

**THE VIRGINIA STOCKED TROUT PROGRAM: AN EVALUATION OF CURRENT
AND FORMER ANGLERS**

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Abstract

Trout anglers comprise about 20% of all anglers in Virginia and expended > 1-million angler-days in pursuit of Virginia trout. Stocked trout account for approximately 80% of the trout angling effort in Virginia (O'Neill 2001) through a program managed by the Virginia Department of Game and Inland Fisheries (VDGIF). Each year, the VDGIF stocks > 1-million catchable-sized trout in about 180 waters in Virginia.

Despite the popularity of stocked trout fishing in Virginia, several factors potentially threaten the future of the stocked trout program in Virginia. First, previous surveys indicate that stocked trout anglers are less satisfied with their fishing experiences in Virginia than other species specialists. Additionally, the sale of stocked trout fishing licenses declined 31% between 2006 and 2013. Revenue generated from the sale of trout licenses is a significant source of income that helps fund the stocked trout program.

Given the popularity of stocked trout fishing in Virginia and the considerable effort of VDGIF in managing the stocked trout program, my research objectives were to 1) identify homogenous angler groups seeking stocked trout in Virginia, 2) compare motivations, satisfaction, and preferences of stocked trout anglers in Virginia, and 3) examine the extent to which prior satisfaction and constraints relate to future participation.

To address objectives 1 and 2, I administered a mail survey of 5,400 licensed trout anglers in Virginia. Using cluster analysis, I identified four distinct groups of stocked trout

anglers: traditional anglers, generalists, occasional specialists, and specialists. Traditional anglers constituted the largest group, comprised of those who fished with bait, harvested the stocked trout they caught, fished more frequently than other groups, had low centrality, and invested less money in trout fishing than did other groups. Generalists included those who took fishing-related vacations, fished with a variety of terminal tackle, harvested their catch, and demonstrated low investment in fishing for stocked trout. Occasional specialists fished infrequently, had low centrality, invested little money in fishing, fished with lures and flies, and released the stocked trout they caught. Specialists had high centrality and investment, fished with flies, and almost always released the stocked trout they caught.

Psychological and natural-setting attributes were stronger motives to fish for stocked trout than were fishery and social motives. Anglers rated catching fish as being more important than keeping fish to eat. Overall, anglers were satisfied only somewhat with stocked trout fishing in Virginia. However, anglers rated satisfaction higher with activity-general characteristics, such as the setting and relaxing, than they did activity-specific factors, such as number or size of fish caught.

Results of stated preference choice models indicated that anglers preferred unannounced stockings rather than stockings announced in advance. Furthermore, anglers preferred stocking of streams rather than lakes, stocking taking place during the spring, and catching six 10-inch trout rather than fewer, larger trout. Compared to weekday stockings, anglers did not show a preference for weekend stockings, despite comments made at public meetings suggesting that many anglers preferred weekend stockings. Although four specialization levels exist for Virginia's stocked trout anglers, choice models suggest that preferences coalesced into only two groups: preferences of specialists differed from those of traditional anglers, generalists, and

occasional specialists. When compared to the status quo fishing trip, traditionalists, generalists, and occasional specialists preferred a prior announced stocking, whereas specialists preferred a delayed announcement and catching fewer, but larger, trout.

To address the third objective, I surveyed 1,100 lapsed trout anglers (individuals who had purchased licenses twice between September 1, 2011, and August 31, 2013, but did not purchase one between September 1, 2013, and August 31, 2014). I found that anglers who placed high importance on non-catch-related factors (e.g., being outdoors, enjoying a relaxing experience, experiencing a natural setting) were more likely to fish for stocked trout again in the future. Constraints did not mediate the effect of prior satisfaction on future participation. However, structural constraints were related positively to future participation, suggesting that individuals who had more time and family commitments were more likely to negotiate those constraints and resume participation in the future.

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Table of Contents

Abstract.....	ii
Acknowledgements.....	v
Table of Contents	vii
List of Tables	ix
List of Figures.....	xi
Chapter 1: Introduction	1
Overview and Justification	1
Specialization	4
Motivations	8
Satisfaction.....	10
Stated Preference Choice Models.....	13
Lapsed Anglers.....	15
Study Objectives.....	17
References.....	17
Chapter 2: Heterogeneity, Motivations, and Satisfaction of Stocked Trout Anglers in Virginia	23
Abstract	23
Introduction.....	24
Methods.....	29
Results	31
Specialization.....	31
Motivations.....	33
Satisfaction	34
Experience, License-buying behavior, and Attitudes.....	34
Discussion.....	36
References.....	41
Chapter 3: Fishing Trip Preferences of Stocked Trout Anglers in Virginia.....	51
Abstract	51
Introduction.....	51
Background	53
Methods.....	55
Survey Design and Implementation.....	55
Data Analysis.....	57
Results	58
All Anglers.....	58
Specialists.....	58
Traditionalists.....	59
Generalists	59
Occasional Specialists.....	60
Comparison to status quo fishing trip	61
Discussion.....	61
Management Implications.....	63
References.....	64
Chapter 4: The Effects of Prior Satisfaction and Constraints on the Intention to Resume Fishing in Virginia	69

Abstract	69
Introduction.....	69
Methods.....	74
Sampling.....	74
Questionnaire design.....	74
Survey Implementation.....	75
Data Analysis.....	75
Results	76
Demographics.....	76
Measurement Models.....	77
Structural Models.....	78
Discussion.....	79
References.....	84
Chapter 5: Synthesis.....	96
References.....	103
Appendix A. Mail survey of current trout anglers.	104
Appendix B. Description of choice sets used in all six versions of the survey of current trout anglers.	116
Appendix C. Mail survey of lapsed trout anglers.	122
Appendix D. Summary of responses to question 10 from the lapsed angler survey.....	130
Appendix E. Summary of responses to question 14 from the lapsed angler survey.....	131
Appendix F. Summary of responses to question 17 from the lapsed angler survey.	132

List of Tables

Table 2- 1. Mean (avidity) or percentage (all other variables) for nine cluster analysis variables used to assign trout anglers to one of four angler subgroups based on responses to a mail survey of Virginia stocked trout anglers.....	43
Table 2- 2. Mean responses (scale 1-7) of four stocked trout angler groups in Virginia to statements regarding how important (7) or unimportant (1) various motives were when fishing for stocked trout. * denotes a significant difference in row means ($P < 0.05$). Row means with the same letter are not statistically different (Duncan’s multiple comparison procedure). Cronbach’s alpha values provided in parentheses for each motivation type.	44
Table 2- 3. Mean responses (scale 1-7) of four stocked trout angler groups in Virginia to statements regarding how satisfied (7) or dissatisfied (1) anglers were when fishing for stocked trout. * denotes a significant difference in row means ($P < 0.05$). Row means with the same letter are not statistically different (Duncan’s multiple comparison procedure). Cronbach’s alpha provided in parentheses for each type of satisfaction.	45
Table 2- 4. Percent responses, by angler group, to the question “During the past 5 years, how many years did you fish for stocked trout in Virginia?” Chi-square = 129.091, $P < 0.01$..	46
Table 2- 5. Percent responses, by angler group, to the question “To what extent do you support or oppose the current regulations that allow year-round trout fishing?” Chi-square = 32.12, $P = 0.02$	47
Table 2- 6. Percent responses to the question “What is your preference for how VDGIF announces stocking date and location?” Chi-square = 88.98, $P < 0.01$	48
Table 2- 7. Percent responses by angler group to the question “What bag limit would you prefer?” Chi-square = 227.42, $P < 0.01$	49
Table 2- 8: Mean responses for questions (1-strongly disagree, 7-strongly agree) related to preferences on stocking practices by angler group. Row means with the same letter are not statistically different (Duncan’s multiple comparison procedure).....	50
Table 3 - 1. Attributes used in constructing scenarios for hypothetical fishing trip scenarios for stocked trout anglers in Virginia. The asterisk denotes the reference category for analysis.	66
Table 3 - 2. Coefficient estimates (β) and standard errors (SE) from stated preference choice models for all stocked trout anglers and for four specialization levels in Virginia; * $P < 0.05$, ** $P < 0.01$. ASC is the intercept. L = likelihood.	67

Table 3 - 3: A comparison of predicted probabilities for five alternative fishing-trip scenarios versus the status quo fishing trip. The status quo fishing trip includes a delayed announcement, streams stocked in the spring during the week and anglers catching 6, 10-inch trout.	68
Table 4 - 1. Levels of satisfaction in stocked trout fishing. I asked participants to what extent they agreed with the following statements regarding their past participation in fishing for stocked trout. Responses were provided on a 7-point Likert scale from strongly disagree (1) to strongly agree (7).	88
Table 4 - 2. Constraints related to fishing for stocked trout in Virginia. Participants were asked to what extent they agreed with the following statements regarding past participation in fishing for stocked trout. Responses were provided on a 7-point Likert scale from strongly disagree (1) to strongly agree (7).	89
Table 4 - 3. Final results of confirmatory factor analyses.	90
Table 4 - 4. Results of confirmatory factor analysis for catch-related and non-catch-related satisfaction. See Table 4-2 for variable descriptions.	91
Table 4 - 5. Results of confirmatory factor analysis for intrapersonal, interpersonal, and structural constraints. See Table 4-2 for variable descriptions.	92
Table 4 - 6. Results of structural equation models.	93

List of Figures

Figure 1: Path model showing the direct effects of prior satisfaction on the intention to participate in the future. Standardized regression coefficients are provided.....	94
Figure 2: Path model showing the direct effects of prior satisfaction and constraints on the intention to participate in the future.....	95

Chapter 1: Introduction

Overview and Justification

Trout fishing remains a popular recreational fishery in the United States, one that has significant economic impacts nationally. In 2011, 7.2 million anglers fished for trout in the United States (26% of total anglers), a number surpassed only by anglers who seek black bass (*Micropterus* spp.) (39%) and panfish (*Lepomis* spp.) (27%) (U.S. Department of the Interior 2011). Collectively, anglers spent nearly 76 million days fishing for trout and averaged 11 fishing trips per angler in 2011. That year, trout anglers spent \$3.6 billion nationally fishing for trout, with an overall economic impact of \$8.6 billion. However, the number of trout anglers in the United States has declined since 1996, when an estimated 9 million anglers pursued trout (U.S. Fish and Wildlife Service 2010).

Trout anglers comprised about 20% of the total number of anglers in Virginia and expended an estimated 1.1 million angler-days in pursuit of trout in Virginia in 2011 (U.S. Department of the Interior 2011). Stocked trout account for approximately 80% of the trout angling effort in Virginia (Virginia Department of Game and Inland Fisheries, unpublished document) through a program managed by the Virginia Department of Game and Inland Fisheries (VDGIF). Virginia trout anglers spent > \$50 million pursuing trout in 2008 (VDGIF 2010).

Anglers who fish for stocked trout often have conflicting desires that make management difficult. Forty-three percent of Virginia trout anglers rated “obtaining fish to eat” as a very important or somewhat important reason for fishing, ranking them below anglers of crappie (*Pomoxis* spp.), striped bass (*Morone saxtilis*), and panfish, but much higher than anglers of

black bass; trout anglers and catfish (*Ictalurus sp.* and *Pylodictus olivaris*) anglers rated “obtaining fish to eat” nearly equally (O’Neill 2001). However, 38% of trout anglers rated “catching a trophy fish” as an important reason for fishing. The mix of trout anglers who desire to catch large fish (~40%) and those who want to eat fish (40%) provides evidence of a diverse population of trout anglers. This challenges fishery managers to meet differing demands of producing large fish and sufficient fish for consumption to satisfy trout anglers.

Perhaps more importantly, trout anglers expressed dissatisfaction with freshwater fishing in Virginia more frequently than did other species specialists (22% of trout anglers, compared to 11-17% among other species specialists) (O’Neill 2001). VDGIF found similar results in the 2009 survey of Virginia anglers (VDGIF 2010). In the 2009 survey, 47% of trout anglers (those who spent $\geq 50\%$ of their fishing effort focused on trout) agreed that catching a trophy fish provided their biggest reward, whereas 41% cited bringing fish home to the table as an important outcome of fishing. Thirty-five percent of trout anglers said they often kept the fish they caught (almost twice as many as all anglers combined). Approximately 55% of trout anglers expressed satisfaction (rated ≥ 5 on a 7-point Likert scale) with freshwater fishing in Virginia, compared to 67% of all anglers. Twenty-three percent of trout anglers expressed dissatisfaction with freshwater fishing in Virginia (rated ≤ 3 on a 7-point Likert scale), compared to 16% of all anglers. Both the O’Neill survey and VDGIF’s 2009 angler survey pooled all trout anglers, eliminating the possibility of determining differential satisfaction of anglers who sought stocked trout versus those who sought wild trout.

My research focuses only on anglers who pursue stocked trout. Although the VDGIF surveyed all anglers in 2001 and 2009, the agency selectively surveyed only trout anglers (those individuals required to purchase a trout license to fish for stocked trout) in 2008, to obtain more

specific information on attitudes and opinions on trout management in Virginia. Fifty-seven percent of respondents preferred the put-and-take program to all other trout fishing opportunities provided by VDGIF and anglers spent, on average, 28 days per year fishing for trout. Half of the respondents expressed dissatisfaction with the size and number of trout stocked and anglers disagreed about how to announce stockings. Anglers favored the current year-round season (81%), as opposed to having an opening day, and 59% of responding trout anglers indicated that stocking date did not influence when they fished. However, comments written in the 2008 survey underscored a general dissatisfaction with the stocked trout program; > 30% of respondents indicated that VDGIF did a fair or poor job of providing trout fishing opportunities.

Ditton (2004) advocated inclusion of social components in managing recreational fisheries resources. Human dimensions of natural resources refers to an area of science that attempts to describe, predict, understand, and affect human thought and action toward natural environments (Manfredo et al. 1996). Human dimensions research on recreational fisheries allows managers to understand human thoughts and actions (i.e., motivations, perceptions, behaviors, and satisfaction) regarding fish and management (Hunt et al. 2013). Often, identifying angling sub-groups gives managers a framework for resource allocation and management that improves decision-making (Bryan 1977).

Since about 1980, reliance on human dimensions research to inform decision-making in fisheries and wildlife management has increased (Manfredo et al. 1998). Although catching fish remains an important aspect of the fishing experience, fisheries managers now are beginning to understand the psychological and social motivations that often influence satisfaction (Spencer 1993). Moreover, social science research helps managers work more effectively with stakeholders to improve satisfaction as well as increase support for management programs and

policies (Jakes et al. 1998). Further, the inclusion of human dimensions in fisheries management can help agencies better understand the basis for controversy and conflict so they can address them more effectively.

Specialization

The formal study of outdoor recreation began with the passage of the Outdoor Resources Recreation Review Act in 1958. This act created a national commission responsible for making recommendations on recreation policy, planning, and management guidelines, and how best to meet current and future recreation needs. Additionally, the commission recommended the establishment of the Bureau of Outdoor Recreation in 1962, with objectives to prepare a nationwide recreation plan and manage federal lands for optimal outdoor recreation. The Multiple Use and Sustained Yield Act of 1960 mandated the U.S. Forest Service to consider recreation in its planning activities, thus elevating recreation to a level comparable to timber and wildlife management. Over the next 20 years, numerous acts underscored the growing interest in outdoor recreation and the need for adequate planning and management, including the Renewable Resources Planning Act of 1974, the National Forest Management Act of 1974, and the Federal Land Policy and Management Act of 1976.

Early efforts to examine the role of public involvement in recreation management utilized recreation surveys. Typically, responses from all participants were pooled to produce an average result indicating what all users prefer. However, Shafer (1969) concluded that managers cannot make overall assumptions about survey respondents (campers in this case) because each camper is different. Thus, Shafer (1969) was the first to document user heterogeneity.

Bryan (1977) defined the concept of recreation specialization as a continuum of behavior from the general to the particular, reflected by equipment and skills used and activity-setting

preferences. The four specialization levels he identified for a sample of trout anglers in Montana, Idaho, and Wyoming included occasional anglers, generalists, technique specialists, and technique-setting specialists. Bryan (1977) suggested that more highly specialized anglers become part of a leisure social world that shared a sense of group identification derived from similar attitudes, beliefs, and experiences. Bryan (1977) offered four propositions:

- First, anglers should become more specialized over time, as they gain knowledge, commitment, and skills.
- Second, highly specialized anglers should come to identify themselves as part of a subgroup that has unique attitudes, values, and behaviors.
- Third, anglers should become less consumption-oriented as they become more specialized.
- Fourth, as specialization increases, dependency on particular resource types increases.

The theory of recreation specialization asserts that recreationists progress along a specialization continuum from novice to expert in their chosen recreational pursuit.

Specialization theory predicts that, as level of specialization increases, the importance of activity-specific aspects (those related to catching fish) of the experience will decrease relative to non-activity-specific aspects (e.g., being outdoors, enjoying a relaxing experience). Previous studies of recreation specialization show that recreationists segment into several subgroups whose major attitudes and behaviors vary along their level of specialization in the chosen recreational activity. For example, novice anglers find greater interest in catching and harvesting fish, whereas more specialized anglers shift their concern to resource conservation and environmental protection (Bryan 1977; Ditton et al. 1992). Other research indicates that more-specialized anglers display greater support for management rules than do less-specialized anglers

(Chipman and Helfrich 1988; Ditton et al. 1992; Salz et al. 2001). As specialization levels increase, dependency on specific resources (i.e., specific fishing locations, preferred species, or trophy-size fish) likely will increase (Ditton et al. 1992).

Even though Bryan (1977) pioneered the concept of recreation specialization, he was criticized for his circular reasoning when measuring and defining specialization. For example, metrics of equipment, skills, and setting preferences were used to both define specialization as well as measure specialization (Ditton et al. 1992). Ditton et al. (1992) incorporated ideas from the literature on social worlds (Unruh 1980) and Bryan's work to provide a re-conceptualized version of recreation specialization. Unruh (1980) defined social worlds as constellations of individuals, organizations, events, and practices that have coalesced into a perceived sphere of interest and involvement for participants. Ditton et al. (1992) found that recreation specialization social worlds and subworlds (and their members) varied along a continuum and they offered eight propositions that linked specialization with elements of social worlds and the previous work of Bryan (1977).

Numerous studies have used single-item metrics to describe specialization. Graefe (1980) first used fishing frequency (number of days fished in the previous 12 months) as a univariate measure of angler specialization. Graefe (1980) found that anglers who fished more often (i.e., more specialized anglers) reported higher skill levels, participated in more diverse fishing settings, and felt rewarded by the experience of pursuing and catching fish. By comparing the single-dimension results with items typically found in multiple-dimension measurement instruments, Graefe (1980) discovered that a single-dimension measurement device effectively described specialization. Similarly, Ditton et al. (1992) showed that highly

specialized anglers placed greater importance on catching trophy fish and on resource dependency (e.g., to catch a trophy fish, the more fish I catch, the happier I am) than did less specialized anglers. Examples of situations where single item measures were correlated to multiple-variable measures exist for SCUBA divers (Sorice et al. 2009) and birders (Scott et al. 2005).

Concerns exist that single-item measures may over-simplify specialization and, consequently, other researchers have employed a multi-scale approach, similar to Bryan (1977). For example, Chipman and Helfrich (1988) classified Virginia river anglers by operationalizing specialization using 13 items within four dimensions: the angler's use of the resource, angling experience, monetary investment in fishing equipment, and the centrality of angling to the angler's life. Their work resulted in six specialization subgroups (Chipman and Helfrich 1988).

Hutt and Bettoli (2007) used a multivariate approach to create specialization subgroups of trout anglers in Tennessee tailwaters. They used 14 variables to create five subgroups along the specialization continuum: occasional anglers, casual anglers, generalists, consumptive specialists, and non-consumptive specialists. Occasional anglers rarely targeted trout and occasionally specialized in fishing for other species, but rated low on investment in and centrality for trout fishing. Conversely, both specialist groups placed greater emphasis on catching fish, targeted trout more frequently, and invested more money in trout fishing equipment. The likelihood of conflict over fisheries management decisions increased in fisheries that included anglers from all subgroups (Hutt and Bettoli 2007).

Compared to univariate approaches to specialization classification, multivariate approaches involve more questions and thus longer surveys. Recent research in fields other than fishing has shown the self-classification method to be effective (Scott et al. 2005; Kerins et al.

2007; Sorice et al. 2009). Needham et al. (2009) used a self-classification system at Lost Lake, Oregon, by having anglers rate themselves as Type I (generalist), Type II (intermediate), or Type III (specialist, veteran) anglers. To test its effectiveness, they compared these results to a traditional multivariate approach and found no difference between the two methods. A self-classification approach resulted in a high level of replicability across groups of Texas SCUBA divers (Sorice et al. 2007). Success of the self-classification measure relies on well-thought-out and detailed descriptions of respective subgroups derived from previous research.

Despite widespread use of recreation specialization, disagreement remains on its definition and measurement. However, specialization remains a key concept in the understanding of users and management of resources. Specialization provides a framework for understanding users' attitudes and behaviors. Improved understanding of user heterogeneity increases the probability of successful resource planning and policy.

Motivations

Research on angler motivations indicates that the reasons why people fish vary (Fedler and Ditton 1994; O'Neill 2001; Ditton 2004; Hutt and Bettoli 2007). Knopf et al. (1973) first reported that four main factors motivate anglers: temporary escape, achievement, exploration, and experiencing natural settings. Matlock et al. (1988) suggested that catching fish motivates anglers to fish and researchers refer to these as catch-related motivations. Ditton (2004) further stated that, within specialization groups, catch-related motives vary. For instance, some angler groups seek fish to eat as a primary motive, whereas more specialized groups seek trophy fish or fish for the experience of the catch (Fedler and Ditton 1994). Highly specialized Virginia river anglers preferred resource-related motives such as catching a trophy fish, using fishing skills needed to catch fish, catching and releasing larger fish, and supporting restrictive harvest

regulations (Chipman and Helfrich 1988). Hutt and Bettoli (2007) found greater differences among mean ratings for five groups of trout anglers in Tennessee tailwaters for the motive “obtaining fish to eat,” which nonconsumptive specialists ranked much lower than the other four groups.

Non-catch related attributes also motivate people to fish. Fedler and Ditton (1994) reviewed 17 angler motivation studies and found that psychological-physiological motivations (e.g., relaxing, getting away from daily routines) ranked “very important” in all 17 studies. Similarly, “experiencing the natural environment” (spending time outside) also ranked high in most studies. Although anglers expressed a desire to get away from other people, many believed fishing was a good way to spend time with friends and family. Less specialized Virginia river anglers cited “escape” and “family-oriented recreation” as motivations for fishing, emphasized the role of luck when catching fish, were satisfied with catching smaller fish, and favored liberal harvest regulations (Chipman and Helfrich 1988). In Tennessee tailwaters, trout anglers rated “fishing with friends” highly across all specialization groups (Hutt and Bettoli 2007).

