EXPLORING THE RELATIONSHIP BETWEEN FISHING REGULATIONS AND ANGLER COMPLIANCE IN VIRGINIA

by

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Abstract

Fishing regulations are often complex and reliant upon a general understanding of geographical awareness. Fishing regulations for the same fish species can vary across neighboring waterways or along a single waterway that is delineated into a river and lake, for example. It is plausible that anglers may not understand these complex regulations and subsequently may act in non-compliance. The purpose of this study was to explore the relationship between fishing regulations and angler compliance on the New River and Claytor Lake in Virginia. A survey was used to collect data from a sample of 15,000 registered Virginia freshwater anglers from July 2016-September 2017. Both anglers' regulatory knowledge and several demographic variables were used to predict the likelihood of anglers' compliance using a regression analysis. The potential policy implications of this research may include an increase in attention for angler education programs and discretionary tactics by law enforcement.

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Dedication

This thesis is dedicated to my wife Allie and daughter Paisley. Thank you for your unconditional love and support. Paisley, I hope you like your new bedtime story.

To my dogs, Aspen and Boone, your wagging tails and constant excitement kept me lighthearted during this process.

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Chapter 1

Introduction

With complicated fishing regulations, it is possible the regulations are creating accidental violators. Recreational fishing regulations are often complex and do not rely on biological research (Radomski, Grant, Jacobson, & Cook, 2001), such as regulations that are geographically defined. Regulations vary across the United States, with each state having a unique set. Regulations can be dependent upon seasonality, species, and/or geographic location. Research has found that there is a high level of non-compliance and exploitation in recreational fishing (Arlinghaus & Cooke, 2009; Muth & Bowe, 1998; Nielson & Mathiesen, 2003). However, few studies have explored why non-compliance is so high. One possible explanation is a lack of understanding of fishing regulations, a problem Pierce and Tomcko (1998) highlighted in their research. However, the authors did not measure anglers' understanding of the regulations as it related to regulatory compliance. The authors only explored the relationship between angler awareness and educating anglers about specific regulations versus regulations as a whole.

Confusion with regulations is not only reserved for the anglers. In a unique story from Pollock (1998), a Virginia Game Warden went quail hunting and ultimately bagged one bird. However, the warden later found out that he had hunted one week prior to the opening of quail season. Consequently, the warden reported himself to his superior officer and was subsequently charged with a misdemeanor crime. While this story does not deal with fishing regulations, there are close parallels between the complexities of fish and game regulations. This illustrative example is important as it shows that even those charged with enforcing certain regulations can become confused by them.

In recreational fisheries, some level of non-compliance may be accepted and even allowed based on the discretion and leniency provided by law enforcement. In a participant observation study of 22 Virginia game wardens, legal and extralegal factors were found to influence the warden's discretion (Carter, 2006). Legal factors included prior convictions or the seriousness of the offense. Extralegal factors such as offender demeanor and age were observed to affect the game warden's discretion. In the study, young offenders were given more leniency compared to older individuals who were expected to know the regulations. The study did not mention offender knowledge of the regulations or intend to try and measure it.

Despite related research such as Carter's (2006), there is currently limited research that actually connects regulatory understanding and subsequent compliance behavior among anglers. Arlinghaus, Cooke, and Potts (2013) noted from previous statistics that an estimated 140 million people participated in recreational fishing across North America, Europe, and Oceania. An estimated range of 220-700 million people participated worldwide. With such a high level of participation in recreational fishing, it is imperative that research focuses on regulatory understanding as it relates to compliance levels. Compared to current research, it was once thought that recreational fishing could not significantly impact fishery resources, though research now suggests the opposite (Arlinghaus & Cooke, 2009; Arlinghaus et al., 2016). A lack of understanding and subsequent non-compliance by an individual angler may ultimately not harm fishing resources; however, non-compliance by just 10% of worldwide anglers (20-70 million), for example, could be devastating for recreational fisheries. On local scales, high levels of non-compliance are the cause of the collapse of some fish species altogether (Post, 2013).

Past research on recreational fishing has largely focused on conservation-oriented topics, with social science or human dimensions and especially criminal justice topics often being

ignored or not included. Hunt, Sutton, and Arlinghaus (2013) argued that it is extremely important to start incorporating those types of research dimensions for a more interdisciplinary approach to managing recreational fishing and other conservation-minded topics. From a criminal justice perspective, often research has only focused on law enforcement without conservation management included. Research such as Filteau's (2012) study on law enforcement tactics for poaching is a good example where quality data were produced, yet little to no connections were made to the conservation management side of the issue. Furthermore, research from Walker, Foote, and Sullivan (2007) also captured some levels of angler non-compliance, yet did not draw connections as to why the act occurred. Connections between the conservation and criminal justice sides of research must be made in order to better manage recreational fisheries and other natural resources.

Statement of the Problem

Previous research by Arlinghaus, Mehner, and Cowx (2002) found that no occurrence of species extinction has occurred from recreational fishing alone. However, it cannot be understated that a high level of exploitation leading to species decline has occurred in recreational fishing (Arlinghaus & Cooke, 2009; Rahel, 2004). It is currently unclear why drastic declines or changes have occurred from recreational fishing. One possibility is that angler non-compliance may be partially to blame. In a study conducted by Diogo, Pereira, and Schmiing (2016), the authors measured non-compliance levels as high as 40%. Non-compliance levels of varying degrees may cause harm to certain fish species that are often sought by anglers. Though not measured in the study, the authors implicitly suggested that a lack of regulatory understanding may be a primary driver for the levels of non-compliance. Using that explanation

for fish declines or general exploitation, it may be likely that if anglers do not understand regulations, they could overfish, or harm protected species by illegally keeping their catch.

