SPECIALIZATION AND DIVERGENT ANGLER PREFERENCES FOR TROUT FISHING IN GEORGIA

by

HAILEY YONDO

(Under the Direction of Brian Irwin and B. Bynum Boley)

ABSTRACT

To satisfy the various preferences and practices of anglers, managers must understand the diversity within the angler population they are serving. Many previous studies on angler preferences and experiences have not focused on capturing the diversity in angler populations. This study addressed the heterogeneity within Georgia's trout angler population to better understand how preferences, constraints, and subsequent negotiation strategies differ across the angler population. The diversity within the Georgia trout angler population was uncovered by clustering anglers based on their level of specialization. Data were collected via a mail survey administered to 4,000 licensed Georgia trout anglers. Results revealed less specialized anglers took less trips, were less satisfied with trout fishing attributes, perceived more constraints when attempting to trout fish, and were less able to negotiate the constraints. Implications suggest tailoring management strategies toward specific groups of anglers that are particularly dissatisfied or constrained to help maintain or increase participation.

INDEX WORDS: Angler specialization; importance-satisfaction analysis; constraints; negotiation strategies; trout management

SPECIALIZATION AND DIVERGENT ANGLER PREFERENCES FOR TROUT FISHING IN GEORGIA

by

HAILEY YONDO

B.S., Michigan State University, 2015

A Thesis Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

MASTER OF SCIENCE

ATHENS, GEORGIA

2018

SPECIALIZATION AND DIVERGENT ANGLER PREFERENCES FOR TROUT FISHING IN GEORGIA

by

HAILEY YONDO

Major Professor:	Brian Irwin
	B. Bynum Boley
Committee:	Cecil Jennings
	Seth Wenger

Electronic Version Approved:

Suzanne Barbour
Dean of the Graduate School
The University of Georgia
May 2018

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my advisors Brian Irwin and Bynum Boley for their dedication to helping me improve my research and communication skills. I could not be more thankful for their patience and guidance throughout my graduate program. Additionally, I am grateful for the opportunities they provided me to present my research. I would also like to thank my committee members for their advice and direction throughout my graduate studies. My writing has greatly improved because of their guidance. Finally, I would like to thank my husband, sister, mom, and dad for their endless support and encouragement.

This research was made possible through the funding provided by the Georgia Department of Natural Resources and the Daniel B. Warnell School of Forestry and Natural Resources at the University of Georgia. I greatly appreciate the support of the Georgia Cooperative Fish and Wildlife Research Unit throughout my graduate program.

TABLE OF CONTENTS

Page

ACKNOWLEDGEMENTS iv

LIST OF TABLES vii

LIST OF FIGURES ix

CHAPTER

1 INTRODUCTION AND LITERATURE REVIEW 1

References 7

2 IMPORTANCE- SATISFACTION ANALYSIS: FINDINGS FROM A GEORGIA TROUT ANGLER SURVEY 12

Abstract 13

Introduction 14

Study Area 17

Methods 18

Results 24

Discussion 29

Summary and Management Implications 32

References 35

3 NEGOTIATIONS OF PERCEIVED CONSTRAINTS TO TROUT FISHING IN GEORGIA BASED ON ANGLER SPECIALIZATION LEVEL 52

Abstract 53

Introduction....54
Study Area....56
Methods....57
Results....63
Discussion....69
Summary and Management Implications....73
References....76
4 CONCLUSIONS....91
APPENDICES
A 2017 GEORGIA TROUT ANGLER SURVEY....94

LIST OF TABLES

Page

Table 1.1: Rotated component matrix from principal component EFA with varimax rotation of statements measuring centrality of trout fishing to an individual's lifestyle from a 2017 study of trout angler preferences in Georgia 40

Table 1.2: Variables used in angler specialization cluster analysis from a 2017 study of trout angler preferences in Georgia.....41

Table 1.3: Gender, approximated age, ethnicity, education, and household income for all respondents to a 2017 Georgia trout angler preferences survey 42

Table 1.4: Angler specialization cluster centers from a 2017 study of trout angler preferences in Georgia 43

Table 1.5: MANOVAs and ANOVAs of mean importance-satisfaction scores by level of angler specialization for 17 trout fishing attributes measured in a 2017 study of trout angler preferences in Georgia.....44

Table 1.6: Quadrant placement of trout fishing attributes by angler specialization from a 2017 study on trout angler preferences in Georgia.....45

Table 1.7: MANOVAs and ANOVAs of mean importance-satisfaction scores by the type of gear used for 17 trout fishing attributes measured in a 2017 Georgia trout angler preferences survey 46

Table 2.1: Variables used in cluster analysis from a 2017 study of trout angler preferences in Georgia 81

Table 2.2: Gender, approximated age, ethnicity, education, and household income for all respondents to a 2017 Georgia trout angler preferences survey 82
Table 2.3: Angler specialization cluster centers from a 2017 study of trout angler preferences in Georgia 83
Table 2.4: MANOVA and ANOVAs of mean constraint scores for 15 potential constraints to trout fishing in Georgia in 2017 84
Table 2.5: MANOVA and ANOVAs of mean constraint negotiation scores for 14 constraint negotiation strategies for trout fishing in Georgia in 2017 85
Table 2.6: MANOVA and ANOVAs of paired standardized constraint and negotiation strategy items identified from a 2017 study on trout anglers in Georgia.....86

LIST OF FIGURES

Page

Figure 1.1: Visual layout of an ISA 47

Figure 1.2: Map of Georgia counties 48

Figure 1.3: ISA of trout angling attributes for the most, moderately, and least specialized clusters from a 2017 study of trout angler preferences in Georgia.....49

Figure 1.4: ISA of both catch and non-catch trout angling attributes for all specialization clusters from a 2017 study of trout angler preferences in Georgia.....50

Figure 1.5: ISA of both catch and non-catch trout angling attributes for all gear types from a 2017 study of trout angler preferences in Georgia 51

Figure 2.1: Map of Georgia counties 87

Figure 2.2: Mean constraint scores for each of the three angler specialization clusters found in a 2017 study on Georgia trout anglers.....88

Figure 2.3: Mean negotiation strategy scores for each of the three angler specialization clusters found in a 2017 study on Georgia trout anglers 89

Figure 2.4: Mean constraint scores and trip frequencies in the previous year identified from a 2017 survey of Georgia trout anglers for the most, moderately, and least specialized cluster 90

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

Georgia's 4,000 miles of trout streams have an economic impact estimated to be over $170 million each year and attract over 100,000 trout anglers annually (Georgia Department of Natural Resources – GA DNR, 2014, 2015). Trout fishing opportunities are economically, socially, and environmentally important to Georgia, making successful management of this resource crucial. However, trout waters in Georgia are relatively unproductive due to high water temperatures, limited food availability, and low alkalinity (Harshbarger 1978; Keefer et al. 2000). The limited supply and low natural productivity of Georgia trout waters coupled with high demand for trout angling motivates the management agency to conduct supplemental stocking of trout.

Approximately one million trout are stocked annually into Georgia waters (Keefer et al. 2000). Some trout species, as with many other sportfish, have been introduced to Georgia waters from outside their native ranges for recreational purposes (Rahel 2000). The two most commonly stocked trout species are nonnative rainbow trout (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*), which were introduced over a century ago and are now considered naturalized species (Keefer et al. 2000). A third important species of trout in Georgia is the eastern brook trout (*Salvelinus fontinalis*), which is native to Georgia, although the original distribution is unclear (Keefer et al. 2000). Most stocked waters are public access streams with general regulations; however, some stocking occurs on streams with special regulations.

With the large revenue generated from trout fishing and the substantial number of trout anglers in Georgia, an overall high demand for trout fishing opportunities is evident. However, individual anglers often have divergent motivations for and preferences while fishing, which are related to behaviors (Petering et al. 1995). Angler specialization has been previously used to group users by their behaviors, motivations, or preferences toward recreational fishing (Bryan 1977; Ditton et al. 1992; Beardmore et al. 2013; Sutton & Oh 2015). Segmenting trout anglers into groups of individuals with similar behaviors, motivations, and preferences may help managers understand variability within the angling population. Understanding varying angler preferences can then help managers better anticipate the effects of management decisions on different user groups and how these diverse user groups may respond to management decisions (Arlinghaus 2005).

This study provides insight about angler preferences in Chapter 2 as well as constraints anglers face when attempting to trout fish in Georgia and subsequent negotiation strategies used to overcome constraints in Chapter 3. Additionally, this study explores the heterogeneity in the Georgia trout angler population by grouping trout anglers into subgroups of similar anglers and investigating the differences between the subgroups. Findings from this study may help fisheries managers better serve the diverse trout angler population by developing management strategies that are tailored to anglers' preferences and help anglers overcome the constraints they perceive.

In Chapters 2 and 3 of this thesis, recreational specialization is used to capture the potential heterogeneity in Georgia's trout angler population. The assumption of angler homogeneity was identified as a weakness of previous research by Bryan (1976), who

attempted to further investigate individual variation in angler preferences through the concept of recreational specialization. In Bryan's (1977) seminal work on the concept, recreational specialization was measured through equipment preferences, skills, and preferences for catch, management, and setting. Recreational specialization was originally thought of as a continuum of behavior in which individuals become more specialized over time (Bryan 1977). As an individual progressed along the specialization continuum, there was thought to be a shift from consumption to preservation and an increased emphasis on the activity's nature and setting (Bryan 1977; Chipman & Helfrich 1988; Ditton et al. 1992). More recent research has since challenged the idea that recreational specialization is a continuum in which individuals start with general preferences and move toward specific preferences over time. This research has found that the level of specialization does not always increase with experience, suggesting a more discrete change in specialization (Kuentzel & McDonald 1992; Fisher 1997; Needham et al. 2007). Additionally, the continuum concept ignores any changes in life course (e.g., desire for elite status, career change, personal life event) that may positively or negatively affect time spent recreating (Kuentzel & McDonald 1992; Scott & Shafer 2001).

Although specialization was initially approached with a univariate measurement, more recent research suggests a multivariate approach for quantifying specialization (Chipman & Helfrich 1988; Fisher 1997; Scott & Shafer 2001), consisting of behavioral, cognitive, and affective measurements (McIntyre & Pigram 1992; Scott & Shafer 2001; McFarlane 2004). An individual is thought of as a specialist with respect to the behavioral dimension when they invest time and resources into one activity at the

expense of other leisure pursuits (Scott & Shafer 2001). The behavioral dimension is typically measured as years of experience in an activity, frequency of participation, or number of visits to various sites (McIntyre & Pigram 1992; Scott & Shafer 2001). The cognitive dimension is commonly measured through skill development or knowledge acquisition and differs from a direct measure of experience in that the desire to develop skills and knowledge in an activity can vary and may lead less experienced individuals to become more skilled or knowledgeable than more experienced individuals (McIntyre & Pigram 1992; Scott & Shafer 2001). The affective dimension of specialization is often measured by self-expression, enduring involvement, or centrality of the activity to one's lifestyle (Scott & Shafer 2001). Self-expression, or personal commitment, with respect to a leisure activity can be thought of as defining oneself in terms of the activity and committing oneself to the norms and values of the activity's social world (Scott & Shafer 2001). Enduring involvement, or behavioral commitment, can be thought of as investments in the activity (e.g., money on equipment, time on skill development, energy on forming friendships) that make dropping out of the activity difficult (Scott, Baker, & Kim 1999). A recreational activity becomes central to one's lifestyle when involvement in the activity is chosen over competing activities and both personal and behavioral commitments are made to the activity (Kim et al. 1997).

In Chapter 2, an Importance-Satisfaction Analysis is conducted to visually assist managers during resource allocation efforts by graphing salient trout fishing attributes into four quadrants based on responses from trout anglers segmented by level of specialization. An Importance-Satisfaction Analysis (ISA) is a modified Importance-Performance Analysis (IPA) where satisfaction of various attributes is measured instead

of performance of a management agency or customer service firm. Martilla & James (1977) first used an IPA to evaluate elements of a marketing program. Since this foundational work, IPA has been commonly used within the business sector to simultaneously identify what attributes customers think are important and their perceptions of agency performance on those same attributes (Sever 2015). While there is little to no application of ISA in fisheries management (e.g., Schroeder et al. 2008), user-group satisfaction is important to understand to promote license sales and potentially increase the number of active anglers. In Chapter 2, the ISA is generated for the overall responses as well as the responses segmented into the different levels of angler specialization to help managers see the varying degrees of importance and satisfaction placed on trout fishing attributes.

In Chapter 3, constraints to trout fishing as well as strategies to negotiate these constraints are explored. Constraints to a recreational activity are factors that can limit one's ability or desire to participate in or enjoy the activity (Jackson 1991; Sutton 2007). However, an individual can continue participating in their leisure activity while experiencing constraints by devoting energy to negotiate the perceived constraints (Kay & Jackson 1991; Shaw et al. 1991). When the perceived constraints are ongoing or non-negotiable, individuals may cease participation in the activity (Backman 1991). Previous research has identified three dimensions that make up leisure constraints: intrapersonal, interpersonal, and structural (Crawford & Godbey 1987). The intrapersonal dimension refers to internal constraints that affect preferences toward an activity (e.g., perceived skill, moral orientation with the activity). The second dimension of constraints is interpersonal, which arises from social interactions with others (e.g., not having friends to

participate with). Structural constraints makeup the third dimension of constraints and are factors that directly interfere with participation (e.g., lack of time, money, access).

Constraint negotiation strategies are methods participants use to reduce the effects of constraints and help individuals adjust the desire to participate in a leisure activity more often (Jackson et al. 1993). Constraint negotiation scales developed in previous research has been activity specific. Some researchers suggest there are two types of negotiation strategies – behavioral and cognitive (Jackson et al. 1993; Jackson & Rucks 1995; Lyu & Oh 2014). Other researchers have identified multiple sub-dimensions of constraint negotiation such as time or financial management, finding partners, acquiring information, improving knowledge or skill, and interpersonal coordination (Hubbard & Mannell 2001; Alexandris et al. 2007). In attempts to better align the negotiation scale with the constraint scale, the multiple sub-dimension approach was employed. Better understanding the perceived constraints and subsequent negotiation strategies trout anglers endure when attempting to trout fish may lead to a better understanding of fluctuations in trout fishing license sales, which is a form of revenue for management agencies. Constraints and negotiation strategies will be explored on each unique level of angler specialization to determine if there is a certain group of trout anglers that perceive more constraints than others, which may help managers target specific groups to potentially increase participation in trout angling.

References

Alexandris, K., C. Kouthouris, and G. Girgolas. 2007. Investigating the relationships among motivation, negotiation, and alpine skiing participation. Journal of Leisure Research 39(4): 648-667.

Arlinghaus, R. 2005. A conceptual framework to identify and understand conflicts in recreational fisheries systems, with implications for sustainable management. Aquatic Resources, Culture and Development 1(2): 145-174.

Backman, S. J. 1991. An investigation of the relationship between activity loyalty and perceived constraints. Journal of Leisure Research 23(4): 332-344.

Beardmore, B., W. Haider, L. M. Hunt, and R. Arlinghaus. 2013. Evaluating the ability of specialization indicators to explain fishing preferences. Leisure Sciences 35(3): 273-292.

Bryan, H. 1976. The sociology of fishing: A review and critique. Pages 83-92 in H. Clepper, editor. Marine Recreational Fisheries. Sport Fishing Institute, Washington, D. C.

Bryan, H. 1977. Leisure value systems and recreational specialization: The case of trout fishermen. Journal of Leisure Research 9(3): 174-188.

Chipman, B. D., and L. A. Helfrich. 1988. Recreational specializations and motivations of Virginia river anglers. North American Journal of Fisheries Management 8: 390-398.

Crawford, D. W., and G. Godbey. 1987. Reconceptualizing barriers to family leisure. Leisure Sciences 9: 119-127.

Ditton, R. B., D. K. Loomis, and S. Choi. 1992. Recreation specialization: Re-conceptualization from social worlds perspective. Journal of Leisure Research 24(1): 33-51.

Fisher, M. R. 1997. Segmentation of the angler population by catch preference, participation, and experience: A management-oriented application of recreation specialization. North American Journal of Fisheries Management 17(1): 1-10.

GA Department of Natural Resources (GA DNR). 2014. Trout fact sheet. Georgia Department of Natural Resources, Social Circle, Georgia.

GA Department of Natural Resources. 2015. Trout fishing in Georgia. Official website of GA Department of Natural Resources. Available at www.georgiawildlife.com/node/740.

Harshbarger, T. J. 1978. Factors affecting regional trout stream productivity. Southeastern Trout Resource: Ecology and Management Symposium Proceedings. Southeastern Forest Experiment Station, Asheville, N. C.

Hubbard, J., and R. C. Mannell. 2001. Testing competing models of the leisure constraint negotiation process in a corporate employee recreation setting. Leisure Sciences 23(3): 145-163.

Jackson, E. L. 1991. Leisure constraints/constrained leisure: Special issue introduction. Journal of Leisure Research 23(4): 279-285.

Jackson, E. L., D. W. Crawford, and G. Godbey. 1993. Negotiation of leisure constraints. Leisure Sciences 15:1-11.

Jackson, E. L., and V. C. Rucks. 1995. Negotiation of leisure constraints by junior-high and high-school students: An exploratory factor analysis. Journal of Leisure Research 27(1): 85-105.

Kay, T., and G. Jackson. 1991. Leisure despite constraint: The impact of leisure constraints on leisure participation. Journal of Leisure Research 23(4): 301-313.

Keefer, L., G. Beisser, H. Chestnutt, B. Couch, K. Kammermeyer, L. Klein, and T. Lovell. 2000. Georgia trout management plan. Georgia Department of Natural Resources (Wildlife Resources Division). Social Circle, Georgia.

Kim, S., D. Scott, and J. L. Crompton. 1997. An exploration of the relationships among social psychological involvement, behavioral involvement, commitment, and future intentions in the context of birdwatching. Journal of Leisure Research 29(3): 320-341.

Kuentzel, W. F., and C. D. McDonald. 1992. Differential effects of past experience, commitment, and lifestyle dimensions on river use specialization. Journal of Leisure Research 24(3): 269-287.

Lyu, S. O., and C. Oh. 2014. Recreationists' constraints negotiation process for continual leisure engagement. Leisure Sciences 36: 479-497.

Martilla, J. A., and J. C. James. 1977. Importance-performance analysis. Journal of Marketing 41(1): 77-79.

McFarlane, B. L. 2004. Recreation specialization and site choice among vehicle-based campers. Leisure Sciences 26(3): 309-322.

McIntyre, N., and J. J. Pigram. 1992. Recreation specialization reexamined: The case of vehicle-based campers. Leisure Sciences 14(1): 3-15.

Needham, M. D., J. J. Vaske, M. P. Donnelly, and M. J. Manfredo. 2007. Hunting specialization and its relationship to participation in response to chronic wasting disease. Journal of Leisure Research 39(3): 413-437.

Petering, R. W., G. L. Isbell, and R. L. Miller. 1995. A survey method for determining angler preference for catches of various fish length and number combinations. North American Journal of Fisheries Management 15(4): 732-735.

Rahel, F. J. 2000. Homogenization of fish faunas across the United States. Science 288(5467): 854-856.

Schroeder, S. A., D. C. Fulton, M. L. Nemeth, R. E. Sigurdson, and R. J. Walsh. 2008. Fishing in the neighborhood: Understanding motivations and constraints for angling among Minneapolis-St. Paul, Minnesota metro residents. American Fisheries Society Symposium 67.

Scott, D., S. M. Baker, and C. Kim. 1999. Motivations and commitments among participants in the Great Texas Birding Classic. Human Dimensions of Wildlife 4(1): 50-67.

Scott, D., and C. S. Shafer. 2001. Recreational specialization: A critical look at the construct. Journal of Leisure Research 33(3): 319-343.

Sever, I. 2015. Importance-performance analysis: A valid management tool? Tourism Management 48: 43-53.

Shaw, S. M., A. Bonen, and J. F. McCabe. 1991. Do more constraints mean less leisure? Examining the relationship between constraints and participation. Journal of Leisure Research 23(4): 286-300.

Sutton, S. G. 2007. Constraints on recreational fishing participation in Queensland, Australia. Fisheries 32(2): 73-83.

Sutton, S. G., and C. Oh. 2015. How do recreationists make activity substitution decisions? A case of recreational fishing. Leisure Sciences 37(4): 332-353.