People participate in recreational activities to achieve different goals or satisfy individual needs. Angler motivations relate to outcomes individuals desire from fishing experiences, whereas satisfaction is determined by the difference between the outcomes an angler desires and the perceived fulfillment of those outcomes (Driver and Knopf 1976; Holland and Ditton 1992; Arlinghaus 2006). This definition clearly distinguishes motivation from satisfaction; motives are a prerequisite to satisfaction (Arlinghaus 2006). Among anglers, motivations comprise the social, psychological, and catch-related attributes that stimulate an angler to go fishing (pre-trip), whereas satisfaction measures how well the trip fulfilled those motivations (post-trip).

Satisfaction

Satisfaction is a multidimensional concept affected by numerous variables, some of which managers may control and many they cannot (Manning 2011). Broad, general measures of satisfaction may have little utility to managers. Widely varying interpretations of satisfaction complicate its measurement. Stakeholders are diverse socially, economically, and culturally and, as a result, exhibit widely disparate levels of motivation, preferences, attitudes, and norms (Graefe and Fedler 1986). Thus, if satisfaction among trout anglers is to be used as an indicator of the quality of fishing experiences, knowledge of angler specialization is required.

The Outdoor Recreation Resources Review Commission defined quality of outdoor recreation in terms of visitor satisfaction (ORRRC 1962) and, in general, managers use satisfaction to measure quality of outdoor recreation experiences (Manning 2011). In outdoor recreation, visitor satisfaction relates to elements of resource, social, and managerial environments (Williams 1989). Hendee (1974) stated that recreation resources offer people a range of experiences that produce differing satisfactions. Specifically, Hendee (1974) realized that users derived satisfaction from multiple factors in addition to harvesting game; a multiple-satisfaction approach to game management makes it possible to increase satisfaction, through better management of hunter-wildlife relationships and surrounding conditions. For anglers, satisfaction often relates to catching fish or some aesthetic aspects of the fishing trip (Spencer 1993). However, to assure satisfaction for all groups, managers need to identify the full suite of factors that promote quality experiences.

Satisfaction in outdoor recreation varies with socio-economic and cultural background and managers should strive to serve this diversity rather than manage for the preferences of one particular group (Manning 2011). Crowding has been well studied and underscores the

multidimensional aspect of satisfaction and the need for multiple-item scales to measure satisfaction (Ditton et al. 1981). Conflict among groups and activities commonly occurs in outdoor recreation and likely increases as the demand for outdoor recreation continues to grow. Substitutability, the extent to which one recreation activity might substitute for another, may affect economic efficiency in providing recreation opportunities and meeting growing demand for recreation to maximize satisfaction (Manning 2011).

Angler satisfaction often correlates with catching fish. Holland and Ditton (1992) defined angler satisfaction as the difference between the outcomes one desires or thinks should be received (motivations) and the fulfillment of those psychological outcomes. Hampton and Lackey (1976) also related satisfaction to expectations (satisfaction = benefits – expectations) using Virginia fee fishing areas as an example; here, stocking practices (the expectancy of catch) appeared to affect angler satisfaction more than the actual catch itself (Hampton and Lackey 1976). The number of walleye caught and size of fish caught correlated with trip satisfaction for anglers in Lake Miltona, Minnesota (Spencer and Spangler 1992). Additionally, successful anglers (at least one fish caught or kept) showed greater fishing and trip satisfaction than did unsuccessful anglers (Spencer 1993). However, social motivations also correlated positively with trip satisfaction. The author concluded that anglers with different motivations experienced different satisfactions in the field (Spencer 1993). In a stochastic model of recreational fisheries, van Poorten et al. (2011) found that angler satisfaction depended on catch, which then influenced the demands stakeholders placed on managers to stock fish and maintain fisheries. This interplay between social dynamics and resource availability affected the formation of a stocking-based model strongly affected by angler catch (satisfaction) and previous fishing success (van Poorten et al. 2011). In Germany, anglers strongly motivated by catching fish were less satisfied

than anglers with intermediate and lower catch orientations. However, for all three angler segments, satisfaction encompassed activity-specific, mostly catch-oriented, components of the fishing experience. Patterson and Sullivan (2013) found a nonlinear, positive relation between satisfaction (dependent variable) and angler catch. Finally, the probability of an increase in angler satisfaction rating correlated positively with mean length and number of Rainbow Trout (*Oncorhynchus mykiss*) caught per hour in Oregon streams (McCormick and Porter 2014).

Non-catch related factors such as aesthetic and social factors also influence angler satisfaction. Only 4% of anglers in a Texas sportfishing association indicated that catching a fish accounted for most of their satisfaction, whereas enjoyment of nature and perceived freedom had greater influence on satisfaction (Holland and Ditton 1992). However, members of that sportfishing association likely constituted a segment of highly specialized anglers who, by definition, have less interest in catch aspects of fishing. Spencer (1993) reported that in addition to catching fish, outdoor and social aspects of fishing in Lake Miltona also significantly influenced satisfaction. Spencer (1993) found that outdoor motivations correlated positively with trip satisfaction, but not catch criteria. Fedler and Ditton (1994) showed that nonconsumptive anglers showed greater perceived satisfaction with their fishing experience than did catch-oriented anglers.

Fisheries management has become multidimensional as economic and social assessments have gained equal footing with biological considerations (Spencer 1993). This transition parallels the shift in management goals from biological objectives rooted in maximum sustained yield to more social goals of optimum sustainable yield (Royce 1983). Improved fisheries management therefore relies on a clearer understanding of angler satisfaction through an evaluation of fishing success and socio-economic-cultural variables.

Stated Preference Choice Models

Often used in transportation and marketing research, discrete choice modeling (DCM) analyzes the choice behavior of individuals and groups who face hypothetical alternatives. A discrete choice model is one in which decision makers choose among a set of alternatives with the goal of understanding the behavioral process that leads to their choice and the associated tradeoffs. By identifying patterns in these choices, DCM models show how different consumers respond to competing products, allowing marketers to examine the relative impact of competing attributes. Researchers in natural resources have only begun to appreciate the utility of understanding a person's choice preference.

Thurstone (1927) proposed the theoretical framework for DCM using random utility theory. Specifically, random utility theory defines utility as a latent construct existing in an individual that researchers cannot observe (Louviere et al. 2010). Random utility theory assumes that two components comprise the latent utilities that affect choices: an observed (explainable) component, and a random (unexplainable) component. Observed components explain differences in choice alternatives and covariates explaining differences in individuals' choices, whereas random components comprise all unidentified factors that affect choice. Discrete choice models use data on individuals' decisions as well as the attributes that comprise the alternatives. If sufficient variability exists in attribute levels across choices and/or alternatives, the modeler can estimate coefficients in a multinomial logit model that indicates the relative importance of those attributes to the decision outcome and thus interpret individuals' preferences.

Stated preference choice modeling (SPCM) evaluates alternatives that do not exist yet (hypothetical choices). SPCM models require an experimental design that can control for interactions among attributes; the first step in an experimental design involves selecting

attributes and levels within attributes. In SPCM, respondents choose among alternative configurations of a multi-attribute product or service (Louviere and Timmermans 1990). The modeler defines each alternative configuration (profile) by varying levels of selected attributes of the good (Mackenzie 1993). The relative importance of each attribute to the overall utility reflects respondents' choices among the alternatives. Preferences for alternative combinations of the attribute levels result from SPCM models (Dennis 1998).

Outdoor recreation researchers (Lawson and Manning 2002; Newman et al. 2005; Cahill et al. 2007; Sorice et al. 2007) and, to a lesser extent, fisheries researchers (Aas et al. 2000; Kim and Oh 2013) have employed stated preference choice analysis to address diverse research questions. In Denali National Park, Alaska, Lawson and Manning (2002) used SPCM to determine the relative importance of six attributes of backpacking in the park. In Yosemite National Park, California, campers identified signs of human use at campsites as the most important detractor for experiencing a wilderness experience and the authors used the results to build simple preference models in Excel for managers (Newman et al. 2005). Cahill et al. (2007) used a stated choice survey to evaluate the relative importance of resource, social, and management attributes of hikers in Acadia National Park. Sorice et al. (2007) used SPCM to investigate the choices divers make in selecting diving trips to marine protected areas. Angler preferences for fishing opportunities afforded to anglers in Norway were determined with SPCM (Aas et al. 2000). Finally, Kim and Oh (2013) used SPCM to evaluate value-added products and services in the for-hire fishing boat industry.

Generally, research on angler preferences has relied on researchers asking a series of independent questions without the ability to synthesize responses. SPCM surpasses static questioning as a powerful tool for measuring preferences and evaluating choices and tradeoffs

(Aas et al. 2000). With SPCM, researchers can evaluate angler preferences for complex sets of regulations (a management program) and possible consequences on the fish stocks in a more holistic manner than in the traditional opinion-measurement approach (Aas et al. 2000).

Lapsed Anglers

By the 1990s, many states experienced declining or stagnant license sales. Declining license sales suggest that participation in fishing by some license buyers has lapsed (referred to as lapsed anglers), which causes concern for a number of reasons (Summers and Costello 2008). First, declining license sales reduce agency income, which could result in less public, financial, and political support for fisheries management efforts (Sutton 2007). Additionally, local businesses that depend on angling could suffer economic loss. Finally, angling provides a quality-of-life benefit that, if not replaced, could affect users negatively (Sutton 2007).

Few studies have examined reasons why angling participation lapses. Fedler and Ditton (1994) reported that about 25% of Texas anglers in a particular year will become inactive within 1 or 2 years. Anglers reported “a lack of time” as their most common constraint and also their most important reason for not fishing. In Australia, 70% of anglers reported lack of time, crowding, unavailability of facilities, and expense as constraints; anglers with higher income, a higher degree of centrality to their lifestyle, motivation by non-catch factors, and male anglers experienced constraints more frequently (Sutton 2007). The primary reasons for lapsed participation by Australian anglers included lack of time, loss of interest, and poor fishing quality (Sutton et al. 2009). Most lapsed anglers reported engaging in other leisure activities since ceasing fishing, but half reported an interest in fishing again (Sutton et al. 2009). Sutton et al. (2009) also found that, when anglers ceased fishing, reasons varied by age, gender, and income.

Additionally, lapsed anglers reported engaging in other leisure activities since ceasing fishing, but half reported an interest in fishing again (Sutton et al. 2009).

Factors that interfere with individuals' ability to achieve the satisfaction or benefits they seek represent leisure constraints (Sutton 2007). Clark (1996) found that ceasing participation in leisure activities related to the challenges, commitments, motivations, and constraints of users. Challenges refer to an individual's skill set being too slight or too great, both of which can lead to ceasing participation (Backman and Crompton 1989). Further, financial commitments in the activity predicted continued participation most reliably (Backman and Crompton 1989). People engage in leisure activities for a number of reasons and these motivations can lead to lapses in participation (Fedler and Ditton 1994). For instance, anglers who fish for non-catch-related motives (seeking solitude, being outside, etc.) have a higher probability of lapsing.

Individuals cease to participate in leisure activities due to various constraints (Clark 1996). Crawford and Godbey (1987) classified constraints as intrapersonal, interpersonal, and structural factors that prevent someone from participating. Intrapersonal constraints are those involving the individual's internal psychological processes that affect preferences toward activities, whereas interpersonal constraints result from interaction with other individuals (e.g., having a social group with which to participate) (Crawford et al. 1991). Interpersonal constraints affect both preferences toward and participation in activities. Finally, structural constraints consist of those factors usually thought of as interfering with recreation participation (e.g., time, money, opportunity, access, and equipment) (Sutton 2007).

Understanding why angling participation lapses may provide insight for agencies to address declining license sales. If agencies understand constraints better, they can implement more effective angler retention programs.

Study Objectives

Previous survey research conducted by VDGIF suggests that Virginia's stocked trout anglers differ in a number of attributes related to stocked trout fishing. Further, stocked trout anglers are less satisfied with their fishing experiences in Virginia than other species specialists (VDGIF, unpublished data). Finally, the number of annual trout licenses sold declined 31% between 2006-2013. Each of these indicate that a thorough evaluation of stocked trout anglers is needed to better manage the program.

My research focused on assessing heterogeneity, motivations, preferences, and satisfaction of stocked trout anglers in Virginia. Additionally, I wanted to elucidate why stocked trout anglers lapsed and what factors may cause them to participate again in the future. The results of my study complement information collected from creel surveys of stocked trout anglers on 17 sites across the state (Hyman 2015). Specifically, my project addressed the following objectives:

1. Characterize anglers who fish for stocked trout in Virginia using the theory of recreational specialization.
2. Determine the differences between specialization groups in their motivations, preferences, and satisfaction levels for stocked trout fishing.
3. Identify factors related to lapses in participation and intentions to participate in the future.

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Chapter 2: Heterogeneity, Motivations, and Satisfaction of Stocked Trout Anglers in Virginia

Abstract

In Virginia, anglers fish for trout more than any other species except Black Bass *Micropterus spp.* Stocked trout account for approximately 80% of the trout angling effort in Virginia through a program managed by the Virginia Department of Game and Inland Fisheries (VDGIF). I conducted a mail survey of 5,400 licensed stocked trout anglers in Virginia to assess angler heterogeneity, motivations, and satisfaction. Using cluster analysis, I identified four distinct groups of stocked trout anglers: traditional anglers, generalists, occasional specialists, and specialists. Traditional anglers constituted the largest group, composed of those who fished with bait, harvested the stocked trout they caught, fished more frequently than other groups (even though trout fishing was not as important in their lives as was true with other groups; thus low centrality), and invested less in trout fishing than did other groups. Generalists took fishing-related vacations, fished with a variety of terminal tackle, harvested their catch, and demonstrated low investment in fishing for stocked trout. Occasional specialists fished infrequently, had low centrality, invested little money in fishing, fished with lures and flies, and released the stocked trout they caught. Specialists had high centrality and investment, fished with flies, and almost always released the stocked trout they caught. Psychological and natural-setting attributes were stronger motives to fish for stocked trout than were fishery and social motives. Anglers rated catching fish as more important than keeping fish to eat. Overall, anglers were satisfied only somewhat with stocked trout fishing in Virginia. However, anglers rated satisfaction higher with activity-general characteristics, such as the setting and relaxing, than they did activity-specific factors, such as number or size of fish caught. Results of this study

offer opportunities to consider both activity-general and activity-specific characteristics when developing policy to improve satisfaction of stocked trout anglers.

Introduction

Trout anglers comprised about 20% of all anglers in Virginia and expended about 1.1 million angler-days in pursuit of trout in Virginia in 2011 (U.S. Department of the Interior 2011); they also spent >\$50 million pursuing trout in 2008 (VDGIF 2010). Stocked trout account for approximately 80% of the trout angling effort in Virginia (O'Neill 2001) through a program managed by the Virginia Department of Game and Inland Fisheries (VDGIF).

Anglers who fish for stocked trout often have conflicting desires that make management difficult. Forty-three percent of Virginia trout anglers rated “obtaining fish to eat” as a very important or somewhat important reason for fishing. However, 38% of trout anglers rated “catching a trophy fish” as an important reason for fishing (O'Neill 2001). The mix of trout anglers who desire to catch large fish (~40%) and those who want to eat fish (40%) provides evidence that trout anglers have multiple motivations. This challenges fishery managers to meet differing demands of producing large fish and sufficient fish for consumption to satisfy trout anglers.

Perhaps more importantly, trout anglers expressed dissatisfaction with freshwater fishing in Virginia more frequently than did any other fish-species specialists (22% of trout anglers, compared to 11-17% among other species specialists) (O'Neill 2001). The VDGIF found similar results in a 2009 survey of Virginia anglers (VDGIF 2010). In the 2009 survey, 47% of trout anglers (those who spent $\geq 50\%$ of their fishing effort focused on trout) agreed that catching a trophy fish provided their biggest reward, whereas 41% cited bringing fish home to the table as an important outcome of fishing. Thirty-five percent of trout anglers said they often kept the fish

they caught (almost twice as many as all anglers combined). Approximately 55% of all trout anglers expressed satisfaction (rated ≥ 5 on a 7-point Likert scale) with freshwater fishing in Virginia, compared to 67% of all anglers. Twenty-three percent of trout anglers expressed dissatisfaction with freshwater fishing in Virginia (rated ≤ 3 on a 7-point Likert scale), compared to 16% of all anglers. Both surveys pooled all trout anglers, eliminating the possibility of determining differential satisfaction of anglers who sought stocked trout versus those who sought wild trout.

The two surveys of Virginia anglers suggest that trout anglers are a heterogeneous population. To understand heterogeneity, Bryan (1977) defined recreation specialization as a continuum of behavior from the general to the particular, reflected by equipment and skills used and activity-setting preferences. The four specialization levels he identified for a sample of trout anglers in Montana, Idaho, and Wyoming included occasional anglers, generalists, technique specialists, and technique-setting specialists. Bryan (1977) suggested that more-highly specialized anglers become part of a leisure social world that shared a sense of group identification derived from similar attitudes, beliefs, and experiences. Bryan (1977) offered four propositions. First, anglers should become more specialized over time, as they gain knowledge, commitment, and skills. Second, highly specialized anglers should identify themselves as being part of a subgroup that has unique attitudes, values, and behaviors. Next, anglers should become less consumption-oriented as they become more specialized. Finally, as specialization increases, dependency on particular resource types increases.

As level of specialization increases, the importance of activity-specific aspects of the experience (those related to catching fish) will decrease relative to non-activity-specific aspects (e.g., being outdoors, enjoying a relaxing experience). Previous studies of recreation

specialization show that recreationists segment into several subgroups whose major attitudes and behaviors vary along their level of specialization. For example, novice anglers find greater interest in catching and harvesting fish, whereas more-specialized anglers shift their concern to resource conservation and environmental protection (Bryan 1977; Ditton et al. 1992). Other research indicates that more-specialized anglers display greater support for management regulations than do less-specialized anglers (Chipman and Helfrich 1988; Ditton et al. 1992; Salz et al. 2001, Hutt and Bettoli 2007). As specialization levels increase, dependency on specific resources (i.e., specific fishing locations, preferred species, or trophy-size fish) likely increase (Ditton et al. 1992).

Research on angler motivations indicates that the reasons why people fish vary (Fedler and Ditton 1994; O'Neill 2001; Ditton 2004; Hutt and Bettoli 2007). Knopf et al. (1973) first reported that four non-catch factors motivate anglers: temporary escape, achievement, exploration, and experiencing natural settings. However, Matlock et al. (1988) suggested that catching fish motivates anglers to fish. Ditton (2004) further stated that, within specialization groups, catch-related motives vary. For instance, some angler groups seek fish to eat as a primary motive, whereas more specialized groups seek trophy fish or fish for the experience of the catch (Fedler and Ditton 1994). Highly specialized Virginia river anglers preferred resource-related motives such as catching a trophy fish, using fishing skills needed to catch fish, catching and releasing larger fish, and supporting restrictive harvest regulations (Chipman and Helfrich 1988). Hutt and Bettoli (2007) found that, for trout anglers in Tennessee tailwaters, specialists rated all motives higher than other angler groups.

Non-catch related attributes also motivate people to fish. Fedler and Ditton (1994) reviewed 17 angler motivation studies and found that psychological-physiological motivations

(e.g., relaxing, getting away from daily routines) ranked “very important” in all 17 studies.

Similarly, experiencing the natural environment (spending time outside) also ranked high in most studies. Although anglers expressed a desire to get away from other people, many believed fishing was a good way to spend time with friends and family. Less-specialized Virginia river anglers cited “escape” and “family-oriented recreation” as motivations for fishing, emphasized the role of luck when catching fish, were satisfied with catching smaller fish, and favored liberal harvest regulations (Chipman and Helfrich 1988). In Tennessee tailwaters, trout anglers rated “fishing with friends” highly across all specialization groups (Hutt and Bettoli 2007).

Angler satisfaction often correlates with catching fish. Holland and Ditton (1992) defined angler satisfaction as the difference between the outcomes one desires or thinks should be received (motivations) and the fulfillment of those psychological outcomes. Hampton and Lackey (1976) also related satisfaction to expectations (satisfaction = benefits – expectations) using Virginia fee fishing areas as an example. Stocking practices (the expectancy of catch) appeared to affect angler satisfaction more than the actual catch itself (Hampton and Lackey 1976). The number of walleye caught and size of fish caught correlated with trip satisfaction for anglers in Lake Milona, Minnesota (Spencer and Spangler 1992). Additionally, successful anglers (at least one fish caught or kept) showed greater fishing and trip satisfaction than did unsuccessful anglers (Spencer 1993). However, social motivations also correlated positively with trip satisfaction. The author concluded that anglers with different motivations experienced different satisfactions in the field (Spencer 1993). In a stochastic model of recreational fisheries, van Poorten et al. (2011) found that angler satisfaction depended on catch, which then influenced the demands stakeholders placed on managers to stock fish and maintain fisheries. This interplay between social dynamics and resource availability affected the formation of a stocking-

based model that was affected strongly by angler catch (satisfaction), but previous fishing success also influenced satisfaction (van Poorten et al. 2011). In Germany, anglers strongly motivated by catching fish were less satisfied than were anglers with intermediate and lower catch orientations. However, for all three angler segments, satisfaction encompassed activity-specific, mostly catch-oriented, components of the fishing experience. Patterson and Sullivan (2013) found a nonlinear, positive relation between satisfaction (dependent variable) and angler catch. Finally, the probability of an increase in angler satisfaction rating correlated positively with mean length and number of Rainbow Trout (*Onchorhynchus mykiss*) caught per hour in Oregon streams (McCormick and Porter 2014).

Non-catch related factors such as aesthetic and social factors also influence angler satisfaction. Only 25% of anglers in a Texas sportfishing association indicated that catching a fish accounted for most of their satisfaction, whereas enjoyment of nature and perceived freedom had greater influence on satisfaction for the remainder of the group (Holland and Ditton 1992). However, members of that sportfishing association likely constituted a segment of highly specialized anglers who, by definition, have less interest in catch aspects of fishing. Spencer (1993) reported that, in addition to catching fish, outdoor and social aspects of fishing in Lake Miltona also significantly influenced satisfaction. Spencer (1993) found that outdoor motivations correlated positively with trip satisfaction, but not catch criteria. Fedler and Ditton (1994) found that non-consumptive anglers showed greater perceived satisfaction with their fishing experience than did catch-oriented anglers.

