural fields are necessary to provide food for waterfowl (e.g., ducks and geese).	1	2	3	4	5
Areas closed to public access are necessary to provide resting areas for wildlife.	1	2	3	4	5

9. Please tell us how much you agree or disagree with the following statements about **management of recreational opportunities** at the one **WMA which you are most knowledgeable about.**

(Circle **one** answer for each statement.)

At the WMA I am most knowledgeable about...	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
I can access the areas that I want to at the time of year I want.	1	2	3	4	5
I can access the areas that I want to for my recreational activity without much trouble.	1	2	3	4	5
Controlled water levels allow me to access the areas that I want to in the fall.	1	2	3	4	5
I experience little disturbance from other recreational users.	1	2	3	4	5
I feel safe and secure when I participate in wildlife-related recreation there.	1	2	3	4	5
Current management provides a diversity of opportunities for wildlife-related recreation.	1	2	3	4	5
Waterfowl (duck and goose) hunting management should be prioritized over the management for other wildlife-related recreation.	1	2	3	4	5
Having a variety of wildlife habitats is important for me to enjoy my recreational activities.	1	2	3	4	5
Providing wildlife habitat is more important than providing wildlife-related recreational opportunities.	1	2	3	4	5
An appropriate balance currently exists between management for hunting and non-hunting recreational opportunities.	1	2	3	4	5
Management currently benefits primarily hunters.	1	2	3	4	5
Hunters' opinions on wildlife management decisions are currently considered more by the WMA managers than non-hunters' opinions.	1	2	3	4	5

10. Please tell us if you would prefer **changes** to the following **wildlife habitat and species management** activities at the one **WMA** **which you are most knowledgeable about**.

(Circle **one** answer for each statement.)

At the WMA I am most knowledgeable about...	Greatly decrease	Somewhat decrease	Stay about the same	Somewhat increase	Greatly increase	Not sure
The number of different wildlife habitat types should...	1	2	3	4	5	6
Efforts toward management for game species should...	1	2	3	4	5	6
Efforts toward management for non-game species should...	1	2	3	4	5	6
Active wetland management (e.g., use of pumps, water control structures, etc.) should...	1	2	3	4	5	6
The depth of managed water levels in the fall should...	1	2	3	4	5	6
The number of agricultural fields that are flooded in the fall should...	1	2	3	4	5	6
Invasive plant species management efforts should...	1	2	3	4	5	6

11. Please tell us if you would prefer **changes** to the following **recreation management** activities at the one **WMA which you are most knowledgeable about.**

(Circle **one** answer for each statement.)

At the WMA I am most knowledgeable about...	Greatly decrease	Somewhat decrease	Stay about the same	Somewhat increase	Greatly increase	Not sure
The amount of vehicle road access to the WMA should...	1	2	3	4	5	6
The number of hiking trails to access areas of the WMA should...	1	2	3	4	5	6
The amount of bicycle access to the WMA should...	1	2	3	4	5	6
The number of parking lots should...	1	2	3	4	5	6
The number of boat launches to access areas of the WMA should...	1	2	3	4	5	6
Access for non-hunting recreational opportunities should...	1	2	3	4	5	6
The number of days that waterfowl hunting is allowed on the WMA in the fall should...	1	2	3	4	5	6
Seasonal closures to avoid conflicts between different types of recreation should...	1	2	3	4	5	6
Wildlife resting areas that are closed to public access should...	1	2	3	4	5	6

The next question asks for your thoughts about funding for WMA management.

12. Please tell us what you think is the **primary source of funds** for wildlife management on WMAs.

(Select only **one**.)

☐<sub>1</sub> Funds from the sale of hunting licenses and equipment

☐<sub>2</sub> Funds from state taxes

☐<sub>3</sub> Access permits or fees

☐<sub>4</sub> Other (please indicate) \_\_\_\_\_

13. Listed below are some actual actions that are currently available that help to secure funds for WMA management as well as some hypothetical actions that might be available in the future to help support WMA management. How likely is it that you would take the following actions **in the next 12 months**, if they were available, in order to help support WMA management?

(Circle **one** answer for each action.)

	Not at all likely	Somewhat unlikely	Neither unlikely nor likely	Somewhat likely	Very likely
Purchase a Michigan Waterfowl Stamp (Michigan Duck Stamp)	1	2	3	4	5
Purchase a Federal Migratory Bird Hunting and Conservation Stamp (Federal Duck Stamp)	1	2	3	4	5
Purchase a Migratory Songbird Conservation Stamp	1	2	3	4	5
Purchase a WMA access permit	1	2	3	4	5
Donate money to WMA management	1	2	3	4	5
Participate in a WMA fundraising event	1	2	3	4	5
Pay a small increase in Michigan state income tax (e.g., 0.375%)	1	2	3	4	5
Pay a small increase in Michigan gas taxes (e.g., \$0.15/gallon)	1	2	3	4	5

In the following questions, it is important to understand what you think about the benefits that people get from nature.

14. Listed below are some benefits to people that could be provided by natural places (not just WMAs, but **any** natural place). Please tell us how important each benefit is to you personally.

(Circle **one** answer for each benefit.)

Benefits provided by natural places	Not at all important	Somewhat unimportant	Neither unimportant nor important	Somewhat important	Very important
1. Places that provide enjoyable scenery, sights, and/or sounds.	1	2	3	4	5
2. Places for abundant wildlife, fish, and plants.	1	2	3	4	5
3. Places for passing down culture, knowledge, and traditions.	1	2	3	4	5
4. Places that provide jobs and income for the local economy.	1	2	3	4	5
5. Places for future generations to know and experience nature.	1	2	3	4	5
6. Places for natural and/or human history.	1	2	3	4	5
7. Places that provide a sense of community and belonging.	1	2	3	4	5
8. Places that have value in just knowing they are there.	1	2	3	4	5
9. Places that provide educational value.	1	2	3	4	5
10. Places that provide natural processes which support life (e.g., climate regulation, storage of greenhouse gasses).	1	2	3	4	5
11. Places that provide hunting, fishing, and/or trapping opportunities.	1	2	3	4	5
12. Places that provide wildlife watching, hiking, camping, paddling, and/or other similar outdoor opportunities.	1	2	3	4	5
13. Places for spiritual renewal.	1	2	3	4	5
14. Places that provide a source of food for humans.	1	2	3	4	5

<b>15. Places for peace, quiet, and stress relief.</b>	1	2	3	4	5
<b>16. Places free from development where there is minimal human impact.</b>	1	2	3	4	5
<b>17. Places that provide safety to communities (e.g., flood and erosion protection).</b>	1	2	3	4	5
<b>18. Places that provide for human health (e.g., clean air to breathe and clean water to drink).</b>	1	2	3	4	5
<b>19. Places that provide public access to nature.</b>	1	2	3	4	5

15. For the benefits to people provided by natural places listed above, please write the number that is next to the **one** benefit that is the **most** important to you personally.