CHAPTER 2

IMPORTANCE-SATISFACTION ANALYSIS: FINDINGS FROM A GEORGIA TROUT ANGLER SURVEY[1]

[1] Yondo H. J., B. B. Boley, B. J. Irwin, and C. A. Jennings. To be submitted to *North American Journal of Fisheries Management.*

Abstract

Information about angler preferences that is not based on direct, current, and widespread feedback from anglers is often relied on when designing and implementing fisheries management strategies. In response, I gathered data via a 2017 mail survey administered to 4,000 Georgia trout license holders. Recipients were asked to evaluate the importance of multiple salient catch and non-catch trout fishing attributes as well as their satisfaction with the performance of those same attributes. For instance, the amount of fish caught might be extremely important to some anglers while others may consider proximity to angling opportunities to be more important. An importance-satisfaction analysis (ISA) was conducted to identify discrepancies between what stakeholders deem important and their satisfaction with the performance of those attributes. This ISA methodology applied to fisheries management may help managers better understand consumer satisfaction of the user groups they serve. Survey responses were grouped by level of angler specialization using K-means cluster analysis with a three-cluster solution. I found that specialization groups differed significantly in the importance of 10 of the 17 trout fishing attributes. Respondents reported the most important attributes to be clear signage of regulations, habitat improvement initiatives, and adding new fishable waters. Satisfaction with the performance of the attributes differed between the groups on seven of the attributes. Average responses for importance and satisfaction were highest for the most specialized group and lowest for the least specialized group, indicating the most specialized group placed more importance on and were more satisfied with the attributes on average. Identifying the heterogeneity in the importance and satisfaction placed on

various attributes of trout angling can lead to a better understanding of angler needs and desires, which can be of great use to managers when attempting to satisfy user groups.

Introduction

As anglers become increasingly diverse, fisheries managers must find ways to satisfy users with divergent preferences while conserving a limited resource (Fisher 1997; Beardmore et al. 2013). Individual anglers can vary in objectives for a fishing experience, which causes divergent preferences for management options (Bryan 1977; Fisher 1997). For example, special regulations (e.g., delayed harvest, artificial lure only) may be favored by individuals who desire outcomes better supported by specific restrictions, but such restrictions may be opposed by anglers who favor less complicated regulations. Hence, understanding diverse angler preferences can be critical to designing and implementing effective management policies because ultimately stakeholders must understand and adhere to regulations for them to be effective (Petering et al. 1995; Arlinghaus 2005; Edison et al. 2006). Thus, modern-day recreational fisheries managers may focus as much on people management as fisheries stock management (Arlinghaus 2005). Additionally, for some anglers, satisfaction with an angling experience can be partly dependent upon non-catch related aspects such as degree of solitude or the social setting of angling, including the attitudes of other anglers encountered (Ditton et al. 1992).

The nature of human involvement in recreational fisheries systems creates a need to evaluate user-group satisfaction of various recreational fishing attributes (Holland & Ditton 1992). Previous studies cautioned against assuming management objectives

should be defined based upon an "average angler" because angler groups contain heterogeneous subgroups with differing objectives (McFadden 1969; Bryan 1976; Hutt & Bettoli 2007; Beardmore et al. 2011). Angler specialization has been and continues to be used to capture the diversity among participants and to group anglers by varying behaviors, motivations, and preferences toward recreational fishing (Bryan 1977; Ditton et al. 1992; Beardmore et al. 2013; Sutton & Oh 2015). Groups that experience the greatest adverse effects from management decisions usually exhibit the greatest opposition to management actions, which underscores the increasing importance of understanding the heterogeneity within an angler population (Arlinghaus 2005). Gaining a better understanding of the heterogeneous angler population can help managers anticipate how various anglers will respond to differing management actions, allow managers time to prepare responses or plan modifications, and ultimately better identify those management options that are most likely to satisfy multiple user groups.

One method that may help fishery managers evaluate angler satisfaction of various recreational fishing attributes is importance-satisfaction analysis (ISA). This ISA method allows for examination of gaps between stakeholders' satisfaction with a set of salient product/service attributes and the level of importance they place on the same list of attributes (Sever 2015). An ISA is a modified importance-performance analysis in which stakeholders' perceptions of organizational performance on attributes are assessed in conjunction with stakeholders' perceptions of importance. The simultaneous measurement of the importance and satisfaction of each attribute provides the ability to visually identify gaps between the importance stakeholders place on an attribute and their level of satisfaction with how the attribute is performing. Through the ISA, these

importance-satisfaction rating are graphed on x and y axes to provide managers with a visual display of how each attribute falls within the four ISA quadrants: Quadrant 1: "Concentrate Here," Quadrant 2: "Keep up Good Work," Quadrant 3: "Low Priority," and Quadrant 4: "Possible Overkill" (Figure 1.1).

Within the business literature (e.g., hospitality, tourism, marketing), ISAs have been applied to identify attributes customers think are important while assessing customer satisfaction with attribute performance (Martilla & James 1977; Boley et al. 2017). An ISA can be used to assess customer satisfaction using the expectancy disconfirmation paradigm (Oliver 1980). For instance, the framework implies that satisfaction occurs when perceived performance is greater than expectations and dissatisfaction occurs when expectations are greater than perceived performance (Oliver 1980; Matzler et al. 2004). Using the ISA methodology, I identify discrepancies between importance and satisfaction of trout fishing attributes and determine how these discrepancies differ based on respondents' level of angler specialization. To my knowledge, there has been little application of ISA within the context of fisheries management (e.g., Schroeder et al. 2008). Hence, I have the dual aims of presenting the ISA method as well as providing a case study on how ISA can be used to identify the crucial attributes to manage. For this case study, I report on Georgia trout anglers' perceptions of the importance and satisfaction of salient catch and non-catch attributes (Matzler et al. 2003; Sever 2015).

Study Area

There are over 500,000 licensed resident trout anglers in Georgia. Many other states also experience high recreational demands for cold-water fisheries. However, Georgia is unique in that it is the southern terminus of native trout habitat in the Appalachian Mountains. The northern portion of Georgia is home to over 4,000 miles of streams inhabited by trout (Figure 1.2; GA DNR 2017). Brook trout *Salvelinus fontinalis* is the only trout species native to Georgia, but both brown trout *Salmo trutta* and rainbow trout *Oncorhynchus mykiss* are considered naturalized (Keefer et al. 2000). There are few naturally reproducing populations of trout within the state, so the Georgia Department of Natural Resources (GA DNR) and the U.S. Fish and Wildlife Service stock rainbow, brown, and brook trout from late March through August to meet the demand of recreational trout anglers (GA DNR 2017). In a 2012 study conducted on the economic impact of trout fishing in Georgia, trout fishing was estimated to have an associated net economic value of $130.3 million annually and a per-trip per-person consumer surplus range from $60.02 to $164.57 (Dorison 2012). Only about 30% of Georgia trout streams are located on public land (Keefer et al. 2000). Although GA DNR attempts to stock public land more frequently and in greater abundance than private land, the amount of private land continues to increase, furthering issues with public access (Keefer et al. 2000, GA DNR 2017). In addition to limited public access to the fishery, the GA DNR has identified the most pertinent threats to sustaining trout populations in Georgia as increases in temperature and sedimentation (Keefer et al. 2000).

Methods

Trout angler survey

The data used in this analysis were collected from a statewide survey of Georgia resident trout license holders. Contact information for resident trout anglers with a 2015 trout license was obtained from the GA DNR license database. Sample members (n = 4,000) were selected from the GA DNR license database by proportionate random sampling based on license type. The sample was comprised of both lifetime license holders and anglers who have to repurchase their licenses every 1-3 years. In Georgia, Lifetime Sportsman Licenses include both hunting and fishing privileges for multiple species and contain a trout license within the license package; however, Lifetime Sportsman License holders may choose to not make use of the trout license. In attempts to avoid mailing survey questionnaires to a large group of individuals who potentially do not use their trout license, lifetime licenses were curtailed from 50% of the population to 25% of the entire sample (n=1,000). There are five different types of lifetime licenses, which were proportionately drawn from the lifetime license sample based on the percentage of lifetime license holders that were in each of the five different license types. Repurchase license holders made up the remaining 75% of the entire sample (n=3,000), in effort to reach a higher number of individuals who were likely to make use of their trout license. There are six different types of repurchase licenses, all of which were proportionately drawn from the license database based on the percentage of repurchase license holders that were in each of the six different license types. The sample members within each of the five lifetime license types and each of the six repurchase license types were randomly selected by first separating anglers into separate spreadsheets based on

license type. Once separated, anglers were randomly chosen for the sample based upon the number of anglers needed to meet the stratified requirements for that license type.

A self-administered mail questionnaire was used to collect information on anglers' demographic characteristics, specialization, and preferences for various trout fishing attributes as well as how satisfied anglers were with the performance of those attributes. Specific measurements of survey items are described below. Additional questions such as preferred fishing season and perceptions of the current and future quality of trout fishing in Georgia were included in the questionnaire to address specific interests of the GA DNR.

Data collection occurred January through June of 2017. Before mailing the survey out to the 4,000 trout anglers, the questionnaire was pretested with a group of 19 local Trout Unlimited members, which resulted in both the removal and addition of questions as well as rewording questions to improve clarity. Following the pretest, there were four mail contacts to the study sample as recommended by Dillman et al. (2014). The first contact was an informational letter to notify the angler that a survey questionnaire was coming in the mail. The questionnaire was mailed approximately a week after the informational letter and was followed by a reminder postcard a few weeks later in February. Lastly, in April, a second questionnaire was mailed to all repurchase license holders within the study sample that had not yet returned their original questionnaire. The second copy of the questionnaire was only sent to non-respondents with repurchase licenses because the running response rate was 7.3% for lifetime license holders and 15.3% for repurchase license holders and funding did not allow for printing and mailing second questionnaires to all non-respondents.

To incentivize respondents, every sample member who completed and returned their survey was entered in a drawing for a Georgia Lifetime Sportsman License worth between $70 and $750 depending upon the age of the angler. Each sample member also received decals provided by the GA DNR along with their questionnaire. The chance to win a lifetime license and the decals were included as incentives to increase response rates as suggested by Dillman et al. (2014).

Construct measurement

Sample members were asked to use a five-point Likert-type scale (1= "not at all important" to 5= "extremely important") to rate the level of perceived importance of 17 different trout fishing attributes. Then, sample members were asked to use another five-point Likert-type scale (1= "very dissatisfied" to 5= "very satisfied") to rate the level of perceived satisfaction for those same 17 trout fishing attributes. Ten of the attributes were related to catch aspects (e.g., number of fish caught, catching stocked trout) and seven of the attributes were non-catch aspects of trout fishing (e.g., having clean bathrooms at access points, access to special regulation streams, distance to trout stream).

Angler specialization was assessed as a three-dimensional construct based upon a previous angler specialization model (McIntyre & Pigram 1992; Scott and Shafer 2001; McFarlane 2004). The three dimensions used to measure angler specialization were behavioral, cognitive, and commitment dimensions. To address the behavioral dimension, anglers were asked to record the number of trout fishing trips they took to each county with trout waters in Georgia in the last 12 months (see Figure 1.2). The second question addressed the cognitive dimension by asking participants to use a four-point scale ranging from "novice" to "expert" to rate their level of skill as a trout angler.

The third construct focused on measuring one's commitment to trout fishing or the centrality of trout fishing to one's lifestyle. The construct was measured through a set of three statements (e.g., "trout fishing is my main form of outdoor recreation"; "I find a lot of my life is centered around trout fishing") modified from Kim et al. (1997). The items within this commitment dimension were asked on a five-point Likert-type scale ranging from 1= "strongly disagree" to 5= "strongly agree".

Data analysis

Principal component exploratory factor analysis (EFA) with varimax rotation was used to determine if the three statements used to measure the commitment dimension of specialization were measuring the same dimension or if multiple dimensions were present (Table 1.1). These three statements were developed by Kim et al. (1997) to measure the degree to which a recreational activity is central to the participants' lifestyle. The Cronbach's alpha for the three centrality to lifestyle statements was 0.781. Alpha values greater than or equal to 0.7 are often considered acceptable reliability (Nunnally 1978; Santos 1999). For each respondent, scores for the three variables were averaged and then rounded to create a single score reflecting an individual's centrality to lifestyle.

The trip frequency variable, which measured the behavioral dimension, was binned to account for the larger variability in responses compared to the other two cluster variables (Table 1.2). The binned trip frequency, centrality to lifestyle rounded averaged scale, and skill rating variables were standardized to a mean of zero and variance of one to account for the different scales on which the variables were measured. Standardization was accomplished by subtracting the mean of the question from each response and dividing by the standard deviation of that question. These standardized variables were

then used in a K-means cluster analysis to identify homogeneous groups of trout anglers based on their specialization (Table 1.2).

Survey respondents were clustered by level of specialization to determine if perceptions of importance and satisfaction vary based on level of angler specialization. There are no specific guidelines for determining the number of clusters in a cluster analysis; however, the clusters must be useful to managers. The number of clusters should be large enough to allow managers to observe the heterogeneity in the population through distinct subgroups, yet not so numerous that the sizes of the clusters become so small that managers attempt to serve the needs of small segments of the population (Payne 1993). K-means cluster analysis was initially explored using three, four, and five cluster centers. The four and five cluster solutions placed only a few individuals with the highest number of trips in one cluster and split the rest of the respondents among the other clusters. Hence, three clusters were chosen for the final solution. Cluster centers (i.e., variable means) from the K-means cluster analysis were used to determine the level of specialization for each of the three clusters.

Importance-Satisfaction Analysis Crosshair Placement

The results from an ISA are typically depicted in a two-dimensional graph in the first quadrant of the Cartesian system. The x-axis is attribute satisfaction and the y-axis is attribute importance, both ranging from low to high. The first quadrant itself is then separated into four sub-quadrants to visually assist in assessing management priorities by helping identify where an attribute's importance and satisfaction are out of proportion. The first sub-quadrant displays high importance and low satisfaction ("Concentrate Here"), the second sub-quadrant displays high importance and high satisfaction ("Keep

up the Good Work"), the third sub-quadrant displays low importance and high satisfaction ("Possible Overkill"), and the fourth sub-quadrant displays low importance and low satisfaction ("Low Priority"). Traditional quadrant nomenclature for the four quadrants was followed (Martilla & James 1977). The ISA visuals display three different discriminating threshold approaches to separate the grid (i.e., cross-hairs on the plot and iso-rating line). One discriminating threshold approach is scale-centered, which places the cross-hairs at the median values of the measurement scale – the five-point Likert-type scale used to measure importance and performance. The second approach that is displayed is data-centered, which places the cross-hairs at the means observed from the data. The third threshold that is shown is an iso-rating line, which is a 45° line that splits the first quadrant into two separate regions. In one region, satisfaction exceeds importance and in the other, satisfaction falls below importance.

Mean importance and satisfaction scores were calculated for each trout fishing attribute within the three angler subgroups. These mean scores were placed on a two-dimensional grid representing the range of importance and satisfaction both from low to high. The grid was then separated into four quadrants as mentioned above. Although data centered threshold lines are the focus of the results, the scale centered and iso-diagonal threshold lines were produced on the same plot to address the various concerns with the independent approaches (Sever 2015; Boley et al. 2017). The means for the three specialization clusters were compared using two separate multivariate analysis of variances (MANOVAs). The first MANOVA identified statistically significant differences between specialization clusters in overall perceived importance trout fishing attributes. The second MANOVA identified differences between clusters in the overall

perceived satisfaction of the trout fishing attributes. Analysis of variance (ANOVA) was used to examine significant differences between clusters at the attribute level. Tukey's Post Hoc Tests were conducted to determine which clusters differed with statistical significance ($\alpha = 0.05$). Based on management recommendations, one MANOVA was conducted for the importance and one for the satisfaction of the trout fishing attributes by the type of gear that the respondent indicated they use when trout fishing (e.g., artificial fly, artificial lure, or bait).

MANOVA has associated assumptions such as independence of observations, equal variance-covariance matrices, multivariate normality (Hair et al. 1998; Stevens 2002). Box M's test was conducted before performing the MANVOAs to determine if the equal variance-covariance matrices assumption was met. The Box's M Tests were significant, indicating the matrices are not equal across the specialization clusters (Importance Box's M = 462.1, $p < 0.01$; Satisfaction Box's M = 552.0, $p < 0.01$). The assumption of normality was tested using Shapiro-Wilk tests. The Shapiro-Wilk tests were significant, indicating neither the importance nor satisfaction data meet the assumption of normality. Because the equal variance-covariance matrices and the normality assumptions were not met, Pillai's criterion was interpreted, which is more robust to violations of assumptions (Hair et al. 1998).

Results

Of the 4,000 questionnaires mailed to the sample of anglers, 624 were completed and returned. Adjusting for 256 non-deliverable surveys, the overall response rate was 16.7%. The response rate for only lifetime license holders was 7.3% and the adjusted

response rate for only repurchase license holders was 20.1%. Of the 624 completed surveys, 96 were unusable because of missing data and due to incomplete responses in the importance and satisfaction results, 469 respondents were used for the following importance and satisfaction analyses.

Most of the respondents were male (84%); the remainder were females (15%) or did not disclose their gender (1%). The mean age of survey respondents was 48 (± 13) years old. The youngest respondent was 19 years old and the oldest respondent was 80 years old. The sample was predominately Caucasian. The mean income level across respondents was between $50,000 and $74,999 and the mean level of education was "some college" (Table 1.3). The mean trip frequency was 8 trips (± 18) with 159 respondents taking 0 trips (minimum value) and 1 respondent taking 280 trips (maximum value). The mean skill rating score was 2.04 (± 0.76; on a 1-4 scale) and the mean centrality to lifestyle score on the rounded averaged scale was 2.43 (± 0.91; on a 1-5 scale).

Of the three angler specialization clusters, the cluster with the highest average of the three standardized clustering variables (i.e., trip frequency, skill rating, and centrality to lifestyle) was considered the most specialized cluster resulting in the following three clusters: most specialized (n = 113), moderately specialized (n = 75), and least specialized (n = 281) (Table 1.4). The most specialized cluster had the highest cluster center for trip frequency and centrality to lifestyle. However, the moderately specialized cluster had the highest cluster center for skill rating, which has also been found in previous specialization research (Oh & Ditton 2006).

The attributes reported as most important were clear signage of regulations, habitat improvement initiatives, and adding new fishable waters (Table 1.5). On average, respondents rated attributes related to catch aspects of trout fishing (mean = 3.41 ± 0.38) to be of the same importance as the non-catch aspects of trout fishing (mean = 3.41 ± 0.36). The most specialized cluster placed slightly more importance on catch (mean = 3.53 ± 0.38) compared to non-catch (mean = 3.50 ± 0.46) attributes, as did the moderately specialized cluster (catch mean = 3.50 ± 0.35; non-catch mean = 3.43 ± 0.43). However, the least specialized cluster placed slightly more importance on non-catch (3.36 ± 0.33) compared to catch (3.34 ± 0.41) attributes. The results of the first MANOVA revealed that there was a statistical difference between the three clusters in the importance they placed on the trout fishing attributes with the most specialized cluster rating the attributes as most important (Pillai's criterion = 0.182, $p < 0.001$). The univariate ANOVAs within the broader MANOVA revealed 10 significant differences among the three clusters in importance of trout fishing attributes (Table 1.5). The mean score of all the importance measures was 3.41 (± 0.36) on a five-point scale. For the most, moderately, and least specialized clusters, the means of the 17 importance measures were 3.52 (± 0.40), 3.47 (± 0.37), and 3.35 (± 0.36), respectively.

The attributes all respondents reported being most satisfied with were the cost of a trout fishing license, catching stocked trout, the number of trout caught, and clean bathrooms at access points (Table 1.5). On average, respondents were somewhat more satisfied with non-catch (mean = 3.30 ± 0.24) than catch attributes (mean = 3.20 ± 0.11). The results of the second MANOVA revealed there was a statistical difference between the three clusters on satisfaction of the trout fishing attributes with the most specialized

cluster being the most satisfied (Pillai's criterion = 0.113, $p = 0.018$). The individual ANOVAs within the MANOVA revealed seven statistical differences between the satisfaction placed on attributes between the three clusters (Table 1.5). The mean score of the satisfaction measures was 3.24 (± 0.18) on a five-point scale. For the most, moderately, and least specialized clusters, the means of the satisfaction measures were 3.37 (± 0.19), 3.25 (± 0.21), and 3.19 (± 0.18), respectively.