Previous survey research conducted by VDGIF suggested that Virginia's stocked trout anglers differed from each other in a number of attributes related to stocked trout fishing. Further, stocked trout anglers were less satisfied with their fishing experiences in Virginia than

were other fish-species specialists (VDGIF 2010). Finally, the number of annual trout licenses sold declined 31% between 2006 and 2013. The combination of these factors led VDGIF to conclude that a thorough evaluation of stocked trout anglers is needed to better manage the program.

My research focused on assessing heterogeneity, motivations, and satisfaction of stocked trout anglers in Virginia. Specifically, my research addressed the following objectives:

1. To characterize anglers who fish for stocked trout in Virginia using the concept of recreational specialization.
2. To describe motivations and satisfaction for each specialization group of stocked trout anglers.

Methods

The study population consisted of Virginia residents who purchased a license to fish for stocked trout between April 1, 2013 and March 31, 2014. I sampled proportionally among three different license types: general trout license (50%), sportsman's license (6%), and lifetime license (44%). I administered a 12-page mail survey to 5,400 anglers using the modified Dillman design (Dillman 2007). The first contact conveyed a personalized letter detailing the study's purpose and how they were selected, a questionnaire, and a pre-paid business reply envelope. On Day 14, I sent a follow-up/thank you postcard and, on Day 28, I sent all non-respondents a reminder containing a second copy of the questionnaire, another pre-paid business-reply envelope, and a personalized cover letter. The survey closed on Day 60, after using only three contacts, which is the maximum allowable number under Virginia Tech's Institutional Review Board current protocols. The questionnaire collected data on angling behavior, motivations, preferences, satisfaction, opinions, and demographics.

I used a recreational specialization framework to assess angler heterogeneity (Bryan 1977, Ditton et al. 1992). Following the methods of Chipman and Helfrich (1988) and O'Neill (2001), I assessed specialization of anglers who fish for stocked trout by calculating z-scores to standardize responses to nine questions (from each of four dimensions) previously correlated with specialization (Chipman and Helfrich 1988). Fishing-magazine subscriptions, fishing-related club membership, and fishing-related vacations comprised the centrality dimension (Table 1). I measured investment by asking participants how much money they spent fishing for stocked trout in the last 12 months and their total investment in fishing equipment. To assess avidity, I asked participants to estimate the number of days spent fishing in the last 12 months for any fish species as well as for stocked trout. Finally, I measured catch orientation by asking participants what type of terminal tackle they most often fish with and how frequently they harvest the stocked trout they catch. I then used hierarchical cluster analysis (Ward's method with Euclidian distances) on standardized z-scores to cluster the anglers into homogenous groups. I conducted analysis for 3 to 5 clusters and visually inspected the cluster dendrogram to determine the final number of clusters.

To assess motivations of stocked trout anglers, I asked participants to indicate how important a variety of motives were when choosing to fish for stocked trout using a scaled response from 1 (extremely unimportant) to 7 (extremely important). I asked 16 questions (Table 2) to measure four types of motivation for fishing for stocked trout: fishery (e.g., to catch fish to eat), psychological (e.g., opportunity for relaxation), natural setting (e.g., to be outdoors), and social (e.g., to be with friends and/or family). Using analysis of variance (ANOVA) with Duncan's multiple comparison procedure, I tested mean motivations among specialization levels.

To assess satisfaction of stocked trout anglers, I asked participants how satisfied they were with their stocked trout fishing experiences during the previous 12 months using a scaled response from 1 (extremely dissatisfied) to 7 (extremely satisfied). I asked 11 questions to assess two different types of satisfaction (Table 3). I assessed activity-general satisfaction by asking six questions (e.g., experiencing a natural setting) and activity-specific satisfaction with five questions (e.g., number of stocked trout caught). I tested mean satisfaction among specialization levels using ANOVA with Duncan's multiple comparison procedure.

The remaining questions assessed angling experience, license-buying behavior, and attitudes toward components of the stocked trout program. I measured support for year-round trout fishing and preferences for how VDGIF announces stocking date and location. I asked anglers about their preference for decreasing, maintaining, or increasing the creel limit (currently 6-fish/day). I assessed preferences for stocking frequency and size of trout stocked and if anglers preferred fishing in lakes, small streams, or large streams. I also asked if anglers purchased a general fishing license primarily to fish for stocked trout. Finally, I assessed demographics by asking respondents' age, gender, and employment status.

Results

Respondents returned 1,815 surveys, of which 296 were returned as undeliverable, yielding an effective response rate of 35.6%. The average age of respondents was 57 and 91% were male. Employment status parsed out as retired (47%), employed (46%), student (3%), unemployed (2%), and homemaker (1%).

Specialization

The cluster analysis ($N = 1,415$) resulted in a 4-cluster solution. I labeled the first cluster, which had 146 respondents (10%), as specialists. Specialists fished an average of 21 days per

year, but only 8 days for stocked trout (specialists fished for wild trout 6 days per year). Eighty-eight percent of specialists never or rarely harvested the stocked trout they caught and 83% fished exclusively with flies (Table 1). Conversely, <1% of specialists fished with bait. Seventy-five percent belonged to a fishing-related organization, 81% subscribed to a fishing-related magazine, and 84% had taken a fishing-related vacation within the last 12 months. Twenty percent of specialists spent >\$2,000 during the previous 12 months fishing for stocked trout and 43% had >\$3,000 invested in fishing equipment.

The second cluster had 625 anglers (44%) and represented the traditional stocked trout angler. Traditional anglers fished 33 days per year, 16 of which were spent fishing for stocked trout (Table 1). Traditional anglers frequently harvested the stocked trout they caught (57%) and many (39%) fished exclusively with bait. Evidence of the lack of centrality of fishing for stocked trout to the lifestyle of traditional anglers included few magazine subscriptions (32%), club memberships (11%), or fishing-related vacations (43%). Most (93%) traditional anglers spent <\$1,000 fishing for stocked trout during the previous year and 78% had invested <\$1,000 in fishing equipment.

I classified 162 anglers (11%) as generalists. Generalists fished an average of 37 days per year, 18 of which were for stocked trout (Table 1). Generalists were harvest-oriented, as 39% almost always harvested the stocked trout they caught. Most (62%) fished with a combination of bait, lures, and flies. Many generalists took a fishing-related vacation (70%), but few belonged to an organization (11%) or subscribed to a fishing-related magazine (40%). Generalists (76%) spent between \$1,000-3,000 fishing for stocked trout during the previous year and most (65%) had invested \$1,000-3,000 in equipment.

I labeled the fourth cluster as occasional specialists ($N = 482$; 34%). Occasional specialists only fished 14 days per year, 6 of which were for stocked trout (Table 1). Occasional specialists never (43%) or rarely (20%) harvested the stocked trout they caught and few fished with bait (9%). Stocked trout fishing was not central to their lifestyle as few of them belonged to an organization (3%), subscribed to a magazine (15%), or took a fishing-related vacation (30%). The majority (94%) of occasional specialists spent $< \$1,000$ in the previous 12 months fishing for stocked trout. Similarly, most (73) invested $< \$1,000$ in fishing equipment.

Motivations

Of the four types of motivations, “fishing in a natural setting” had the highest mean score, whereas social motives had the lowest (Table 2). The question with the highest overall score was “the joy of catching fish.” Surprisingly, the question that had the lowest score was to “catch fish to eat” (4.39). All four-motivation categories displayed inverse relationships to age, which suggests that motives were stronger for younger anglers ($r = -0.07$ to -0.11 , $P < 0.01$).

Fishery motivations differed significantly among specialization groups (Table 2, $P < 0.01$). Traditionalists and generalists, who harvested stocked trout more frequently, were more motivated by items such as “catching fish to eat” or “catching a trophy fish” than were specialists and occasional specialists. Conversely, I did not detect a difference in psychological and physiological motivations among the four groups ($P = 0.91$). Psychological and physiological motives varied by only 0.1 among the four clusters. Specialists were motivated more strongly by fishing in a natural setting (e.g., to be outdoors, to be close to the water) than were the other three clusters ($P = 0.01$). Finally, no difference existed ($P = 0.40$) among the four clusters for social motives.

Satisfaction

Satisfaction scores varied among angler groups. Overall satisfaction with the stocked trout program was higher for specialists than for the other three angler groups (Table 3, $P < 0.01$). On a 7-point scale, all anglers rated satisfaction with activity-general characteristics 5.6, which was higher than the 4.5 rating for activity-specific characteristics. Traditionalists and generalists rated satisfaction with activity-general attributes of stocked trout fishing higher than did either specialist group ($P = 0.02$). The activity-general satisfaction questions that rated highest were “enjoying a relaxing experience” and “being outdoors,” whereas the question with the lowest score was “not feeling crowded.” No difference existed among the four angler groups ($P = 0.07$) for activity-specific satisfaction. Anglers expressed neutral satisfaction with the number of big stocked trout caught (mean = 3.9), but moderately satisfied with the largest trout caught (mean = 4.5) and the number of stocked trout caught (mean = 4.6).

Activity-general and activity-specific satisfactions were not related to years spent fishing for trout, age, or distance the angler was willing to travel to have a satisfactory fishing experience. Frequency of fishing in the previous five years was related positively to both activity-general ($r = 0.22$, $P < 0.01$) and activity-specific ($r = 0.08$, $P < 0.01$) satisfaction.

Experience, License-buying behavior, and Attitudes

Respondents had fished for stocked trout in Virginia an average of 29 years. Traditionalists (32 years) and generalists (33 years) fished more years than either of the two specialist groups (26 and 25 years for specialists and occasional specialists, respectively) ($P < 0.01$). When asked how many of the previous five years respondents had fished, a significant difference existed among clusters ($X^2 = 129.1$, $P < 0.01$); specialists and occasional specialists fished fewer years than other groups (Table 4). A higher percentage of individuals in these

specialist groups also did not fish at all in the previous five years and fewer fished in all five of the previous years. Specialists were willing to drive 465 miles for a satisfying trout fishing experience, significantly ($P < 0.01$) farther than the other three angler groups (traditionalists = 95 miles, generalists = 137 miles, occasional specialists = 98 miles). Angler groups differed slightly regarding support or opposition for regulations that allow year-round trout fishing (Table 5, $P = 0.03$). Occasional specialists were more apt to be neutral than the other three groups. However, $\geq 70\%$ of all four angler groups strongly or moderately supported year-round trout fishing, whereas $\leq 6\%$ strongly or moderately opposed year-round trout fishing.

The distribution of responses for stocking announcement type also differed among angler groups (Table 6, $P < 0.01$). Nearly half of specialists preferred unannounced stockings; only 11% supported announcing all dates and locations of stockings at the start of the season. Conversely, about half of traditionalists (51%) and generalists (47%) preferred a prior announcement. For those anglers those preferring a prior announcement, announcements each day and announcements at the start of the season rated higher than weekly and monthly announcements.

Specialists were more supportive of reducing the daily creel limit, whereas the other three angler groups preferred maintaining the creel limit at six trout/day (Table 7, $P < 0.01$). Most responses regarding trout the frequency of stocking and size of fish stocked (Table 8) clustered about the neutral point (range = 3.5-4.4). No difference existed for three of the questions (“I would prefer to see larger trout stocked even if that means fewer trout per stocking” (mean = 4.4), “I would prefer the stream to be stocked less often with more trout per stocking” (mean = 3.5), and “I would rather catch one or two big trout than 6 smaller trout” (mean = 4.3). Although specialists and occasional specialists rated the item “I would prefer to see more trout stocked

even if the trout were smaller” higher than the other two angler groups, mean responses still hovered near the mid-point (overall mean=3.8). Similarly, both of those specialist groups preferred to see trout stocked more often with fewer trout per stocking. Finally, specialists significantly preferred that VDGIF not stock trout in locations that currently support wild trout ($P < 0.01$).

Discussion

The stocked trout anglers represented in this study reflect a heterogeneous population that differed slightly in avidity, investment, centrality, and resource use. My results are similar to prior angler specialization studies (Graefe 1980, Chipman and Helfrich 1988, Ditton et al. 1992, Hutt and Bettoli 2007, Hyman 2015) that identified anglers as ranging from low to high specialization, as originally described by Bryan (1977). Hutt and Bettoli (2007) identified five angler groups among those who fish for stocked trout in Tennessee tailwaters and ranged from minimally to highly specialized. Similar to what Hutt and Bettoli (2007) detected, I found stocked trout anglers were more harvest-oriented at lower specialization levels (traditionalists and generalists), spent less money on stocked trout fishing, and had low centrality. However, anglers surveyed in Virginia fished for stocked trout substantially fewer times per year compared to Tennessee anglers.

Although I identified four distinct groups of stocked trout anglers, specialists and occasional specialists responded similarly on many management-related questions, and traditionalists and generalists often closely aligned to each other. This suggests that managers may be able to diversify stocked trout fishing opportunities in Virginia by designing a program that reflects the diversity of the anglers by focusing on two groups of anglers rather than four. For example, specialists and occasional specialists likely would support restrictive gear

regulations, reduced creel limits, and unannounced stockings. Conversely, traditionalists and generalists would favor more-liberal gear restrictions and creel limits, and stockings announced in advance. Thus, specialization provides a conceptual framework for examining how angler heterogeneity interacts with management activities.

Studying motivations provides insight into why anglers fish. The importance of specific motivations to anglers has been debated and includes activity-general and activity-specific motives (Calvert 2002). Anglers rated all motives as important (≥ 4), but some interesting differences existed among groups. “Fishing in a natural setting” was the highest rated of the four categories of motivations and specialists placed greater emphasis on this as a motive to fish for stocked trout. Similarly, Hutt and Bettoli (2007) found that “being outdoors” was a stronger motive for more specialized groups. Both specialists groups rated fishery motives lower than traditionalists and generalists. This likely relates to harvest orientation – specialists release most of the stocked trout they catch, whereas traditionalists and generalists harvest stocked trout more frequently. This finding is similar to motivations of Tennessee stocked trout anglers, where less specialized anglers placed greater emphasis on catching and harvesting trout (Hutt and Bettoli 2007). Similarly, “catching fish to eat” was a weaker motive for specialists than it was for traditionalists and generalists. Anglers rated psychological and physiological motives highly, and no differences existed among angler groups. Conversely, Hutt and Bettoli (2007) found that specialists rated psychological motivations higher than did other angler groups. Finally, social motives rated lower in importance than other motives among Virginia anglers, but still were moderately important to stocked trout anglers across all groups, which is similar to the results of Fedler and Ditton (1994).

Understanding why people fish for stocked trout has important implications. First, understanding why people fish is fundamental to understanding angler behavior (Fedler and Ditton 1994). Second, managers need to be aware of how motives vary when developing and/or modifying programs, and the effect that may have on anglers. Given the advancing average age of respondents in my study (57 years) and the 31% decline in sales of annual stocked trout licenses from 2006 to 2013, managers with VDGIF need to examine and understand why anglers fish for stocked trout if they hope to meet the diverse motives I observed in this study. Understanding and responding to the diverse motives could help in retaining current anglers and potentially recruit new ones.

In general, satisfaction was high for all groups, but I found that specialists, those anglers with a lower catch orientation, had a higher overall satisfaction with stocked trout fishing than did other angler groups. Additionally, activity-general satisfaction was higher than activity-specific satisfaction for all angler groups. Fisheries managers have greater control over activity-specific attributes and results here suggest that improvements can be made with the number and size of trout caught. Results also suggest that improved satisfaction across all groups is possible. Diversifying stocking practices could improve angler satisfaction. For example, some sites could be managed for higher angler catch rates while others could receive fewer, but larger, trout. On stocked trout streams in Oregon, McCormick and Porter (2014) found that an increase in angler satisfaction was related positively to an increase in mean length and number of fish caught per hour. Hyman (2015) found that catch rate and the importance an angler placed on catching something significantly affected the probability of an angler reporting high satisfaction. It generally is not practical for VDGIF to stock more, larger fish, but a diverse stocking program that includes sites managed for higher catch rates and other sites managed for fewer, but larger,

trout may improve overall satisfaction. This approach requires outreach efforts to direct anglers to waters that are managed to better meet their expectations.

Virginia's stocked trout anglers expressed moderate satisfaction with activity-general attributes. However, similar research has produced conflicting results. Patterson et al. (2013) found that satisfaction among stocked trout anglers in Alberta did not relate to catch rates. These authors contended that proximity of fishing sites, physical setting, social factors, and personal experience influenced angler satisfaction more than catch rates. Matlock et al. (1988) concluded that the consumptive aspects of fishing were more important than the social-psychological attributes often measured. Spencer (1993) found that satisfaction of anglers at Lake Miltona, Minnesota, varied between those with consumptive versus non-consumptive motives. Results here suggest that VDGIF should consider promoting activity-general attributes of stocked trout fishing in addition to activity-specific attributes.

Hampton and Lackey (1976) proposed that fisheries managers consider activity-general characteristics when developing management plans. Weithman and Anderson (1978) suggested that managers not concern themselves with factors they cannot control. However, fishery managers may be able to affect the quality of an outdoor experience (Spencer 1993). For example, anglers motivated by being outdoors or enjoying a relaxing experience while fishing for stocked trout may seek pristine locations that are litter free. Limited entry or special regulations could be desirable to anglers who seek less crowded conditions or to be alone. Results of this study offer VDGIF opportunities to consider both activity-general and activity-specific characteristics when developing policy to improve satisfaction of stocked trout anglers.

Effective fisheries management considers not only the fishery, but habitat and users as well. Stocking hatchery-raised trout creates fisheries where they otherwise would not exist.

Agencies manage these “put-and-take” fisheries to provide short-term angling recreation. Therefore, habitat generally is not an issue as agencies stock fish when water temperatures favor high survival. Understanding the population dynamics of hatchery-raised trout may be less important (do they grow, what is the survival rate, do they “holdover” and recruit to the population) than for wild fish or fished stocked in a put-grow-take fishery. Consideration of the human dimensions of stocked trout users may be most important when managing these artificial fisheries. Therefore, effective stocked-trout management relies on understanding angler characteristics, motivations, and preferences to maximize satisfaction.

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Table 2- 1. Mean (avidity) or percentage (all other variables) for nine cluster analysis variables used to assign trout anglers to one of four angler subgroups based on responses to a mail survey of Virginia stocked trout anglers.

Cluster variable	Angler group			
	Specialist <i>N</i> = 143	Traditional <i>N</i> = 625	Generalist <i>N</i> = 162	Occasional Specialist <i>N</i> = 482
Centrality				
Club membership				
Yes	75	11	11	3
No	25	89	89	97
Magazine subscription				
Yes	81	32	40	15
No	19	68	60	85
Fishing vacation				
Yes	84	43	30	30
No	16	57	70	70
Investment				
Money spent fishing				
≤ \$1,000	50	93	20	94
\$1,000-1,999	29	7	57	6
\$2,000-2,999	10	0	19	0
≤ \$3,000	11	0	4	0
Total investment				
≤ \$1,000	12	78	6	73
\$1,000-1,999	24	17	35	19
\$2,000-2,999	21	4	30	5
≤ \$3,000	43	1	29	3
Avidity				
Days fished all species	21	33	37	14
Days fished for stocked trout	8	16	18	6
Catch orientation				
Terminal tackle				
Flies	83	3	4	27
Lures	11	7	11	24
Combination	5	52	70	39
Bait	1	39	16	9
Harvest frequency				
Never	67	2	5	43
Rarely	22	6	7	20
Occasionally	8	16	22	21
Often	3	18	27	10
Almost always	0	57	39	6

Table 2- 2. Mean responses (scale 1-7) of four stocked trout angler groups in Virginia to statements regarding how important (7) or unimportant (1) various motives were when fishing for stocked trout. * denotes a significant difference in row means ($P < 0.05$). Row means with the same letter are not statistically different (Duncan's multiple comparison procedure). Cronbach's alpha values provided in parentheses for each motivation type.

Statement	Angler group			
	Specialist	Traditional	Generalist	Occasional Specialist
Fishery* (0.49)	4.7 ^a	5.3 ^c	5.5 ^c	5.0 ^b
Challenge of fishing	5.8	5.6	5.7	5.7
Catch fish to eat*	2.5 ^a	5.1 ^c	4.9 ^c	4.0 ^c
Joy of catching fish	6.1	6.1	6.6	6.1
Catch a trophy fish*	4.3 ^{ab}	4.6 ^b	4.7 ^b	4.1 ^a
Psychological/physiological (0.79)	5.5	5.4	5.5	5.4
Getting physical exercise	4.8	4.9	4.9	4.9
Opportunity for relaxation	6.0	5.9	5.9	5.9
Get away from the daily routine	5.9	5.9	6.0	6.0
Experience new/different things	5.1	4.9	5.0	4.8
Natural setting* (0.54)	6.3 ^a	5.7 ^b	5.7 ^b	5.8 ^b
Scenic quality of the area	6.0	5.8	5.8	5.8
To be outdoors	6.1	6.1	6.1	6.1
To be close to the water*	6.6 ^a	5.3 ^b	5.1 ^b	5.5 ^b
Social (0.52)	5.1	5.1	5.1	5.0
To be alone	4.8	4.7	4.6	4.8
To be with friends/family	5.5	5.6	5.7	5.5
Introduce someone to trout fishing*	5.0 ^a	5.0 ^a	5.2 ^a	4.6 ^b

Table 2- 3. Mean responses (scale 1-7) of four stocked trout angler groups in Virginia to statements regarding how satisfied (7) or dissatisfied (1) anglers were when fishing for stocked trout. * denotes a significant difference in row means ($P < 0.05$). Row means with the same letter are not statistically different (Duncan's multiple comparison procedure). Cronbach's alpha provided in parentheses for each type of satisfaction.