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Objective number from Question 14 (1–19)



16. Listed below are the same benefits to people that could be provided by natural places as Question 14. To what extent do you agree or disagree that **current WMA management provides these benefits?**

(Circle **one** answer for each benefit.)

Current WMA management provides...	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Places that provide enjoyable scenery, sights, and/or sounds.	1	2	3	4	5
Places for abundant wildlife, fish, and plants.	1	2	3	4	5
Places for passing down culture, knowledge, and traditions.	1	2	3	4	5
Places that provide jobs and income for the local economy.	1	2	3	4	5
Places for future generations to know and experience nature.	1	2	3	4	5
Places for natural and human history.	1	2	3	4	5
Places that provide a sense of community and belonging.	1	2	3	4	5
Places that have value in just knowing they are there.	1	2	3	4	5
Places that provide educational value.	1	2	3	4	5
Places that provide natural processes which support life (e.g., climate regulation, storage of greenhouse gasses).	1	2	3	4	5
Places that provide hunting, fishing, and/or trapping opportunities.	1	2	3	4	5
Places that provide wildlife watching, hiking, camping, paddling, and/or other similar outdoor opportunities.	1	2	3	4	5
Places for spiritual renewal.	1	2	3	4	5
Places that provide a source of food for humans.	1	2	3	4	5
Places for peace, quiet, and stress relief.	1	2	3	4	5
Places free from development where there is minimal human impact.	1	2	3	4	5
Places that provide safety to communities (e.g., flood and erosion protection).	1	2	3	4	5
Places that provide for human health (e.g., clean air to breathe and clean water to drink).	1	2	3	4	5
Places that provide public access to nature.	1	2	3	4	5

In the following questions, you will be asked about your participation in conservation-related activities.

17. Please tell us how often you participated in each of the following activities, if they were available, **in the past 12 months**.

(Circle **one** answer for each activity.)

	Never	Rarely	Occasionally	Often	Very Often
Made my yard or my land more desirable to wildlife.	1	2	3	4	5
Volunteered my personal time and effort for habitat improvement projects on public land in my community.	1	2	3	4	5
Voted to support a policy or regulation that supports conservation.	1	2	3	4	5
Contributed money to support local conservation causes.	1	2	3	4	5
Recruited others to participate in wildlife-related recreational activities.	1	2	3	4	5
Participated as an active member in a conservation group.	1	2	3	4	5
Contributed money to a conservation organization.	1	2	3	4	5
Attended meetings about conservation issues.	1	2	3	4	5
Contacted elected officials or government agencies about conservation issues.	1	2	3	4	5
Talked to others about conservation issues.	1	2	3	4	5

18. Are you or have you been a member of any of the following organizations **in the past 12 months?**

*(Please select **all** that apply).*

- ☐ National/international environmental or conservation organization (e.g., The Nature Conservancy, National Wildlife Federation, Sierra Club, World Wildlife Fund)
- ☐ Local/regional conservation organizations (e.g., Clinton River Watershed Council, Southeast Michigan Land Conservancy).
- ☐ Birding, birdwatching, or bird conservation group (e.g., American Birding Association, National Audubon Society, American Bird Conservancy, Michigan Audubon, local Audubon chapter)
- ☐ Fishing conservation organization (e.g., Trout Unlimited, Izzaak Walton)
- ☐ National, state, or local waterfowl hunting or wetland conservation group (e.g., Ducks Unlimited, Delta Waterfowl, Michigan Duck Hunters Association, Shiawassee Flats Citizens and Hunters Association, St. Clair Flats Waterfowlers, Inc.)
- ☐ Hunting or conservation organization not focused on waterfowl (e.g., National Wild Turkey Federation, Rocky Mountain Elk Foundation, Quality Deer Management Association, Michigan United Conservation Clubs)

**The last set of questions asks about you.**

19. What is your gender? (*Please select one*)

- ☐<sub>1</sub> Female
- ☐<sub>2</sub> Male
- ☐<sub>3</sub> Other \_\_\_\_\_
- ☐<sub>4</sub> Prefer not to say

20. Enter zip code of primary residence in Michigan

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21. In what year were you born?

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22. What is the **highest** level of education you have **completed**? (*Select one*)

- ☐<sub>1</sub> Some high school or less
- ☐<sub>2</sub> High school diploma or GED
- ☐<sub>3</sub> Some college (no degree)
- ☐<sub>4</sub> Associate's degree or Bachelor's degree
- ☐<sub>5</sub> Graduate or professional school
- ☐<sub>6</sub> Prefer not to say

23. What ethnicity do you consider yourself? (*Select one.*)

- ☐<sub>1</sub> Hispanic or Latino
- ☐<sub>2</sub> Not Hispanic or Latino
- ☐<sub>3</sub> Prefer not to say

24. From what racial origin(s) do you consider yourself? (*Select all that apply.*)

- ☐<sub>1</sub> American Indian or Native Alaskan
- ☐<sub>1</sub> Asian
- ☐<sub>1</sub> Black or African American
- ☐<sub>1</sub> Native Hawaiian or other Pacific Islander
- ☐<sub>1</sub> White
- ☐<sub>1</sub> Prefer not to say

25. Which of these categories best describes the place where you live now? (Select **one**)

- ☐<sub>1</sub> Large urban area (population 500,000 or more)
- ☐<sub>2</sub> Medium urban area (population between 50,000 and 500,000)
- ☐<sub>3</sub> Small city (population between 10,000 and 50,000)
- ☐<sub>4</sub> Small town (population between 2,000 and 10,000)
- ☐<sub>5</sub> Rural area (population less than 2,000)
- ☐<sub>6</sub> Prefer not to say

26. What was your household income last year (before taxes and other deductions)? (Select **one**)

- ☐<sub>1</sub> <\$24,999
- ☐<sub>2</sub> \$25,000 to \$49,999
- ☐<sub>3</sub> \$50,000 to \$74,999
- ☐<sub>4</sub> \$75,000 to \$99,999
- ☐<sub>5</sub> \$100,000 to \$124,999
- ☐<sub>6</sub> \$125,000 to \$149,999
- ☐<sub>7</sub> \$150,000 to \$199,999
- ☐<sub>8</sub> \$200,000 to \$249,999
- ☐<sub>9</sub> \$250,000 to \$299,999
- ☐<sub>10</sub> \$300,000 or more
- ☐<sub>11</sub> Prefer not to say

27. Thinking about the questions you have answered in this survey, do you have any additional thoughts or opinions that you'd like to share with the researchers?