Importance-Satisfaction Graphs

With the MANOVAs and ANOVAs primarily focusing on statistically significant differences between the clusters, determining if these differences manifested into different quadrant placement within the ISAs is of interest. Thus, ISA visuals showing Georgia trout angler's importance and satisfaction perceptions of the 17 trout angling attributes were created for each cluster. Data centered cross-hairs, which are the averages of all cluster respondents (n = 469), are shown in solid lines and the iso-diagonal line where importance equals satisfaction is shown as a dotted line (Figure 1.3). There was some agreement across the three clusters regarding the quadrant the fishing attributes fall within (Table 1.6). The four attributes of catching stocked trout, the number of trophy managed streams, the cost of a trout fishing license, and habitat improvement initiatives all fell into the same quadrants across clusters. There was agreement in Quadrant 1: "Concentrate Here" that habitat improvement initiatives should receive attention. There was also agreement in Quadrant 3 that catching stocked trout and the cost of a trout fishing license were "Possible Overkill". Lastly, there was agreement in Quadrant 4 that the number of trophy managed streams was a "Low Priority".

For the most specialized cluster, 7 of the 17 attributes fell below the iso-rating line. This indicates that satisfaction exceeds importance for these seven attributes and that managers are generally performing well on these attributes (Figure 1.3). Four of these seven attributes were related to catch attributes and three of them were related to non-catch attributes. Only four attributes – number of trout caught (catch), catching stocked trout (catch), having campgrounds at access points (non-catch), and the cost of a trout fishing license (non-catch) – fell below the iso-rating line for the moderately specialized cluster (Figure 1.3). For the least specialized cluster, five attributes fell below the iso-rating line, three of them being catch related and two being non-catch related attributes. Figure 1.4 shows the ISA visual with all clusters on the same visual separated by catch and non-catch attributes.

Results of MANOVAs evaluating differences between three gear types (i.e., artificial flies, artificial lure, bait) in importance and satisfaction of the 17 trout fishing attributes indicated there was a significant difference between respondents who use the three different gear types. The artificial lure anglers placed the most importance on the attributes (Pillai's criterion = 1.30, $p < 0.001$). The univariate ANOVAs within the broader MANOVA revealed four significant differences among the three gear types in importance of 17 different trout fishing attributes (Table 1.7). The four significant differences were access to stocking schedules, the number of trophy-managed streams, campgrounds at access sites, and habitat improvement initiatives. The results of the second gear type MANOVA revealed that there was not a statistical difference between the three gear types in the satisfaction of the trout fishing attributes (Pillai's criterion =

0.076, $p = 0.297$). The results for the ISA of the trout fishing attributes grouped by the type of gear respondents indicated they use can be seen in Figure 1.5.

Discussion

I successfully applied the ISA methodology to explore attribute preferences and user satisfaction of trout anglers in Georgia. Additionally, this study sought to apply multiple ISAs to better understand varying preferences surrounding the use of the trout resource in Georgia. I uncovered patterns of fishery attributes and angler satisfaction that will serve as the basis for devising new strategies for managing trout fishing and trout anglers in GA. Successful application of these results also will be instrumental in improving trout angler retention and possible recruitment in the state. Further, the ISA visual can help redirect resource allocation efforts to attributes that are reported to be high in importance but relatively low in satisfaction.

Increasing angler specialization has been suggested to correspond to a general shift from activity-specific (i.e., catch related aspects) to activity-general (i.e., non-catch related aspects) in the motivations to fish (Bryan 1977; Chipman & Helfrich 1988; Ditton et al. 1992). These past findings would suggest a higher mean score for the importance of non-catch attributes compared to the catch attributes for the most specialized cluster and a lower mean importance score for non-catch attributes compared to catch attributes for the least specialized cluster, neither of which were found in this study. However, previous researchers have proposed and supported a "focus expansion" rather than a "focus shift" hypothesis. Specifically, as anglers become more specialized there is an increase in importance on activity-general (i.e., non-catch) preferences, but not

necessarily a shift away from the activity-specific (i.e., catch) preferences (Kim & Oh 2013, Sutton & Oh 2015). The findings in this study were consistent with the "focus expansion" findings, in that the most specialized cluster placed higher importance on non-catch attributes (mean = 3.50 ± 0.46) than the moderately (mean = 3.43 ± 0.43) or least (mean = 3.36 ± 0.33) specialized clusters, while still placing relatively high importance on catch attributes (mean = 3.53 ± 0.38). The relationship between specialization and relative importance of activity-specific (i.e., catch) versus activity-general (i.e., non-catch) preferences has been suggested to differ based on the study population (Sutton & Oh 2015).

Interestingly, the least specialized cluster had the highest number of respondents and was the least satisfied of the three clusters identified in this study. The least specialized cluster had only three attributes fall above the mean satisfaction line, compared to the most and moderately specialized clusters, which had 14 and 6 attributes, respectively (Figure 1.3). The least specialized cluster also had the lowest average trip frequency (2 trips/year). Increasing the least specialized cluster's satisfaction with the trout fishing experience could be an important goal to growing license sales because they represent the largest proportion of trout anglers while being the least satisfied with the experience.

Anglers with a higher commitment (i.e., centrality to lifestyle) to fishing are less likely to get the same level of satisfaction from another activity as they do from fishing (Sutton & Oh 2015), which means they are less likely to substitute fishing for another recreational activity. Keeping these anglers satisfied could result in a consistent base of

license purchases, which is a reliable source of revenue GA DNR can use for future trout management initiatives.

A debated aspect of this ISA approach is the placement of the discriminating thresholds to separate the grid (i.e., cross-hairs on the plot). Martilla and James (1977), the first researchers to employ ISA, suggest using the scale-centered approach. A problem associated with this scale-centered approach is that it tends to record high importance for all attributes, as it is not data driven, but driven by the chosen scale (Sever 2015). The inflation in importance ratings is also partially caused by the consideration of one attribute at a time when rating importance of attributes, which reduces the variation in importance ratings (Oh 2001). Additionally, this "ceiling effect" occurs because researchers select attributes that are important in regard to the research subject and therefore likely to already be somewhat important to individuals that take part in or make use of the subject (Oh 2001).

Alternatively, many researchers use the data-centered approach, which removes the inflated importance ratings found in the scale-centered approach (Sever 2015). This approach results in each attribute being compared relative to the other attributes rather than absolute measures of importance and performance. This data-centered approach is especially beneficial for providing mangers with a clear insight and guidance on where to best allocate scarce resources that are inherent with a finite budget (Oh 2001; Sever 2015). With the limited resources of public agencies like the GA DNR, the data-driven method was chosen to provide clear direction on attribute prioritization.

Summary and Management Implications

Other researchers interested in pursuing this line of research could benefit from considering fisheries-based ISAs as a tool to help determine if and where the importance and satisfaction placed on the trout fishing attributes vary by geographic location or target species. Further, investigating the existence of the "focus expansion" hypothesis for increasingly specialized anglers in other populations also would be beneficial.

My results and interpretations may have been influenced slightly by the inclusion of anglers holding the "Sportsman's License", which grants them trout fishing privileges, without regard to whether they fish for trout. I attempted to mitigate this potential bias by increasing the percentage of samples of repurchase license holders (50%) compared to lifetime license holders. For example, if an individual repurchases a license every 1-3 years, that person is more likely to use the license (i.e., fish for trout) than someone who does not have to make an effort to acquire the trout license but has the privilege granted in perpetuity anyway.

Given the nature of survey research, some questions on the survey asked anglers to recall past information that has the potential to be altered or forgotten over time. For example, one such question is about the number of trout fishing trips one made to various counties in Georgia over the past 12 months. Retrospective questions may have caused respondents to round to multiples of 5 or 10 for questions such as trip frequency and amount of money spent on trout fishing. Furthermore, measurement error could be introduced if the responses were systematically understated or overstated.

On the survey, the frequency of trout fishing trips was only evaluated in Georgia. A few individuals quantitatively indicated they more often fish in other states or have

vacation homes in other states from which they take their trout fishing trips. However, the total number of trout fishing trips regardless of location was not determined. The assessment of only Georgia trout fishing trips may have affected angler specialization cluster membership. Major life events (e.g., birth of child, death of loved one, new/loss of job, significant health changes, etc.) may cause a change in the frequency of trout fishing trips compared to previous years. Major life events were not assessed in this survey, which also may have influenced specialization cluster membership.

This study suggests that trout anglers in GA not only place importance on attributes related to catch, but also on trout fishing attributes that are not related to catching trout. Georgia trout anglers placed the most importance on clear signage of regulations, habitat improvement initiatives, and adding new fishable waters. Although it was of high importance, adding new fishable waters had one of the three lowest satisfaction scores. Respondents in the most specialized cluster (n = 113) had the highest average trip frequency and were the most satisfied of the three angler specialization clusters. Respondents in the least specialized cluster (n = 281) took the fewest trips on average and were the least satisfied. In addition to adding new fishable waters and habitat improvement initiatives, the least specialized cluster reported having clear signage of regulations as one of the top most important attributes.

In summary, identifying the discrepancy between the importance and satisfaction of attributes to angler populations by conducting multiple ISAs for various specialization subgroups will lead to a better understanding of angler needs and desires, which can be of great use to managers during the decision-making process (McFadden 1969; Ditton 1977). This research has potential to directly assist fisheries managers in fulfilling the

responsibilities of the public trust doctrine, in which trust resources are managed by management agencies on behalf of all stakeholders, not only those who organize and communicate most effectively (Forstchen & Smith 2014). It also provides marketers and managers with information on different subgroups that they may try to target. For example, if the state is trying to increase license sales among the least specialized cluster of anglers, they can look at the least specialized ISA graph and determine which aspects should be improved in order to increase satisfaction with the angling experience. The ISA method also provides the fisheries literature with an additional tool for measuring stakeholders' perceptions towards a range of salient issues.

References

Arlinghaus, R. 2005. A conceptual framework to identify and understand conflicts in recreational fisheries systems, with implications for sustainable management. Aquatic Resources, Culture and Development 1(2): 145-174.

Beardmore, B., W. Haider, L. M. Hunt, and R. Arlinghaus. 2011. The importance of trip context for determining primary angler motivations: are more specialized anglers more catch-oriented than previously believed? North American Journal of Fisheries Management 31(5): 861-879.

Beardmore, B., W. Haider, L. M. Hunt, and R. Arlinghaus. 2013. Evaluating the ability of specialization indicators to explain fishing preferences. Leisure Sciences 35(3): 273-292.

Boley, B. B., N. G. McGehee, and A. L. T. Hammett. 2017. Importance-performance analysis (IPA) of sustainable tourism initiatives: the resident perspective. Tourism Management 58: 66-77.

Bryan, H. 1976. The sociology of fishing: A review and critique. Pages 83-92 in H. Clepper, editor. Marine recreational fisheries. Sport Fishing Institute, Washington, D. C.

Bryan, H. 1977. Leisure value systems and recreational specialization: the case of trout fishermen. Journal of Leisure Research 9(3): 174-188.

Chipman, B. D., and L. A. Helfrich. 1988. Recreational specializations and motivations of Virginia river anglers. North American Journal of Fisheries Management 8: 390-398.

Dillman, D. A., J. D. Smyth, and L. M. Christian. 2014. Internet, phone, mail, and mixed-mode surveys: the tailored design method. (4th ed.). Hoboken, NJ: John Wiley & Sons.

Ditton, R. B. 1977. Human perspectives in optimum sustainable yield fisheries management. Marine Recreational Fisheries 2: 29-41.

Ditton, R. B., D. K. Loomis, and S. Choi. 1992. Recreation specialization: re-conceptualization from social worlds perspective. Journal of Leisure Research 24(1): 33-51.

Dorison, A. 2012. Estimating the economic value of trout angling in Georgia: a travel cost model approach. (Unpublished Master's thesis). University of Georgia, Athens, Georgia.

Edison, T. W., D. H. Wahl, M. J. Diana, D. P. Philipp, and D. J. Austen. 2006. Angler opinion of potential bluegill regulations on Illinois lakes: effects of angler demographics and bluegill population size structure. North American Journal of Fisheries Management 26(4): 800-811.

Fisher, M. R. 1997. Segmentation of the angler population by catch preference, participation, and experience: a management-oriented application of recreation specialization. North American Journal of Fisheries Management 17(1): 1-10.

Forstchen, A. B., and C. A. Smith. 2014. The essential role of human dimensions and stakeholder participation in states' fulfillment of public trust responsibilities. Human Dimensions of Wildlife 19(5): 417-426.

Georgia Department of Natural Resources. 2017. Trout fishing in Georgia. Wildlife Resources Division. Retrieved from http://georgiawildlife.com/Trout.

Hair, J. F., R. E. Anderson, R. L. Tatham, and W. C. Black. 1998. Multivariate data analysis. 5th ed. Prentice-Hall, Upper Saddle River, New Jersey.

Holland, S. M., and R. B. Ditton. 1992. Fishing trip satisfaction: a typology of anglers. North American Journal of Fisheries Management 12: 28-33.

Hutt, C. P., and P. W. Bettoli. 2007. Preferences, specialization, and management attitudes of trout anglers fishing in Tennessee tailwaters. North American Journal of Fisheries Management 27(4): 1257-1267.

Keefer, L., G. Beisser, H. Chestnutt, B. Couch, K. Kammermeyer, L. Klein, and T. Lovell. 2000. Georgia trout management plan. Georgia Department of Natural Resources (Wildlife Resources Division). Social Circle, Georgia.

Kim, H., and C. Oh. 2013. Applying the theory of recreation specialization to better understand recreationists' preferences for value-added service development. Leisure Sciences, 35: 455-474.

Kim, S., D. Scott, and J. L. Crompton. 1997. An exploration of the relationships among social psychological involvement, behavioral involvement, commitment, and future intentions in the context of birdwatching. Journal of Leisure Research 29(3): 320-341.

Martilla, J. A., and J. C. James. 1977. Importance-performance analysis. Journal of Marketing 41(1): 77-79.

Matzler, K., F. Bailom, H. H. Hinterhuber, B. Renzl, and J. Pichler. 2004. The asymmetric relationship between attribute-level performance and overall customer satisfaction: a reconsideration of the importance-performance analysis. Industrial Marketing Management 33(4): 271-277.

Matzler, K., E. Sauerwein, and K. Heischmidt. 2003. Importance-performance analysis revisited: the role of the factor structure of customer satisfaction. The Service Industries Journal 23(2): 112-129.

McFadden, J. T. 1969. Trends in freshwater sport fisheries of North America. Transactions of the American Fisheries Society 98(1): 136-150.

McFarlane, B. L. 2004. Recreation specialization and site choice among vehicle-based campers. Leisure Sciences 26(3): 309-322.

McIntyre, N., and J. J. Pigram. 1992. Recreation specialization reexamined: the case of vehicle-based campers. Leisure Sciences 14(1): 3-15.

Nunnally, J. C. 1978. Psychometric theory. New York, New York. McGraw-Hill.

Oh, C., and R. B. Ditton. 2006. Using recreation specialization to understand multi-attribute management preferences. Leisure Sciences 28(4): 369-384.

Oh, H. 2001. Revisiting importance-performance analysis. Tourism Management 22(6): 617-627.

Oliver, R. L. 1980. A cognitive model of the antecedents and consequences of satisfaction decisions. Journal of Marketing Research 17(4): 460-469.

Payne, A. 1993. The essence of services marketing. London, UK. Prentice Hall International.

Petering, R. W., G. L. Isbell, and R. L. Miller. 1995. A survey method for determining angler preference for catches of various fish length and number combinations. North American Journal of Fisheries Management 15(4): 732-735.

Santos, J. R. A. 1999. Cronbach's alpha: a tool for assessing the reliability of scales. Journal of Extension 37(2).

Schroeder, S. A., D. C. Fulton, M. L. Nemeth, R. E. Sigurdson, and R. J. Walsh. 2008. Fishing in the neighborhood: understanding motivations and constraints for angling among Minneapolis-St. Paul, Minnesota metro residents. American Fisheries Society Symposium 67.

Scott, D., and C. S. Shafer. 2001. Recreational specialization: a critical cook at the construct. Journal of Leisure Research 33(3): 319-343.

Sever, I. 2015. Importance-performance analysis: a valid management tool? Tourism Management 48: 43-53.

Stevens, J. 2002. Applied multivariate statistics for the social sciences. 4th ed. Lawrence Erlbaum Associates, Mahwah, New Jersey.

Sutton, S. G., and C. Oh. 2015. How do recreationists make activity substitution decisions? A case of recreational fishing. Leisure Sciences 37(4): 332-353.

Table 1.1 Rotated component matrix from principal component EFA with varimax rotation of statements measuring centrality of trout fishing to an individual's lifestyle from a 2017 study of trout angler preferences in Georgia.

Centrality statement	Component
Trout fishing is my main form of recreation	0.872
I find a lot of my life is centered around trout fishing	0.885
I have strong preferences about the types of trout water I like to fish	0.739
Cronbach alpha	0.781

Table 1.2 Variables used in angler specialization cluster analysis from a 2017 study of trout angler preferences in Georgia.

	Bin	Category	Number of trips	Percentage of respondents
Trout fishing trip frequency in the last 12 months (Behavioral dimension)	1	None	0	30
	2	Few	1 - 6	38
	3	Several	7 - 12	15
	4	Many	13 - 24	10
	5	A lot	≥ 25	7
Perceived level of skill as a trout angler (Cognitive dimension)	1	Novice		24
	2	Intermediate		49
	3	Advanced		24
	4	Expert		3
Centrality to Lifestyle	Mean	Factor Loading	Cronbach Alpha	
(Commitment dimension)	2.49		0.781	
- Trout fishing is my main form of outdoor recreation	2.44	0.869		
- I find a lot of my life is centered around trout fishing	2.18	0.876		
- I have strong preferences about the types of trout water I like to fish	2.87	0.766		

Table 1.3 Gender, approximated age, ethnicity, education, and household income for all respondents to a 2017 Georgia trout angler preferences survey. Demographics are also broken down by most, moderately, and least specialized clusters.

	Total		Most Specialized		Moderately Specialized		Least Specialized	
	N	%	N	%	N	%	N	%
Gender								
Male	396	84	94	83	66	88	236	84
Female	68	14	19	17	8	11	41	15
Undisclosed	5	1	0	0	1	1	4	1
Age (mean)	47		45		48		48	
Ethnicity								
African American	12	3	1	1	1	1	10	4
Asian	2	0	0	0	1	1	1	0
American Indian	2	0	0	0	1	1	1	0
Caucasian	430	92	103	91	71	95	256	91
Hispanic	6	1	3	3	0	0	3	1
Other	3	1	0	0	0	0	3	1
Undisclosed	14	3	6	5	1	1	7	2
Education								
Less than high school	12	3	3	3	1	1	8	3
High school or GED	124	26	42	37	16	21	66	23
Technical, vocational, or trade	66	14	17	15	15	20	34	12
Some College (includes junior college)	96	20	22	19	14	19	60	21
Bachelor's Degree	111	24	18	16	20	27	73	26
Master's Degree	34	7	5	4	5	7	24	9
Ph.D./Professional Degree	17	4	5	4	2	3	10	4
Undisclosed	9	2	1	1	2	3	6	2
Household Income								
Less than $25,000	44	9	16	14	4	5	24	9
$25,000 - $49,999	98	21	22	19	17	23	59	21
$50,000 - $74,999	114	24	35	31	16	21	63	22
$75,000 - $99,999	63	13	16	14	5	7	42	15
$100,000 - $199,999	104	22	19	17	25	33	60	21
$200,000+	24	5	3	3	3	4	18	6
Undisclosed	22	5	2	2	5	7	15	5

Table 1.4 Angler specialization cluster centers from a 2017 study of trout angler preferences in Georgia.

		Cluster Centers		
Dimension	Variable	Most Specialized	Moderately Specialized	Least Specialized
Behavioral	Trip Frequency	1.43	-0.24	-0.52
Commitment	Centrality to Lifestyle	0.81	0.14	-0.44
Cognitive	Skill Rating	0.49	1.32	-0.61
	Mean	*0.91*	*0.41*	*-0.52*

Table 1.5 MANOVAs and ANOVAs of mean importance-satisfaction scores by level of angler specialization for 17 trout fishing attributes measured in a 2017 study of trout angler preferences in Georgia. Tukey's Post Hoc Test was used to determine statistically significant differences, which are labeled with different letters.