Statement	Angler group			
	Specialist	Traditional	Generalist	Occasional Specialist
Overall satisfaction*	5.5 ^a	4.9 ^b	5.1 ^b	5.1 ^b
Activity-specific satisfaction (0.83)	4.7	4.5	4.6	4.4
Number of trout caught*	4.9 ^a	4.6 ^a	4.9 ^a	4.3 ^b
Size of largest trout caught*	4.8 ^a	4.5 ^{ab}	4.6 ^{ab}	4.3 ^b
Trout distribution	4.5	5.1	4.5	4.3
Average size of trout caught	4.7	4.4	4.3	4.3
Number of big trout caught	4.2	3.9	4.0	4.0
Activity-general satisfaction* (0.80)	5.5 ^a	5.6 ^{ab}	5.7 ^b	5.5 ^a
Interactions with other anglers*	5.1 ^a	5.5 ^b	5.5 ^b	5.1 ^a
Information provided by VDGIF	5.3	5.3	5.1	5.1
Not feeling crowded	4.6	4.8	4.8	4.9
Experiencing a natural setting	5.8	5.7	5.9	5.7
Relaxing experience*	5.9 ^a	6.0 ^{ab}	6.2 ^b	5.8 ^a
Being outdoors*	6.3 ^{ab}	6.4 ^{ab}	6.5 ^b	6.2 ^a

Table 2- 4. Percent responses, by angler group, to the question “During the past 5 years, how many years did you fish for stocked trout in Virginia?” Chi-square = 129.091, P < 0.01.

Item	Angler group			
	Specialist	Traditional	Generalist	Occasional Specialist
0 years	6.9	2.2	1.2	11.9
1 year	4.2	6.4	2.5	11.9
2 years	9.7	8.2	2.5	9.4
3 years	13.2	11.2	10.6	11.2
4 years	7.6	6.6	4.3	7.4
5 years	58.3	65.4	78.9	58.5

Table 2- 5. Percent responses, by angler group, to the question “To what extent do you support or oppose the current regulations that allow year-round trout fishing?” Chi-square = 32.12, P = 0.02.

Item	Angler group			
	Specialist	Traditional	Generalist	Occasional Specialist
Strongly oppose	4.1	3.9	1.9	2.5
Moderately oppose	1.4	2.3	3.1	2.3
Slightly oppose	4.1	5.2	8.7	2.5
Neutral	11.0	10.7	9.3	17.6
Slightly support	3.4	5.8	4.3	5.5
Moderately support	15.8	18.6	18.6	19.5
Strongly support	60.3	53.5	54.0	50.1

Table 2- 6. Percent responses to the question “What is your preference for how VDGIF announces stocking date and location?” Chi-square = 88.98, P < 0.01.

Response	Angler group			
	Specialist	Traditional	Generalist	Occasional Specialist
Unannounced	49.0	20.6	22.2	33.3
Announced at 4PM day of stocking	25.9	28.2	30.9	24.4
Prior-8AM each day	4.2	18.0	10.5	8.4
Prior-8AM each week	7.0	9.1	6.2	6.7
Prior-8AM each month	3.5	2.1	3.7	2.9
Prior-at the start of the stocking season	10.5	22.0	26.5	24.2

Table 2- 7. Percent responses by angler group to the question “What bag limit would you prefer?” Chi-square = 227.42, P < 0.01.

Response	Angler group			
	Specialist	Traditional	Generalist	Occasional Specialist
Decrease the limit to less than 6/day	53.8	8.0	9.3	15.3
Increase the limit to more than 6/day	0.7	16.8	13.6	6.3
Maintain the current limit at 6/day	45.5	75.2	77.2	78.7

Table 2- 8: Mean responses for questions (1-strongly disagree, 7-strongly agree) related to preferences on stocking practices by angler group. Row means with the same letter are not statistically different (Duncan's multiple comparison procedure).

Response	Angler group			
	Specialist	Traditional	Generalist	Occasional Specialist
Prefer more trout stocked even if smaller*	4.0 ^a	3.7 ^{ab}	3.5 ^b	3.9 ^a
Prefer larger trout stocked even if fewer	4.2	4.4	4.5	4.3
Prefer more stockings with fewer trout*	4.8 ^a	4.2 ^b	4.2 ^b	4.5 ^a
Prefer less stockings with more trout	3.3	3.6	3.5	3.6
Prefer to catch 1 or 2 big trout than 6 smaller	4.2	4.3	4.3	4.5
Prefer no trout stocked in sites that support wild trout*	5.4 ^a	4.2 ^{bc}	4.1 ^c	4.5 ^b

Chapter 3: Fishing Trip Preferences of Stocked Trout Anglers in Virginia

Abstract

This study sought to understand choices anglers make when fishing for stocked trout in Virginia. I surveyed 1,439 stocked trout anglers and used a stated preference choice model to evaluate choices anglers make related to stocking announcements, type of water stocked, season trout are stocked, day of week stocked, and the size and number of trout that anglers prefer to catch. When having to make a decision about whether to “go on a trip” as described or not go due to the scenario’s established pre-conditions, anglers chose a fishing trip in 94% of the trip choice situations presented to them, and each attribute was significant. Surprisingly, anglers did not prefer stockings announced in advance nor weekend stockings. Anglers preferred unannounced stockings, stocking streams rather than lakes, stockings that occur during the spring, and catching six 10-inch trout rather than fewer, larger trout. Although four specialization levels exist for Virginia’s stocked trout anglers, choice models suggest that preferences coalesced into only two groups; preferences of specialists differed from those of traditional anglers, generalists, and occasional specialists. Traditionalists, generalists, and occasional specialists preferred a prior announced stocking, whereas specialists preferred a delayed announcement and catching fewer, but larger, trout. Creating a diverse stocking program based on attributes measured in this study should help managers meet the desires of a diverse constituency of stocked trout anglers in Virginia.

Introduction

Trout anglers comprised about 20% of all anglers in Virginia and expended about 1.1 million angler-days in pursuit of Virginia trout in 2011 (U.S. Department of the Interior 2011);

they also spent >\$50 million pursuing trout in 2008 (VDGIF 2010). Stocked trout account for approximately 80% of the trout angling effort in Virginia (O'Neill 2001) and is supported through a program managed by the Virginia Department of Game and Inland Fisheries (VDGIF).

Trout anglers express dissatisfaction with freshwater fishing in Virginia more frequently than do any other fish-species specialists (22% of trout anglers, compared to 11-17% among other species specialists, O'Neill 2001). In a 2009 survey, 47% of trout anglers (those who spent $\geq 50\%$ of their fishing effort focused on all trout) agreed that catching a trophy fish provided their biggest reward, whereas 41% cited bringing fish home to the table as an important outcome of fishing (VDGIF 2010). Approximately 55% of trout anglers expressed satisfaction (rated ≥ 5 on a 7-point Likert scale) with freshwater fishing in Virginia, compared to 67% of all anglers. Twenty-three percent of trout anglers expressed dissatisfaction with freshwater fishing in Virginia (rated ≤ 3 on a 7-point Likert scale), compared to 16% of all anglers.

To enhance satisfaction, fishery managers require information on angler preferences. Angler preferences for various management alternatives have received less research attention than other human dimensions research areas (Oh et al. 2005). Traditionally, public involvement in fisheries management has consisted primarily of 1-way communication occurring at open-admission, large public meetings and, therefore, angler preferences were understood poorly; as a result, important decision-making lacked true public input and often was left to the manager's discretion. With the advent of human dimensions as a subdiscipline of fisheries science, fisheries managers began measuring stakeholders values and preferences (McMullin and Pert 2010).

Early research on angler preferences relied on researchers asking a series of independent questions (static questioning) without the ability to synthesize responses. Stated preference

choice modeling (SPCM) can enhance understanding of preferences and evaluating choices and tradeoffs by evaluating angler preferences for complex sets of regulations and possible consequences on the fish (Aas et al. 2000). The purpose of my study is to better understand preferences and tradeoffs of anglers for stocked trout management. Further, I sought to identify how these preferences and tradeoffs varied among various specialization levels of stocked trout anglers.

Background

The VDGIF currently announces most trout stockings at 4 PM the day of stocking and stockings most often occur during the spring, in streams, and on weekdays. Additionally, the size and density of trout stocked promote anglers catching more trout that are smaller in size (trout stocked typically range from 10-12 inches in length). However, many anglers prefer different attributes. In a survey of Virginia trout anglers conducted in 2014, 28% of respondents preferred unannounced trout stockings, whereas 45% preferred stockings announced in advance (see Chapter 2). Additionally, 52% of anglers preferred to catch one or two large trout rather than six smaller trout. During public meetings in 2013 and 2015, many trout anglers asked VDGIF to stock more frequently on weekends. Because of these disparate preferences among anglers, evaluations of alternative management scenarios to existing approaches to trout stocking are needed as a means to potentially meet these varied desires of anglers.

Bryan (1977, 1979) defined the concept of recreation specialization as a continuum of behavior from the general to the particular, reflected by equipment and skills used and activity-setting preferences. The four specialization levels he identified for a sample of trout anglers in Montana and Wyoming included occasional anglers, generalists, technique specialists, and technique-setting specialists. Bryan (1977) suggested that more-highly specialized anglers

become part of a leisure social world that shares a sense of group identification derived from similar attitudes, beliefs, and experiences. Bryan (1977) offered four propositions. First, anglers should become more specialized over time, as they gain knowledge, commitment, and skills. Second, highly specialized anglers should identify themselves as part of a subgroup that has unique attitudes, values, and behaviors. Third, anglers should become less consumption-oriented as they become more specialized. Fourth, as specialization increases, dependency on particular resource types increases. These propositions formed the cornerstone of subsequent research on recreation specialization.

The concept of recreation specialization asserts that recreationists progress along a specialization continuum from novice to expert in their chosen recreational pursuit. As level of specialization increases, the importance of activity-specific aspects of the experience will decrease relative to non-activity-specific aspects. Previous studies of recreation specialization show that recreationists segment into several subgroups characterized by the attitudes and behaviors displayed as the level of specialization in the chosen recreational activity varies. For example, novice anglers find greater interest in catching and harvesting fish, whereas more specialized anglers shift their concern to resource conservation and environmental protection (Bryan 1977; Ditton et al. 1992, Hutt and Bettoli 2007, Hutt et al. 2013). Other research indicates that more-specialized anglers display greater support for management rules than do less-specialized anglers (Chipman and Helfrich 1988; Ditton et al. 1992; Salz et al. 2001, Hutt and Bettoli 2007). As specialization levels increase, dependency on specific resources (i.e., specific fishing locations, preferred species, or trophy-size fish) likely will increase (Ditton et al. 1992, Beardmore et al. 2013, Ward et al. 2013).

Stocked trout anglers face a number of decisions on whether to take a fishing trip, and many of the attributes that affect these decisions are controlled directly by the VDGIF. My goal was to better understand attribute selection in multi-attribute trip profiles for stocked trout fishing in Virginia. I used stated preference choice models to estimate marginal utilities to examine the effect of varying attributes on fishing trip selection. Since stocked trout anglers are not a homogenous group, I posited that trip preferences would vary with specialization levels. My study objectives included measuring the importance of various attributes when stocked trout anglers choose between hypothetical fishing trips. I also compared the predicted probabilities of choosing a fishing trip for a variety of alternatives to the status quo fishing trip. Analysis of fishing trip preferences allows VDGIF to make informed decisions on stocked trout management.

Methods

Survey Design and Implementation

To better understand angler preferences, I surveyed, using a self-administered mail questionnaire, 5,400 trout anglers who were licensed to fish during the period of January 1 – December 31, 2013. Anglers must possess both a general fishing license and a trout license to fish for stocked trout in Virginia. In lieu of an annual trout license, many anglers purchase a lifetime trout license. I used a modified Tailored Design Method (Dillman 2007). My first contact conveyed a personalized letter detailing the study's purpose and how participants were selected, a questionnaire, and a pre-paid business-reply envelope. On Day 14, I sent everyone a follow-up/thank you postcard, and, on Day 28, all non-respondents were sent a second copy of the questionnaire, another pre-paid business-reply envelope, and a personalized cover letter. The

survey closed on Day 60, after using only three contacts, which is the maximum allowable number under Virginia Tech's Institutional Review Board current protocols.

I selected five attributes related to trout stocking based on comments received from stocked trout anglers at public meetings and discussions with VDGIF fisheries staff. Attributes reflected real decisions that anglers make when selecting a fishing trip and decisions that VDGIF makes regarding stocking trout (Table 3-1). The first attribute reflects how VDGIF announces stockings, which can be announced in advance on Mondays, announced at 4 PM the day of stocking, or not be announced at all. For the second attribute, I provided anglers the option of trout being stocked in a lake or a stream. For the third attribute, trout could be stocked in the fall (October-November), winter (December-February), or spring (March-May). Trout could be stocked either on weekdays or weekends for the fourth attribute. Finally, anglers could select whether they prefer catching six, 10-inch trout or two, 14-inch trout.

The various levels for the five attributes produced 72 possible choice sets that participants could face. A factorial design including all combinations of attribute levels provides independent estimation of each attribute effect (Oh et al. 2005). To reduce respondent burden, I employed a fractional factorial design consisting of 24 choice sets divided into six blocks, each with four choice sets. Separate survey versions then were designed for each of the six blocks and 900 individuals were assigned randomly to receive one of the four versions. Generating fractional factorial designs involves reducing the number of choice sets needed to estimate the desired effects while maintaining orthogonality (every attribute is uncorrelated) of the full factorial (Bennett and Adamowicz 2001).

The development of SPCM is based on random utility theory, which assumes that individuals make choices to maximize utility (Manski 1977). I asked participants to select a

hypothetical fishing trip for stocked trout based on different levels of attributes. Based on this stated preference, utility is estimated through an indirect utility function that is comprised of a deterministic component and random error (Louviere et al. 2000). The deterministic component produces a coefficient for each attribute, which then can be used to assess the marginal utility for each attribute. Marginal utilities demonstrate the individual contribution of each attribute and can be used to rank policy scenarios (Oh et al. 2005).

Data Analysis

I used the recreation specialization framework to assess angler heterogeneity (Bryan 1977, Ditton et al. 1992). Following the methods of Chipman and Helfrich (1988) and O'Neill (2001), I assessed specialization of anglers who fish for stocked trout by calculating z-scores to standardize responses to nine questions previously correlated with specialization (Chipman and Helfrich 1988, see Chapter 2).

I fit SPCM models for all anglers and for each specialization level using a conditional logit. The use of a conditional logit assumes homogeneity of preferences across the surveyed population, which, based on specialization research, rarely occurs (Hutt et al. 2013). By computing a separate SPCM model for each specialization level, I accounted for heterogeneity of preferences of stocked trout anglers. For each SPCM model, I estimated marginal utilities.

I computed the probability of taking a fishing trip based on the attributes that occur most frequently and refer to this scenario as the “status quo”. The status quo fishing trip included announcing stockings at 4 PM the day of stocking (delayed announcement), stocking in a stream, during the spring, on a weekday, and anglers catching six 10-inch trout. I then computed predicted probabilities for alternative fishing-trip scenarios (by varying announcement type and size and number of trout caught) to compare to the status quo fishing trip. How VDGIF

announces stockings and whether anglers prefer catching more/smaller or fewer/larger trout has been a great source of controversy for VDGIF. Therefore, I first varied announcement type and held the other four attributes constant. Then, I calculated a predicted probability of taking a fishing trip by just varying the number/size of trout caught. Finally, I varied both announcement type and number/size of trout caught while holding the other three attributes constant.

Results

Of the 5,400 surveys sent out, 296 were returned as undeliverable. I received 1,815 completed surveys, for an effective response rate of 35.6%. Of the 1,815 returned, I was unable to conduct cluster analysis on 376 surveys due to incomplete responses. Therefore, sample size for these analyses was 1,439 surveys.

All Anglers

Respondents selected one of 2 fishing trip alternatives over the “no trip” option in 94% of the choice sets. In the overall model, all attributes were significant (Table 3-2, $P < 0.05$).

Anglers preferred unannounced stockings to delayed announcements and delayed announcements to stockings announced before. Anglers preferred trout stocked in streams versus lakes and they preferred spring stocking to fall stocking and preferred fall stockings to winter stockings. Weekday stockings were preferred over weekend stockings. Finally, anglers preferred catching six 10-inch trout compared to catching two 14-inch trout.

Specialists

Specialists constituted 10% (N = 148) of all respondents. Specialists typically fish with flies and almost always release the trout they catch. Fishing is central to their lifestyle, as they often belong to fishing-related organizations, subscribe to fishing-related magazines, and vacation to fish. Additionally, specialists spend more money fishing for stocked trout and have

invested more in fishing equipment than have anglers in other specialization levels (see Chapter 2).

Specialists preferred delayed announcements and fishing for stocked trout in streams rather than in lakes (Table 3-2). No significant difference existed in angler utility among seasons, suggesting that when compared to fishing in the fall, specialists did not prefer fishing in the winter or the spring. The significant negative coefficient for weekends indicates that specialists preferred weekday stockings. Specialists had no preference for the number and size of trout caught.

Traditionalists

Traditional anglers (44%, N = 636) often fish with bait, and most harvest the stocked trout they catch. Fishing for stocked trout was not central to their lifestyle, as evidenced by the lack of magazine subscriptions, club memberships, and fishing-related vacations. Most traditional anglers spent <\$1,000 fishing for stocked trout during the previous year and had invested <\$1,000 in fishing equipment (see Chapter 2).

Traditional anglers preferred unannounced stockings to delayed announcements (Table 3-2). When compared to delayed announcements, prior announcements were not a significant predictor of trip choice. Traditional anglers favored streams significantly over lakes. Fall stockings were preferred to winter, but there was no difference in preference between fall and spring stockings. Traditional anglers favored weekday stockings over weekend stockings and catching more, but smaller, trout over larger but fewer fish.

Generalists

Generalists (11%, N = 162) fished more frequently than all other groups. They were harvest-oriented, and most fished with a combination of bait, lures, and flies. Many generalists

took a fishing-related vacation, but few belonged to an organization or subscribed to a fishing-related magazine. Generalists spent between \$1,000 and 3,000 fishing for stocked trout during the previous year and most had invested between \$1,000 and 3,000 in equipment (see Chapter 2).

Generalists showed no preference for an announcement type as neither unannounced nor prior-announced stockings were significant predictors of trip choice over delayed announcements. Generalists showed a significant preference for streams over lakes. Compared to fall stockings, generalists did not favor winter stockings, but did prefer that stockings occur in the spring. Weekend stockings were not a significant predictor of trip choice and generalists preferred catching more, but smaller, trout rather than catching fewer, but larger trout.

Occasional Specialists

Occasional specialists (34%, N = 493) rarely harvested the stocked trout they caught and few fished with bait. Stocked trout fishing was not central to their lifestyle, as most did not belong to an organization, subscribe to a magazine, or take a fishing-related vacation. The majority of occasional specialists spent <\$1,000 in the previous 12 months fishing for stocked trout. Similarly, most occasional specialists invested <\$1,000 in fishing equipment.

Occasional specialists preferred delayed stocking announcements over announcements prior to stocking, but there was no preference between delayed and unannounced stockings (Table 3-2). Similar to other specialization groups, occasional specialists preferred stockings in streams rather than in lakes. Fall stockings were preferred to winter stockings, but no difference existed between fall and spring stockings. No difference existed between weekday and weekend stockings, and occasional specialists preferred catching more, but smaller, trout, over larger but fewer fish.

Comparison to status quo fishing trip

Finally, I compared angler preferences for the status quo fishing trip to five alternative fishing trips (Table 3-3). The status quo fishing trip consisted of a delayed announcement, stockings that occur in the spring, in streams, and on a weekday, and anglers preferring to catch six 10-inch trout. For all anglers, the only alternative fishing trip that had a higher probability of being chosen included a prior announcement and anglers catching six, 10-inch trout. Traditionalists, generalists, and occasional specialists selected this latter alternative as the preferred option, whereas specialists preferred stockings announced at 4PM the day of stocking, and catching two, 14-inch trout. Generally, the alternative fishing trip with the lowest probability of being selected had unannounced stockings and two, 14-inch trout caught.

Discussion

My study sought to understand angler preferences for various attributes of fishing trips for stocked trout. The VDGIF controls all five of the attributes explored in this study; therefore, a better understanding of choices that anglers make when choosing a fishing trip provides not only insight into angler behavior, but also a model for designing a stocking program that better meets anglers' preferences.

Previous studies have suggested that many anglers prefer that stockings be announced in advance to allow better planning of fishing trips (see Chapter 2, Hyman et al. 2016). However, results from choice models indicate that overall, anglers preferred that stockings be announced at 4:00 PM the day of stocking or be unannounced. The non-significant coefficient for stockings announced in advance, for traditionalists and generalists, is surprising given the support noted in other surveys. This suggests that given a choice that includes other trip attributes, these two angler groups prefer the status quo announcement type or perhaps more likely, that

announcement type is less important than other attributes I evaluated. In this study, a prior announcement meant that all stockings would be announced weekly on Mondays. It could be that anglers would be more supportive of an alternative prior announcement (daily, monthly, or for the entire season).

Given a choice of fishing lakes or streams, Virginia's stocked trout anglers strongly preferred fishing in streams. This preference for stream fishing was stronger for specialists who fish with fly-fishing equipment. Bryan (1977) found similar results when studying trout anglers in Montana, Wyoming, and Idaho. In that study, 100% of technique-setting specialists preferred fishing small streams, whereas 21-31% of the other specialization groups preferred lakes (Bryan 1977).

Overall, Virginia's stocked trout anglers preferred fishing in the spring, followed by the fall, and then the winter. The VDGIF stocks trout from October through May each year (warm water temperatures preclude stocking trout from June to September in most stocked trout waters). Hyman et al. (2016) found that fishing effort for stocked trout in Virginia was highest in the spring, lowest in the winter, and moderate in the fall. Our results indicate that VDGIF should stock trout in the fall and spring to maximize angler utility.

The VDGIF conducts most trout stockings on weekdays, which was preferred by specialists and traditionalists, which is surprising given that anglers have expressed during public meetings an interest in being able to better plan fishing trips. This observation is of particular relevance to hatchery managers as stocking during the week allows more flexibility in getting waters stocked during the traditional work week compared to stocking on weekends.

Trout anglers often desire to catch more and larger fish (see Chapter 2), which is not feasible given hatchery constraints. The attribute I modeled in this study provided realistic

choices of the number and size of trout that can be stocked. Results indicate that most stocked trout anglers prefer to catch more, but smaller, fish. Generally, specialists prefer a fishing experience that includes catching larger fish (Beardmore et al. 2013), but in my study, specialists did not show a significant preference for catching two 14-inch trout over six 10-inch trout.

Management Implications

Developing a trout-stocking program that maximizes angler utility requires an understanding of the importance of stocking announcements, waterbody type, season, day of the week, and the number and size of trout that anglers prefer to catch. These five attributes represent decisions that VDGIF managers must make when stocking trout. Generally, anglers preferred the status-quo fishing trip that consisted of a delayed announcement, spring stocking on a stream during the week, and catching six 10-inch trout. To improve satisfaction, VDGIF can alter attributes to better meet the preferences and characteristics of angler groups. For example, specialists, who generally practice catch and release and fish with flies, may favor a stream stocked with fewer, but larger, trout and one that is managed with special regulations. Alternatively, other angler groups might prefer prior announcements on some sites. Creating a diverse stocking program based on attributes I measured should fulfill the desires of a diverse constituency of stocked trout anglers in Virginia.