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28. One of the next steps for Michigan State University researchers is to host WMA stakeholder workshops in 2019. Are you interested in potentially participating in one of these stakeholder workshops?

- ☐<sub>1</sub> Yes.

Please provide your name, address, and email address below so that we may contact you:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Email address: \_\_\_\_\_

- ☐<sub>2</sub> No

**Thank you for your time and participation. Your responses are valuable for the success of this research project!**

## APPENDIX F: MICHIGAN COASTAL WILDLIFE MANAGEMENT AREA WATERFOWL HUNTER SURVEY



Thank you for your interest in this research study about Michigan's coastal Wildlife Management Areas (WMAs) and waterfowl hunting. We are interested in the opinions and behaviors of everyone who spends time hunting waterfowl (e.g., ducks and geese). We are particularly interested in your waterfowl hunting experiences, your experiences with WMAs, and your thoughts on ways to improve these WMAs for waterfowl hunting. Even if you've only been waterfowl hunting in Michigan once or have never visited a WMA, we want to hear from you!

Michigan State University researchers are working closely with the Michigan Department of Natural Resources and the U.S. Fish and Wildlife Service for this study. Your responses are important to this study and will be used to help improve the management of WMAs in the future. Please be assured that your participation in the study, and all of your responses, will be kept confidential. Participation is voluntary, you may choose not to participate at all, or you may refuse to answer certain questions or discontinue your participation at any time without consequence. This survey should take about 20 minutes to complete. You must be 18 or older to participate. By completing this survey, you are voluntarily agreeing to participate in this research study.

**Thank you for your help!**

1. Please tell us **all** of the nature-based activities in which you have participated during **the past 12 months**.

(Please select **all that apply**.)

- ☐ <sub>1</sub> Hunting waterfowl (ducks and geese)
- ☐ <sub>1</sub> Hunting other game species
- ☐ <sub>1</sub> Fishing
- ☐ <sub>1</sub> Viewing birds (e.g., birdwatching, bird feeding)
- ☐ <sub>1</sub> Viewing wildlife, not including birds (e.g., wildlife watching, wildlife photography)
- ☐ <sub>1</sub> Learning about nature away from home (e.g., attending festivals or lectures, visiting a nature center)
- ☐ <sub>1</sub> Backyard/at home nature activities (e.g., gardening, landscaping)
- ☐ <sub>1</sub> Non-motorized outdoor recreation activities (e.g., hiking, backpacking, horseback riding, bicycling, skiing, swimming, canoeing and kayaking)
- ☐ <sub>1</sub> Motorized outdoor recreation activities (e.g., motorized boating, riding ATVs, snowmobiling)
- ☐ <sub>1</sub> Other nature-based activities (e.g., picnicking, relaxing in nature, camping)

2. During last year's (2018) waterfowl hunting season, about how many **trips** did you take **to hunt for waterfowl** (ducks and geese), including outside of Michigan?

(Enter number)

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NUMBER OF WATERFOWL HUNTING TRIPS IN 2018

3. Please tell us where you do **most** of your waterfowl hunting.

(Please select only **one** response.)

- ☐ <sub>1</sub> Mostly public land or waters
- ☐ <sub>2</sub> Mostly private property owned by you or your family
- ☐ <sub>3</sub> Mostly private property owned by a friend or another landowner who gives you permission to hunt for free
- ☐ <sub>4</sub> Mostly private property that is open to the public, such as nature conservancies or nature preserves
- ☐ <sub>5</sub> Mostly private property you lease or pay to hunt on
- ☐ <sub>6</sub> Equal mix of public and private lands
- ☐ <sub>7</sub> I'm not sure.

4. We are interested in what **waterfowl hunting means to you**. Please tell us how much you disagree or agree with the following statements about your **personal** participation in waterfowl hunting.

(Circle **one** answer for each statement.)

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat agree	Strongly agree
Waterfowl hunting is one of the most enjoyable activities I do.	1	2	3	4	5
Most of my friends go waterfowl hunting.	1	2	3	4	5
Waterfowl hunting has a central role in my life.	1	2	3	4	5
A lot of my life is organized around waterfowl hunting.	1	2	3	4	5
If I couldn't go waterfowl hunting, I am not sure what I would do instead.	1	2	3	4	5

5. A person can participate in many different activities and can think of themselves in a variety of ways. Please tell us the extent to which you personally identify with each of the following.