	Total (n = 469)		Most Specialized (n = 113)		Moderately Specialized (n = 75)		Least Specialized (n = 281)		Significance ($p < 0.05$)	
	I	S	I	S	I	S	I	S	I	S
Catch Attributes										
A) The number of trout you catch	3.16	3.35	3.36 z	3.55 z	3.41 z	3.52 z	3.02 y	3.22 y	0.004	0.001
B) The size of the trout you catch	3.29	3.26	3.39 zy	3.45 z	3.55 z	3.17 zy	3.17 y	3.20 y	0.015	0.028
C) Catching wild trout	3.20	3.12	3.47 z	3.29	3.16 zy	3.01	3.10 y	3.09	0.012	0.031
D) Catching stocked trout	2.98	3.37	3.24 z	3.55 z	3.08 zy	3.53 z	2.85 y	3.26 y	0.002	0.001
E) Adding new fishable waters	3.96	3.12	4.17 z	3.33 z	4.13 z	3.01 y	3.84 y	3.07 y	0.002	0.014
F) Clear signage of regulations	4.07	3.24	4.10	3.28	3.92	3.21	4.09	3.23	0.388	0.850
G) Access stocking schedules	3.42	3.09	3.48	3.17	3.27	3.16	3.43	3.04	0.466	0.302
H) Access reports on fishing conditions	3.51	3.21	3.63	3.28	3.33	3.29	3.51	3.16	0.171	0.255
I) The number of trout you see	3.58	3.17	3.61	3.30	3.81	3.25	3.51	3.10	0.066	0.058
J) The number of trophy managed trout streams	3.97	3.03	2.88 y	3.10	3.31 z	3.03	2.91 y	3.00	0.016	0.456
Non-Catch Attributes										
K) Clean bathrooms at access points	3.37	3.33	3.44	3.41	3.36	3.33	3.34	3.30	0.769	0.472
L) Campgrounds at access points	3.17	3.25	3.12	3.35	3.19	3.23	3.19	3.21	0.865	0.329
M) The cost of a trout fishing license	2.90	3.83	2.95	3.92	2.85	3.80	2.90	3.80	0.880	0.493
N) The distance to the trout stream from your residence	3.47	3.25	3.25 y	3.51 z	3.65 z	3.16 zy	3.51 zy	3.16 y	0.034	0.007
O) Youth education programs on trout fishing	3.59	3.15	3.96 z	3.27	3.52 y	3.23	3.45 y	3.09	0.000	0.062
P) The recruitment of new trout anglers	3.29	3.13	3.58 z	3.30 z	3.24 zy	3.16 zy	3.19 y	3.06 y	0.004	0.008
Q) Habitat improvement initiatives	4.05	3.19	4.23 z	3.23	4.21 zy	3.13	3.94 y	3.20	0.006	0.731
Importance-Satisfaction Means	*3.41*	*3.24*	*3.52*	*3.37*	*3.47*	*3.25*	*3.35*	*3.19*	*0.000*	*0.018*

Table 1.6 Quadrant placement of trout fishing attributes by angler specialization from a 2017 study on trout angler preferences in Georgia.

Trout fishing attributes	Most Specialized	Moderately Specialized	Least Specialized
Catch Attributes			
A) The number of trout you catch	Q3. Possible Overkill	Border of Q2 & Q3	Q4. Low Priority
B) The size of the trout you catch	Q3. Possible Overkill	Q1. Concentrate Here	Q4. Low Priority
C) Catching wild trout	Q2. Keep up Good Work	Q4. Low Priority	Q4. Low Priority
D) Catching stocked trout	Q3. Possible Overkill*	Q3. Possible Overkill*	Q3. Possible Overkill*
E) Adding new fishable waters	Q2. Keep up Good Work	Q1. Concentrate Here	Q1. Concentrate Here
F) Clear signage of regulations	Q2. Keep up Good Work	Q1. Concentrate Here	Q1. Concentrate Here
G) Access stocking schedules	Q1. Concentrate Here	Q4. Low Priority	Q1. Concentrate Here
H) Access reports on fishing conditions	Q2. Keep up Good Work	Q3. Possible Overkill	Q1. Concentrate Here
I) The number of trout you see	Q2. Keep up Good Work	Q2. Keep up Good Work	Q1. Concentrate Here
J) The number of trophy managed trout streams	Q4. Low Priority*	Q4. Low Priority*	Q4. Low Priority*
Non-Catch Attributes			
K) Clean bathrooms at access points	Q2. Keep up Good Work	Q3. Possible Overkill	Q3. Possible Overkill
L) Campgrounds at access points	Q3. Possible Overkill	Q4. Low Priority	Q4. Low Priority
M) The cost of a trout fishing license	Q3. Possible Overkill*	Q3. Possible Overkill*	Q3. Possible Overkill*
N) The distance to the trout stream from your residence	Q3. Possible Overkill	Q1. Concentrate Here	Q1. Concentrate Here
O) Youth education programs on trout fishing	Q2. Keep up Good Work	Q1. Concentrate Here	Q1. Concentrate Here
P) The recruitment of new trout anglers	Q2. Keep up Good Work	Q4. Low Priority	Q4. Low Priority
Q) Habitat improvement initiatives	Q1. Concentrate Here*	Q1. Concentrate Here*	Q1. Concentrate Here*

[a]Asterisk (*) indicates attributes that fall in the same quadrant across all three clusters. Attributes were determined to be on the border if the mean for the cluster attribute was the same as the mean for the cross-hair to the hundredth decimal place.

Table 1.7 MANOVAs and ANOVAs of mean importance-satisfaction scores by the type of gear used for 17 trout fishing attributes measured in a 2017 Georgia trout angler preferences survey. Tukey's Post Hoc Test was used to determine statistically significant differences in means, which are labeled with different superscript letters.

	Total (n = 564)		Artificial flies (n = 130)		Artificial lures (n = 179)		Bait (n = 255)		Significance (p < 0.05)	
	I	S	I	S	I	S	I	S	I	S
Catch Attributes										
A) The number of trout you catch	3.16	3.35	3.02	3.14	3.16	3.35	3.24	3.45	0.238	
B) The size of the trout you catch	3.32	3.25	3.30	3.16	3.46	3.20	3.24	3.33	0.133	
C) Catching wild trout	3.21	3.12	3.38	3.08	3.24	3.12	3.11	3.13	0.115	
D) Catching stocked trout	2.94	3.35	2.80	3.25	3.07	3.49	2.93	3.31	0.100	
E) Adding new fishable waters	3.94	3.12	4.07	3.02	3.97	3.13	3.86	3.17	0.120	
F) Clear signage of regulations	4.05	3.23	3.90	3.17	4.09	3.26	4.10	3.25	0.166	
G) Access stocking schedules	3.41	3.10	3.15 y	3.08	3.49 z	3.11	3.49 z	3.10	0.024	
H) Access reports on fishing conditions	3.50	3.21	3.61	3.14	3.50	3.25	3.44	3.22	0.389	
I) The number of trout you see	3.60	3.16	3.57	3.02	3.69	3.24	3.55	3.19	0.380	
J) The number of trophy managed trout streams	3.02	3.04	3.27 z	2.95	3.03 zy	3.11	2.89 y	3.04	0.012	
Non-Catch Attributes										
K) Clean bathrooms at access points	3.37	3.31	3.20	3.25	3.34	3.33	3.47	3.33	0.186	
L) Campgrounds at access points	3.16	3.23	2.91 y	3.17	3.18 zy	3.31	3.29 z	3.21	0.028	
M) The cost of a trout fishing license	2.91	3.82	2.73	3.83	2.87	3.78	3.02	3.85	0.112	
N) The distance to the trout stream from your residence	3.48	3.29	3.49	3.15	3.49	3.32	3.46	3.35	0.967	
O) Youth education programs on trout fishing	3.55	3.14	3.66	2.93	3.59	3.19	3.46	3.20	0.245	
P) The recruitment of new trout anglers	3.26	3.13	3.45	3.03	3.23	3.13	3.18	3.19	0.069	
Q) Habitat improvement initiatives	4.04	3.21	4.25 z	3.06	4.00 zy	3.23	3.96 y	3.27	0.021	
Importance-Satisfaction Means	*3.41*	*3.24*	*3.40*	*3.14*	*3.44*	*3.27*	*3.39*	*3.27*	*0.000*	*0.297*

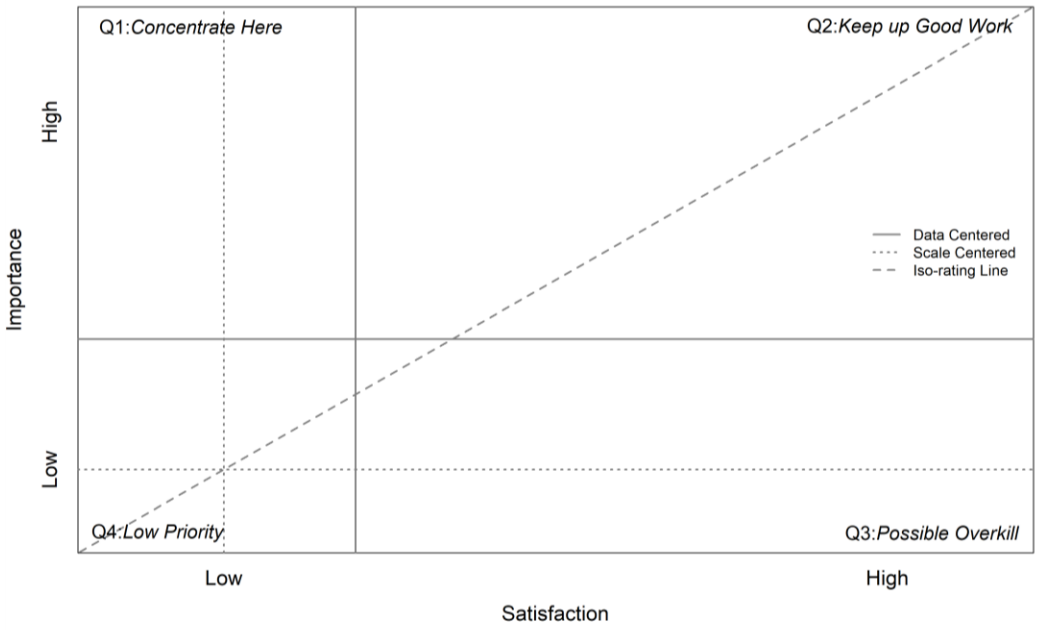


Figure 1.1 Visual layout of an ISA. The solid line crosshairs form the four data-centered quadrants (i.e., mean of importance or satisfaction responses). The dotted line crosshairs form the scale-centered quadrants (i.e., mean of the measurement scale). The hashed line is an iso-rating line that shows where importance equals satisfaction.

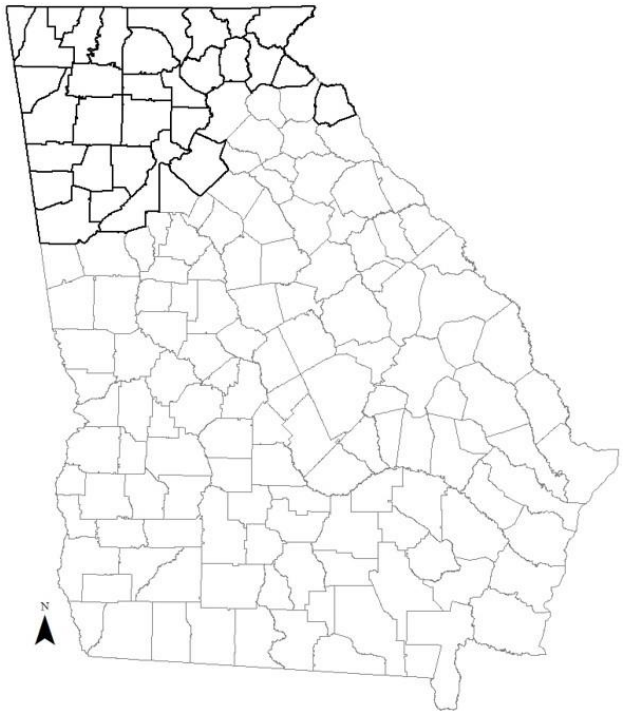


Figure 1.2 Map of Georgia counties. Counties outlined in black are counties with trout angling opportunities as of 2017.

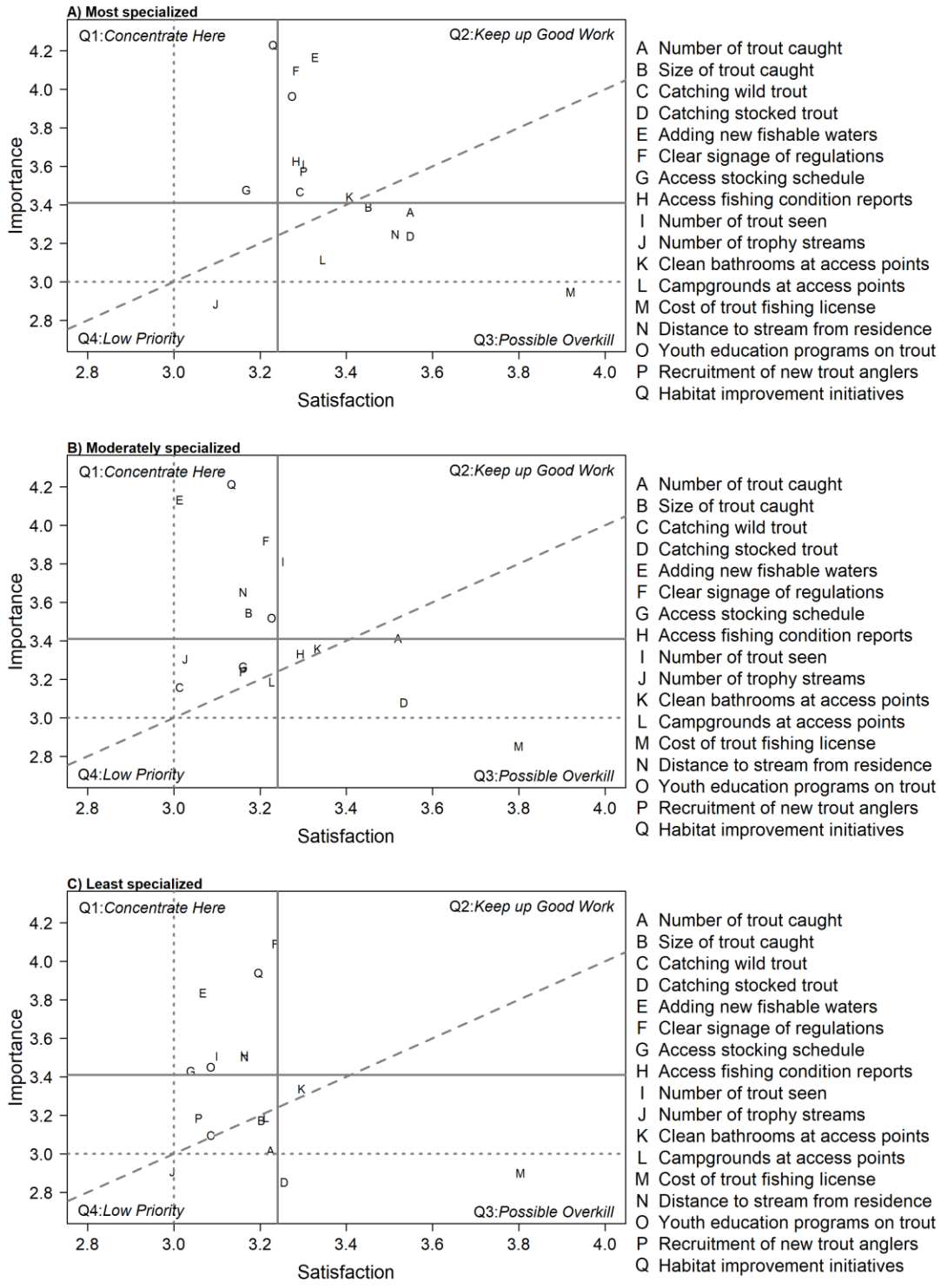


Figure 1.3 ISA of trout angling attributes for the most, moderately, and least specialized clusters from a 2017 study of trout angler preferences in Georgia. Letters A through J refer to averages for catch attributes, while K through Q are for non-catch attributes. Data centered crosshairs (solid line) are centered to the mean responses for all cluster members. Scale centered crosshairs (dotted line) are centered to the mean of the measurement scale. The dashed line is a 1:1 reference line.

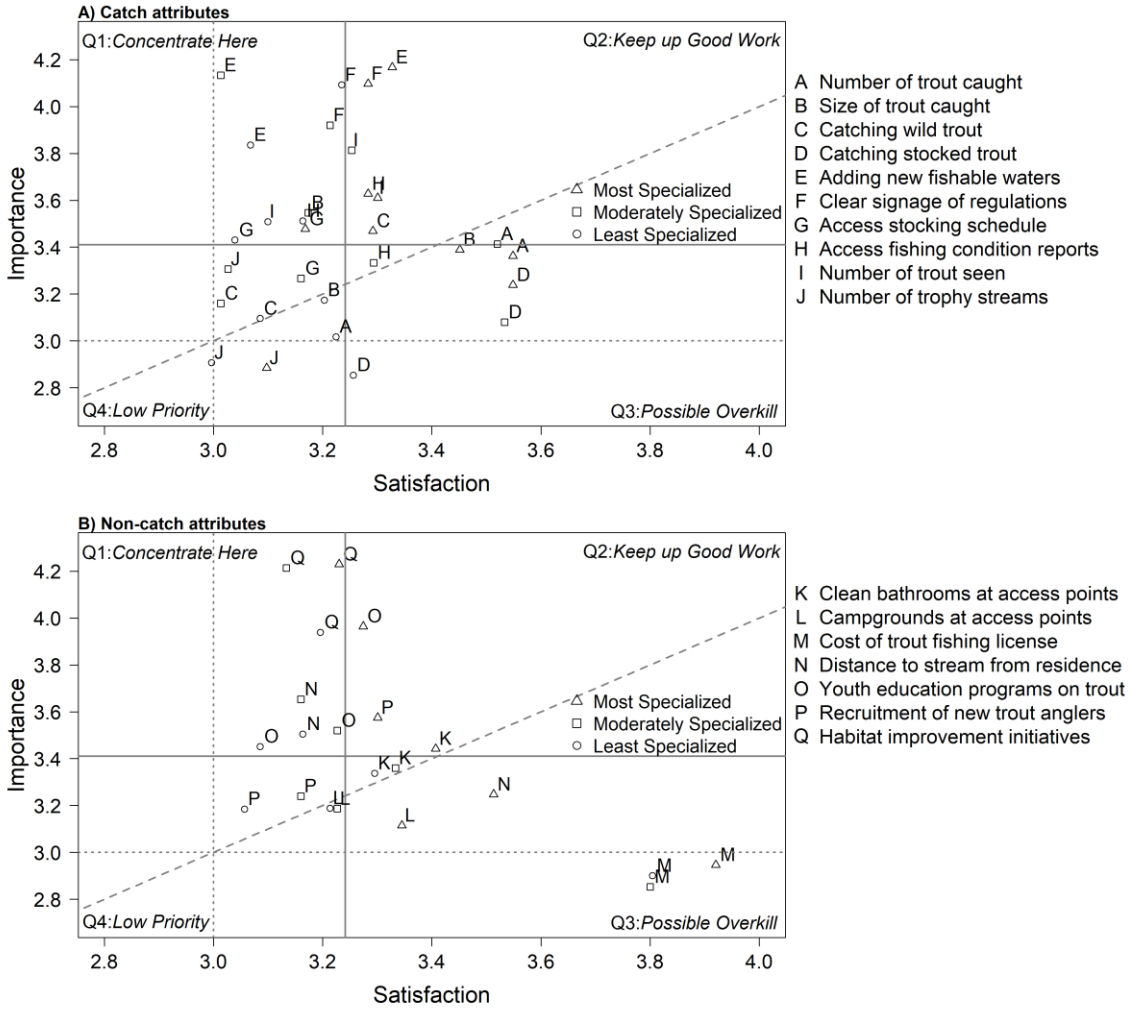


Figure 1.4 ISA of both catch and non-catch trout angling attributes for all specialization clusters from a 2017 study of trout angler preferences in Georgia. Data centered crosshairs (solid line) are centered to the mean responses for all cluster members. Scale centered crosshairs (dotted line) are centered to the mean of the measurement scale. The dashed line is a 1:1 reference line.