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Table 3 - 1. Attributes used in constructing scenarios for hypothetical fishing trip scenarios for stocked trout anglers in Virginia. The asterisk denotes the reference category for analysis.

Attribute	Level 1	Level 2	Level 3
Stocking announcement	Unannounced	Announced prior to stocking on Mondays at 8 AM	Delayed – announced at 4:00 PM the day of stocking*
Type of water	Trout are stocked in a stream	Trout are stocked in a lake*	
Season	Trout are stocked in the fall (October – November)*	Trout are stocked in the winter (December – February)	Trout are stocked in the spring (March – May)
Day of week	Trout are stocked during the week (Monday – Friday)*	Trout are stocked on a weekend day (Saturday-Sunday)	
Trout catch	Prefer to catch six trout that are 10 inches*	Prefer to catch two trout that are 14 inches	

Table 3 - 2. Coefficient estimates (β) and standard errors (SE) from stated preference choice models for all stocked trout anglers and for four specialization levels in Virginia; * $P < 0.05$, ** $P < 0.01$. ASC is the intercept. L = likelihood.

Variable	Overall (N = 1439)		Specialists (N = 148)		Traditional Anglers (N = 636)		Generalists (N = 162)		Occasional Specialists (N = 493)	
	β	SE	β	SE	β	SE	β	SE	β	SE
ASC	0.717**	0.062	0.480*	0.220	0.647**	0.092	0.427*	0.189	0.977**	0.110
Unannounced	0.214**	0.046	-0.219	0.170	0.408**	0.069	0.230	0.145	0.053	0.081
Announced Before Stream	-0.184**	0.057	-0.551**	0.200	-0.026	0.087	-0.029	0.175	-0.322**	0.100
Winter	0.860**	0.042	1.794**	0.164	0.660**	0.063	1.123**	0.129	0.835**	0.072
Spring	-0.386**	0.045	-0.234	0.171	-0.352**	0.068	-0.244	0.143	-0.614**	0.079
Weekend	0.166*	0.066	0.336	0.249	0.151	0.098	0.462*	0.209	0.011	0.115
Two 14-inch trout	-0.222**	0.042	-0.493**	0.148	-0.295**	0.063	-0.129	0.128	-0.065	0.072
-2 log(L)	-0.319**	0.043	0.146	0.155	-0.446**	0.064	-0.443**	0.130	-0.255**	0.074
Number of scenarios	-5,437		-461		-2,433		-599		-1,765	
	5,624		564		2,464		628		1,840	

Table 3 - 3: A comparison of predicted probabilities for five alternative fishing-trip scenarios versus the status quo fishing trip. The status quo fishing trip includes a delayed announcement, streams stocked in the spring during the week and anglers catching 6, 10-inch trout.

Scenario	Announce	Water	Season	Day	Catch	Status Quo (%)	Alternative (%)	Neither (%)
All Anglers								
1	Prior	Stream	Spring	Weekday	6, 10 in	43	53	4
2	Not at all	Stream	Spring	Weekday	6, 10 in	52	43	4
3	Delayed	Stream	Spring	Weekday	2, 14 in	55	40	5
4	Prior	Stream	Spring	Weekday	2, 14 in	50	46	4
5	Not at all	Stream	Spring	Weekday	2, 14 in	59	36	5
Specialists								
1	Prior	Stream	Spring	Weekday	6, 10 in	54	43	3
2	Not at all	Stream	Spring	Weekday	6, 10 in	62	36	2
3	Delayed	Stream	Spring	Weekday	2, 14 in	45	53	2
4	Prior	Stream	Spring	Weekday	2, 14 in	51	47	2
5	Not at all	Stream	Spring	Weekday	2, 14 in	58	39	3
Traditionalists								
1	Prior	Stream	Spring	Weekday	6, 10 in	38	57	5
2	Not at all	Stream	Spring	Weekday	6, 10 in	48	46	6
3	Delayed	Stream	Spring	Weekday	2, 14 in	57	36	7
4	Prior	Stream	Spring	Weekday	2, 14 in	48	46	6
5	Not at all	Stream	Spring	Weekday	2, 14 in	57	36	7
Generalists								
1	Prior	Stream	Spring	Weekday	6, 10 in	43	54	4
2	Not at all	Stream	Spring	Weekday	6, 10 in	49	47	4
3	Delayed	Stream	Spring	Weekday	2, 14 in	58	37	5
4	Prior	Stream	Spring	Weekday	2, 14 in	53	43	4
5	Not at all	Stream	Spring	Weekday	2, 14 in	58	36	5
Occasional Specialists								
1	Prior	Stream	Spring	Weekday	6, 10 in	47	50	3
2	Not at all	Stream	Spring	Weekday	6, 10 in	56	41	3
3	Delayed	Stream	Spring	Weekday	2, 14 in	54	42	3
4	Prior	Stream	Spring	Weekday	2, 14 in	53	44	3
5	Not at all	Stream	Spring	Weekday	2, 14 in	62	35	4

Chapter 4: The Effects of Prior Satisfaction and Constraints on the Intention to Resume Fishing in Virginia

Abstract

Stocked trout anglers in Virginia are less satisfied than anglers who fish for other fish species. Additionally, sales of licenses required to fish for stocked trout declined 31% between 2006 and 2013. In 2014, we surveyed 1,100 lapsed trout anglers (individuals who had purchased licenses twice between September 1, 2011, and August 31, 2013, but did not purchase one between September 1, 2013, and August 31, 2014). I evaluated the effects of prior satisfaction and constraints on lapsed anglers' intention to fish for stocked trout again using a structural equation model. Measurement models confirmed that commonly used indicators I used to measure satisfaction and constraints were appropriate for each construct. Using the structural model, I found that anglers who placed high importance on non-catch-related factors (e.g., being outdoors, enjoying a relaxing experience, experiencing a natural setting) were more likely to fish for stocked trout in the future. Constraints did not mediate the effect of prior satisfaction on future participation. However, structural constraints were related positively to future participation, suggesting that individuals who had more time and family commitments were more likely to negotiate those constraints and participate in the future. These results suggest that the Virginia Department of Game and Inland Fisheries should focus on promoting the activity-general attributes of stocked trout fishing when attempting to retain anglers and keep them from lapsing.

Introduction

In Virginia, fishing for trout ranks second in popularity behind black bass *Micropterus spp.* Trout anglers composed about 20% of all anglers in Virginia and expended an estimated 1.1

million angler-days in pursuit of Virginia trout in 2011 (U.S. Department of the Interior 2011). Stocked trout account for approximately 80% of the trout angling effort in Virginia (O’Neill 2001) through a program managed by the Virginia Department of Game and Inland Fisheries (VDGIF). A survey conducted in 2009 indicated that trout anglers are significantly less satisfied with their fishing than are anglers who fish for other fish species (VDGIF 2010). Additionally, the sale of trout licenses by VDGIF declined 31% between 2006 and 2013. Low satisfaction and declining license sales potentially threaten the future of the stocked trout program in Virginia.

By the 1990s, many states experienced declining or stagnant fishing license sales. Declining license sales suggest that participation in fishing by some license buyers has lapsed, which raises concern for a number of reasons (Summers and Costello 2008). First, declining license sales reduce agency income, which could result in less public and financial support for fisheries management efforts (Sutton 2007). Additionally, local businesses that depend on angling could suffer economic loss. Finally, angling provides a quality-of-life benefit that, if not replaced, could affect users negatively (Sutton 2007).

Factors that interfere with an individual’s ability to achieve the satisfaction or the benefits being sought from leisure represent constraints (Sutton 2007). Crawford and Godbey (1987) classified leisure constraints as intrapersonal, interpersonal, and structural factors that prevent participation. Intrapersonal constraints involve an individual’s internal psychological processes that affect preferences toward activities, whereas interpersonal constraints result from interaction with other individuals (e.g., having a social group with which to participate) (Crawford et al. 1991). Structural constraints consist of those factors usually thought of as interfering with recreation participation (e.g., time, money, opportunity, access, and equipment) (Sutton 2007).

Crawford and Godbey (1987) initially offered individual models for each of the three categories of constraints. Subsequent research posited that individuals encounter constraints hierarchically and in order of importance (Crawford et al. 1991). Those authors suggested that leisure behavior forms when intrapersonal constraints are either absent or have been negotiated. Next, individuals face interpersonal constraints to leisure participation, particularly if the activity often occurs with other individuals. If individuals overcome interpersonal constraints, they then will encounter structural constraints; participation will occur when users negotiate structural constraints. However, if structural constraints are strong, non-participation likely will result. This hierarchical conceptualization of leisure constraints better addresses the process of constraint negotiation because prior models treated each constraint discretely (Crawford et al. 1991).

Several studies have examined reasons why anglers lapse in their participation. Fedler and Ditton (1994) reported that about 25% of Texas anglers in a particular year would become inactive within 1 or 2 years. Anglers reported 'a lack of time' as their most common constraint and also their most important reason for not fishing (Fletcher and King 1988, Fedler and Ditton 1994). In Australia, 70% of anglers reported lack of time, crowding, unavailability of facilities, and expense as constraints; anglers with higher income, a higher degree of centrality to their lifestyle, motivation by non-catch factors, and male anglers experienced constraints more frequently (Sutton 2007). Most lapsed anglers reported engaging in other leisure activities since ceasing fishing, but half reported an interest in fishing again (Sutton et al. 2009). Sutton et al. (2009) also found that when anglers ceased fishing, reasons varied by age, gender, and income. In that study, age generally had a negative effect on constraints, females were more constrained than males, and income had a negative effect on constraints.

Fisheries management goals traditionally focused on biological and ecological characteristics while information on users comes from responses at public hearings (Hunt and Grado 2010). Fisheries managers have a history of making decisions without the benefit of sound human dimensions information (McMullin and Pert 2010). With the emergence of human dimensions as a subdiscipline of fisheries science in the late 20th century, fisheries managers began measuring stakeholders' values and preferences (McMullin and Pert 2010). More recently, managers have begun to establish management goals based on social criteria such as satisfaction (Arlinghaus 2006; Connelly and Brown 2000; Spencer 1993; Spencer and Spangler 1992). Fishing success (catch and/or harvest) influences angler satisfaction, but several studies have shown aesthetic and social variables also can influence angler satisfaction (Knopf et al. 1973, Duttweiler 1976, Hampton and Lackey 1976, Spencer and Spangler 1992, Arlinghaus 2006).

Fisheries management activities should optimize human benefits or users' satisfaction. Pollock et al. (1994) suggested that much of the research on recreational satisfaction focuses on the relationship between an individual's overall satisfaction with an experience and his or her preferences with specific components of that experience. Arlinghaus (2006) reported 12 satisfaction components that reflected the major activity-general and activity-specific sub-dimensions of angler motivations (Fedler and Ditton 1994, Arlinghaus and Mehner 2004). However, no studies exist that relate prior satisfaction with fishing and the intent to participate in the future.

Previous research has examined lapsed anglers using univariate and bivariate techniques. Multivariate techniques, such as confirmatory factor analysis (CFA) and structural equation modeling (SEM) have become popular methods in the social sciences for verifying theoretical

models (Oh et al. 2013). Advantages of multivariate models include multiple dependent variables, control for measurement error, computation of direct and indirect effects, and studying relationships among latent constructs (Weston and Gore 2006). Confirmatory factor analysis represents a statistical technique used to verify the factor structure of a set of observed variables. Using existing research and theory, CFA allows the researcher to test the hypothesis that a relationship exists between observed variables and their underlying latent constructs. Latent constructs are theoretical in nature; we cannot observe them directly and, therefore, we cannot measure them directly. To measure a latent construct, researchers use indicators that represent the underlying construct. The indicators are directly observable and believed by the researcher to accurately represent the variable that we cannot observe. Structural equation models have two components, a measurement model (the CFA) and a structural model, which collectively represent how a researcher relates a series of hypotheses. In SEM, researchers estimate the interrelations among a set of variables (either latent or observed).

I sought to provide a more comprehensive understanding of factors that affect lapsed anglers' intention to participate again in the future. I posited that prior satisfaction with trout fishing would relate positively to anglers' future participation. I further hypothesized that constraints mediate the effect of satisfaction on participation and that constraints would relate inversely to anglers' intention to fish in the future.

This study builds on previous research on satisfaction with and constraints to fishing, and quantifies how well indicators of satisfaction (Fedler and Ditton 1994, Arlinghaus and Mehner 2004, Arlinghaus 2006) and constraints (Fedler and Ditton 1994, Sutton 2007, Sutton et al. 2009) actually measure what they intend to. Accordingly, my first objective was to confirm that commonly used items used to measure satisfaction and constraints actually measure the intended

metrics. The second objective was to examine the extent to which prior satisfaction directly or indirectly (via three levels of constraints) relates to future participation.

Methods

Sampling

To understand why some of Virginia's stocked-trout anglers lapse, I conducted a mail survey on a random sample of 1,100 anglers who had purchased consecutive trout licenses between September 1, 2011, and August 31, 2013, but did not purchase a license between September 1, 2013, and August 31, 2014.

Questionnaire design

I asked 12 questions, each with a 7-point Likert-type scale, to assess level of satisfaction with the respondent's last stocked trout fishing experience (Table 4-1). Catch-related satisfaction questions included number of trout caught, size of largest trout caught, number of big trout caught, average size of trout caught, and whether fish were well-distributed. I also asked non-catch-related satisfaction questions pertaining to opinions about interactions with other anglers, availability of information on stocked trout fishing, perceived crowding, experiencing a natural setting, relaxing, being outdoors, and the overall fishing experience (Holland and Ditton 1992).

I then asked participants to indicate their level of agreement that intrapersonal, interpersonal, and structural constraints affected their past participation with stocked trout fishing on a 7-point Likert-type scale (Table 4-2). Examples of intrapersonal barriers include not wanting to harm the resource, kill or injure fish, feeling that it is inappropriate to fish more, and a lack of skills. Examples of interpersonal constraints include when people an angler knows do not have the time, money, skills, or interest to fish for stocked trout. Interpersonal constraints

also include not knowing people with whom to fish for stocked trout. Examples of structural barriers include family and work commitments, affordability of trout fishing, crowding, low catch rates of stocked trout, and participation in other, but competing, recreational activities.

To assess lapsed anglers' intention to participate in the future, I asked participants their intention to resume their fishing activity during the next 12 months and within the next five years. I rated future participation on a 7-point scale ranging from not at all likely (1) to extremely likely (7). Finally, I facilitated a focus group with 10 trout anglers to pretest and review the draft survey instrument and identify any ambiguities.

Survey Implementation

I used a modified Tailored Design Method (Dillman 2007) to implement the survey. The first contact included a personalized letter detailing the study's purpose and how we selected the participant, a questionnaire, and a pre-paid business reply envelope. On Day 5, I sent everyone a reminder/thank you postcard, and, on Day 28, all non-respondents were sent a questionnaire, pre-paid business-reply envelope, and a personalized cover letter. The survey closed on Day 60.

Data Analysis

I identified missing data and examined those missing observations for patterns of 'missingness' (Schafer and Graham 2002). Using SPSS, I examined missing observations to see if the data were missing at random and used the expectation-maximization (EM) algorithm to replace missing data.

I developed two measurement models (CFAs), which clarified whether the conceptualization of latent factors were homogenous and thus, meaningful constructs. The first measurement model examined whether the latent constructs of prior satisfaction with catch-related attributes (five indicators) and non-catch-related attributes (seven indicators) were

correlated. The second measurement model examined whether indicators selected to measure intrapersonal, interpersonal, and structural constraints were consistent with previous research (Crawford et al. 1991).

I used two separate structural equation models to examine the mediating role of constraints on future participation. The first model allowed for a direct effect of prior satisfaction on future participation whereas the partial-mediation model did not.

I assessed model fit with the use of multiple indicators including goodness of fit (χ^2 and GFI), parsimony correction (root-mean-square error of approximation [RMSEA]), and comparative fit (comparative fit index [CFI]) (Schreiber et al. 2006). I examined modification indices to determine if model fit could improve with changes to the model. I analyzed measurement and structural models in SPSS Amos version 22 and used the maximum likelihood estimation method. For each model, standardized coefficients are reported.

Results

Of 1,100 surveys sent to participants, 144 surveys were returned as undeliverable. I received 264 surveys, for an effective response rate of 29%.

Demographics

Respondents ranged in age from 19 to 87 (average age: 52 years). Males constituted 91% of respondents. Most respondents (70%) were employed, but 25% were retired. Although 23% had graduated from high school, more had completed some college experience since high school (27%) or had graduated from a 2- or 4-year college (27%). Annual income of respondents varied considerably; nearly 25% of respondents reported an income > \$100,000, whereas 12% earned < \$25,000 annually.

Measurement Models

Each CFA model exhibited acceptable fit (Table 4-3). All factors significantly loaded on the two latent constructs for satisfaction, thus supporting satisfaction as a two-construct measure (Arlinghaus 2006). However, modification indices indicated that “the overall fishing experience” also was related to catch-related satisfaction. Additionally, “the availability of stocked trout fishing information provided by VDGIF” had a low factor loading (0.40). Removal of these two variables improved model fit. The final model had acceptable GFI (0.93) and CFI (0.95) values, whereas the RMSEA (0.09) slightly exceeded acceptable levels (Table 4-3). Standardized regression weights (Table 4-4) ranged from 0.50 (“friendly interactions with other anglers”) to 0.92 (ability to have a relaxing experience). Other observed variables with high factor loadings included size of the largest stocked trout caught (0.89), number of big stocked trout caught (0.80), and experiencing a natural setting (0.82). The variance explained by factors ranged from 25-85% (Table 4-4). Cronbach alpha values suggested that items provided a reliable scale to the constructs they measured.

All indicators for intrapersonal and interpersonal constraints loaded significantly. “Not catching enough stocked trout to satisfy me” was the only insignificant factor loading ($P = 0.35$) for structural constraints (Table 4-5). Modification indices indicated that further improvements to the structural-constraints construct would be achieved by removing “my favorite fishing places were too crowded” and “could not afford to fish for stocked trout.” Removal of these three indicator variables greatly improved model fit. Standardized factor loadings ranged from 0.49 (“I do not have the necessary skills to catch stocked trout”) to 0.85 (“I have too many family commitments”) (Table 4-5). Standardized regression weights for the structural constraints of family commitments, participation in other recreational activities, and work commitments were

0.85, 0.65, and 0.76 respectively, and were higher than intrapersonal and interpersonal constraints. The variance explained by factors ranged from 24 - 72% (Table 4-5). Cronbach alpha values suggest that items provided a reliable scale to the constructs they measured.

Structural Models

To test the hypothesis that constraints mediate the effect of prior satisfaction on intention to participate in the future, I developed two structural equation models. The first model allowed for a direct effect between satisfaction and future participation (Figure 1). The direct effect of catch-related satisfaction on future participation was not significant ($\beta = 0.08$, $t = 1.24$, $P = 0.215$). However, non-catch-related satisfaction did have a significant direct effect on future participation ($\beta = 0.26$, $t = 3.26$, $P = 0.001$), suggesting that for every 1 SD increase in satisfaction, the likelihood that anglers will participate in the future increases by 0.26. In other words, anglers who were more satisfied with past fishing experiences would be more likely to fish for stocked trout in the future.

Previous research suggests that intrapersonal, interpersonal, and structural constraints occur hierarchically (Crawford et al. 1991). In this study, intrapersonal constraints had a positive effect on interpersonal constraints and interpersonal constraints had a positive effect on structural constraints. In the fully mediated model, the paths from catch and non-catch-related satisfaction were not related to intrapersonal, interpersonal, and structural constraints (Figure 2). Non-catch satisfaction had a significant effect on intention to participate in the future ($\beta = 0.21$, $t = 2.811$, $P = 0.005$), but the indirect effect via constraints was 0. Thus, constraints did not mediate the effect of past satisfaction on future participation. Surprisingly, structural constraints had a positive, direct effect on future participation ($\beta = 0.18$, $t = 2.297$, $P = 0.022$) (Table 6),

suggesting that lapsed anglers who had more commitments or who participated in other activities were more likely to fish for stocked trout in the future.

Discussion

My results support a 2-dimensional view of satisfaction, and that indicators generally measured each construct well. Angler satisfaction is a multi-dimensional construct comprised of activity-general (non-catch-related factors) and activity-specific (catch-related factors) determinants (Fedler and Ditton 1994, Arlinghaus and Mehner 2004, Arlinghaus 2006). Fishing satisfaction represents a subjective value that is both difficult to quantify and influenced by factors other than catch rate (Graefe and Fedler 1986). I found size-related catch-satisfaction factor loadings were greater than variables not related to size for stocked trout anglers in Virginia. In Tennessee tailwaters, more-specialized trout anglers placed greater emphasis on trophy trout (Hutt and Bettoli 2007). Additionally, satisfaction related positively to the largest trout or salmon caught in Lake Ontario, New York (Connelly and Brown 2000). Although VDGIF stocks some trophy-sized trout, most stocked trout in Virginia's catchable-trout program typically range from 200 to 300 mm total length. Results here may suggest that stocking larger trout might increase future participation.

The importance of non-catch satisfaction measures such as "experiencing a natural setting" and "having a relaxing experience" suggests that lapsed anglers value trout fishing for intrinsic reasons (not related to catching fish). This mirrors other studies and suggests common motives for why anglers choose to fish (Driver and Knopf 1976, Hampton and Lackey 1976, Fedler and Ditton 1986, Arlinghaus and Mehner 2004). I found a low, but significant, factor loading for "information made available by VDGIF" on non-catch satisfaction, which suggests a need for further research to confirm its value as a meaningful indicator. At Lake Milona,

Minnesota, providing information about fishing did not influence satisfaction for most anglers (Spencer and Spangler 1992). However, Connelly and Brown (2000) found that providing fishing information related positively to satisfaction for anglers in New York. Satisfaction with non-catch attributes remains an important aspect of promoting fishing.