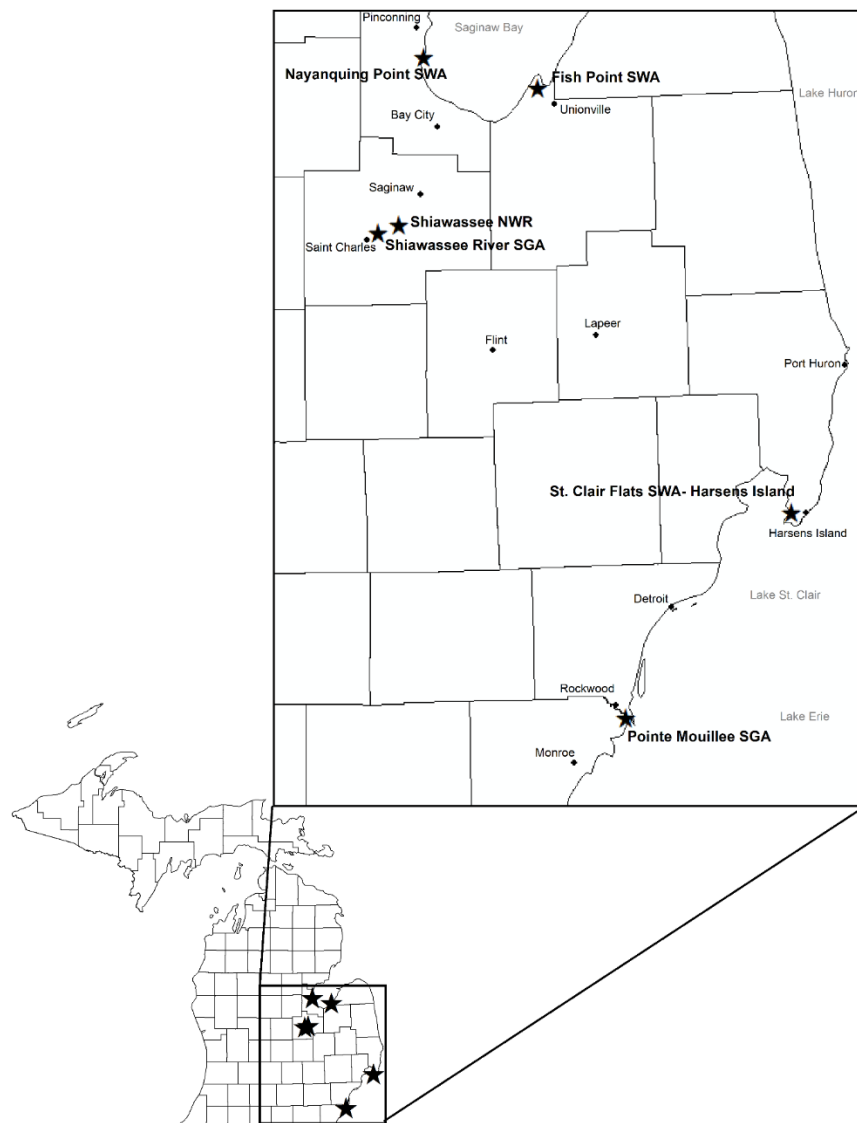
(Circle **one** answer for each statement.)

I identify myself as a/an...	Not at all	Slightly	Moderately	Strongly	Very strongly
Waterfowl Hunter	1	2	3	4	5
Other Type of Hunter	1	2	3	4	5
Angler	1	2	3	4	5
Birdwatcher	1	2	3	4	5
Outdoor Enthusiast (e.g., hiking, bicycling, camping, paddling)	1	2	3	4	5
Conservationist	1	2	3	4	5
Preservationist	1	2	3	4	5



**We are interested in your experiences and opinions about six coastal Wildlife Management Areas (WMAs) in southeast Michigan (see map below). These areas are managed by state and federal fish and wildlife agencies to provide wildlife habitat and wildlife-related recreation. Even if you are not familiar with these areas, your opinions are important.**

- Nayanquing Point State Wildlife Area, Pinconning
- Fish Point State Wildlife Area, Unionville
- Shiawassee River State Game Area, St. Charles
- Shiawassee National Wildlife Refuge, Saginaw
- St. Clair Flats State Wildlife Area-Harsens Island Unit, Harsens Island
- Pointe Mouillee State Game Area, Rockwood



6. Below are listed the current management objectives for the WMAs. Please tell us how important or unimportant these WMA management objectives are to you personally. Even if you have not visited a WMA, your opinions are important.

(Circle **one** answer for each objective.)

WMA Management Objective	Not at all important	Somewhat unimportant	Neither unimportant nor important	Somewhat important	Very important	Not sure
1. Provide habitat for migrating waterfowl (e.g., ducks and geese).	1	2	3	4	5	6
2. Provide nesting habitat for waterfowl.	1	2	3	4	5	6
3. Provide areas of no disturbance for waterfowl.	1	2	3	4	5	6
4. Manage wetlands (e.g., marshes, swamps) for a diversity of wetland wildlife species.	1	2	3	4	5	6
5. Protect wetlands (e.g., marshes, swamps).	1	2	3	4	5	6
6. Provide waterfowl (duck and goose) hunting opportunities.	1	2	3	4	5	6
7. Provide deer hunting opportunities.	1	2	3	4	5	6
8. Provide small game hunting opportunities.	1	2	3	4	5	6
9. Provide wildlife trapping opportunities.	1	2	3	4	5	6
10. Provide opportunities for a diversity of wildlife-related recreational activities.	1	2	3	4	5	6

7. Of the 10 WMA management objectives listed in Question 6 (above), which is the **one** objective that is the **most** important to you?

(Please indicate the number of the **one** objective in the box below.)

Objective number from Question 6 (1–10)

8. Please tell us if you have ever heard about the following WMAs prior to this survey, and whether you have visited them **in the past 12 months**.

*(Circle YES or NO for each question.)*

WMA and nearest city or town	I have heard about this WMA before.		I have visited this WMA <b><u>in the past 12 months</u></b> .	
Nayanquing Point State Wildlife Area, Pinconning	YES	NO	YES	NO
Fish Point State Wildlife Area, Unionville	YES	NO	YES	NO
Shiawassee River State Game Area State Game Area, St. Charles	YES	NO	YES	NO
Shiawassee National Wildlife Refuge, Saginaw	YES	NO	YES	NO
St. Clair Flats State Wildlife Area-Harsens Island Unit, Harsens Island	YES	NO	YES	NO
Pointe Mouillee State Game Area, Rockwood	YES	NO	YES	NO

*If you have **not** visited any of the WMAs listed above in the past 12 months, please continue to Question 15 on Page 10.*

9. For **all** of the WMAs that you visited **in the past 12 months**, please tell us your **main reason** for visiting them in the past 12 months. Select only **one** main reason for each area you visited in the past 12 months. Leave columns blank for those WMAs that you did **not** visit in the past 12 months.

(Circle only **one** main reason for each area you visited in the past 12 months.)

Main Reason for Visiting	Nayanquing Point SWA	Fish Point SWA	Shiawassee River SGA	Shiawassee NWR	St. Clair Flats SWA-Harsens Island	Pte. Mouillee SGA
Waterfowl (duck and goose) hunting	1	1	1	1	1	1
Small game hunting	2	2	2	2	2	2
Big game (e.g., deer, turkey) hunting	3	3	3	3	3	3
Furbearer hunting or trapping	4	4	4	4	4	4
Fishing	5	5	5	5	5	5
Birdwatching	6	6	6	6	6	6
Wildlife observation (other than birdwatching)	7	7	7	7	7	7
Photography	8	8	8	8	8	8
Hiking, walking, or running	9	9	9	9	9	9
Biking	10	10	10	10	10	10
Motorized boating	11	11	11	11	11	11
Paddling (e.g., canoeing, kayaking)	12	12	12	12	12	12
Dog training	13	13	13	13	13	13
Mushrooming, berry picking, or foraging for food	14	14	14	14	14	14
Outdoor/environmental education	15	15	15	15	15	15
Other (please describe) _____	16	16	16	16	16	16

**The following questions ask your opinions about the management of wildlife habitat and recreation at the one WMA for which you are most knowledgeable about.**

10. Of the WMAs you reported visiting in the past 12 months, which one are you most knowledgeable about? If you are equally knowledgeable about more than one, please select your favorite WMA.