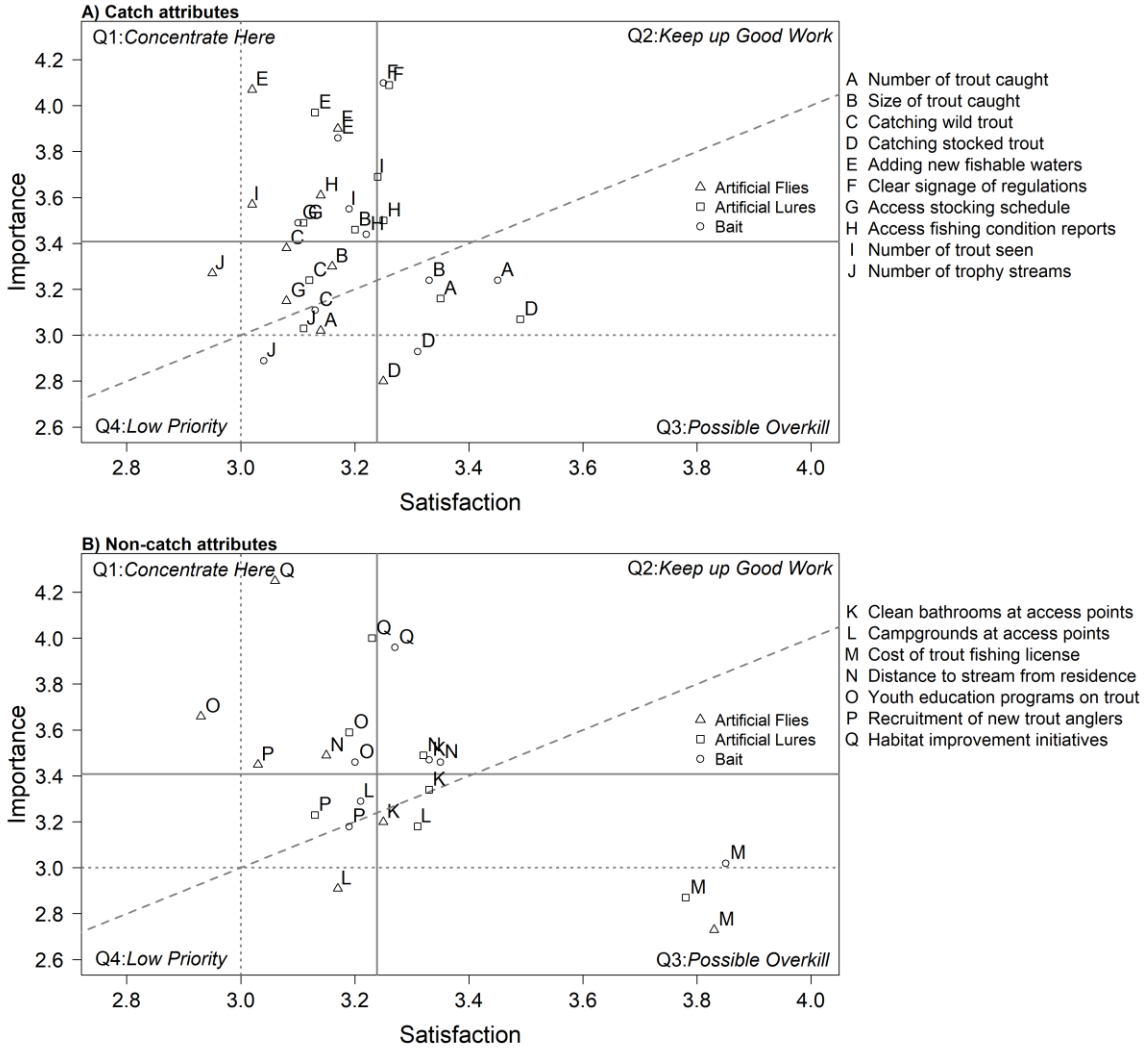


Figure 1.5 ISA of both catch and non-catch trout angling attributes for all gear types from a 2017 study of trout angler preferences in Georgia. Data centered crosshairs (solid line) are centered to the mean responses for all cluster members. Scale centered crosshairs (dotted line) are centered to the mean of the measurement scale. The dashed line is a 1:1 reference line.

CHAPTER 3

NEGOTIATIONS OF PERCEIVED CONSTRAINTS TO TROUT FISHING IN GEORGIA BASED ON ANGLER SPECIALIZATION LEVEL[2]

[2] Yondo, H. J., B. B. Boley, B. J. Irwin, and C. A. Jennings. To be submitted to *North American Journal of Fisheries Management.*

Abstract

Participants in leisure activities, such as trout angling, often face constraints that play a pivotal role in determining participation levels and dropout rates. Some recreational anglers may be able to negotiate constraints by altering the timing or frequency of participation, acquiring new skills, or modifying aspects of non-recreational aspects such as family or work responsibilities. With this in mind, data were collected via a mail survey from Georgia resident trout license holders to identify both perceived constraints and strategies used to negotiate them. To capture variation among anglers, survey responses were grouped by level of angler specialization. This grouping was conducted using K-means cluster analysis, which resulted in a three-cluster solution of most, moderate, and least specialized anglers. ANOVAs were used to detect potential differences among the three specialization clusters, which revealed the least specialized anglers experienced constraints more frequently and, on average, negotiated constraints less frequently than the most or moderately specialized anglers. The least specialized anglers used negotiation strategies involving overcoming perceived lack of skill more frequently than their counterparts. The most frequently experienced constraints overall were lack of time due to work or family obligations and "distance of Georgia's trout waters from my home". The most frequently used negotiation strategies overall were "learn to enjoy being outside and stress less about catching fish" and "encourage family or friends to go fishing with me". This research benefits fishery managers by providing a better understanding of angling groups that perceive more constraints and are less likely to overcome these constraints through constraint negotiation strategies. With this

information, managers can tailor efforts towards reducing constraints for angling groups that have low participation and may drop out of the activity all together.

Introduction

People who use angling as a leisure activity face many constraints that play a pivotal role in their continued participation, such as buying licenses and equipment, or whether they eventually drop out of the activity (Jackson & Scott 1999; Fedler & Ditton 2001). Constraints can influence participation by altering the ability to engage in the activity or by interfering with the desired benefits gained from the activity (Ritter et al. 1992; Sutton 2007). Constraints to leisure activities can include lack of time, partners with whom to participate, or information about how and where to participate. Although participation may differ when constraints are perceived differently by anglers, experiencing constraints does not necessarily lead to cessation of participation for all individuals (Jackson et al. 1993).

Individuals may attempt to negotiate perceived constraints to continue participation and obtain the benefits sought from participating in recreational fishing (Jackson et al. 1993; Fedler & Ditton 2001). Constraints may be negotiated in several ways. These include becoming more aware of opportunities, acquiring new skills, altering timing or frequency of participation, or modifying aspects of non-recreational life like family and work responsibilities to better accommodate participation (Kay & Jackson 1991; Scott 1991; Jackson et al. 1993; Hubbard & Mannell 2001; White 2008). However, not all individuals are successful in developing negotiation strategies (Jackson et al. 1993). Better understanding constraints to angling and how these constraints are

negotiated by heterogeneous anglers can benefit management agencies because recruitment and retention of participants is often a management goal with financial implications. By identifying major constraints to participation, management agencies can attempt to reduce the effects of perceived constraints and encourage continued or increased participation to help ensure future license sales.

The fisheries literature contains many examples of how constraints to recreational angling have been negotiated across a variety of types of anglers such as disabled (Freudenberg & Arlinghaus 2010), recreational (Sutton & Oh 2015), coral reef (Pavlowich & Kapuscinski 2017), and salmon anglers (Stensland et al. 2017). However, little research has explored how constraints are negotiated among heterogeneous trout anglers who vary by level of specialization. Previous research has provided evidence against the "average angler" assumption, suggesting instead that anglers may be heterogeneous with differing objectives and can be divided into homogeneous subgroups (McFadden 1969; Bryan 1976; Hutt & Bettoli 2007; Beardmore et al. 2011). Angler specialization has been and continues to be used to capture the diversity among participants and to group anglers by varying behaviors, motivations, and preferences toward recreational fishing (Bryan 1977; Ditton et al. 1992; Beardmore et al. 2013; Sutton & Oh 2015). Perceived constraints and negotiation strategies may differ based on the angler's level of commitment to the activity, which is often used in part to measure angler specialization (Sutton 2007; Lyu & Oh 2014). Better understanding the differences in how anglers' participation is constrained and the strategies they use to navigate constraints can allow managers to offer different opportunities for anglers to overcome whatever constraints they experience.

Anglers who are less effective at negotiating constraints participate less frequently and are more likely to discontinue participation, which leaves managers with decreased license sales and funding (Fedler & Ditton 2001). Conversely, helping anglers to identify and overcome constraints to angling would benefit the angler, the agency, and the resources. In this study, I seek to determine the extent to which constraints occur uniformly across the trout angler population in Georgia by identifying if and where differences occur in perceived constraints to trout fishing among anglers of differing level of specialization. Negotiation strategies of the angler specialization clusters will also be examined to determine which cluster is able to negotiate perceived constraints most effectively.

Study Area

There are over 500,000 licensed resident trout anglers in Georgia. Many other states also experience high recreational demands for cold-water fisheries. However, Georgia is unique in that it is the southern terminus of native trout habitat in the Appalachian Mountains. The northern portion of Georgia is home to over 4,000 miles of streams inhabited by trout (Figure 2.1; GA DNR 2017). Brook trout *Salvelinus fontinalis* is the only trout species native to Georgia, but both brown trout *Salmo trutta* and rainbow trout *Oncorhynchus mykiss* are considered naturalized (Keefer et al. 2000). There are few naturally reproducing populations of trout within the state, so the Georgia Department of Natural Resources (GA DNR) and the U.S. Fish and Wildlife Service stock rainbow, brown, and brook trout from late March through August to meet the demand of recreational trout anglers (GA DNR 2017). In a 2012 study conducted on the

economic impact of trout fishing in Georgia, trout fishing generated an estimated net economic value of $130.3 million annually and a per-trip per-person consumer surplus range from $60.02 to $164.57 (Dorison 2012).

Methods

Trout angler survey

The data used in this analysis were collected from a statewide survey of Georgia resident trout license holders. Contact information for resident trout anglers with a 2015 trout license was obtained from the GA DNR license database. Sample members (n = 4,000) were selected from the GA DNR license database by proportionate random sampling based on license type. The sample was comprised of both lifetime license holders and anglers who have to repurchase their licenses every 1-3 years. In Georgia, Lifetime Sportsman Licenses include both hunting and fishing privileges for multiple species and contain a trout license within the license package; however, Lifetime Sportsman License holders may choose to not make use of the trout license. In attempts to avoid mailing survey questionnaires to a large group of individuals who potentially do not use their trout license, lifetime license holders were limited to 25% of the entire sample (n=1,000). There are five different types of lifetime licenses. I sampled the five types of lifetime license holders proportionately based on the percentage of each of the type. Repurchase license holders made up the remaining 75% of the entire sample (n=3,000). There are six different types of repurchase licenses, all of which were proportionately drawn from the license database based on the percentage of each license type. The sample members within each of the five lifetime license types and each of the

six repurchase license types were randomly selected by first separating anglers into separate spreadsheets based on license type. Once separated, anglers were randomly chosen for the sample based upon the number of anglers needed to meet the stratified requirements for that license type.

A self-administered mail questionnaire was used to collect information on the constraints anglers face when attempting to participate in recreational trout angling along with strategies they may use to negotiate past the potential perceived constraints. Additional questions were included in the questionnaire to address the Georgia Department of Natural Resource's interests, such as preferred fishing season and perceptions of the current and future quality of trout fishing in GA.

Data collection occurred January through June of 2017. Before mailing the survey out to the 4,000 trout anglers, the questionnaire was pretested with a group of 19 local Trout Unlimited members, which resulted in both the removal and addition of questions as well as rewording questions to improve clarity. Following the pretest, there were four mail contacts to the study sample as recommended by Dillman et al. (2014). The first contact was an informational letter to notify the angler that a survey questionnaire was coming in the mail. The questionnaire was mailed approximately a week after the informational letter and was followed by a reminder postcard a few weeks later in February. Lastly, in April, a second questionnaire was mailed to all repurchase license holders within the study sample that had not yet returned their original questionnaire. The second copy of the questionnaire was only sent to non-respondents with repurchase licenses because the running response rate was 7.3% for lifetime license

holders and 15.3% for repurchase license holders and funding did not allow for printing and mailing second questionnaires to all non-respondents.

To incentivize respondents, every sample member who completed and returned their survey was entered in a drawing for a Georgia Lifetime Sportsman License worth between $70 and $750 depending upon the age of the angler. Each sample member also received decals provided by the GA DNR along with their questionnaire. The chance to win a lifetime license and the decals were included as incentives to increase response rates as suggested by Dillman et al. (2014).

Dimension measurement

I identified 15 potential constraints experienced by Georgia trout anglers based on previous constraint research (Fedler and Ditton 2001; Larson et al. 2012). Following the work of Crawford and Godbey (1987), the constraints were organized into three categories: structural, interpersonal, and intrapersonal. Structural constraints are commonly thought of as limiting factors to leisure activities that arise from life circumstances such as limited time, money, and access (Crawford et al. 1991; Fedler & Ditton 2001). Structural constraints do not include constraints that involve interactions with others (i.e., interpersonal constraints) and operationally depart from intrapersonal constraints, which are largely based on one's level of experience and confidence with the activity. Interpersonal constraints are constraints associated with the interaction or lack thereof with other individuals (e.g., having a fishing partner and actions of other anglers; Crawford et al. 1991; Fedler & Ditton 2001). Intrapersonal constraints involve internal or psychological processes that negatively affect preferences or behaviors towards activities (e.g., perceived lack of skill, difficulty understanding regulations; Crawford et

al. 1991; Fedler & Ditton 2001). Individual constraints were measured on a four-point Likert-type scale that asked respondents to rate each constraint from being "not a barrier" to a "major barrier".

Previous studies measuring strategies individuals use to overcome perceived constraints are specific to the activity in question such as endurance running (Rice et al. 2018) and surfing (Fendt & Wilson 2012). I developed 14 new strategies specific to trout angling based on the constraint negotiation literature (Jackson & Rucks 1995; Hubbard & Mannell 2001; Alexandris et al. 2007). Individual constrain negotiation items were measured on a five-point Likert-type scale (range: "never" to "always) that asked how often they employ the constraint negotiation strategies. Constraint negotiation strategies were organized into the same categories as the constraints – structural, interpersonal, and intrapersonal.

Angler specialization was assessed as a three-dimensional construct based upon a previous angler specialization model (McIntyre & Pigram 1992; Scott & Shafer 2001; McFarlane 2004). The three dimensions used to measure angler specialization were behavioral, cognitive, and commitment. To address the behavioral dimension, anglers were asked to record the number of trout fishing trips they took to each county with trout waters in Georgia in the last 12 months. To address the cognitive dimension, anglers were asked to use a four-point scale ranging from "novice" to "expert" to rate their skill level as a trout angler. The third dimension of commitment measured the centrality of trout fishing to one's lifestyle. The construct was measured through a set of three statements (e.g., "trout fishing is my main form of outdoor recreation"; "I find a lot of my life is centered around trout fishing") modified from Kim et al. (1997). The items within

this commitment dimension were asked on a five-point Likert-type scale ranging from 1= "strongly disagree" to 5= "strongly agree".

Data analysis

K-means cluster analysis was used to separate anglers by level of specialization. Following the work of McIntyre and Pigram (1992) and Scott and Shafer (2001), angler specialization was measured using trip frequency, centrality to lifestyle, and self-reported skill rating. Before running the cluster analysis, the trip frequency variable was binned to account for the larger variability in responses compared to the other two cluster variables and the centrality to lifestyle variable was averaged based on strong factor loadings and a coefficient alpha of 0.781 (Table 2.1). The binned trip frequency, centrality to lifestyle rounded averaged scale, and skill rating variables were standardized to a mean of zero and variance of one to account for the different scales on which the variables were measured. Standardization was accomplished by subtracting the overall mean of the question from each response and dividing by the standard deviation of that question. These standardized variables were then used in a K-means cluster analysis to identify homogeneous clusters of trout anglers based on their specialization.

There are no specific guidelines for determining the number of clusters in a cluster analysis; however, the clusters should be useful to managers. The number of clusters should be large enough to allow managers to observe the heterogeneity in the population through distinct subgroups, yet not so numerous and small that serving each would be impractical and untenable (Payne 1993). K-means cluster analysis was initially explored using three, four, and five cluster centers. The four and five cluster solutions placed only a few individuals with the highest number of trips in one cluster and split the

rest of the respondents among the other clusters. Hence, three clusters were chosen for the final solution. Cluster centers (i.e., variable means) from the K-means cluster analysis were used to determine the level of specialization for each of the three clusters.

Fourteen pairs of a constraint and a negotiation strategy were constructed to determine how effectively trout anglers were able to negotiate specific constraints. For example, the constraint of costs of trout fishing was paired with the negotiation strategy of budgeting money so one can afford to go trout fishing. Constraint items were on a scale of one to four and negotiation strategy items were on a scale of one to five. To accommodate the different scales, constraint and negotiation strategy items for each respondent were standardized to a mean of zero and a standard deviation of one. Each constraint response was also subtracted from its paired negotiation response, and then these differences were averaged across respondents within their respective angler specialization clusters. The 14 averages were then summed for each of the three angler specialization clusters to examine general differences in constraint negotiation among the angler clusters.

The respondent means of perceived constraints and negotiation strategies, and the standardized paired constraint and negotiation strategy were compared across the angler specialization clusters using three separate multivariate analysis of variances (MANOVAs) to identify statistically significant differences (Hair et al. 1998). The first MANOVA was used to identify differences in constraints faced by anglers across the three specialization clusters. The second MANOVA was used to identify differences in negotiation strategies used by anglers across the three specialization clusters. The third MANOVA was used to determine differences across the three specialization clusters

between the pairs of a constraint and a negotiation strategy. Tukey's Post Hoc Tests were conducted to determine which clusters differed with statistical significance ($\alpha = 0.05$). MANOVA has associated assumptions such as independence of observations, equal variance-covariance matrices, and multivariate normality (Hair et al. 1998; Stevens 2002). Box M's test was conducted before performing the MANOVAs to determine if the equal variance-covariance matrices assumption was met. The Box's M Tests were significant, indicating the matrices are not equal across the specialization clusters (Constraint Box's M = 627.35, $p < 0.001$; Negotiation Box's M = 302.58, $p < 0.001$; Paired Box's M = 308.12, $p < 0.001$). The assumption of normality was tested using Shapiro-Wilk tests. The Shapiro-Wilk tests were significant, indicating the data do not meet the assumption of normality. Because the equal variance-covariance matrices and the normality assumptions were not met, Pillai's criterion, which is more robust to violations of assumptions (Hair et al. 1998), was used for interpreting differences.

Results

Of the 4,000 questionnaires mailed to the study sample, 624 were completed and returned by respondents. Due to invalid addresses, 255 surveys were returned as undeliverable. This resulted in an adjusted response rate of 16.7%. Of the 624 completed surveys, 146 were removed because of missing data; the remaining 478 respondents were used for the following analyses.

Most of the respondents were male (84%) with the remainder made up of females (14%) and those who did not disclose their gender (1%). The mean age of survey respondents was 47 years old (± 13). The youngest respondent was 20 years old and the

oldest respondent was 80 years old. The sample was predominately Caucasian. The majority of the sample (56%) had received at least some college education or higher (i.e., bachelor's degree, master's degree, and Ph.D./professional degree) and 57% of the sample had household incomes less than $75,000 (Table 2.2). The mean trip frequency was 8 trips (± 18) with 146 respondents taking 0 trips (minimum value) and 1 respondent taking 280 trips (maximum value). The mean skill rating score was 2.08 (± 0.77; on a 1-4 scale) and the mean centrality to lifestyle score on the rounded averaged scale was 2.47 (± 0.93; on a 1-5 scale).

Of the three angler specialization clusters, the cluster with the highest average of the three standardized clustering variables (i.e., trip frequency, skill rating, and centrality to lifestyle) was considered the most specialized cluster resulting in the following three clusters: most specialized (n = 113), moderately specialized (n = 75), and least specialized (n = 281) (Table 2.3). The most specialized cluster had the highest cluster center for trip frequency and centrality to lifestyle. However, the moderately specialized cluster had the highest cluster center for skill rating, which has also been found in previous specialization research (Oh & Ditton 2006).