I posited that prior satisfaction with stocked trout fishing would be related positively to lapsed anglers' intention to participate again in the future. However, I found that satisfaction with non-catch attributes rather than activity-specific satisfaction was more important to future participation by lapsed anglers. Although I did not measure motivations, the link between motivations and satisfaction in other studies suggests that lapsed anglers' motivations to fish may not have been catch related. Fishing is a multifaceted activity in which anglers seek multiple benefits that are both catch- and non-catch related (Hendee 1974, Ditton et al. 1992, Fedler and Ditton 1994, Aas and Kaltenborn 1995, Wilde et al. 1998, Arlinghaus 2006). In Minnesota, a positive relation existed between activity-general motivations and satisfaction for Sunfish *Lepomis spp.* and Walleye *Stizostedion vitreum* anglers (Spencer 1993). Holland and Ditton (1992) suggested that many factors influence angler satisfaction and that, for some anglers, fishing satisfaction has more to do with complex feelings associated with leisure than with catching fish. My results suggests that managers should promote the social, physiological, and psychological benefits of trout fishing to encourage lapsed anglers to participate in the future.

Leisure constraints theory has emerged as the dominant theoretical framework for understanding leisure participation. Several studies have examined the effects of constraints on fishing participation (Clark 1996, Fedler and Ditton 2001, Sutton 2007). I included five of the seven intrapersonal constraints from Fedler and Ditton (2001) and found that all indicators loaded significantly, thus verifying these items as useful. Similarly, I confirmed that the six

indicators for interpersonal constraints indeed measure constraints associated with other people. However, structural constraints were best modeled with three indicators, each of which dealt with other commitments. Structural constraints represent attributes that interfere with a person's ability to participate and, in this study, a low catch rate of stocked trout was an insignificant measure. Although I did not measure angler motivations, it is possible that lapsed stocked trout anglers may be more motivated to fish by social or psychological factors and less by actually catching fish (Spencer 1993, Fedler and Ditton 1994). Excluding "my favorite fishing places were too crowded" and "could not afford to fish for stocked trout" greatly improved the model fit. Fishing for stocked trout often involves fishing in crowded conditions; therefore, it is not surprising that lapsed anglers did not consider this a constraint. However, anglers who pursue other fish species may perceive crowding as a structural constraint. In Australia, 26% of anglers agreed that crowding constrained their fishing participation (Sutton 2007). In Virginia, most stocked trout anglers fish close to home and not with specialized gear (Hyman 2015); therefore, fishing-related expenses likely are not a structural constraint. Conversely, in Australia, 22% of anglers agreed that affordability constrained their participation (Sutton 2007). This could differ for anglers who pursue other fish species.

I found that only structural constraints related to future participation by lapsed anglers. However, this relation was positive. Other studies have documented that anglers perceive that structural constraints such as time and family commitments, limit or negate their time spent fishing (Fedler and Ditton 2001, Sutton 2007). Contrary to early constraint research, which assumed an inverse relationship between constraints and participation, leisure constraints no longer are seen as insurmountable obstacles, and recent research has emphasized constraint negotiation (Jackson et al. 1993, Jackson 2000, Wright et al. 2001, Schroeder et al. 2012).

Schroeder et al. (2012) did not find the expected negative relationship between constraints and hunting participation for Minnesota waterfowl hunters. In that study, successful constraint negotiation fully mediated the constraints–participation relationship, while involvement had both direct and indirect effects on participation. The positive relationship that I observed between various structural constraints may suggest that anglers answered these items while considering their ability to negotiate these constraints in the future.

In this study, respondents disagreed that intrapersonal constraints affected their past participation with fishing for stocked trout. Similarly, intrapersonal constraints did not have an effect on lapsed anglers' intention to participate in the future. My results are consistent with Clark (1996) and Fedler and Ditton (2001) who found that intrapersonal constraints had little influence on fishing participation or behavior. Intrapersonal constraints are internal to the participant and psychological in nature. Lapsed stocked trout anglers in Virginia did not believe that their participation harmed the resource. Individuals who have not fished may perceive intrapersonal constraints as barriers to participation, whereas lapsed anglers likely have negotiated them.

Similar to intrapersonal constraints, respondents disagreed that interpersonal constraints affected their past participation with fishing for stocked trout, a similar to the findings of other studies (Clark 1996, Fedler and Ditton 2001). Fedler and Ditton (2001) found that mean responses for interpersonal constraints also fell on the disagree end of the 5-point response scale. Clark (1996) found that saltwater fishing participation was not related to interpersonal constraints. My results are consistent with these studies and suggest that lapsed anglers do not rely on social interactions when considering whether to resume fishing for stocked trout.

This study sought to provide a more comprehensive understanding of factors that affect lapsed stocked trout anglers' intention to participate again in the future. I found that lapsed anglers who were more satisfied with activity-general characteristics of stocked trout fishing would be more likely to fish again in the future. Conversely, no relation existed between activity-specific traits and future participation. Anglers often view trout fishing as an activity that occurs in remote and/or scenic locations. Promoting activity-general attributes of stocked trout fishing in Virginia could retain anglers. Additionally, given the low satisfaction observed for activity-specific attributes, VDGIF should seek to increase the size of stocked trout caught. This could be accomplished by creating quality fisheries (stocking fewer, but larger, trout) and potentially managing these fisheries with more restrictive regulations. A more comprehensive understanding of angler satisfaction should enable the VDGIF to better market stocked trout fishing to recruit and retain anglers.

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Table 4 - 1. Levels of satisfaction in stocked trout fishing. I asked participants to what extent they agreed with the following statements regarding their past participation in fishing for stocked trout. Responses were provided on a 7-point Likert scale from strongly disagree (1) to strongly agree (7).

	Mean	SD
Catch-related satisfaction (F1)		
V1 – Number of big stocked trout I caught	3.17	1.69
V2 – Average size of stocked trout I caught	3.82	1.73
V3 – How well stocked trout were distributed in the stocked section	3.75	1.75
V4 – Size of largest stocked trout I caught	3.87	1.82
V5 – Number of stocked trout I caught	3.76	1.87
Non-catch-related satisfaction (F2)		
V6 – Experiencing a natural setting	5.68	1.43
V7 – Being outdoors	6.40	1.06
V8 – Ability to have a relaxing experience	5.70	1.47
V9 – Not feeling crowded	4.56	1.76
V10 - Friendly interactions I had with other anglers	5.08	1.54
V11 - The availability of stocked trout fishing information provided by the VDGIF	4.75	1.94
V12 – Overall fishing experience	4.87	1.61

Table 4 - 2. Constraints related to fishing for stocked trout in Virginia. Participants were asked to what extent they agreed with the following statements regarding past participation in fishing for stocked trout. Responses were provided on a 7-point Likert scale from strongly disagree (1) to strongly agree (7).

	Mean	SD
Intrapersonal constraints (F1)		
V1 - I believe increasing my fishing activity for stocked trout would harm the resource	2.17	1.49
V2 - I do not like to kill stocked trout	2.88	2.17
V3 - Catching stocked trout causes too much injury to the fish	2.32	1.58
V4 - I do not feel it is appropriate to fish for stocked trout more often	2.23	1.49
V5 - I do not have the necessary skills to catch stocked trout	1.72	1.29
Interpersonal Constraints (F2)		
V6 - The people I know did not have time to fish anymore for stocked trout	3.38	1.72
V7 - I did not know other people to fish with for stocked trout	2.78	1.70
V8 - The people I know did not have the money to fish for stocked trout	2.60	1.71
V9 - The people I know did not have the necessary skills to catch stocked trout	2.56	1.62
V10 - The people I know were not interested in fishing anymore for stocked trout	3.15	1.67
V11 - The people I know did not fish for stocked trout	2.74	1.62
Structural constraints (F3)		
V12 – My favorite stocked trout fishing places were too crowded	3.92	1.91
V13 - I had too many family commitments to fish for stocked trout	3.60	1.92
V14 - I did not catch enough stocked trout to satisfy me	4.26	2.01
V15 - I could not afford to fish for stocked trout	2.42	1.73
V16 - Other recreational activities took up my time that could have been spent fishing for stocked trout	3.37	1.96
V17 –I had too many work commitments to fish for stocked trout	3.47	2.06

Table 4 - 3. Final results of confirmatory factor analyses.

Latent factor	χ^2	d.f.	CFI	GFI	RMSEA
Satisfaction	102.089	34	0.953	0.928	0.087
Constraints	145.222	74	0.932	0.932	0.060

Table 4 - 4. Results of confirmatory factor analysis for catch-related and non-catch-related satisfaction. See Table 4-2 for variable descriptions.

Factors and indicators	Standardized loading	t	P	R ²
Catch-related satisfaction				0.90 ^a
V1 – NUMBIG	0.80	Fixed		0.64
V2 – AVGSIZE	0.89	16.57	< 0.001	0.79
V3 – DISTRIBUTE	0.68	11.63	< 0.001	0.46
V4 – SIZEBIG	0.89	16.48	< 0.001	0.79
V5 – NUMBER	0.75	13.22	< 0.001	0.56
Non-catch-related satisfaction				0.83 ^a
V6 – NATURAL	0.82	Fixed	< 0.001	0.67
V7 – OUTDOORS	0.74	13.20	< 0.001	0.55
V8 – RELAX	0.92	16.57	< 0.001	0.85
V9 – NOCROWD	0.56	9.42	< 0.001	0.32
V10 - INTERACT	0.50	8.27		0.25

^a denotes Cronbach's Alpha estimate

Table 4 - 5. Results of confirmatory factor analysis for intrapersonal, interpersonal, and structural constraints. See Table 4-2 for variable descriptions.

Factors and indicators	Standardized loading	t	P	R ²
Intrapersonal				0.73 ^a
V1 – SKILLSELF	0.49	Fixed		0.24
V2 – KILL	0.54	6.00	< 0.001	0.29
V3 - INJURY	0.76	7.04	< 0.001	0.58
V4 – APPROPRIATE	0.66	6.68	< 0.001	0.44
V5 - HARM	0.55	6.08	< 0.001	0.30
Interpersonal				0.78 ^a
V6 – DONTFISH	0.66	Fixed		0.40
V7 – OTHPEOPLE	0.67	8.54	< 0.001	0.45
V8 - MONEY	0.57	7.	< 0.001	0.32
V9 - SKILLSOTH	0.60	7.89	< 0.001	0.36
V10 - NOINTEREST	0.52	6.98	< 0.001	0.27
V11 - TIME	0.63	8.47	< 0.001	0.44
Structural				0.79 ^a
V13 – WORK	0.76	Fixed	0.001	0.58
V16 - ACTIVITIES	0.65	9.61	0.001	0.42
V17 - FAMILY	0.85	10.79	0.001	0.72

^a denotes Cronbach's Alpha estimate

Table 4 - 6. Results of structural equation models.

Structural Models	χ^2	df	CFI	GFI	RMSEA
Partial	127.292	51	0.958	0.925	0.075
Full	520.163	285	0.921	0.875	0.056

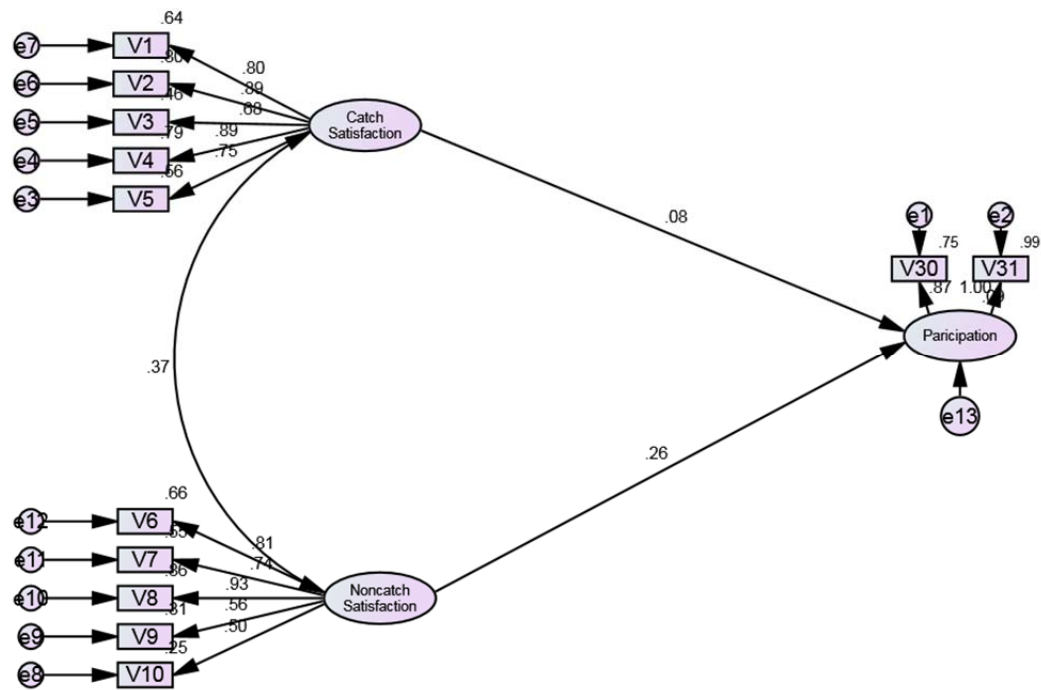


Figure 1: Path model showing the direct effects of prior satisfaction on the intention to participate in the future. Standardized regression coefficients are provided.

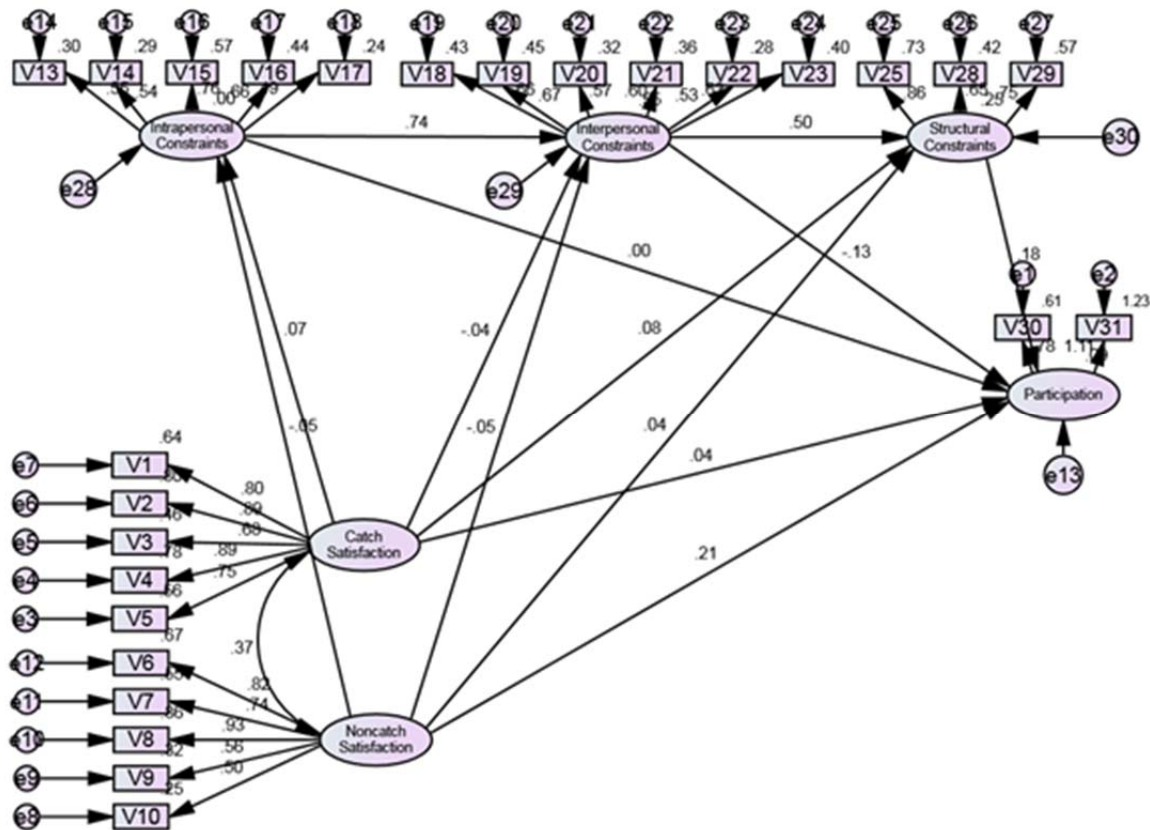


Figure 2: Path model showing the direct effects of prior satisfaction and constraints on the intention to participate in the future.

Chapter 5: Synthesis

Stocked trout anglers differed in their avidity, catch orientation, investment, and centrality. Among the anglers I surveyed (i.e., those ≥ 18 years of age and who had purchased a fishing license since 2013), I found four distinct groups among stocked trout anglers (specialists, traditionalists, generalists, and occasional specialists). Although 4-groups were identified, pairs of groups (specialists and occasional specialists versus traditionalists and generalists) did respond similarly regarding motivations, satisfaction, and opinions. Recognizing the differences among these groups may have important management implications as the VDGIF develops stocking and management strategies and markets the program to specific angler segments. For example, specialists and occasional specialists tend to fish with lures and flies and release their catch, whereas traditionalists and generalists often fish with bait and harvest their catch.

I examined motivations and satisfaction based on activity-general and activity-specific attributes (Arlinghuas 2006). Activity-general characteristics include items such as enjoying the outdoors, fishing with friends and/or family, and enjoying a relaxing experience. Although fishery managers recognize the importance of activity-general attributes to angler motivations (Hampton and Lackey 1976, Fedler and Ditton 1994), they frequently believe they have little ability to manipulate these attributes (Spencer 1993). I found satisfaction with activity-general attributes of stocked trout fishing was high (~5.5 on a 7-point scale) among all groups. Fishing in a natural setting was a stronger motivation for specialists than for traditionalists and generalists. Specialists' desire for natural settings and their preference for fishing with lures and flies suggest that VDGIF could enhance specialists' fishing opportunities for stocked trout by establishing restrictive-regulation opportunities in scenic and pristine waters. Conversely, VDGIF could provide opportunities for traditionalists and generalists in less-pristine waters

managed with more-liberal regulations that allow anglers to keep more and smaller trout. All anglers assigned moderate importance to psychological and physiological motivations, suggesting that they view fishing for stocked trout as a way to get away from the daily routine and to relax. Additionally, lapsed anglers expressed high satisfaction with activity-general characteristics, suggesting that these anglers would be likely to resume fishing for stocked trout as long as those characteristics are maintained. Therefore, understanding the importance of activity-general factors has implications for retaining stocked trout anglers and possibly recruiting new and lapsed anglers. The VDGIF should promote characteristics such as experiencing a natural setting and being outdoors through a variety of strategic marketing campaigns.

Activity-specific characteristics generally relate to the size and number of trout caught. These fishery-related factors motivated traditionalists and generalists more so than specialists. Although Hyman (2015) found high satisfaction among stocked-trout anglers who were interviewed while fishing in Virginia, my surveys of current and lapsed stocked-trout anglers indicated that they are only slightly satisfied. Additionally, activity-specific satisfaction was lower for lapsed anglers compared to current anglers. Would satisfaction improve if VDGIF manipulated the number and/or size of the trout that the agency stocks? Hyman (2015) found that angler catch rate for stocked trout remained near the management objective of one fish per hour of angling for up to 30 days after stocking, suggesting that VDGIF does not need to increase the number of trout stocked. However, if dissatisfaction is being fostered by the misperception that catch rate is low (i.e., good only on the day of stocking), better communication of the facts to anglers might improve satisfaction and help retention. Since fishing effort tends to be higher on days closer to stocking events (Hyman 2015), this also might

be informative to anglers who prefer less-crowded conditions when fishing (i.e., catch rates remain high and fishing pressure is low up to 30 days from stocking).

Based on the results from Chapter 2, anglers from all specialization groups expressed low satisfaction with the number of large trout caught. However, results from choice models indicate that specialists preferred catching fewer/larger trout, whereas all other angler groups preferred catching six, 10-inch trout. Nearly 20% of lapsed anglers cited their inability to catch larger fish as the main reason for not purchasing a license. These disparate results underscore the variety of opinions that stocked trout anglers have regarding their preference on the size of fish stocked. The VDGIF could consider increasing the number of larger trout stocked either throughout stocking sites or by creating “quality” fisheries where fewer, but larger, trout are stocked. These “quality” sites would serve multiple purposes. First, they would diversify the program by having unique fisheries established that contain larger fish. Second, these quality fisheries could be marketed to cater to specific angler groups (specialists) who seek a different fishing experience, thus enhancing the visibility of the program. Additionally, these sites could help prevent anglers from lapsing. Finally, quality fisheries may serve to recruit new anglers, particularly anglers who currently fish for wild, but not stocked, trout. However, if stocking fewer/larger trout strains hatchery capabilities and reduces the production of trout stocked for other waters, then other anglers could be affected. Therefore, creation of these “quality” sites requires VDGIF to fully understand the trade-offs associated with stocking fewer/larger trout on overall trout production.

Stocked trout programs often are referred to as “put-and-take fisheries” because agencies stock catchable-sized trout and expect anglers to harvest most of the trout they catch. My results suggest that specialists and occasional specialists rarely harvest trout, which has important

implications for how VDGIF manages stocked-trout fisheries. Hyman (2015) found similar results for anglers interviewed while fishing. Given that specialists generally practice catch-and-release and fish with lures and flies, VDGIF could employ alternative and more-restrictive management strategies. Currently, VDGIF manages some streams that contain wild trout and put-grow-take trout with restrictive regulations (e.g., 400-mm minimum length limit, 2 trout/day creel limit), but those strategies have not been applied to waters containing catchable-size stocked trout. A key point here is that specialists and occasional specialists constituted 45% of all respondents, yet VDGIF manages only about 10% of its stocked waters with alternative regulations, restrictions more likely to be accepted and/or tolerated by specialists than among generalists. Creating more fishing opportunities that are better suited to the desires of these specialized anglers could improve the satisfaction of and retain more existing specialists, bring back lapsed specialists, and potentially recruit new ones. However, before VDGIF converts any existing stocked-trout waters to fisheries managed with stricter regulations, it must ascertain whether such changes may affect satisfaction and expectations of other existing users negatively, especially traditionalists and generalists.