*(Please select only one.)*

- ☐<sub>1</sub> Nayanquing Point State Wildlife Area
- ☐<sub>2</sub> Fish Point State Wildlife Area
- ☐<sub>3</sub> Shiawassee River State Game Area
- ☐<sub>4</sub> Shiawassee National Wildlife Refuge
- ☐<sub>5</sub> St. Clair Flats State Wildlife Area - Harsens Island Unit
- ☐<sub>6</sub> Pte. Mouillee State Game Area

11. Please tell us how much you agree or disagree with the following statements about **wildlife habitat and species management** at the one **WMA which you are most knowledgeable about.**

(Circle **one** answer for each statement.)

At the WMA I am most knowledgeable about...	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
Waterfowl (e.g., duck and goose) habitat management should be prioritized over other wildlife species management.	1	2	3	4	5
Management for threatened and endangered species should be prioritized over other wildlife species management.	1	2	3	4	5
Management to provide habitats for a large variety of wildlife species should be prioritized over habitat management for a 2few specific wildlife species.	1	2	3	4	5
Current management benefits primarily game species.	1	2	3	4	5
The current way habitat is managed provides the opportunity to see a lot of waterfowl (e.g., ducks and geese).	1	2	3	4	5
The current way habitat is managed provides the opportunity to <u>harvest</u> a lot of waterfowl.	1	2	3	4	5
Wetlands (e.g., marshes, swamps) are currently managed sufficiently to provide wildlife habitat.	1	2	3	4	5
Flooded agricultural fields are necessary to provide food for waterfowl (e.g., ducks and geese).	1	2	3	4	5
Flooded agricultural fields are necessary to provide waterfowl hunting opportunity.	1	2	3	4	5
Areas closed to public access are necessary to provide resting areas for wildlife.	1	2	3	4	5

12. Please tell us how much you agree or disagree with the following statements about **management of recreational opportunities** at the one **WMA which you are most knowledgeable about**. (Circle **one** answer for each statement.)

At the WMA I am most knowledgeable about...	Strongly disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Strongly agree
I can access the areas that I want to at the time of year I want.	1	2	3	4	5
I can access the areas that I want to for my recreational activity without much trouble.	1	2	3	4	5
Controlled water levels allow me to access the areas that I want to in the fall.	1	2	3	4	5
I experience little disturbance from other recreational users.	1	2	3	4	5
I feel safe and secure when I participate in wildlife-related recreation there.	1	2	3	4	5
Current management provides a diversity of opportunities for wildlife-related recreation.	1	2	3	4	5
Waterfowl (duck and goose) hunting management should be prioritized over the management for other wildlife-related recreation.	1	2	3	4	5
Having a variety of wildlife habitats is important for me to enjoy my recreational activities.	1	2	3	4	5
Providing wildlife habitat is more important than providing wildlife-related recreational opportunities.	1	2	3	4	5
Hunting pressure is currently managed sufficiently to provide the opportunity to harvest a lot of waterfowl.	1	2	3	4	5
Drawings for hunting zones are necessary for a high-quality waterfowl hunt.	1	2	3	4	5
An appropriate balance currently exists between management for hunting and non-hunting recreational opportunities.	1	2	3	4	5
Management currently benefits primarily hunters.	1	2	3	4	5
Hunters' opinions on wildlife management decisions are currently considered more by the WMA managers than non-hunters' opinions.	1	2	3	4	5

13. Please tell us if you would prefer **changes** to the following **wildlife habitat and species management** activities at the one **WMA** **which you are most knowledgeable about**.

(Circle **one** answer for each statement.)

At the WMA I am most knowledgeable about...	Greatly decrease	Somewhat decrease	Stay about the same	Somewhat increase	Greatly increase	Not sure
The number of different wildlife habitat types should...	1	2	3	4	5	6
Efforts toward management for game species should...	1	2	3	4	5	6
Efforts toward management for non-game species should...	1	2	3	4	5	6
Active wetland management (e.g., use of pumps, water control structures, etc.) should...	1	2	3	4	5	6
The depth of managed water levels in the fall should...	1	2	3	4	5	6
The number of agricultural fields that are flooded in the fall should...	1	2	3	4	5	6
Invasive plant species management efforts should...	1	2	3	4	5	6



14. Please tell us if you would prefer **changes** to the following **recreation management** activities at the one **WMA which you are most knowledgeable about.**

(Circle **one** answer for each statement.)

At the WMA I am most knowledgeable about...	Greatly decrease	Somewhat decrease	Stay about the same	Somewhat increase	Greatly increase	Not sure
The amount of vehicle road access to the WMA should...	1	2	3	4	5	6
The number of hiking trails to access areas of the WMA should...	1	2	3	4	5	6
The amount of bicycle access to the WMA should...	1	2	3	4	5	6
The number of parking lots should...	1	2	3	4	5	6
The number of boat launches to access areas of the WMA should...	1	2	3	4	5	6
Access for non-hunting recreational opportunities should...	1	2	3	4	5	6
The number of days that waterfowl hunting is allowed on the WMA in the fall should...	1	2	3	4	5	6
Seasonal closures to avoid conflicts between different types of recreation should...	1	2	3	4	5	6
Wildlife resting areas that are closed to public access should...	1	2	3	4	5	6

The next question asks for your thoughts about funding for WMA management.

15. Please tell us what you think is the **primary source of funds** for wildlife management on WMAs.

(Select only **one**.)

☐<sub>1</sub> Funds from the sale of hunting licenses and equipment

☐<sub>2</sub> Funds from state taxes

☐<sub>3</sub> Access permits or fees

☐<sub>4</sub> Other (please indicate) \_\_\_\_\_

16. Listed below are some actual actions that are currently available that help to secure funds for WMA management as well as some hypothetical actions that might be available in the future to help support WMA management. How likely is it that you would take the following actions **in the next 12 months**, if they were available, in order to help support WMA management?