Constraints to Angling

Overall, interpersonal constraints (e.g., "crowds on Georgia's trout streams", "conflicting actions of other anglers") was reported to be the most limiting type of constraint on average (mean = 1.77 ± 0.25), followed closely by structural constraints (e.g., "costs of trout fishing", "quality of trout fishing in Georgia"; mean = 1.72 ± 0.47) and intrapersonal constraints (e.g., "limited trout fishing skills", "lack of personal interest in trout fishing"; mean = 1.53 ± 0.19). However, the two most limiting constraints, on

average, were structural. A "lack of time due to my work obligations" was reported as the most limiting type of constraint to trout fishing in Georgia (mean = 2.45 ± 1.11). This structural constraint was followed by another structural constraint "distance of Georgia's trout waters from my home" (mean = 2.19 ± 1.07). A third structural constraint, a "lack of time to trout fish due to my family obligations" (mean = 2.06 ± 0.98) and one interpersonal constraint, "crowds on Georgia's trout streams" (mean = 2.06 ± 0.93), also ranked high among the 14 potential constraints considered here (Table 2.4; Figure 2.2).

The results of the first MANOVA revealed there was a statistically significant difference between the three specialization clusters on the constraints to trout fishing in Georgia, with the least specialized anglers being the most constrained cluster (Pillai's criterion = 0.272, $p < 0.001$). The subsequent ANOVAs revealed 10 statistically significant differences on the constraints to trout fishing between the three specialization clusters (Table 2.4; Figure 2.2). The least specialized cluster reported higher average constraint scores on all constraints to trout angling except for a few structural constraints (i.e., "my health", "Georgia's weather", and "quality of trout fishing in Georgia") and a couple of interpersonal constraints (i.e., "crowds on Georgia's trout streams" and "conflicting actions of other trout anglers"). The most (mean = 1.77 ± 0.48) and moderately (mean = 1.80 ± 0.42) specialized clusters reported experiencing higher interpersonal constraints on average compared to the least specialized cluster (mean = 1.76 ± 0.20).

For the most and moderately specialized clusters, the two most inhibiting constraints were "Crowds on Georgia's trout streams" (means = 2.26 ± 0.90; 2.27 ± 0.98) and "lack of time due to work obligations" (means = 2.24 ± 1.05; 2.43 ± 1.11). For the

least specialized cluster, “lack of time due to work obligations” (mean = 2.54 ± 1.13) was the most limiting constraint with “distance of Georgia’s trout waters from my home” (mean = 2.33 ± 1.08) as the second most limiting constraint. The most significant differences between the three angling clusters were on the constraints of “limited trout fishing skills”, “lack of friends or family to go trout fishing with”, and “distance of Georgia’s trout waters from my home”. The least specialized cluster was more constrained than the most or moderately specialized clusters in perceiving limited trout fishing skills. The least and moderately specialized clusters reported being more constrained by both lack of friends or family with whom to go trout fishing and the distance of trout waters from their residence than the most specialized cluster.

Negotiation of Constraints

With perceptions of constraints presented by level of specialization, examining constraint negotiation strategies by level of specialization is interesting. On average, the intrapersonal strategy of “learn to enjoy being outside and stress less about catching fish” (mean = 3.86 ± 1.36) was reported as the most often used negotiation strategy. This strategy was followed by the interpersonal strategy of “encourage family or friends to go fishing with me” (mean = 3.61 ± 1.17; Table 2.5; Figure 2.3). Intrapersonal negotiation strategies (e.g., “practice to improve my trout fishing skills”, “seek help to improve my trout fishing skills”) were the most commonly used negotiation strategies on average (mean = 3.03 ± 0.52), followed closely by interpersonal strategies (mean = 3.01 ± 0.66; e.g., “search for uncrowded trout fishing locations”, “carpool/share rides to the trout stream”) indicating structural constraints (mean = 2.53 ± 0.51) may be harder to overcome.

The results of the second MANOVA revealed there was a statistically significant difference among the three specialization clusters for the negotiation strategies used to overcome constraints to trout fishing in Georgia, with the most specialized cluster reporting the overall highest negotiation score (Pillai's criterion = 0.284, $p < 0.001$). The subsequent ANOVAs revealed nine statistically significant differences between the three specialization clusters (Table 2.5; Figure 2.3). The least specialized cluster reported using intrapersonal negotiation strategies more often than the other two types of negotiation strategies. The most and moderately specialized clusters reported using interpersonal negotiation strategies most often.

"Encourage family or friends to go fishing with me" (means = 3.95 ± 1.09; 3.38 ± 1.16) and "learn to enjoy being outside and stress less about catching fish" (means = 3.90 ± 1.45; 3.98 ± 1.24) were the two most frequently used negotiation strategies for the most and least specialized clusters. The moderately specialized cluster rated their two most frequently used negotiation strategies as "encourage family or friends to go fishing with me" (mean = 3.93 ± 1.16) and "search for uncrowded trout fishing locations" (mean = 3.70 ± 1.19). The most and least specialized clusters appeared to rely less on "budget my money so I can afford to go trout fishing" (means = 2.20 ± 1.27; 1.91 ± 1.10) or "carpool/share rides to the trout streams" (means = 2.24 ± 1.28; 1.99 ± 1.19) as negotiation strategies to continue or increase participation in trout fishing. The moderately specialized cluster infrequently reported using "budget my money so I can afford to go trout fishing" (mean = 1.83 ± 1.19) and "use inexpensive equipment to make my trout fishing cheaper" (mean = 1.88 ± 1.10). None of the three specialization clusters frequently used budgeting or inexpensive equipment as negotiation strategies. However,

a higher percentage of respondents in the moderately specialized cluster (48%) reported a household income of over $75,000 than the most (35%) or least (43%) specialized clusters. This household income dissimilarity may partially explain why the moderately specialized cluster did not report using monetary negotiation strategies very often.

Constraint and Negotiation Strategy Pairs

The results of the third MANOVA revealed there was a statistically significant difference among the three specialization clusters for the paired constraint and negotiation strategy, with the most specialized cluster reporting the overall highest score, again indicating they were relatively better able to negotiate perceived constraints (Pillai's criterion = 0.250, $p < 0.001$). The subsequent ANOVAs revealed 11 statistically significant differences between the three specialization clusters (Table 2.6). The least specialized cluster had negative scores for all constraint and negotiation strategy pairs except for "using inexpensive fishing equipment" to negotiate the "costs of trout fishing" and "learning to enjoy being outside and stress less about catching fish" to negotiate "lack of information about Georgia's trout fishing opportunities". The negative numbers for the least specialized cluster indicate they are less able to successfully negotiate constraints than the most or moderately specialized clusters. The most specialized cluster had the highest averages across all constraint and negotiation pairs with the exception of "using inexpensive fishing equipment" to negotiate "costs of trout fishing" and "searching for uncrowded trout fishing locations" to negotiate "crowds on Georgia's trout streams". The ability of the respondents in the most specialized cluster to successfully negotiate constraints may likely explain their higher number of fishing days compared to the moderate and least specialized clusters (Figure 2.4).

Discussion

This study's main objective was to determine how anglers of differing level of specialization face and overcoming structural, interpersonal, and intrapersonal constraints. Although previous research has found that more specialized anglers generally experience more constraints than less specialized anglers (Sutton 2007), they were only consistent with this study on one of the three constraint categories. Interpersonal constraints (e.g., "crowds on Georgia's trout streams" and "conflicting actions of other anglers") were experienced more often by the most and moderately specialized clusters than the least specialized cluster. This finding suggests that the most and moderately specialized clusters feel more constrained by crowds and/or actions of other anglers on the trout streams than the least specialized cluster and may seek trout fishing opportunities that offer more solitude, remoteness, or less angling pressure. Respondents in the least specialized cluster reported being more limited by constraints in the intrapersonal and structural constraints than the most or moderately specialized clusters, which indicates that their lack of previous experience and the perceived obstacle of time are difficult constraints to overcome.

In a similar study on recreational angler constraints, time constraints and lack of fishing partners were the salient factors that separated dropouts from active anglers (Fedler and Ditton 2001). These results are consistent with this study in that time constraints related to both family and work as well as lack of friends or family with whom to go trout fishing were more problematic for the least specialized cluster that had overall less participation than the other two clusters. One approach that may increase the number of possible fishing partners is establishing a family plan where anglers could get

discounted trout license rates based on immediate family members also having a trout license. Such a strategy could help anglers recruit fishing partners more easily and may help anglers spend more family time on a trout stream.

Lack of time because of work or family obligations, distance of Georgia's trout waters from home, and crowds on Georgia's trout streams were consistently reported as constraints to all of those who trout fishing in Georgia. Managers may help trout anglers better negotiate lack of time by providing opportunities adjacent to urban population centers. This closer proximity of opportunity to urban centers could be accomplished in areas where hypolimnetic release dams provide colder waters suitable for trout and could reduce travel times to fishing destinations. Likewise, a desire to be with family members could be met through angling opportunities and events that are geared towards families. As suggested by Ritter et al. (1992), one strategy to help partially alleviate the perception of crowds on Georgia's trout streams may be to provide information on current use levels or to use variable fee structures to distribute use across space and time. The least specialized cluster reported lack of fishing partners as a constraint often faced when attempting to trout fish in Georgia. One strategy to lessen this constraint may be to provide opportunities for corporate groups to go trout fishing or days that are designated to bringing a friend, parent, sibling, or child trout fishing. Consistent with the findings of Ritter et al. (1992), cost was reported to be a small constraint to trout fishing, and budgeting and using inexpensive equipment were less often used negotiation strategies. These findings suggest respondents are willing to pay to receive the benefits sought from trout fishing, which may allow managers flexibility to be creative in the fee structure related to the trout resource.

On average, the respondents in the most, moderately, and least specialized clusters took 25, 4, and 2 trips, respectively, in the previous 12 months. Furthermore, all the respondents in the most specialized cluster took at least one trout fishing trip within the last year. Of the respondents in the moderately and least specialized clusters, 27% and 44% took zero trips within the last year, respectively. These results indicate that the most specialized cluster was relatively better able to negotiate perceived constraints and continue participating in trout fishing at a higher frequently than the moderately or least specialized clusters (Figure 2.4).

The second objective of the study was to evaluate how constraint negotiation strategies varied among different levels of specialization. Previous literature has shown that the ability to negotiate constraints increases with a higher level of commitment (Sutton 2007; Lyu & Oh 2014). This finding was consistent with the results of my study in that the most specialized cluster had higher means than the least specialized cluster on 10 of the 14 negotiation strategies. Of the four negotiation strategy means that were higher for the least specialized cluster compared to the most, three were related to skill acquisition and acceptance. Helping the least specialized anglers successfully negotiate constraints may increase their trout angling participation. One suggestion to help the least specialized anglers negotiate these constraints is to bring them together through a beginner's trout fishing social media or email group. A group like this may help these least specialized anglers share the ways they negotiate perceived constraints with other anglers, especially since respondents in this cluster were not as concerned with crowds or the actions of other anglers preventing them from trout angling. These types of beginner groups would also provide a safe space for beginners to exchange information and build

confidence to overcome their higher intrapersonal constraints. The ability to negotiate through perceived constraints may be why the respondents in the most specialized cluster participate in trout fishing more often than the respondents in the least specialized cluster. These findings could also indicate that the least specialized cluster is the most vulnerable to dropping out of trout fishing because of non-negotiable perceived constraints.

Of the 14 negotiation minus constraint pairings for the least specialized cluster, 12 were negative numbers, indicating the least specialized respondents' participation was not only hindered by the increased perceived constraints, but also by the lesser ability to successfully negotiate them. The only two negotiation minus constraint pairings the least specialized cluster was able to successfully negotiate were using inexpensive equipment to overcome the costs of trout fishing and learning to enjoy being outside and stressing less about catching fish to overcome the constraint of lacking information about trout fishing opportunities. Household income was distributed relatively evenly across the three specialization clusters, and cost was not reported to be a major constraint by any of the three clusters. Accordingly, the least specialized cluster may just be more affected by their low skill level and the common structural constraints of lack of time and distance to trout waters than are other anglers.

These findings suggest the least specialized cluster could benefit from building relationships with others that are interested in trout fishing so that they have people to fish with as their ability grows. Transitioning anglers from the least specialized cluster to the moderate and potentially most specialized cluster is important to ensure a sustainable source of repeat license sales and associated economic benefits that accrue to the state economy from trout fishing activities.

Summary and Management Implications

The results of this survey included responses from anglers who hold a "Sportsman's License", which allows fishing and hunting for multiple species, including fishing for trout. Individuals who hold a Sportsman's License may choose to not fish for trout, regardless of the allowance of their license. Including these anglers may have influenced my results and interpretations of the data. I attempted to overcome this bias by sampling fewer Sportsman's License holders than repurchase license holders. I sampled more repurchase license holders under the assumption that an individual who has to purchase a trout fishing license every 1-3 years is more likely to use their license to fish for trout than an individual who is granted the right to trout fish in perpetuity along with multiple other species. Future research could separate anglers into license types to see those with lifetime licenses perceive and process angling constraints differently than those required to repurchase their license every 1-3 years.

While survey research provides the ability to poll a large sample of anglers about a common issue such as angling constraints, simple quantitative methods prevent an in-depth exploration of how the constraints are perceived, how they act as barriers to angling, or how they may change over time for an individual. It is suggested that qualitative research methods such as interviews and focus groups be used to elicit the answers to why anglers face constraints and why they have difficulty overcoming them.

Some of the questions asked on the survey were retrospective. There is a potential for past information to be altered or forgotten over time. The number of trout fishing trips an individual made to various counties in Georgia over the past 12 months is an example of a retrospective question asked on the survey. Respondents may have

rounded to multiples of 5 or 10 for questions such as trip frequency and amount of money spent on trout fishing, which could be a result of retrospective questioning. Additionally, measurement error may have been introduced if responses were systematically understated or overstated.

Angler specialization cluster membership may have been influenced in that the frequency of trout fishing trips was only assessed in Georgia instead of total number of trout fishing trips taken in the past year regardless of location. A few individuals qualitatively indicated they prefer to fish in North Carolina or have vacation homes from which they trout fish in other states. Life events that may have caused an individual to not fish within the last year despite fishing frequently in previous years (e.g., birth of child, death of loved one, new/loss of job, significant health changes, etc.) were not assessed, which also may have affected specialization cluster membership. It is suggested that future research include constraints related to major life events to see how often individuals decrease their participation in recreational fishing due to events like birth or death in the family, marriage, moving, significant personal or familial health changes, getting a new job or leaving a previous job. This could help managers better understand how to recruit anglers at different points in their life and/or help managers ensure that anglers do not completely dropout of the activity at different challenging points in their life. Future research could also ask open ended questions or ask individuals to rank constraints and negotiation strategies to get a better idea of which constraints and negotiation strategies are the most influential to participation frequency. Including activity attachment (i.e., the extent to which an angler could find the same benefits from another activity as s/he does from trout angling) in future analyses could

further explain why more specialized anglers are better able to negotiate constraints than less specialized anglers.

In summary, this study has identified multiple subgroups of anglers among the trout fishing population in GA, which suggests that managers should diversify management policies to accommodate specific groups. For example, managers may experience better outcomes by not treating all anglers the same and not solely treating constraints as equally negotiable by all anglers. However, investigating how constraints are negotiated by each subgroup (e.g., level of angler specialization) may offer better insight into how those constraints could be better negotiated by each anger subgroup. Identifying constraints experienced when attempting to trout fish in Georgia and negotiation strategies anglers use to overcome those constraints will lead to a better understanding of the needs of trout anglers in Georgia. My research may directly assist fisheries managers by providing subgroup-specific information that can then be used to devise strategies to overcome subgroup-specific constraints. For example, if the state is trying to increase the number of trout fishing trips, looking at the most common constraints faced by all anglers, as well as the constraints experienced by least specialized cluster would allow tailored strategies aimed at improving the participation rates of both clusters.

References

Alexandris, K., C. Kouthouris, and G. Girgolas. 2007. Investigating the relationships among motivation, negotiation, and alpine skiing participation. Journal of Leisure Research 39(4): 648-667.

Beardmore, B., W. Haider, L. M. Hunt, and R. Arlinghaus. 2011. The importance of trip context for determining primary angler motivations: are more specialized anglers more catch-oriented than previously believed? North American Journal of Fisheries Management 31(5): 861-879.

Beardmore, B., W. Haider, L. M. Hunt, and R. Arlinghaus. 2013. Evaluating the ability of specialization indicators to explain fishing preferences. Leisure Sciences 35(3): 273-292.

Bryan, H. 1976. The sociology of fishing: a review and critique. Marine Recreational Fisheries 1: 83-92.

Bryan, H. 1977. Leisure value systems and recreational specialization: the case of trout fishermen. Journal of Leisure Research 9(3): 174-188.

Crawford, D. W., and G. Godbey. 1987. Reconceptualizing barriers to family leisure. Leisure Sciences 9: 119-127.

Crawford, D. W., E. L. Jackson, and G. Godbey. 1991. A hierarchical model of leisure constraints. Leisure Sciences 13(4): 309-320.

Dillman, D. A., J. D. Smyth, and L. M. Christian. 2014. Internet, Phone, Mail, and Mixed-Mode Surveys: The Tailored Design Method. (4th ed.). Hoboken, NJ: John Wiley & Sons.

Ditton, R. B., D. K. Loomis, and S. Choi. 1992. Recreational specialization: re-conceptualization from a social worlds perspective. Journal of Leisure Research. 24(1): 33-51.

Dorison, A. 2012. Estimating the economic value of trout angling in Georgia: a travel cost model approach. (Unpublished Master's thesis). University of Georgia, Athens, Georgia.

Fedler, A. J., and R. B. Ditton. 2001. Dropping out and dropping in: a study of factors for changing recreational fishing participation. North American Journal of Fisheries Management 21(2): 283-292.

Fendt, L. S., and E. Wilson. 2012. "I just push through the barriers because I live for surfing": How women negotiate their constraints to surf tourism. Annals of Leisure Research 15(1): 4-18.

Freudenberg, P, and R. Arlinghaus. 2010. Benefits and constraints of outdoor recreation for people with physical disabilities: Inferences from recreational fishing. Leisure Sciences 32(1): 55-71.

Georgia Department of Natural Resources. 2017. Trout fishing in Georgia. Wildlife Resources Division. Retrieved from http://georgiawildlife.com/Trout.

Hair, J. F., R. E. Anderson, R. L. Tatham, and W. C. Black. 1998. Multivariate data analysis. 5th ed. Prentice-Hall, Upper Saddle River, New Jersey.

Hubbard, J., and R. C. Mannell. 2001. Testing competing models of the leisure constraint negotiation process in a corporate employee recreation setting. Leisure Sciences 23(3): 145-163.

Hutt, C. P., and P. W. Bettoli. 2007. Preferences, specialization, and management attitudes of trout anglers fishing in Tennessee tailwaters. North American Journal of Fisheries Management 27(4): 1257-1267.

Jackson, E. L., D. W. Crawford, and G. Godbey. 1993. Negotiation of leisure constraints. Leisure Sciences 15(1): 1-11.

Jackson, E. L., and V. C. Rucks. 1995. Negotiation of leisure constraints by junior-high and high-school students: an exploratory study. Journal of Leisure Research 27(1): 85-105.

Jackson, E. L., and D. Scott. 1999. Constraints to leisure. In E. L. Jackson and T. L. Burton (Eds.), *Leisure studies: prospects for the twenty-first century* (299-321). State College, PA: Venture Publishing.

Kay, T., and G. Jackson. 1991. Leisure despite constraint: the impact of leisure constraints on leisure participation. Journal of Leisure Research 23(4): 301-313.

Keefer, L., G. Beisser, H. Chestnutt, B. Couch, K. Kammermeyer, L. Klein, and T. Lovell. 2000. Georgia trout management plan. Georgia Department of Natural Resources (Wildlife Resources Division). Social Circle, Georgia.

Kim, S., D. Scott, and J. L. Crompton. 1997. An exploration of the relationships among social psychological involvement, behavioral involvement, commitment, and future intentions in the context of birdwatching. Journal of Leisure Research 29(3): 320-341.