The VDGIF currently announces the location of most stockings at 4 PM on the day of stocking. However, my survey of current anglers indicates that angler opinions vary widely on how VDGIF should announce stockings. Results from Chapter 2 indicated that approximately half of respondents favored announcements before stocking, whereas the remainder was divided between maintaining the current policy of delayed announcement or not announcing stockings at all. Specialists preferred unannounced stockings, whereas traditionalists, generalists, and occasional specialists preferred a prior announcement (particularly announcements made each day at 8 AM or at the beginning of the fishing season). The current system of announcing

stockings was favored by only about 25% of anglers in each group. However, results from the choice models in Chapter 3 differed. Specialists and occasional specialists preferred the delayed announcement to prior announcements at 8 AM the day of stocking. Additionally, there was no significant difference in preference for stocking announcements for traditionalists and generalists. Similar to the 2008 Virginia trout survey, angler preferences for how VDGIF announces stockings vary widely (VDGIF, unpublished data) and my results using different techniques support this. Consideration of these differences again may be important to fulfilling and improving angler satisfaction. Results here suggest that VDGIF should consider employing a variety of stocking announcements to meet these differences. For example, unannounced stockings on special regulation and delayed harvest streams would appear to be well received by specialists who frequent those waters. Increasing the stockings that receive a prior announcement should be favored by traditionalists, generalists, and occasional specialists. An additional strategy could include using specific prior announcement strategies by waters so anglers who wanted to know at the beginning of the season could go to the waters announced then, but other waters could be announced in advance monthly, weekly, or daily. However, despite the potential advantages users might realize with a more specialized announcement approach, implementing and maintaining this strategy undoubtedly would demand greater time investment and logistical work for agency staff; a cost:benefit analysis on the feasibility of adopting such a system would be recommended before any such implementation.

I sought to determine whether various constraints caused stocked trout anglers to lapse. Constraints were low and did not appear to prevent anglers from fishing for stocked trout in Virginia. Rather, it appears that stocked-trout anglers purchase licenses intermittently and reasons for that remain unknown. For example, I found that only 50% of current stocked trout

license buyers purchase licenses in consecutive years. Currently, when an angler purchases a trout license, that license is valid for one year from the date of purchase. This rolling-renewal system likely contributes to intermittent license-purchasing behavior (Warren Schlechte, Texas Parks and Wildlife Department, personal communication). In my survey of lapsed trout anglers, I found that the majority of lapsed anglers intended to fish for stocked trout again in the future. Implementing a license-renewal reminder system may prevent stocked trout anglers from lapsing by warning them when their license is about to expire and encouraging them to renew. Given my results regarding activity-general motivations and satisfaction, promoting those characteristics related to stocked trout fishing during such a license-renewal reminder process likely would enhance the effectiveness of the effort to retain existing anglers and help minimize the number of lapsed anglers. For example, if VDGIF sends a reminder, it should include information on the benefits that stocked trout fishing provides, such as being outdoors, fishing with friends and family, and being close to scenic waters.

The popularity of stocked-trout fishing in Virginia likely could be improved by diversifying the program. The anglers I surveyed appear to be only marginally satisfied with the current stocked-trout program in Virginia. Additionally, current license-buying behavior is sporadic, but many anglers stated an intent to resume fishing in the future. I suggest that the following modifications could improve satisfaction with trout fishing and retain anglers, while possibly recruiting new ones:

1. Promote activity-general characteristics of stocked trout fishing.
2. Increase the number of larger trout stocked in select waters.
3. Use variable announcement strategies to inform anglers when and where trout are stocked.

4. Create quality trout fisheries by stocking larger trout and managing with gear restrictions (e.g., single hook, artificial lure only), higher minimum length limits, and reduced creel limits.
5. Implement a license-renewal system to remind anglers when their license will expire.

To maintain a viable stocked trout program in the future, VDGIF must recognize that stocked trout anglers are a heterogeneous group that differs in what motivates them to fish, how satisfied they are, and what preferences they have regarding stocked-trout fishing. Although it is important to understand current anglers and retain them, a need also exists to diversify the demographics of stocked trout anglers. Currently, most stocked trout anglers are aging (>50 years old), white males; <10% of current stocked trout anglers are female, but my survey work did not examine the complete demographic profile of all anglers. Without such information, VDGIF currently cannot describe accurately their existing stocked trout angler population nor can they understand the desires, expectations, and motivations these individuals have. To maintain a viable, well-funded program in the future, VDGIF should examine the demographics of all stocked trout anglers, including students, women, minorities, and non-residents, and conduct research to better understand the motives and preferences of these poorly understood demographics. To successfully increase participation by these under-represented groups will require VDGIF to develop new marketing strategies, based on demographic research, designed to promote fishing for stocked trout in ways meaningful to all types of anglers. My results suggest that promoting stocked-trout fishing as a means to participate in outdoor recreation in scenic areas, increasing the number of special regulation waters, and diversifying stocking announcements may help in retaining and recruiting anglers and ensuring the future of VDGIF's stocked trout program.

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Appendix A. Mail survey of current trout anglers.

Stocked Trout Management in Virginia



Thank you for your participation! The objective of this survey is to better understand the opinions and preferences of anglers who fished for stocked trout in Virginia last year. Results from this survey will help improve angler satisfaction and assist in the development of a Stocked Trout Management Plan. Your response is important, even if you only fish for stocked trout on rare occasions or didn't fish at all.



1. How many days did you fish for any species in Virginia during the last 12 months?

2. During the past 12 months, how many days did you fish for **stocked trout** in the following types of waters that are managed by the Virginia Department of Game and Inland Fisheries?

Put-and-take trout waters

Delayed harvest waters (catch and release only from October 1 - June 15)

Urban program waters

Fee fishing areas (Douthat Lake, Crooked Creek, Big Tumbling Creek)

3. Did you fish for stocked trout at one of the Heritage Day waters on April 5, 2014?

Yes No

4. During the previous 12 months, how many days did you fish for **wild trout** in Virginia?

5. Did you fish for stocked trout in any other states during the past 12 months?

Yes No

5a. If you did, in which states did you fish for stocked trout during the past 12 months?

6. How many years have you been fishing for stocked trout?

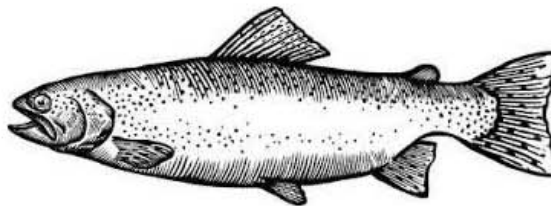
7. During the past 5 years, how many years did you fish for stocked trout in Virginia?

0 years 1 year 2 years 3 years 4 years 5 years

8. How long do you drive to reach the area where you fish most often for stocked trout?

Less than 30 minutes 30 minutes to 59 minutes 1 to 2 hours More than 2 hours

9. How many hours are you willing to drive to have a satisfactory experience fishing for stocked trout?

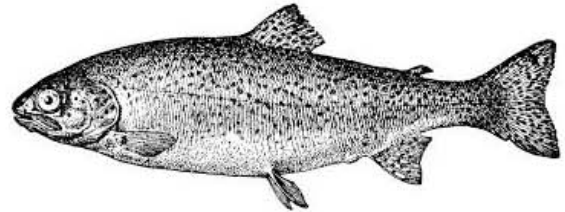


10. What was the farthest distance (in miles, one way) you ever traveled specifically to fish for stocked trout?

.....

11. Please indicate the extent to which you think the following reasons are important or unimportant to you personally as you make your decision on whether to fish for stocked trout.

	Extremely Unimportant	Moderately Unimportant	Slightly Unimportant	Neutral	Slightly Important	Moderately Important	Extremely Important
The challenge or sport of fishing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To catch fish to eat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Getting physical exercise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Opportunity for relaxation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To be alone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The joy of catching fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To be with friends and/or family	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The scenic quality of the area	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To catch a trophy fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To be outdoors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To get away from the daily routine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To introduce someone to trout fishing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To experience new and different things	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To improve my fishing skills	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To be close to the water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

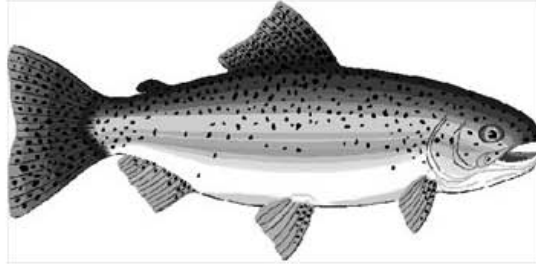


12. To what extent do you agree or disagree with the following three statements?

	Strongly Agree	Agree	Mildly Agree	Neutral	Mildly Disagree	Disagree	Strongly Disagree
When fishing for stocked trout, I am not satisfied unless I catch something.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A fishing trip for stocked trout is successful, even if no trout are caught.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
When fishing for stocked trout, I am happy even if I do not catch any fish.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13. How satisfied were you overall and in each of the types of waters listed with your experiences fishing for stocked trout in Virginia during the last 12 months??

	Extremely Dissatisfied	Moderately Dissatisfied	Slightly Dissatisfied	Neutral	Slightly Satisfied	Moderately Satisfied	Extremely Satisfied	Not Applicable
Overall experience with stocked trout fishing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Catchable stocked trout waters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Delayed harvest waters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Urban waters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Heritage day	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fee fishing areas (Douthat Lake, Crooked Creek, Big Tumbling Creek)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



14. For the following statements, please indicate to what extent you were satisfied with each aspect of your experience while fishing for stocked trout in Virginia during the last 12 months:

	Extremely Dissatisfied	Moderately Dissatisfied	Slightly Dissatisfied	Neutral	Slightly Satisfied	Moderately Satisfied	Extremely Satisfied
Number of stocked trout I caught	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Size of largest stocked trout I caught	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Friendly interactions I had with other anglers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The availability of trout fishing information provided by the Virginia Department of Game and Inland Fisheries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How well stocked trout were distributed across the habitats	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not feeling crowded	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average size of stocked trout I caught	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of big stocked trout I caught	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Experiencing a natural setting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Relaxing experience	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Being outdoors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15. To what extent do you support or oppose the current regulations that allow year-round trout fishing?

- Strongly Oppose
 Slightly Oppose
 Slightly Support
 Strongly Support
 Moderately Oppose
 Neutral
 Moderately Support

16. Currently, stocking date and locations are announced at 4 PM the day of stocking. What is your preference regarding release of information about stocking?

- | | | |
|--|--|---|
| <input type="checkbox"/> No announcement at all | <input type="checkbox"/> Date and location announced at 8 AM each day | <input type="checkbox"/> Date and location announced at 8 AM each month |
| <input type="checkbox"/> Announced at 4 PM on the day of stocking (current method) | <input type="checkbox"/> Date and location announced at 8 AM each week | <input type="checkbox"/> Date and location announced in advance for the entire fishing season |

17. The current daily bag limit is 6 trout. If a revision of this regulation were to be proposed, what would you prefer?

- | | |
|---|---|
| <input type="checkbox"/> Increase bag limit to allow take of more fish | <input type="checkbox"/> Maintain current bag limit |
| <input type="checkbox"/> Decrease bag limit to allow take of fewer fish | |

18. During the last 12 months, how often did you keep some or all of the stocked trout that you caught?

- Never Rarely Occasionally Often Almost Always

19. Please indicate to what level you agree or disagree with each of the following statements regarding stocked trout fishing:

	Strongly Disagree	Disagree	Mildly Disagree	Neutral	Mildly Agree	Agree	Strongly Agree
I would prefer to see more trout stocked even if they were smaller.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would prefer to see larger trout stocked even if that means fewer trout per stocking.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would prefer the stream to be stocked more often with fewer trout per stocking.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would prefer the stream to be stocked less often with more trout per stocking.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would rather catch 1 or 2 big trout than 6 smaller trout.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I would prefer that no trout are stocked in locations that support wild/native trout.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CHOOSE YOUR PREFERRED FISHING TRIP

On the following three pages, you will be asked to choose between pairs of fishing trips for stocked trout in Virginia. These hypothetical fishing trips are based on 5 different attributes (first column).

Please review the following definitions before looking at the example provided below:

Stocking Announcement - Currently, stockings are announced the day of stocking (4 PM), by the Virginia Department of Game and Inland Fisheries. Alternatively, the day and location of stockings for a given week could be announced prior to stocking (Monday). Or, stockings could be not announced at all.

Type of Water - whether trout are stocked in a stream or a lake

Season -whether trout are stocked in the fall (October and November), winter (December - February), or spring (March - May)

Day of Week - Whether trout are stocked on a weekday (Monday - Friday) or a weekend (Saturday or Sunday)

Trout Catch - The size and number of stocked trout that you prefer to catch.

EXAMPLE - Below you will find an example of the type of question and information choices you will be provided on the following pages.

Suppose that you could only choose from the fishing trips below (Trip A, Trip B, or neither trip). Which one would you prefer?

Attribute	Trip A	Trip B
Stocking Announcement	Day of stocking (4 PM)	Prior to stocking (Monday)
Type of Water	Lake	Stream
Season	Spring	Spring
Day of Week	Weekend	Weekday
Trout catch and size in inches	2 fish caught - average size 14inches	6 fish caught - average size 10 inches

Given these choices, I would choose:

- Trip A Trip B Neither

Please read the description of each pair of fishing trips (Trip A and Trip B) carefully, because they will differ in at least one attribute.

20. Suppose that you could only choose from the fishing trips below (Trip A, Trip B, or neither trip). Which one would you prefer?

Attribute	Trip A	Trip B
Stocking Announcement	Prior to stocking (Monday)	Not announced at all
Type of Water	Lake	Stream
Season	Winter	Spring
Day of Week	Weekend	Weekday
Trout catch and size in inches	6 fish caught - average size 10 inches	6 fish caught - average size 10 inches

Given these choices, I would choose:

Trip A Trip B Neither

21. Suppose that you could only choose from the fishing trips below (Trip A, Trip B, or neither trip). Which one would you prefer?

Attribute	Trip A	Trip B
Stocking announcement	Day of stocking (4 PM)	Prior to stocking (Monday)
Type of water	Lake	Stream
Season	Winter	Fall
Day of Week	Weekend	Weekday
Trout catch and size in inches	6 fish caught - average size 10 inches	2 fish caught - average size 14 inches

Given these choices, I would choose:

Trip A Trip B Neither

22. Suppose that you could only choose from the fishing trips below (Trip A, Trip B, or neither trip). Which one would you prefer?

Attribute	Trip A	Trip B
Stocking announcement	Not announced at all	Not announced at all
Type of Water	Stream	Stream
Season	Fall	Winter
Day of Week	Weekday	Weekend
Trout catch and size in inches	2 fish caught - average size 14 inches	2 fish caught - average size 14 inches

Given these choices, I would choose:

Trip A Trip B Neither

23. Suppose that you could only choose from the fishing trips below (Trip A, Trip B, or neither trip). Which one would you prefer?

Attribute	Trip A	Trip B
Stocking announcement	Not announced at all	Prior to stocking (Monday)
Type of Water	Lake	Lake
Season	Fall	Fall
Day of Week	Weekday	Weekday
Trout catch and size in inches	2 fish caught - average size 14 inches	2 fish caught - average size 14 inches

Given these choices, I would choose:

Trip A Trip B Neither

24. Which of the following best describes how you usually fished for stocked trout during the last 12 months?

- Used artificial flies most of the time Used bait most of the time
 Used artificial lures most of the time Combination of flies, lures, or bait

25. During the last 12 months, where did you fish for stocked trout most often?

- Ponds and lakes Large streams Small streams

26. Are you a member of a fishing-related club or organization (for example Trout Unlimited, BASS, etc.)

- Yes No

27. Do you subscribe to any fishing-related magazines?

- Yes No

28. To fish for stocked trout, anglers must also possess a general fishing license (county or state). Did you purchase a county or state general fishing license primarily to fish for trout in the last 12 months?

- Yes I have a lifetime freshwater fishing license I did not need to purchase a freshwater fishing license
 No

29. Have you made an overnight trip, specifically to fish (for any species) during the past 12 months?

- Yes No



30. Where do you usually get information, including stocking dates and locations, about Virginia's trout stocking program? (check all that apply)

- Virginia Department of Game and Inland Fisheries webpage Social media (Facebook, Twitter, etc.) Family or friend
 Virginia Department of Game and Inland Fisheries hotline Other Virginia Department of Game and Inland Fisheries publication
- Other: _____

31. During the past 12 months, approximately how much money did you spend while fishing for stocked trout (gas, food, lodging, bait/tackle/equipment, guide/rental fee, etc.)?

- Less than \$1,000 \$1,000 to \$1,999 \$2,000 to \$3,000 More than \$3,000

32. Please estimate your total investment in trout fishing equipment at the present time.

- Less than \$1,000 \$1,000 to \$1,999 \$2,000 to \$3,000 More than \$3,000

33 What is your age?

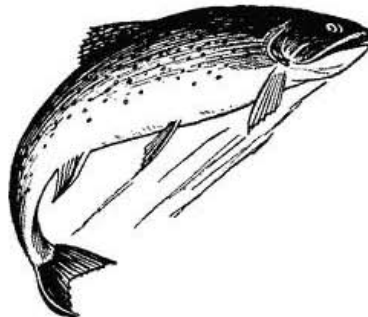
.....

34. What is your gender?

..... Male Female

35. What is your employment status?

- Employed Unemployed Homemaker Retired Student



36. What is your city or county of residence?

- | | | | |
|---|---|--|---|
| <input type="checkbox"/> Accomack County | <input type="checkbox"/> City of Danville | <input type="checkbox"/> King and Queen County | <input type="checkbox"/> Prince George County |
| <input type="checkbox"/> Albermarle County | <input type="checkbox"/> Dickenson County | <input type="checkbox"/> Lancaster County | <input type="checkbox"/> Prince William County |
| <input type="checkbox"/> City of Alexandria | <input type="checkbox"/> Dinwiddie County | <input type="checkbox"/> Lee County | <input type="checkbox"/> Pulaski County |
| <input type="checkbox"/> Alleghany County | <input type="checkbox"/> City of Emporia | <input type="checkbox"/> City of Lexington | <input type="checkbox"/> City of Radford |
| <input type="checkbox"/> Amelia County | <input type="checkbox"/> Essex County | <input type="checkbox"/> Loudoun County | <input type="checkbox"/> Rappahannock County |
| <input type="checkbox"/> Amherst County | <input type="checkbox"/> City of Fairfax | <input type="checkbox"/> Louisa County | <input type="checkbox"/> Richmond County |
| <input type="checkbox"/> Appomattox County | <input type="checkbox"/> City of Falls Church | <input type="checkbox"/> Lunenburg County | <input type="checkbox"/> City of Richmond |
| <input type="checkbox"/> Arlington County | <input type="checkbox"/> Fairfax County | <input type="checkbox"/> City of Lynchburg | <input type="checkbox"/> Roanoke County |
| <input type="checkbox"/> Alleghany County | <input type="checkbox"/> Fauquier County | <input type="checkbox"/> Madison County | <input type="checkbox"/> City of Roanoke |
| <input type="checkbox"/> Amelia County | <input type="checkbox"/> Floyd County | <input type="checkbox"/> City of Manassas | <input type="checkbox"/> Rockbridge County |
| <input type="checkbox"/> Amherst County | <input type="checkbox"/> Fluvanna County | <input type="checkbox"/> City of Manassas Park | <input type="checkbox"/> Rockingham County |
| <input type="checkbox"/> City of Bedford | <input type="checkbox"/> Franklin County | <input type="checkbox"/> City of Martinsville | <input type="checkbox"/> Russell County |
| <input type="checkbox"/> Bland County | <input type="checkbox"/> City of Franklin | <input type="checkbox"/> Mathews County | <input type="checkbox"/> City of Salem |
| <input type="checkbox"/> Botetourt County | <input type="checkbox"/> Frederick County | <input type="checkbox"/> Mecklenburg County | <input type="checkbox"/> Scott County |
| <input type="checkbox"/> City of Bristol | <input type="checkbox"/> City of Fredericksburg | <input type="checkbox"/> Middlesex County | <input type="checkbox"/> Shenandoah County |
| <input type="checkbox"/> Brunswick County | <input type="checkbox"/> City of Galax | <input type="checkbox"/> Montgomery County | <input type="checkbox"/> Smyth County |
| <input type="checkbox"/> Buchanan County | <input type="checkbox"/> Giles County | <input type="checkbox"/> Nelson County | <input type="checkbox"/> City of South Boston |
| <input type="checkbox"/> Buckingham County | <input type="checkbox"/> Gloucester County | <input type="checkbox"/> New Kent County | <input type="checkbox"/> Southampton County |
| <input type="checkbox"/> City of Buena Vista | <input type="checkbox"/> Goochland County | <input type="checkbox"/> City of Newport News | <input type="checkbox"/> Spotsylvania County |
| <input type="checkbox"/> Campbell County | <input type="checkbox"/> Grayson County | <input type="checkbox"/> City of Norfolk | <input type="checkbox"/> Stafford County |
| <input type="checkbox"/> Caroline County | <input type="checkbox"/> Greene County | <input type="checkbox"/> Northampton County | <input type="checkbox"/> City of Staunton |
| <input type="checkbox"/> Carroll County | <input type="checkbox"/> Greenville County | <input type="checkbox"/> Northumberland County | <input type="checkbox"/> City of Suffolk |
| <input type="checkbox"/> Charles City County | <input type="checkbox"/> Halifax County | <input type="checkbox"/> City of Norton | <input type="checkbox"/> Surry County |
| <input type="checkbox"/> Charlotte County | <input type="checkbox"/> City of Hampton | <input type="checkbox"/> Nottoway County | <input type="checkbox"/> Sussex County |
| <input type="checkbox"/> City of Charlottesville | <input type="checkbox"/> Hanover County | <input type="checkbox"/> Orange County | <input type="checkbox"/> Tazewell County |
| <input type="checkbox"/> City of Chesapeake | <input type="checkbox"/> City of Harrisonburg | <input type="checkbox"/> Page County | <input type="checkbox"/> City of Virginia Beach |
| <input type="checkbox"/> Chesterfield County | <input type="checkbox"/> Henrico County | <input type="checkbox"/> Patrick County | <input type="checkbox"/> Warren County |
| <input type="checkbox"/> Clarke County | <input type="checkbox"/> Henry County | <input type="checkbox"/> City of Petersburg | <input type="checkbox"/> Washington County |
| <input type="checkbox"/> City of Clifton Forge | <input type="checkbox"/> Highland County | <input type="checkbox"/> City of Poquoson | <input type="checkbox"/> City of Waynesboro |
| <input type="checkbox"/> City of Colonial Heights | <input type="checkbox"/> City of Hopewell | <input type="checkbox"/> Pittsylvania County | <input type="checkbox"/> Westmoreland County |
| <input type="checkbox"/> City of Covington | <input type="checkbox"/> Isle of Wight County | <input type="checkbox"/> City of Portsmouth | <input type="checkbox"/> City of Williamsburg |
| <input type="checkbox"/> Craig County | <input type="checkbox"/> James City County | <input type="checkbox"/> Powhatan County | <input type="checkbox"/> City of Winchester |
| <input type="checkbox"/> Culpeper County | <input type="checkbox"/> King George County | <input type="checkbox"/> Prince Edward County | <input type="checkbox"/> Wise County |
| <input type="checkbox"/> Cumberland County | <input type="checkbox"/> King William County | | <input type="checkbox"/> Wythe County |
| | | | <input type="checkbox"/> York County |

37. Do you have any additional comments you care to share about Virginia's stocked trout management program?

Please return your completed survey in the business reply envelope provided as soon as possible.