(Circle **one** answer for each action.)

	Not at all likely	Somewhat unlikely	Neither unlikely nor likely	Somewhat likely	Very likely
Purchase a Michigan Waterfowl Stamp (Michigan Duck Stamp)	1	2	3	4	5
Purchase a Federal Migratory Bird Hunting and Conservation Stamp (Federal Duck Stamp)	1	2	3	4	5
Purchase a Migratory Songbird Conservation Stamp	1	2	3	4	5
Purchase a WMA access permit	1	2	3	4	5
Donate money to WMA management	1	2	3	4	5
Participate in a WMA fundraising event	1	2	3	4	5
Pay a small increase in Michigan state income tax (e.g., 0.375%)	1	2	3	4	5
Pay a small increase in Michigan gas taxes (e.g., \$0.15/gallon)	1	2	3	4	5

In the following questions, it is important to understand what you think about the benefits that people get from nature.

17. Listed below are some benefits to people that could be provided by natural places (not just WMAs, but **any** natural place). Please tell us how important each benefit is to you personally.

(Circle **one** answer for each benefit.)

Benefits provided by natural places	Not at all important	Somewhat unimportant	Neither unimportant nor important	Somewhat important	Very important
1. Places that provide enjoyable scenery, sights, and/or sounds.	1	2	3	4	5
2. Places for abundant wildlife, fish, and plants.	1	2	3	4	5
3. Places for passing down culture, knowledge, and traditions.	1	2	3	4	5
4. Places that provide jobs and income for the local economy.	1	2	3	4	5
5. Places for future generations to know and experience nature.	1	2	3	4	5
6. Places for natural and/or human history.	1	2	3	4	5
7. Places that provide a sense of community and belonging.	1	2	3	4	5
8. Places that have value in just knowing they are there.	1	2	3	4	5
9. Places that provide educational value.	1	2	3	4	5
10. Places that provide natural processes which support life (e.g., climate regulation, storage of greenhouse gasses).	1	2	3	4	5
11. Places that provide hunting, fishing, and/or trapping opportunities.	1	2	3	4	5
12. Places that provide wildlife watching, hiking, camping, paddling, and/or other similar outdoor opportunities.	1	2	3	4	5
13. Places for spiritual renewal.	1	2	3	4	5
14. Places that provide a source of food for humans.	1	2	3	4	5
15. Places for peace, quiet, and stress relief.	1	2	3	4	5

<b>16. Places free from development where there is minimal human impact.</b>	1	2	3	4	5
<b>17. Places that provide safety to communities (e.g., flood and erosion protection).</b>	1	2	3	4	5
<b>18. Places that provide for human health (e.g., clean air to breathe and clean water to drink).</b>	1	2	3	4	5
<b>19. Places that provide public access to nature.</b>	1	2	3	4	5

18. For the benefits to people provided by natural places listed above, please write the number that is next to the **one** benefit that is the **most** important to you personally.

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Objective number from Question 17 (1–19)

19. Listed below are the same benefits to people that could be provided by natural places as Question 17. To what extent do you agree or disagree that **current WMA management provides these benefits?**

(Circle **one** answer for each benefit.)

Current WMA management provides...	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Places that provide enjoyable scenery, sights, and/or sounds.	1	2	3	4	5
Places for abundant wildlife, fish, and plants.	1	2	3	4	5
Places for passing down culture, knowledge, and traditions.	1	2	3	4	5
Places that provide jobs and income for the local economy.	1	2	3	4	5
Places for future generations to know and experience nature.	1	2	3	4	5
Places for natural and human history.	1	2	3	4	5
Places that provide a sense of community and belonging.	1	2	3	4	5
Places that have value in just knowing they are there.	1	2	3	4	5
Places that provide educational value.	1	2	3	4	5
Places that provide natural processes which support life (e.g., climate regulation, storage of greenhouse gasses).	1	2	3	4	5
Places that provide hunting, fishing, and/or trapping opportunities.	1	2	3	4	5
Places that provide wildlife watching, hiking, camping, paddling, and/or other similar outdoor opportunities.	1	2	3	4	5
Places for spiritual renewal.	1	2	3	4	5
Places that provide a source of food for humans.	1	2	3	4	5
Places for peace, quiet, and stress relief.	1	2	3	4	5
Places free from development where there is minimal human impact.	1	2	3	4	5
Places that provide safety to communities (e.g., flood and erosion protection).	1	2	3	4	5
Places that provide for human health (e.g., clean air to breathe and clean water to drink).	1	2	3	4	5
Places that provide public access to nature.	1	2	3	4	5

In the following questions, you will be asked about your participation in conservation-related activities.

20. Please tell us how often you participated in each of the following activities, if they were available, **in the past 12 months**.

(Circle **one** answer for each activity.)

	Never	Rarely	Occasionally	Often	Very Often
Made my yard or my land more desirable to wildlife.	1	2	3	4	5
Volunteered my personal time and effort for habitat improvement projects on public land in my community.	1	2	3	4	5
Voted to support a policy or regulation that supports conservation.	1	2	3	4	5
Contributed money to support local conservation causes.	1	2	3	4	5
Recruited others to participate in wildlife-related recreational activities.	1	2	3	4	5
Participated as an active member in a conservation group.	1	2	3	4	5
Contributed money to a conservation organization.	1	2	3	4	5
Attended meetings about conservation issues.	1	2	3	4	5
Contacted elected officials or government agencies about conservation issues.	1	2	3	4	5
Talked to others about conservation issues.	1	2	3	4	5

21. Are you or have you been a member of any of the following organizations **in the past 12 months**? (Please select **all** that apply).

- ☐ National, state, or local waterfowl hunting or wetland conservation group (e.g., Ducks Unlimited, Delta Waterfowl, Michigan Duck Hunters Association, Shiawassee Flats Citizens and Hunters Association, St. Clair Flats Waterfowlers, Inc.)
- ☐ Hunting or conservation organization not focused on waterfowl (e.g., National Wild Turkey Federation, Rocky Mountain Elk Foundation, Quality Deer Management Association, Michigan United Conservation Clubs)
- ☐ Fishing conservation organization (e.g., Trout Unlimited, Izzaak Walton)
- ☐ Birding, birdwatching, or bird conservation group (e.g., American Birding Association, National Audubon Society, American Bird Conservancy, Michigan Audubon, local Audubon chapter)
- ☐ National/international environmental or conservation organization (e.g., The Nature Conservancy, National Wildlife Federation, Sierra Club, World Wildlife Fund)
- ☐ Local/regional conservation organizations (e.g., Clinton River Watershed Council, Southeast Michigan Land Conservancy).