Larson, L. R., J. W. Whiting, and G. T. Green. 2012. Diversity in state parks: a cross-cultural examination of outdoor recreation and park use in Georgia. Report

submitted to the Georgia Department of Natural Resources' Parks, Recreation, & Historic Sites Division.

Lyu, S. O., and C. Oh. 2014. Recreationists' constraints negotiation process for continual leisure engagement. Leisure Sciences 36: 479-497.

McFadden, J. T. 1969. Trends in freshwater sport fisheries of North America. Keynote symposium, Transactions of the American Fisheries Society, 98(1): 136-150.

McFarlane, B. L. 2004. Recreation specialization and site choice among vehicle-based campers. Leisure Sciences 26(3): 309-322.

McIntyre, N., and J. J. Pigram. 1992. Recreation specialization reexamined: the case of vehicle-based campers. Leisure Sciences 14(1): 3-15.

Oh, C., and R. B. Ditton. 2006. Using recreation specialization to understand multi-attribute management preferences. Leisure Sciences 28(4): 369-384.

Pavlowich, T., and Kapuscinski, A. R. 2017. Understanding spearfishing in a coral reef fishery: Fishers' opportunities, constraints, and decision-making. PLoS ONE 12(7): e0181617.

Payne, A. 1993. The essence of services marketing. London, UK. Prentice Hall International.

Rice, J. A., M. E. Hambrick, and T. J. Aicher. 2018. A qualitative investigation of sport activity participation and constraint negotiation among African American endurance runners. Journal of Sport Behavior 41(1): 64-88.

Ritter, C., R. B. Ditton, and R. K. Riechers. 1992. Constraints to sport fishing: implications for fisheries management. Fisheries 17(4): 16-19.

Scott, D. 1991. The problematic nature of participation in contract bridge: a qualitative study of group-related constraints. Leisure Sciences 13: 321-336.

Scott, D., and C. S. Shafer. 2001. Recreational specialization: a critical look at the construct. Journal of Leisure Research 33(3): 319-343.

Stensland, S., O. Aas, and M. Mehmetoglu. 2017. Understanding constraints and facilitators to salmon angling participation: Insights from structural equation modeling. Human Dimensions of Wildlife 22(1): 1-17.

Stevens, J. 2002. Applied multivariate statistics for the social sciences. 4th ed. Lawrence Erlbaum Associates, Mahwah, New Jersey.

Sutton, S. G. 2007. Constraints to recreational fishing participation in Queensland, Australia. Fisheries 32(2): 73-83.

Sutton, S. G., and C. Oh. 2015. How do recreationists make activity substitution decisions? A case of recreational fishing. Leisure Sciences 37(4): 332-353.

White, D. D. 2008. A structural model of leisure constraints negotiation in outdoor recreation. Leisure Sciences 30(4): 342-359.

Table 2.1 Variables used in cluster analysis from a 2017 study of trout angler preferences in Georgia.

	Bin	Category	Number of trips	Percentage of respondents
Trout fishing trip frequency in the last 12 months (Behavioral dimension)	1	None	0	30
	2	Few	1 - 6	38
	3	Several	7 - 12	15
	4	Many	13 - 24	10
	5	A lot	≥ 25	7
Perceived level of skill as a trout angler (Cognitive dimension)	1	Novice		24
	2	Intermediate		49
	3	Advanced		24
	4	Expert		3
Centrality to Lifestyle (Commitment dimension)	Mean	Factor Loading	Cronbach Alpha	
	2.49		0.781	
- Trout fishing is my main form of outdoor recreation	2.44	0.869		
- I find a lot of my life is centered around trout fishing	2.18	0.876		
- I have strong preferences about the types of trout water I like to fish	2.87	0.766		

Table 2.2 Gender, approximated age, ethnicity, education, and household income for all respondents to a 2017 Georgia trout angler preferences survey. Demographics are also broken down by most, moderately, and least specialized clusters.

	Total		Most Specialized		Moderately Specialized		Least Specialized	
	N	%	N	%	N	%	N	%
Gender								
Male	403	84	96	82	70	86	237	85
Female	69	14	21	18	10	12	38	14
Undisclosed	6	1	0	0	1	1	5	2
Age (mean)	47		46		49		47	
Ethnicity								
African American	12	3	1	1	1	1	10	4
Asian	1	0	0	0	0	0	1	0
American Indian	4	1	0	0	3	4	1	0
Caucasian	439	94	107	96	76	95	256	93
Hispanic	5	1	2	2	0	0	3	1
Other	4	1	1	1	0	0	3	1
Undisclosed	13	3	6	5	1	1	6	2
Education								
Less than high school	13	3	4	3	0	0	9	3
High school or GED	122	26	42	36	16	20	64	23
Technical, vocational, or trade	68	14	17	15	15	19	36	13
Some College (includes junior college)	100	21	23	20	15	19	62	23
Bachelor's Degree	114	24	18	16	23	29	73	27
Master's Degree	36	8	7	6	8	10	21	8
Ph.D./Professional Degree	16	3	5	4	2	3	9	3
Undisclosed	9	2	1	1	2	3	6	2
Household Income								
Less than $25,000	43	9	17	15	4	5	22	8
$25,000 - $49,999	100	22	23	20	15	20	62	23
$50,000 - $74,999	113	25	33	29	17	23	63	24
$75,000 - $99,999	65	14	18	16	7	9	40	15
$100,000 - $199,999	107	24	20	18	28	37	59	22
$200,000+	27	6	3	3	4	5	20	8
Undisclosed	23	5	3	3	6	8	14	5

Table 2.3 Angler specialization cluster centers from a 2017 study of trout angler preferences in Georgia.

		Cluster Centers		
Dimension	Variable	Most Specialized	Moderately Specialized	Least Specialized
Behavioral	Trip Frequency	1.43	-0.24	-0.52
Commitment	Centrality to Lifestyle	0.81	0.14	-0.44
Cognitive	Skill Rating	0.49	1.32	-0.61
	Mean	*0.91*	*0.41*	*-0.52*

Table 2.4 MANOVA and ANOVAs of mean constraint scores for 15 potential constraints to trout fishing in Georgia in 2017. Tukey's Post Hoc Test was used to determine statistically significant differences in means, which are labeled with different superscript letters.

Potential constraints	Total (n = 478)	Most Specialized (n = 117)	Moderately Specialized (n = 81)	Least Specialized (n = 280)	Significance ($p < 0.05$)
Structural means	*1.72*	*1.58*	*1.73*	*1.77*	
Costs of trout fishing	1.17	1.14	1.17	1.18	0.729
My health	1.29	1.15	1.37	1.33	0.044
Georgia's weather	1.36	1.37	1.32	1.36	0.861
Quality of trout fishing in Georgia	1.67	1.74	1.78	1.60	0.117
Distance of Georgia's trout waters from my home	2.19	1.82 y	2.25 z	2.33 z	0.000
Ability to access trout fishing locations (e.g., lack transportation)	1.53	1.35 y	1.54 zy	1.60 z	0.021
Lack of time to trout fish due to my family obligations	2.06	1.79 y	1.96 zy	2.20 z	0.000
Lack of time to trout fish due to my work obligations	2.45	2.24 y	2.43 zy	2.54 z	0.048
Interpersonal means	*1.77*	*1.77*	*1.80*	*1.76*	
Crowds on Georgia's trout streams	2.06	2.26 z	2.27 z	1.92 y	0.000
Conflicting actions of other trout anglers	1.60	1.74 z	1.63 zy	1.53 y	0.046
Lack of friends or family to go trout fishing with	1.64	1.31 y	1.49 y	1.83 z	0.000
Intrapersonal means	*1.53*	*1.32*	*1.35*	*1.68*	
Lack of information about Georgia's trout fishing opportunities	1.71	1.60	1.58	1.80	0.045
Difficulty understanding Georgia's trout fishing regulations	1.62	1.42 y	1.53 zy	1.73 z	0.003
Limited trout fishing skills	1.52	1.17 y	1.10 y	1.79 z	0.000
Lack of personal interest in trout fishing	1.28	1.10 y	1.19 y	1.38 z	0.000
Constraint means	*1.68*	*1.55*	*1.64*	*1.74*	*0.000*

Table 2.5 MANOVA and ANOVAs of mean constraint negotiation scores for 14 constraint negotiation strategies for trout fishing in Georgia in 2017. Tukey's Post Hoc Test was used to determine statistically significant differences in means, which are labeled with different superscript letters.

Constraint negotiation strategy	Total (n = 478)	Most Specialized (n = 117)	Moderately Specialized (n = 81)	Least Specialized (n = 280)	Significance ($p < 0.05$)
Structural means	*2.53*	*2.69*	*2.51*	*2.47*	
Organize my family obligations so I have time to go fishing	2.43	2.54	2.47	2.37	0.370
Organize my work schedule so I have time to go fishing	2.54	2.67	2.72	2.44	0.085
Use inexpensive fishing equipment to make my trout fishing cheaper	2.35	2.30 zy	1.88 y	2.51 z	0.000
Budget my money so I can afford to go trout fishing	1.97	2.20	1.83	1.91	0.043
Search for high quality trout fishing spots	3.35	3.72 z	3.67 z	3.11 y	0.000
Interpersonal coordination means	*3.01*	*3.27*	*3.22*	*2.84*	
Search for uncrowded trout fishing locations	3.30	3.58 z	3.70 z	3.07 y	0.000
Find people with similar interests to go fishing with	3.04	3.31 z	3.07 zy	2.92 y	0.014
Encourage family or friends to go fishing with me	3.61	3.95 z	3.93 z	3.38 y	0.000
Carpool/share rides to the trout stream	2.08	2.24	2.17	1.99	0.147
Intrapersonal means	*3.03*	*3.10*	*2.60*	*3.12*	
Practice to improve my trout fishing skills	3.15	3.42 z	2.93 y	3.11 zy	0.031
Seek help to improve my fishing skills	2.52	2.57 zy	2.19 y	2.60 z	0.028
Accept my lack of trout fishing skills and do the best I can	2.94	2.76 y	1.94 x	3.30 z	0.000
Study to improve my trout fishing skills (e.g., books, blogs, internet, TV)	2.67	2.86	2.52	2.63	0.103
Learn to enjoy being outside and stress less about catching fish	3.86	3.90 z	3.42 y	3.98 z	0.005
Constraint negotiation means	*2.84*	*3.00*	*2.75*	*2.81*	*0.000*

Table 2.6 MANOVA and ANOVAs of paired standardized constraint and negotiation strategy items identified from a 2017 study on trout anglers in Georgia. Tukey's Post Hoc Test was used to determine statistically significant differences in means, which are labeled with different superscript letters. Both constraints and negotiation strategies were standardized to a mean of 0 and standard deviation of 1. Larger numbers suggest anglers were better able to negotiate the constraint, while negative numbers indicate the constraint exceeded the negotiation ability.

Negotiation strategy	Constraint	Total	Most specialized	Moderately specialized	Least specialized	Significance ($p < 0.05$)
Budget my money so I can afford to go trout fishing	Costs of trout fishing	0.05	0.29 z	-0.08 zy	-0.02 y	0.034
Use inexpensive fishing equipment to make my trout fishing cheaper	Costs of trout fishing	0.08	0.10 zy	-0.29 y	0.19 z	0.008
Search for high quality trout fishing spots	Quality of trout fishing in Georgia	0.01	0.22 z	0.13 zy	-0.12 y	0.031
Carpool/share rides to the trout stream	Ability to access trout fishing locations (e.g., lack transportation)	0.08	0.41 z	0.13 zy	-0.07 y	0.004
Accept my lack of trout fishing skills and do the best I can	Limited trout fishing skills	-0.01	0.30 z	-0.16 y	-0.10 y	0.001
Practice to improve my trout fishing skills	Limited trout fishing skills	-0.03	0.60 z	0.33 z	-0.39 y	0.000
Seek help to improve my trout fishing skills	Limited trout fishing skills	0.02	0.49 z	0.27 z	-0.26 y	0.000
Study to improve my trout fishing skills (e.g., books, blogs, internet, TV)	Limited trout fishing skills	0.01	0.60 z	0.41 z	-0.36 y	0.000
Search for uncrowded trout fishing locations	Crowds on Georgia's trout streams	0.00	0.01	0.09	-0.03	0.648
Organize my work schedule so I have time to go fishing	Lack of time to trout fish due to my work obligations	-0.05	0.23 z	0.10 zy	-0.22 y	0.002
Organize my family obligations so I have time to go fishing	Lack of time to trout fish due to my family obligations	-0.04	0.32 z	0.09 zy	-0.24 y	0.000
Encourage friends or family to go fishing with me	Lack of friends or family to go trout fishing with	0.01	0.66 z	0.44 z	-0.39 y	0.000
Learn to enjoy being outside and stress less about catching fish	Lack information about Georgia's trout fishing opportunities	0.02	0.17	-0.17	0.01	0.246
Find people with similar interests to go fishing with	Conflicting actions of other trout anglers	0.00	0.05	-0.01	-0.01	0.918
Mean of negotiation minus constraint		*0.01*	*0.32*	*0.09*	*-0.14*	*0.000*

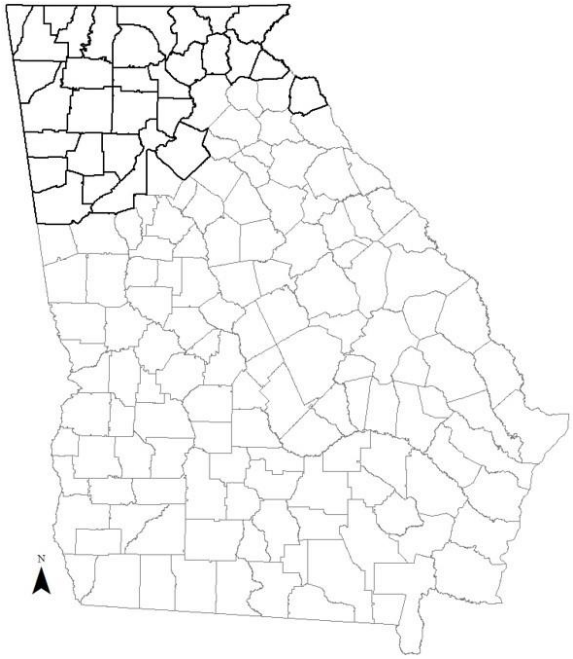


Figure 2.1 Map of Georgia counties. Counties outlined in black are counties with trout angling opportunities as of 2017.

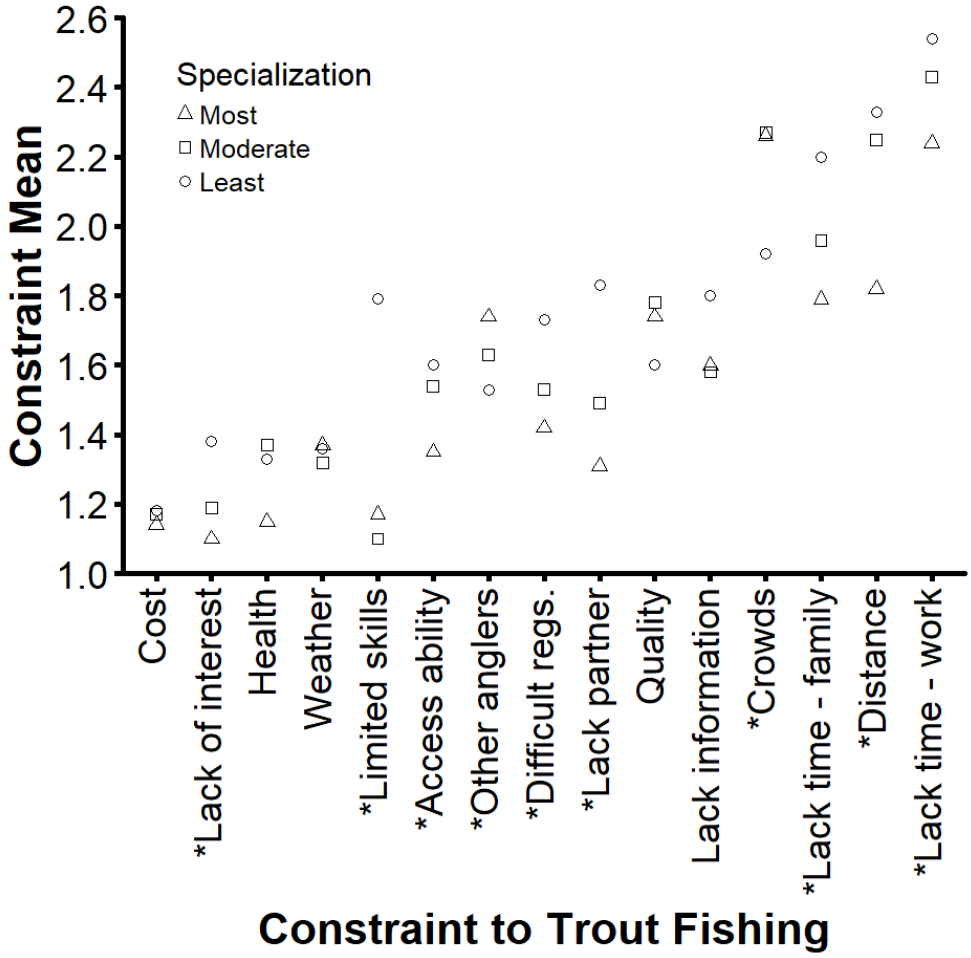


Figure 2.2 Mean constraint scores for each of the three angler specialization clusters found in a 2017 study on Georgia trout anglers. Constraints marked with an asterisk (*) significantly differed between at least two of the three specialization clusters.

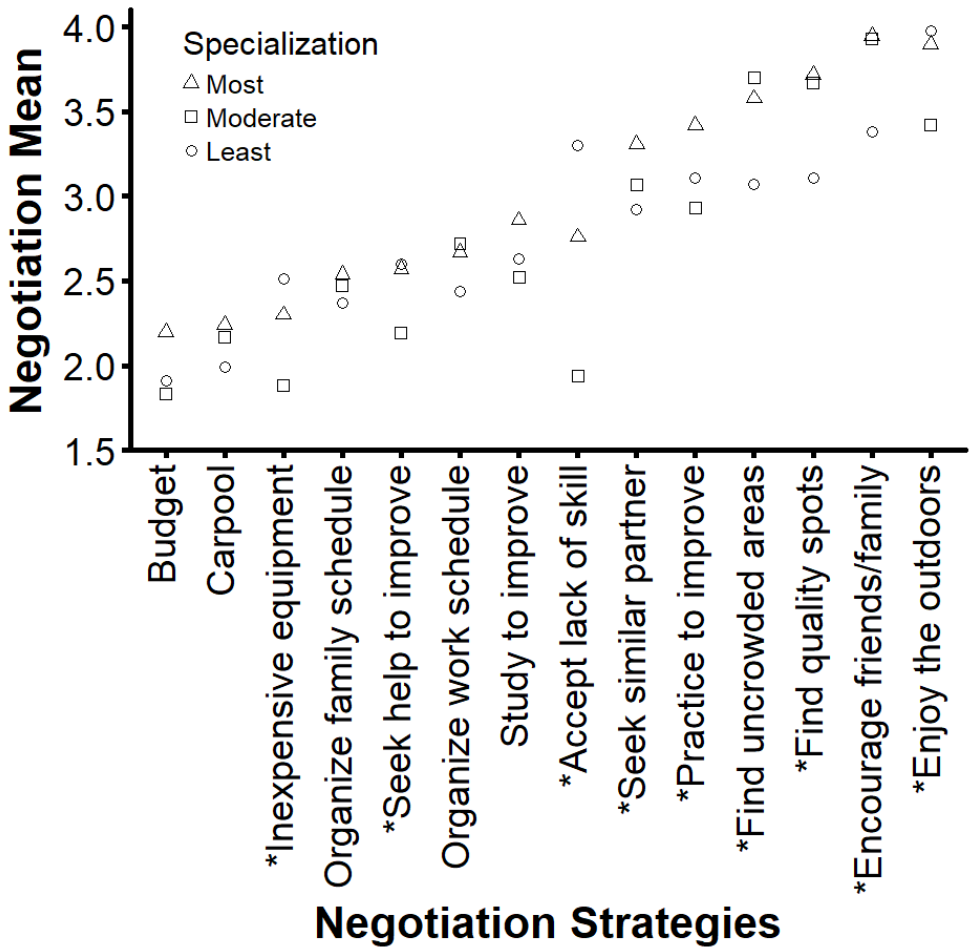


Figure 2.3 Mean negotiation strategy scores for each of the three angler specialization clusters found in a 2017 study on Georgia trout anglers. Negotiation strategies marked with an asterisk (*) significantly differed between at least two of the three specialization clusters.