Thank you!

Appendix B. Description of choice sets used in all six versions of the survey of current trout anglers.

Version 1

# 20	Trip A	Trip B
Stocking Announcement	Prior to stocking (Monday)	Not announced at all
Type of Water	Lake	Stream
Season	Winter	Spring
Day Of Week	Weekend	Weekday
Trout catch and size in inches	6 fish caught- average size 10 inches	6 fish caught – average size 10 inches
# 21		
Stocking Announcement	Day of stocking (4 PM)	Prior to stocking (Monday)
Type of Water	Lake	Stream
Season	Winter	Fall
Day Of Week	Weekend	Weekday
Trout catch and size in inches	6 fish caught- average size 10 inches	2 fish caught – average size 14 inches
# 22		
Stocking Announcement	Not announced at all	Not announced at all
Type of Water	Stream	Stream
Season	Fall	Winter
Day Of Week	Weekday	Weekend
Trout catch and size in inches	2 fish caught- average size 14 inches	2 fish caught – average size 14 inches
#23		
Stocking Announcement	Not announced at all	Prior to stocking (Monday)
Type of Water	Lake	Lake
Season	Fall	Fall
Day Of Week	Weekday	Weekday
Trout catch and size in inches	2 fish caught- average size 14 inches	2 fish caught – average size 14 inches

Version 2

# 20	Trip A	Trip B
Stocking Announcement	Prior to stocking (Monday)	Not announced at all
Type of Water	Lake	Lake
Season	Fall	Fall
Day Of Week	Weekend	Weekday
Trout catch and size in inches	6 fish caught - average size 10 inches	2 fish caught - average size 14 inches

# 21		
Stocking Announcement	Day of stocking (4 PM)	Not announced at all
Type of Water	Lake	Lake
Season	Winter	Winter
Day Of Week	Weekday	Weekend
Trout catch and size in inches	2 fish caught - average size 14 inches	6 fish caught - average size 10 inches

# 22		
Stocking Announcement	Not announced at all	Prior to stocking (Monday)
Type of Water	Lake	Stream
Season	Fall	Spring
Day Of Week	Weekday	Weekday
Trout catch and size in inches	2 fish caught - average size 14 inches	2 fish caught - average size 14 inches

#23		
Stocking Announcement	Day of stocking (4 PM)	Prior to stocking (Monday)
Type of Water	Stream	Stream
Season	Winter	Winter
Day Of Week	Weekend	Weekday
Trout catch and size in inches	2 fish caught - average size 14 inches	2 fish caught - average size 14 inches

Version 3

# 20	Trip A	Trip B
Stocking Announcement	Not announced at all	Prior to stocking (Monday)
Type of Water	Lake	Lake
Season	Winter	Fall
Day Of Week	Weekday	Weekday
Trout catch and size in inches	6 fish caught - average size 10 inches	6 fish caught - average size 10 inches
# 21		
Stocking Announcement	Prior to stocking (Monday)	Prior to stocking (Monday)
Type of Water	Lake	Stream
Season	Winter	Winter
Day Of Week	Weekend	Weekday
Trout catch and size in inches	2 fish caught - average size 14 inches	6 fish caught - average size 10 inches
# 22		
Stocking Announcement	Day of stocking (4 PM)	Prior to stocking (Monday)
Type of Water	Lake	Lake
Season	Fall	Spring
Day Of Week	Weekend	Weekend
Trout catch and size in inches	6 fish caught - average size 10 inches	2 fish caught - average size 14 inches
#23		
Stocking Announcement	Day of stocking (4 PM)	Not announced at all
Type of Water	Stream	Stream
Season	Fall	Fall
Day Of Week	Weekday	Weekday
Trout catch and size in inches	6 fish caught - average size 10 inches	2 fish caught - average size 14 inches

Version 4

# 20	Trip A	Trip B
Stocking Announcement	Prior to stocking (Monday)	Prior to stocking (Monday)
Type of Water	Stream	Lake
Season	Fall	Winter
Day Of Week	Weekday	Weekday
Trout catch and size in inches	6 fish caught - average size 10 inches	6 fish caught - average size 10 inches
# 21		
Stocking Announcement	Not announced at all	Not announced at all
Type of Water	Stream	Lake
Season	Winter	Spring
Day Of Week	Weekend	Weekend
Trout catch and size in inches	6 fish caught - average size 10 inches	2 fish caught - average size 14 inches
# 22		
Stocking Announcement	Day of stocking (4 PM)	Prior to stocking (Monday)
Type of Water	Lake	Lake
Season	Fall	Fall
Day Of Week	Weekend	Weekend
Trout catch and size in inches	2 fish caught - average size 14 inches	6 fish caught - average size 10 inches
#23		
Stocking Announcement	Prior to stocking (Monday)	Not announced at all
Type of Water	Lake	Stream
Season	Winter	Fall
Day Of Week	Weekday	Weekend
Trout catch and size in inches	2 fish caught - average size 14 inches	2 fish caught - average size 14 inches

Version 5

# 20	Trip A	Trip B
Stocking Announcement	Not announced at all	Not announced at all
Type of Water	Lake	Stream
Season	Fall	Winter
Day Of Week	Weekend	Weekday
Trout catch and size in inches	6 fish caught - average size 10 inches	6 fish caught - average size 10 inches
# 21		
Stocking Announcement	Day of stocking (4 PM)	Not announced at all
Type of Water	Lake	Lake
Season	Winter	Winter
Day Of Week	Weekday	Weekday
Trout catch and size in inches	6 fish caught - average size 10 inches	2 fish caught - average size 14 inches
# 22		
Stocking Announcement	Prior to stocking (Monday)	Prior to stocking (Monday)
Type of Water	Stream	Stream
Season	Fall	Fall
Day Of Week	Weekday	Weekend
Trout catch and size in inches	6 fish caught - average size 10 inches	6 fish caught - average size 10 inches
#23		
Stocking Announcement	Prior to stocking (Monday)	Prior to stocking (Monday)
Type of Water	Stream	Lake
Season	Winter	Spring
Day Of Week	Weekday	Weekday
Trout catch and size in inches	2 fish caught - average size 14 inches	2 fish caught - average size 14 inches

Version 6

#	Trip A	Trip B
# 20		
Stocking Announcement	Not announced at all	Prior to stocking (Monday)
Type of Water	Lake	Stream
Season	Winter	Winter
Day Of Week	Weekday	Weekend
Trout catch and size in inches	6 fish caught - average size 10 inches	2 fish caught - average size 14 inches
# 21		
Stocking Announcement	Prior to stocking (Monday)	Not announced at all
Type of Water	Lake	Lake
Season	Fall	Winter
Day Of Week	Weekend	Weekday
Trout catch and size in inches	2 fish caught - average size 14 inches	2 fish caught - average size 14 inches
# 22		
Stocking Announcement	Not announced at all	Not announced at all
Type of Water	Stream	Lake
Season	Winter	Fall
Day Of Week	Weekend	Weekday
Trout catch and size in inches	2 fish caught - average size 14 inches	6 fish caught - average size 10 inches
#23		
Stocking Announcement	Day of stocking (4 PM)	Not announced at all
Type of Water	Lake	Stream
Season	Fall	Spring
Day Of Week	Weekday	Weekday
Trout catch and size in inches	2 fish caught - average size 14 inches	6 fish caught - average size 10 inches

Appendix C. Mail survey of lapsed trout anglers.

Survey of Stocked Trout Anglers Lapsed Participation



Thank you for your participation! Many people enjoy fishing for trout in Virginia. Today, we would like you to think only about your past experiences fishing for stocked trout. The objective of this survey is to better understand why some anglers, who previously purchased a Virginia trout license, did not do so last season.

We are defining last season as September 1, 2013 through August 31, 2014. Results from this survey will allow the Virginia Department of Game and Inland Fisheries to manage the stocked trout program to maximize angler participation and improve angler satisfaction. Results will also assist in the development of a Stocked Trout Management Plan - therefore, your responses are valuable to the future management of the program.



1. In what year did you last fish for stocked trout in Virginia?

2. During that year, how many days did you fish for stocked trout in Virginia?

3. For each of the following statements, please indicate the level of satisfaction you experienced when you last fished for stocked trout in Virginia.

		Extremely Dissatisfied	Moderately Dissatisfied	Slightly Dissatisfied	Neutral	Slightly Satisfied	Moderately Satisfied	Extremely Satisfied
Number of stocked trout I caught	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Size of largest stocked trout I caught . .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Friendly interactions I had with other anglers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The availability of stocked trout fishing information provided by the Virginia Department of Game and Inland Fisheries	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
How well stocked trout were distributed within the stocked section	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Not feeling crowded	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Average size of stocked trout I caught	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of big stocked trout I caught . .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Experiencing a natural setting	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ability to have a relaxing experience . .	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Being outdoors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overall fishing experience	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. Did you fish for stocked trout in any other states last season (September 1, 2013-August 31, 2014)?

Yes No

If yes, in which state(s) did you fish for stocked trout?

9. How important were each of the following factors in determining why you did not fish for stocked trout last season in Virginia?

	Extremely Unimportant	Moderately Unimportant	Somewhat Unimportant	Neutral	Somewhat Important	Moderately Important	Extremely Important
My declining health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I was too busy with work	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Extra cost of trout fishing license	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of fishing partners	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of access to stocked trout waters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fishing regulations are too strict and/or complicated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My participation in recreational other activities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lack of interest in stocked trout fishing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Poor fishing quality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cost of fishing-related expenses	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I was too busy with family activities and responsibilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

10. Were there any other reasons why you did not fish for stocked trout last season?

11. Stocking date and locations currently are announced at 4 PM the day of stocking. What is your preference regarding release of information about stocking? (Check one)

- No announcement at all
- Announced at 4 PM on the day of stocking (current method)
- Date and location announced at 8 AM each day
- Date and location announced at 8 AM on Monday each week
- Date and location announced at 8 AM on the 1st day of each month
- Date and location announced in advance for the entire fishing season

12. To what extent do you support or oppose the current regulations that allow year-round fishing for stocked trout?

- Strongly Oppose
- Slightly Oppose
- Slightly Support
- Strongly Support
- Moderately Oppose
- Neutral
- Moderately Support
- No Opinion

13. To what extent do you agree with the following statements regarding your past participation in fishing for stocked trout?

	Strongly Disagree	Moderately Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Moderately Agree	Strongly Agree
I believe increasing my fishing activity for stocked trout would harm the resource	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The people I know did not have time to fish anymore for stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I did not know other people to fish with for stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I did not like to kill stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The people I know did not have the money to fish for stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
My favorite stocked trout fishing places were too crowded	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Catching stocked trout caused too much injury to the fish	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The people I know did not have the necessary skills to catch stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I had too many family commitments to fish for stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The people I know were not interested in fishing anymore for stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I did not catch enough stocked trout to satisfy me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I did not feel it is appropriate to fish for stocked trout more often	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The people I know did not fish for stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I could not afford to fish for stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I did not have the necessary skills to catch stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other recreational activities took up my time that could have been spent fishing for stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I had too many work commitments to fish for stocked trout	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

14. Assuming you did not fish for stocked trout last season, what were your favorite ways to spend your free time?



15. Which of the following statements most accurately describes your personal situation?
(check only one response)

- Since I stopped fishing for stocked trout, I spend less time participating in recreational activities.
- Since I stopped fishing for stocked trout, I spend more time participating in other recreational activities that I took up before I stopped fishing.
- Since I stopped fishing for stocked trout, I spend more time participating in other recreational activities that I took up after I stopped fishing.

24. What is your city or county of residence?

- | | | | |
|---|---|--|---|
| <input type="checkbox"/> Accomack County | <input type="checkbox"/> Dinwiddie County | <input type="checkbox"/> Loudoun County | <input type="checkbox"/> City of Radford |
| <input type="checkbox"/> Albermarle County | <input type="checkbox"/> City of Emporia | <input type="checkbox"/> Louisa County | <input type="checkbox"/> Rappahannock County |
| <input type="checkbox"/> City of Alexandria | <input type="checkbox"/> Essex County | <input type="checkbox"/> Lunenburg County | <input type="checkbox"/> Richmond County |
| <input type="checkbox"/> Alleghany County | <input type="checkbox"/> City of Fairfax | <input type="checkbox"/> City of Lynchburg | <input type="checkbox"/> City of Richmond |
| <input type="checkbox"/> Amelia County | <input type="checkbox"/> City of Falls Church | <input type="checkbox"/> Madison County | <input type="checkbox"/> Roanoke County |
| <input type="checkbox"/> Amherst County | <input type="checkbox"/> Fairfax County | <input type="checkbox"/> City of Manassas | <input type="checkbox"/> City of Roanoke |
| <input type="checkbox"/> Appomattox County | <input type="checkbox"/> Fauquier County | <input type="checkbox"/> City of Manassas Park | <input type="checkbox"/> Rockbridge County |
| <input type="checkbox"/> Arlington County | <input type="checkbox"/> Floyd County | <input type="checkbox"/> City of Martinsville | <input type="checkbox"/> Rockingham County |
| <input type="checkbox"/> Augusta County | <input type="checkbox"/> Fluvanna County | <input type="checkbox"/> Mathews County | <input type="checkbox"/> Russell County |
| <input type="checkbox"/> Bath County | <input type="checkbox"/> Franklin County | <input type="checkbox"/> Mecklenburg County | <input type="checkbox"/> City of Salem |
| <input type="checkbox"/> Bedford County | <input type="checkbox"/> City of Franklin | <input type="checkbox"/> Middlesex County | <input type="checkbox"/> Scott County |
| <input type="checkbox"/> City of Bedford | <input type="checkbox"/> Frederick County | <input type="checkbox"/> Montgomery County | <input type="checkbox"/> Shenandoah County |
| <input type="checkbox"/> Bland County | <input type="checkbox"/> City of Fredericksburg | <input type="checkbox"/> Nelson County | <input type="checkbox"/> Smyth County |
| <input type="checkbox"/> Botetourt County | <input type="checkbox"/> City of Galax | <input type="checkbox"/> New Kent County | <input type="checkbox"/> City of South Boston |
| <input type="checkbox"/> City of Bristol | <input type="checkbox"/> Giles County | <input type="checkbox"/> City of Newport News | <input type="checkbox"/> Southampton County |
| <input type="checkbox"/> Brunswick County | <input type="checkbox"/> Gloucester County | <input type="checkbox"/> City of Norfolk | <input type="checkbox"/> Spotsylvania County |
| <input type="checkbox"/> Buchanan County | <input type="checkbox"/> Goochland County | <input type="checkbox"/> Northampton County | <input type="checkbox"/> Stafford County |
| <input type="checkbox"/> Buckingham County | <input type="checkbox"/> Grayson County | <input type="checkbox"/> Northumberland County | <input type="checkbox"/> City of Staunton |
| <input type="checkbox"/> City of Buena Vista | <input type="checkbox"/> Greene County | <input type="checkbox"/> City of Norton | <input type="checkbox"/> City of Suffolk |
| <input type="checkbox"/> Campbell County | <input type="checkbox"/> Greenville County | <input type="checkbox"/> Nottoway County | <input type="checkbox"/> Surry County |
| <input type="checkbox"/> Caroline County | <input type="checkbox"/> Halifax County | <input type="checkbox"/> Orange County | <input type="checkbox"/> Sussex County |
| <input type="checkbox"/> Carroll County | <input type="checkbox"/> City of Hampton | <input type="checkbox"/> Page County | <input type="checkbox"/> Tazewell County |
| <input type="checkbox"/> Charles City County | <input type="checkbox"/> Hanover County | <input type="checkbox"/> Patrick County | <input type="checkbox"/> City of Virginia Beach |
| <input type="checkbox"/> Charlotte County | <input type="checkbox"/> City of Harrisonburg | <input type="checkbox"/> City of Petersburg | <input type="checkbox"/> Warren County |
| <input type="checkbox"/> City of Charlottesville | <input type="checkbox"/> Henrico County | <input type="checkbox"/> Pittsylvania County | <input type="checkbox"/> Washington County |
| <input type="checkbox"/> City of Chesapeake | <input type="checkbox"/> Henry County | <input type="checkbox"/> City of Poquoson | <input type="checkbox"/> City of Waynesboro |
| <input type="checkbox"/> Chesterfield County | <input type="checkbox"/> Highland County | <input type="checkbox"/> City of Portsmouth | <input type="checkbox"/> Westmoreland County |
| <input type="checkbox"/> Clarke County | <input type="checkbox"/> City of Hopewell | <input type="checkbox"/> Powhatan County | <input type="checkbox"/> City of Williamsburg |
| <input type="checkbox"/> City of Clifton Forge | <input type="checkbox"/> Isle of Wight County | <input type="checkbox"/> Prince Edward County | <input type="checkbox"/> City of Winchester |
| <input type="checkbox"/> City of Colonial Heights | <input type="checkbox"/> James City County | <input type="checkbox"/> Prince George County | <input type="checkbox"/> Wise County |
| <input type="checkbox"/> City of Covington | <input type="checkbox"/> King George County | <input type="checkbox"/> Prince William County | <input type="checkbox"/> Wythe County |
| <input type="checkbox"/> Craig County | <input type="checkbox"/> King William County | <input type="checkbox"/> Pulaski County | |
| <input type="checkbox"/> Culpeper County | <input type="checkbox"/> King and Queen County | | |
| <input type="checkbox"/> Cumberland County | <input type="checkbox"/> Lancaster County | | |
| <input type="checkbox"/> City of Danville | <input type="checkbox"/> Lee County | | |
| <input type="checkbox"/> Dickenson County | <input type="checkbox"/> City of Lexington | | |

25 Do you have any additional comments you would like to share about the stocked trout program in Virginia?

Please return your completed survey in the business reply envelope as soon as possible. Thank you!

Appendix D. Summary of responses to question 10 from the lapsed angler survey.

Code	Number of responses	Percentage
Actions of other fishermen	1	1
Age	1	1
Fish out of state	1	1
Fish special regulation waters	1	1
Lifestyle	1	1
Military requirements	1	1
Morning stocking	1	1
Needs habitat improvements	1	1
Not enough special regulation waters	1	1
People are catching over the limit	1	1
Prefer to fish Bass	1	1
Time of stocking	1	1
Fish private waters	2	1
Poor areas being stocked	2	1
Poor quality of fish	2	1
Prefer to fish wild water	2	1
Weather	2	1
Disabled	3	2
New home/area	3	2
Health issues	4	3
Lack of advanced notice of stocking	4	3
Access	5	4
Crowded	5	4
Lack of even stocking	5	4
Family	6	4
Distance	7	5
Truck followers	7	5
Busy	8	6
Cost	8	6
Waters are always fished out	8	6
Low stocking numbers	12	9
Small size	13	10
No other reason	14	10

Appendix E. Summary of responses to question 14 from the lapsed angler survey.

Code	Responses	Percentage	Code	Responses	Percentage
Beekeeping	1	0.31	Musky fishing	1	0.31
Bow hunting	1	0.31	mountain biking	1	0.31
Car shows	1	0.31	off roading	1	0.31
cooking	1	0.31	photography	1	0.31
Dirtbike racing	1	0.31	playing cards	1	0.31
disc golf	1	0.31	practicing bow hunting	1	0.31
housework	1	0.31	private stream fishing	1	0.31
driving	1	0.31	target shooting	1	0.31
fishing private waters	1	0.31	trapping	1	0.31
float fishing	1	0.31	white marlin fishing	1	0.31
gold/relic hunting	1	0.31	woodworking	1	0.31
horseback riding	1	0.31	work	1	0.31
improving hunting land	1	0.31	working on cars	1	0.31
LMB fishing	1	0.31	working with young adults	1	0.31
motorcycling	1	0.31	yardsales	1	0.31
Archery	2	0.63	native trout fishing	2	0.63
Backpacking	2	0.63	non-recreational activities	2	0.63
Bowling	2	0.63	outdoor activities	2	0.63
Canoeing	2	0.63	preparing for hunting season	2	0.63
fly fishing	2	0.63	reading	2	0.63
ATV Riding	3	0.94	shooting	2	0.63
Baseball	3	0.94	wild trout fishing	2	0.63
health problems	3	0.94	house work	2	0.63
Biking	4	1.26	writing	2	0.63
farming	4	1.26	yardwork	2	0.63
home improvements	4	1.26	playing music	3	0.94
Boating	6	1.89	running	3	0.94
kayaking	6	1.89	striper fishing	3	0.94
Catfish fishing	11	3.47	too busy	3	0.94
golfing	11	3.47	traveling	3	0.94
gardening	12	3.78	volunteering	4	1.26
hiking	14	4.41	sports	6	1.89
Camping	19	5.99	satwater fishing	9	2.83
family	31	9.77	other fishing	20	6.3
hunting	46	14.5	SMB fishing	26	8.2

Appendix F. Summary of responses to question 17 from the lapsed angler survey.

Code	Responses	Percentage	Code	Responses	Percentage
Different species stocked	1	0.3	Less crowded	2	0.7
Different stocking announcements	1	0.3	Urban Program in Northern VA	2	0.7
Enforcement of regulations	1	0.3	Better financial situation	3	1.1
Fees included in license	1	0.3	Family	3	1.1
Larger creel limit	1	0.3	no stocking announcements	3	1.1
Lower creel limit	1	0.3	Better health	4	1.5
more catch and release	1	0.3	Finding someone to fish with	4	1.5
more delayed harvest waters	1	0.3	opening day in April	5	1.9
more special regulation areas	1	0.3	Better quality fish	6	2.2
season closes Jan 1	1	0.3	Lower fees	7	2.6
season closes Sept 1	1	0.3	Lower license fees	9	3.3
signage for access/regulations	1	0.3	Better access	12	4.5
stock Northern VA	1	0.3	Better stocking distribution	15	5.6
stocking of Brown Trout	1	0.3	Stop truck followers	15	5.6
weekend stocking	1	0.3	more stockings	16	6
winter stocking	1	0.3	Advanced stocking schedule	22	8.2
year round stocking	1	0.3	more free time	28	10.4
Additional waters stocked	2	0.7	more trout stocked	40	14.9
Age of family	2	0.7	Larger fish	50	18.6
Higher quality fish	2	0.7			