**The last set of questions asks about you.**

22. What is your gender? (*Please select one*)

- ☐<sub>1</sub> Female  
☐<sub>2</sub> Male  
☐<sub>3</sub> Other \_\_\_\_\_  
☐<sub>4</sub> Prefer not to say

23. Enter zip code of primary residence in Michigan

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24. In what year were you born?

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25. What is the **highest** level of education you have **completed**? (*Select one*)

- ☐<sub>1</sub> Some high school or less  
☐<sub>2</sub> High school diploma or GED  
☐<sub>3</sub> Some college (no degree)  
☐<sub>4</sub> Associate's degree or Bachelor's degree  
☐<sub>5</sub> Graduate or professional school  
☐<sub>6</sub> Prefer not to say

26. What ethnicity do you consider yourself? (*Select one.*)

- ☐<sub>1</sub> Hispanic or Latino  
☐<sub>2</sub> Not Hispanic or Latino  
☐<sub>3</sub> Prefer not to say

27. From what racial origin(s) do you consider yourself? (*Select all that apply.*)

- ☐<sub>1</sub> American Indian or Native Alaskan  
☐<sub>1</sub> Asian  
☐<sub>1</sub> Black or African American  
☐<sub>1</sub> Native Hawaiian or other Pacific Islander  
☐<sub>1</sub> White  
☐<sub>1</sub> Prefer not to say

28. Which of these categories best describes the place where you live now? (Select **one**)

- ☐<sub>1</sub> Large urban area (population 500,000 or more)
- ☐<sub>2</sub> Medium urban area (population between 50,000 and 500,000)
- ☐<sub>3</sub> Small city (population between 10,000 and 50,000)
- ☐<sub>4</sub> Small town (population between 2,000 and 10,000)
- ☐<sub>5</sub> Rural area (population less than 2,000)
- ☐<sub>6</sub> Prefer not to say

29. What was your household income last year (before taxes and other deductions)? (Select **one**)

- ☐<sub>1</sub> <\$24,999
- ☐<sub>2</sub> \$25,000 to \$49,999
- ☐<sub>3</sub> \$50,000 to \$74,999
- ☐<sub>4</sub> \$75,000 to \$99,999
- ☐<sub>5</sub> \$100,000 to \$124,999
- ☐<sub>6</sub> \$125,000 to \$149,999
- ☐<sub>7</sub> \$150,000 to \$199,999
- ☐<sub>8</sub> \$200,000 to \$249,999
- ☐<sub>9</sub> \$250,000 to \$299,999
- ☐<sub>10</sub> \$300,000 or more
- ☐<sub>11</sub> Prefer not to say

30. Thinking about the questions you have answered in this survey, do you have any additional thoughts or opinions that you'd like to share with the researchers?

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One of the next steps for Michigan State University researchers is to host WMA stakeholder workshops in 2019. Are you interested in potentially participating in one of these stakeholder workshops?

- ☐<sub>1</sub> Yes. Please provide your name, address, and email address below so that we may contact you:

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Email address: \_\_\_\_\_

- ☐<sub>2</sub> No

**Thank you for your time and participation. Your responses are valuable for the success of this research project!**



## APPENDIX G: NON-RESPONSE TABLES

**Table 39**

*Comparisons of respondents and non-respondents for dichotomous variables included in four stakeholder surveys (Angler, Birdwatcher, Community Member, and Waterfowl Hunter). Chi-square tests had one degree of freedom.*

Variable	Angler				Birdwatcher			
	Respondents n (%)	Non-Respondents n (%)	$X^2$	$p$	Respondents n (%)	Non-Respondents n (%)	$X^2$	$p$
Knowledge of no WMAs								
Yes	74 (28.9)	6 (12.8)	5.32	0.021	193 (17.1)	23 (19.8)	0.55	0.457
No	182 (71.1)	41 (87.2)			937 (82.9)	93 (80.2)		
Visited no WMAs								
Yes	81 (46.3)	20 (52.6)	0.50	0.478	430 (45.9)	45 (50.6)	0.71	0.398
No	94 (53.7)	18 (47.4)			507 (54.1)	44 (49.4)		
Gender								
Female	61 (24.6)	10 (21.3)	0.24	0.625	679 (60.7)	80 (68.4)	2.61	0.110
Male	187 (75.4)	37 (78.7)			439 (39.3)	37 (31.6)		
Race American Indian								
Yes	8 (3.4)	1 (2.1)	0.21	1.000				
No	230 (96.6)	47 (97.9)						
Race Asian								
Yes	3 (1.3)	0 (0.0)	0.61	1.000				
No	235 (98.7)	48 (100.0)						
Race Black*								
Yes	3 (1.3)	4 (8.3)	8.37	0.017				
No	235 (98.7)	44 (91.7)						
Race White								
Yes	227 (95.4)	44 (91.7)	1.11	0.290	1076 (98.2)	103 (100.0)	1.91	0.410
No	11 (4.6)	4 (8.3)			20 (1.8)	0 (0.0)		

**Table 39** (cont'd)

Race Other					
Yes	5 (2.1)	0 (0.0)	1.03	0.594	
No	233 (97.9)	48 (100.0)			