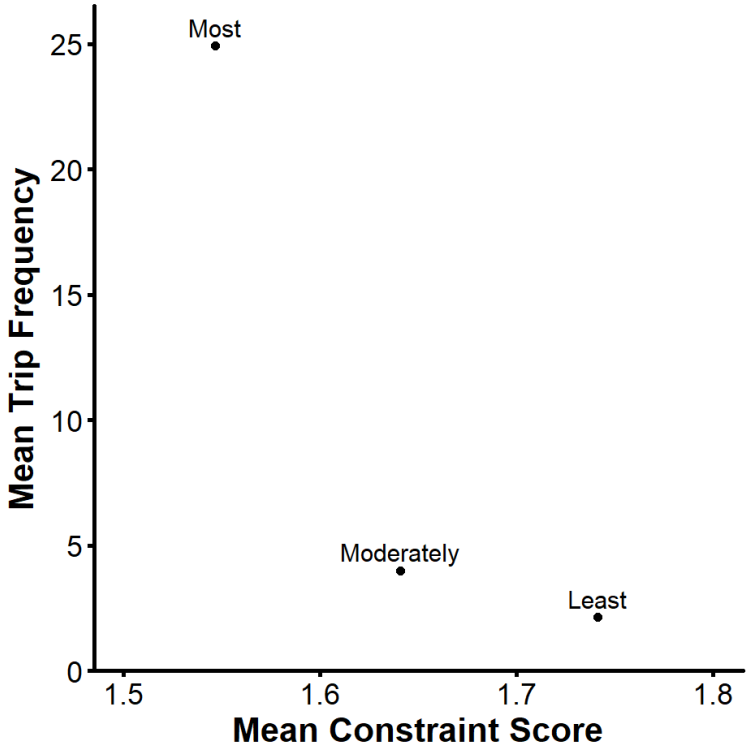


Figure 2.4 Mean constraint scores and trip frequencies in the previous year identified from a 2017 survey of Georgia trout anglers for the most, moderately, and least specialized cluster.

CHAPTER 4

CONCLUSIONS

Managing fishery resources for an "average angler" assumes a lack of heterogeneity in the angler population. This study addressed angler preferences, constraints, and negotiation strategies by level of angler specialization. Angler specialization can be used to group anglers by varying behaviors, motivations, and preferences toward recreational fishing. Here, the level of specialization was determined by how central trout fishing is to an angler's life, the number of trout fishing trips taken in the past year, and the angler's level of skill. Understanding the variation in angler preferences, constraints anglers face when attempting to trout fish, and the negotiation strategies anglers use to overcome constraints is important so managers can tailor management plans to meet the needs of many anglers. Meeting the needs of more than one type of angler can help managers retain and recruit anglers, which will ultimately help trout fishing continue contributing to the economic activity in the state.

The first research chapter (Chapter 2) in this thesis focused on the importance and satisfaction trout anglers place on different salient trout fishing attributes. I used importance-satisfaction analysis (ISA) to identify discrepancies between importance and satisfaction and how those discrepancies varied based on level of angler specialization. The most specialized cluster, which had the highest average trip frequency, placed more importance on the trout fishing attributes measured in the survey than the moderately or least specialized clusters. The most specialized cluster was also the most satisfied with

the trout fishing attributes compared to the moderately or least specialized clusters. Despite the differences found across all three specialization clusters, there was some agreement, particularly in the high importance placed on adding new fishable trout waters, clear signage of regulations, and habitat improvement initiatives. There was also agreement across clusters in the high satisfaction, but lower importance of the cost of a trout fishing license.

The second research chapter (Chapter 3) in this thesis focused on the constraints anglers face when trout fishing in Georgia and the negotiation strategies anglers use to overcome the constraints and continue trout angling. Angler specialization was also used in this study to determine how constraints and negotiation strategies differed based on level of angler specialization. The most specialized cluster reported perceiving less constraints on average followed by the moderately and least specialized clusters. The least specialized cluster took the fewest trips on average. The negotiation strategies trout anglers use to overcome perceived constraints and continue participating in trout fishing also differed by angler specialization level. On average, the most specialized cluster reported negotiating constraints most often followed by the least and moderately specialized clusters. Trout anglers across the three specialization clusters agreed that lack of time due to work obligations was a primary constraint to their participation in trout fishing. Respondents across the three clusters reported encouraging their family and friends to go trout fishing with them as a strategy used to continue or increase their own participation.

The Georgia counties that were most frequently visited by the respondents for trout fishing trips in the previous 12 months were Fannin, Union, and White counties.

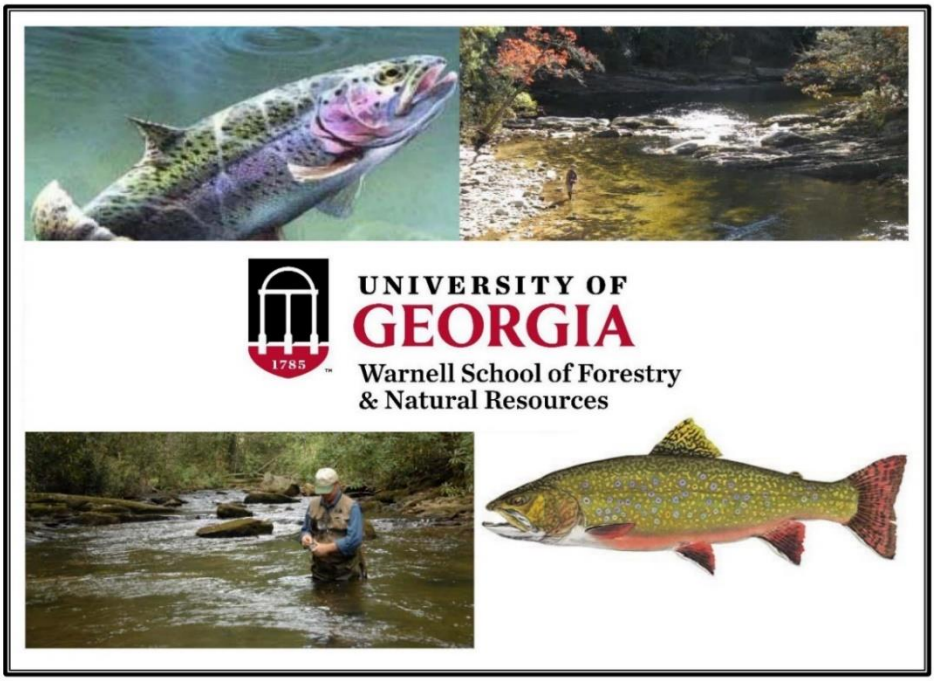
Findings presented in chapters 2 and 3 revealed the cost associated with trout fishing was less important attribute compared to others measured and not a major factor keeping respondents from trout angling, regardless of the level of angler specialization. Clear signage of regulations was reported to be relatively important for trout anglers in Georgia and difficulty understanding Georgia's trout fishing regulations ranked in the middle of the constraints to trout angling.

Future research could focus on broader spatial differences (i.e., across multiple states) to identify spatial similarities or differences among anglers of different levels of specialization. Likewise, repeating this study following changes to fishing regulations or other management actions could prove informative by allowing measurement of shifts in angler responses. This study has implications for fishery managers who desire to serve a wide range of their angler populations. The findings of this study will allow managers to adapt management plans to meet the needs of different types of anglers who have different preferences, experience different constraints, and use different negotiation strategies to overcome perceived constraints. Tailoring management plans to meet the needs of a wide range of anglers may help retain or recruit trout anglers and ultimately help maintain or grow the large financial contribution that trout angling produces for the state's economy.

APPENDIX A

2017 GEORGIA TROUT ANGLER SURVEY

2017 Georgia Trout Angler Survey



You have been selected as a Georgia trout stamp holder to participate in this survey. Your answers will help GA DNR trout managers better understand Georgia trout anglers' preferences and attitudes about trout fishing in Georgia. Your responses are very important and confidential. Your participation is voluntary, so you may stop at any time. If you are less than 18 years old, please do not complete the survey. As an indication of our appreciation for your assistance, those who return their completed surveys by May 15th will be automatically entered into a drawing for a Georgia Lifetime Sportsman License[1].

Participants who complete and return the survey will automatically be entered into a drawing for a Georgia Lifetime Sportsman License worth a value of $500*

[1] Those who choose not to participate may contact Bynum Boley at bboley@uga.edu to enter the drawing.

1. **Have you been trout fishing <u>in Georgia</u> within the last 12 months? (*Check ONE*)**
   - ☐ Yes
   - ☐ No → (Skip to question 3)

2. **Please indicate the number of trips you made for the purpose of trout fishing within the last 12 months to any <u>Georgia county</u> shown on the map below.**

Map 1: Trout Counties in Georgia

3. **How likely are you to renew your GA trout license when yours expires next? (*Check ONE*)**
   - ☐ Very Unlikely (1)
   - ☐ Unlikely (2)
   - ☐ Unsure (3)
   - ☐ Likely (4)
   - ☐ Very Likely (5)
   - ☐ *I have a lifetime license*

4. **Do you plan to trout fish less or more next year? (*Check ONE and please briefly explain why*)**
   - ☐ Much Less (1)
   - ☐ Less (2)
   - ☐ About the Same (3)
   - ☐ More (4)
   - ☐ Much More (5)

   Why? _____
   _____
   _____
   _____

5. Given your experience with GA trout fishing, how likely are you to recommend others to purchase a GA trout license?

☐ Very Unlikely (1)
☐ Unlikely (2)
☐ Neutral (3)
☐ Likely (4)
☐ Very Likely (5)

6. For which species of trout do you prefer to fish? (*Check ONE*)

☐ Brook
☐ Brown
☐ Rainbow
☐ *No preference*

7. What do you typically do with the trout you catch? (*Check ONE)*

☐ Release
☐ Keep
☐ Both (release some, keep some)

8. In what season(s) do you typically take your trout fishing trips in Georgia? (*Mark ALL that apply*)

☐ Spring (March-May)
☐ Summer (June-August)
☐ Fall (September-November)
☐ Winter (December-February)

9. Do you primarily fish on private or public land? (*Check ONE*)

☐ Private Land
☐ Public Land

10. How long does it take you to drive to the areas where you normally fish for trout? (*Check ONE*)

☐ Under ½ hour
☐ ½ to 1 hour
☐ Between 1 to 2 hours
☐ 2 hours or more

11. On which type of Georgia streams do you prefer to trout fish? (*Check ONE*)

☐ Artificial lure only streams
☐ Delayed harvest streams
☐ Trophy trout streams
☐ General regulation streams
☐ *No Preference*

12. Do you prefer to fish for stocked trout (i.e., raised in a hatchery) or wild trout (i.e., naturally reproducing)?

☐ Stocked trout
☐ Wild trout
☐ *No Preference*

13. On most days of trout fishing, which scenario would you rather catch? (*Check ONE*)

☐ 1 trout / ≥ 20 inches
☐ 2 trout / 16 inches each
☐ 4 trout / 12 inches each
☐ 8 trout / 9 inches each

14. When you fish for trout, what type of bait do you primarily use? (*Check ONE*)

☐ Artificial flies (e.g., dry flies/nymphs/streamers)
☐ Artificial lures (e.g., crank bait, rooster tail, plastic worm)
☐ Bait (e.g., corn, crickets, powerbait, worms)

15. Georgia's daily harvest limit for all trout species is 8 in total. Do you feel this total daily limit should be:

☐ Unchanged
☐ Increased to _____ (write in #)
☐ Reduced to _____ (write in #)

Why? _____
_____

16. An annual trout license in Georgia costs $5. Do you feel this price should be:

☐ Unchanged
☐ Increased to _____ (write in $)
☐ Reduced to _____ (write in $)

Why? _____
_____

17. Please indicate your level of satisfaction with the following aspects of trout fishing in Georgia, using a scale where 1 = "Very Dissatisfied" to 5 = "Very Satisfied." (*Please circle one number per statement*)

How satisfied are you with …	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied
The overall trout fishing experience provided in GA	1	2	3	4	5
The number of public trout fishing access points in GA	1	2	3	4	5
The Georgia Department of Natural Resources' (GA DNR) management of trout fishing in GA	1	2	3	4	5

18. How would you rate the current quality of trout fishing in GA? (*Check ONE*)

☐ Poor (1)
☐ Fair (2)
☐ Good (3)
☐ Very Good (4)
☐ Excellent (5)

19. I believe that 10 years from now (~2027), the quality of trout fishing in Georgia will be… (*Check ONE*)

☐ Much Worse (1)
☐ Worse (2)
☐ About the Same (3)
☐ Better (4)
☐ Much Better (5)

20. Some trout streams have special fishing regulations such as only allowing artificial lures or being catch and release only. Do you disagree or agree with the following statements pertaining to these Special Regulation Areas? The scale ranges from 1 = "Strongly Disagree" to 5 = "Strongly Agree." *(Please circle one number per statement)*

Attitudes Towards Special Regulation Areas	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	*Do not Know*
Too many trout waters are managed under special regulations in Georgia	1	2	3	4	5	*dk*
Special Regulation Areas add to my trout fishing satisfaction in Georgia	1	2	3	4	5	*dk*
Special Regulation Areas prevent me from fishing in the manner I prefer	1	2	3	4	5	*dk*
I would fish more if there were more Special Regulation Areas	1	2	3	4	5	*dk*
I am in support of adding more Special Regulation Areas	1	2	3	4	5	*dk*
Special Regulations are confusing	1	2	3	4	5	*dk*

21. Please circle the degree to which the following items act as a barrier or constraint to your ability to trout fish as much as you would like to in Georgia, using a scale where 1= Not a barrier and 4= Major barrier *(Circle ONE Response per item).*

Potential Barriers	Not a Barrier	Slight Barrier	Moderate Barrier	Major Barrier
Costs of trout fishing	1	2	3	4
Quality of trout fishing in Georgia	1	2	3	4
Distance of Georgia's trout waters from my home	1	2	3	4
Ability to access trout fishing locations (e.g., lack transportation)	1	2	3	4
Lack of personal interest in trout fishing	1	2	3	4
Lack of information about Georgia's trout fishing opportunities	1	2	3	4
Difficulty in understanding Georgia's trout fishing regulations	1	2	3	4
My health	1	2	3	4
Limited trout fishing skills	1	2	3	4
Conflicting actions of other trout anglers	1	2	3	4
Crowds on Georgia's trout streams	1	2	3	4
Lack of time to trout fish due to my work obligations	1	2	3	4
Lack of time to trout fish due to my family obligations	1	2	3	4
Lack of friends or family to go trout fishing with	1	2	3	4
Georgia's weather	1	2	3	4

22. How often do you engage in the following strategies to deal with barriers or constraints to trout fishing, using a scale where 1 = "Never" to 5 = "Always"? (*Please circle one number per statement*)

How often do you use these strategies to overcome barriers or constraints to trout fishing?	Never	Rarely	Sometimes	Often	Always
Budget my money so I can afford to go trout fishing	1	2	3	4	5
Use inexpensive fishing equipment to make my trout fishing cheaper	1	2	3	4	5
Organize my work schedule so I have time to go fishing.	1	2	3	4	5
Organize my family obligations so I have time to go fishing	1	2	3	4	5
Carpool/share rides to the trout stream	1	2	3	4	5
Search for uncrowded trout fishing locations	1	2	3	4	5
Search for high quality trout fishing spots	1	2	3	4	5
Accept my lack of trout fishing skills and do the best I can	1	2	3	4	5
Learn to enjoy being outside and stress less about catching fish	1	2	3	4	5
Practice to improve my trout fishing skills	1	2	3	4	5
Seek help to improve my fishing skills	1	2	3	4	5
Study to improve my trout fishing skills (e.g., books, blogs, internet, TV)	1	2	3	4	5
Find people with similar interests to go fishing with	1	2	3	4	5
Encourage family or friends to go fishing with me	1	2	3	4	5

23. Do you disagree or agree with the following statements about to the importance of trout fishing to your lifestyle?
The scale ranges from 1 = "Strongly Disagree" to 5 = "Strongly Agree." ***(Please circle one number per statement)***

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Trout fishing is my main form of outdoor recreation	1	2	3	4	5
I find a lot of my life is centered around trout fishing	1	2	3	4	5
I have strong preferences about the types of trout water I like to fish	1	2	3	4	5
I usually trout fish with people about the same skill level as myself	1	2	3	4	5
Most of my friends have the same interests in trout fishing as I do	1	2	3	4	5

24. How important are the following motivations to why you go trout fishing.
The scale ranges from 1 = "Not at all Important" to 5 = "Very Important." ***(Please circle one number per statement)***

Motivations for trout fishing	Not at all Important	Unimportant	Neutral	Important	Very Important
To try to catch a trophy trout	1	2	3	4	5
To experience solitude	1	2	3	4	5
To be outdoors	1	2	3	4	5
To have thrills	1	2	3	4	5
To spend time with friends and family	1	2	3	4	5
To catch as many fish as possible	1	2	3	4	5
To get away from the regular routine	1	2	3	4	5
To be close to nature	1	2	3	4	5
To experience adventure and excitement	1	2	3	4	5
To be with people of similar values	1	2	3	4	5
To catch fish for eating	1	2	3	4	5
To outwit difficult to catch fish using sophisticated techniques	1	2	3	4	5
To get away from crowds of people	1	2	3	4	5
To be with others who enjoy the same things as me	1	2	3	4	5

25. How would you rate your level of skill as a trout angler?

☐ Novice
☐ Intermediate
☐ Advanced
☐ Expert

26. How much money (total) do think you spent on trout fishing over the last 12 months? (e.g., travel, equipment, licenses)

_____ **($)**

27. Are you a member of an organized angler group (e.g., Trout Unlimited, North GA Trout Online)? → ☐ Yes ☐ No

28. The following questions are about different aspects of trout fishing and trout management.
First, circle the <u>importance</u> of the following aspects of trout fishing and trout management.
Second, circle your level of <u>satisfaction</u> with the current performance of Georgia on the same list of items.

Aspects of Trout Fishing & Trout Management	**<u>How important is/are…?</u>** *1= Not At All Important* *2=Somewhat Unimportant* *3=Neutral* *4= Somewhat Important* *5= Extremely Important* ***Importance Rating (1-5)***	**<u>How satisfied are you with…</u>** *1=Very Dissatisfied* *2=Dissatisfied* *3=Neutral* *4=Satisfied* *5= Very Satisfied* ***Satisfaction Rating (1-5)***
The number of trout you catch	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
The size of the trout you catch	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
Catching wild trout	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
Catching stocked trout	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
Adding new fishable waters	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
Clean bathrooms at access points	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
Clear signage of regulations	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
Campgrounds at access points	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
Access stocking schedules	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
Access reports on fishing conditions	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
The number of trout you see	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
The number of trophy managed trout streams	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
The cost of a trout fishing license	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
The distance to the trout stream from your residence	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
Youth education programs on trout fishing	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
The recruitment of new trout anglers	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5
Habitat improvement initiatives	1 - 2 - 3 - 4 - 5	1 - 2 - 3 - 4 - 5

Don't forget to fill out* ***both columns!* **Don't forget to fill out* ***both columns!*** ☺

29. Which category best describes your race? (*Please mark your answer)*

☐ African American ☐ Asian ☐ American Indian ☐ Caucasian ☐ Hispanic ☐ Other: _____

30. What is the zip code of your current residence? _____ (Please write in)

31. What is the highest level of education you have completed so far?

☐ Less than high ☐ High School or GED ☐ Technical, vocational or trade ☐ Some College (includes junior college)
☐ Bachelor's Degree ☐ Master's Degree ☐ Ph.D./Professional Degree

32. What is your approximate annual household income before taxes?

☐ Less than $25,000 ☐ $25,000-$49,999 ☐ $50,000-$74,999 ☐ $75,000-$99,999 ☐ $100,000-$199,999 ☐ $200,000+

Thank you for taking the time to complete the survey! Please place it in the stamped envelope provided and mail it back to us for a chance to win a GA Lifetime Sportsman License.

If you have any additional comments that you would like to add, please share them on the back of the survey☺

Please share any additional comments that you would like to add here:

If you have any additional questions, please contact:
Bynum Boley, University of Georgia, 180 E. Green St. Athens, GA 30602
email:bboley@uga.edu, phone: 706-583-8930