**Table 39** (cont'd)

Variable	Community Member				Waterfowl Hunter			
	Respondents n (%)	Non-Respondents n (%)	$X^2$	$p$	Respondents n (%)	Non- Respondents n (%)	$X^2$	$p$
Knowledge of no WMAs								
Yes	22 (29.3)	5 (38.5)	0.43	0.510	10 (2.7)	5 (2.7)	0.00	0.970
No	53 (70.7)	8 (61.5)			360 (97.3)	184 (97.4)		
Visited no WMAs								
Yes	23 (50.0)	7 (100.0)	6.18	0.015	58 (16.0)	35 (18.7)	0.64	0.430
No	23 (50.0)	0 (0.0)			304 (84.0)	152 (81.3)		
Gender								
Female	33 (41.8)	6 (50.0)	0.29	0.590	14 (3.8)	9 (4.6)	0.19	0.670
Male	46 (58.2)	6 (50.0)			351 (96.2)	187 (95.4)		
Race American Indian								
Yes	4 (5.1)	0 (0.0)	0.69	1.000	5 (1.4)	3 (1.5)	0.01	1.000
No	75 (94.9)	13 (100.0)			349 (98.6)	195 (98.5)		
Race Asian								
Yes	3 (3.8)	0 (0.0)	0.51	1.000	1 (0.3)	0 (0.0)	0.56	1.000
No	76 (96.2)	13 (100.0)			353 (99.7)	198 (100.0)		
Race Black*								
Yes	4 (5.1)	0 (0.0)	0.69	1.000	1 (0.3)	3 (1.5)	2.68	0.130
No	75 (94.9)	13 (100.0)			353 (99.7)	195 (98.5)		
Race White								
Yes	67 (84.8)	12 (92.3)	0.52	0.684	348 (98.3)	184 (92.9)	10.51	0.001
No	12 (15.2)	1 (7.7)			6 (1.7)	14 (7.1)		
Race Other								
Yes	3 (3.8)	0 (0.0)	0.51	1.000	5 (1.4)	3 (1.5)	0.01	1.000
No	76 (96.2)	13 (100.0)			348 (98.6)	195 (98.5)		

**Table 40**

*Mean comparisons of respondents and non-respondents for continuous variables included in four stakeholder surveys (Angler, Birdwatcher, Community Member, and Waterfowl Hunter).*

Variable		Angler					Birdwatcher				
		Mean	SD	t	df	p	Mean	SD	t	df	p
Trips	respondents	16.99	29.15	-2.05	297	0.04	25.90	54.63	2.42	1243	0.02
	non-respondents	26.75	35.35				13.23	32.99			
Centrality	respondents	3.24	0.96	1.17	301	0.24					
	non-respondents	3.06	0.93								
Birding Ability	respondents						4.62	1.30	1.97	1246	0.05
	non-respondents						4.37	1.40			
ID Angler	respondents	3.26	1.32	-0.60	301	0.55	1.71	1.10	-0.53	1167	0.60
	non-respondents	3.38	1.28				1.76	1.19			
ID Waterfowl Hunter	respondents	1.31	0.86	-1.07	272	0.28	1.19	0.65	-1.45	1158	0.15
	non-respondents	1.46	0.89				1.29	0.86			
ID Other Hunter	respondents	2.41	1.53	-0.34	279	0.73	1.34	0.91	-1.88	1157	0.06
	non-respondents	2.50	1.65				1.51	1.21			
ID Birdwatcher	respondents	2.37	1.21	0.90	278	0.37	4.01	1.04	1.01	1241	0.31
	non-respondents	2.20	1.26				3.91	1.09			
ID Outdoor Enthusiast	respondents	3.59	1.30	0.64	289	0.52	3.67	1.19	0.16	1211	0.87
	non-respondents	3.47	1.30				3.65	1.17			
ID Conservationist	respondents	3.46	1.17	1.18	286	0.24	4.08	1.00	0.76	1227	0.45
	non-respondents	3.24	1.25				4.01	1.04			
ID Preservationist	respondents	3.21	1.16	0.77	280	0.44	3.80	1.13	-0.18	1225	0.86
	non-respondents	3.07	1.32				3.82	1.14			
Conservation Behavior	respondents	2.37	0.78	0.47	294	0.64	3.05	0.88	1.60	1242	0.11
	non-respondents	2.31	0.83				2.91	0.87			
Year of Birth	respondents	1971.00	13.02	-1.39	290	0.17	1961.00	14.31	2.39	1200	0.02
	non-respondents	1974.00	14.92				1958.00	13.73			

**Table 40** (cont'd)

Education	respondents	3.38	1.05	-0.33	292	0.74	4.22	0.82	0.82	1236	0.41
	non-respondents	3.43	1.00				4.16	0.96			
Income	respondents	4.12	2.00	1.44	245	0.15	4.18	2.09	0.05	1065	0.96
	non-respondents	3.63	1.73				4.16	1.96			

**Table 40** (cont'd)

Variable		Community Member					Waterfowl Hunter				
		Mean	SD	t	df	p	Mean	SD	t	df	p
Trips	respondents						13.80	13.90	2.13	547	0.03
	non-respondents						11.26	11.57			
Centrality	respondents						3.54	0.94	2.66	563	0.01
	non-respondents						3.31	1.00			
Birding Ability	respondents										
	non-respondents										
ID Angler	respondents	2.14	1.45	0.13	80	0.90	3.61	1.20	-0.16	550	0.87
	non-respondents	2.08	1.51				3.63	1.23			
ID Waterfowl Hunter	respondents	1.52	1.25	0.88	80	0.38	4.12	1.00	2.16	561	0.03
	non-respondents	1.18	0.60				3.92	1.12			
ID Other Hunter	respondents	1.94	1.51	0.07	80	0.94	3.67	1.11	-0.75	544	0.45
	non-respondents	1.91	1.58				3.75	1.18			
ID Birdwatcher	respondents	2.51	1.18	-1.30	85	0.20	2.16	1.05	-0.74	535	0.46
	non-respondents	3.00	1.00				2.24	1.16			
ID Outdoor Enthusiast	respondents	3.27	1.12	0.00	86	1.00	3.33	1.22	0.31	547	0.76
	non-respondents	3.27	1.27				3.30	1.18			
ID Conservationist	respondents	3.41	1.18	0.20	86	0.85	4.01	1.00	0.91	555	0.37
	non-respondents	3.33	1.50				3.92	1.06			
ID Preservationist	respondents	3.29	1.18	0.54	86	0.59	3.46	1.17	-0.15	543	0.88
	non-respondents	3.08	1.56				3.48	1.20			
Conservation Behavior	respondents	2.28	0.83	1.04	92	0.30	3.16	0.91	3.69	560	0.00
	non-respondents	2.02	0.90				2.86	0.87			
Year of Birth	respondents	1963.00	17.75	0.69	90	0.49	1970.00	16.15	1.90	557	0.06
	non-respondents	1960.00	16.57				1967.00	16.40			

**Table 40** (cont'd)

Education	respondents	3.83	1.00	1.28	91	0.21	3.60	0.98	0.33	562	0.74
	non-respondents	3.42	1.31				3.57	0.97			
Income	respondents	4.56	2.00	1.10	72	0.28	4.60	2.11	0.05	492	0.96
	non-respondents	3.80	2.30				4.59	2.16			