In earlier research by Glass and Maughan (1984) and Gigliotti and Taylor (1990), the authors made connections between non-compliance in recreational fisheries and a lack of regulatory understanding by anglers. Based on their findings, each of these researchers recommended the need for future research on the topic in order to better understand why non-compliance was occurring and if lack of regulatory knowledge was a contributing factor. However, studies on angler non-compliance have continued to largely ignore the reasoning behind angler actions regarding non-compliance. One exception was a study conducted by Eliason (2004). While his study documented several reasons why some offenders violated fishing regulations, examples of accidental non-compliance from a lack of regulatory understanding were only rarely noted by the wildlife offenders and law enforcement officers surveyed. Many questions have been left unanswered or unexplored such as the possible linkage between anglers' tested knowledge and subsequent behavior.

While rates of non-compliance have been found to be relatively high among anglers, evidence has been found that anglers typically favor fishing regulations as opposed to not having any (Dawson & Wilkins, 1981). If this is the case, why are anglers not following the regulations? Some research has alluded to or found that a lack of regulatory understanding is to blame; however, no consensus has been made. Research by Johnson, Arlinghaus, and Martinez (2009) also suggested ineffective fishing regulations education may be a driver for angler non-compliance. However, their research did not measure for this variable directly. Furthermore, Gigliotti and Taylor (1990) noted the complexities of recreational fishing management are due to

the balancing act of protecting a natural resource along with allowing for the human recreation of catching fish and potentially harming the resource in the process.

Regulations are typically the primary enforcement tool designed to give some protection to the resource. However, effective fisheries management cannot be accomplished if the anglers participating do not know or understand the regulations (Martin, 1995). As previously noted, high levels of non-compliance do exist and ultimately have harmed fisheries resources. Gigliotti and Taylor (1990) provided an example in which increased law enforcement presence at a specific lake with compliance issues led to a reduction in non-compliance as well as a reduction in the fishery's population decline. However, there was no mention of regulatory knowledge or education of the regulations by law enforcement to the anglers; therefore, the exact cause of the initial non-compliance was not determined. The results of this study are important because it is an example where direct law enforcement intervention protected the natural resource. However, as noted by previous research (Eliason, 2011; Falcon, 2003; Forsyth & Forsyth, 2009), game and fisheries law enforcement is often very sparse and must cover large tracts of land. Therefore, it is important for fishing regulations to be understood by anglers in the hopes they will be observed. A quote by Aldo Leopold (1989) drives this point home: "A peculiar virtue in wildlife ethics is that the hunter ordinarily has no gallery to applaud or disapprove of his conduct. Whatever his acts, they are dictated by his own consciences, rather than by a mob of onlookers" (p. 178).

Purpose of the Research

This research is designed to capture fishing regulation knowledge and demographics of anglers who have fished within the New River near Claytor Lake and/or Claytor Lake in Virginia, as well as the likelihood that anglers would act in non-compliance of waterway specific regulations. The results of this study are important for three main reasons: 1) they increase the

depth of research concerning angler regulation compliance, 2) they provide results that fisheries and criminal justice professionals can apply, and 3) they combine conservation-minded research with criminal justice research.

The combination of research topics in this paper's study is important because the American model of conservation is unlike any other across the world. In the United States, many conservation programs are directly funded from fees in the way of fishing licenses and tax stamps (Sutton, Stoll, & Ditton, 2001). In 2016 alone, 35.8 million individuals ages 16 and older participated in freshwater recreational fishing, excluding the Great Lakes (United States Fish and Wildlife Service, 2017). Additionally, anglers spent around $46 billion on expenditures related to fishing such as equipment, travel, and licenses. One percent of that total ($461 million) came from license sales, which are mostly used for fishing conservation programs across the country. The economic importance of recreational fishing in this country and the ties it has with fisheries conservation cannot be ignored. Any attempt to understand why anglers may act in non-compliance with fishing regulations may be beneficial from a law enforcement view, but also a conservation/economic view.

Lastly, part of the dilemma with this paper's research topic is that there is currently not a lot of previous research to use as a foundation. Previous research has been strictly limited to the conservation or criminal justice fields with little overlap. Despite some of the problems with a lack of integrated research, it is the central goal of this paper's research to fill in the gaps missing from the previous literature regarding angler knowledge of regulations and subsequent compliance actions. In the attempt to do so, an integration of human dimensions from criminal justice and fisheries conservation and management can evolve.

Research Hypotheses

This study seeks to build upon previous angler compliance research while expanding upon some aspects that have not been adequately covered. These hypotheses have been created to strengthen previous research findings and link fishing regulation knowledge with non-compliance. The hypotheses are as follows:

1. Respondents with less knowledge of the fishing regulations will be less likely to comply with them.

   (Null Hypothesis) There will be no difference among respondents' likelihood to act in compliance and their knowledge of the fishing regulations. The lack of knowledge is an operationalization of confusion or ignorance of the fishing regulations for the area of study.

2. Respondents who use less specialized fishing methods will be less likely to know the fishing regulations for the area under examination.

   (Null Hypothesis) There will be no difference among the respondents' fishing method and their knowledge of fishing regulations. Specialization of fishing methods ranges from a highly specialized method such as fly fishing for targeted species to a less specialized method such as spin fishing or cane pole fishing for non-targeted species.

Limitations of the Study

All research is limited by some factors and this study is no exception. While these limitations may decrease the generalizability of the study, the results may nonetheless still increase the body of knowledge on the topic. While this study's focus areas are very localized, future research may build off the methods of this study and apply them to other locations.

The sample for this study is comprised of all individuals who registered for a Virginia freshwater fishing license or combination license between July 1, 2016 and September 5, 2017. The registration process for a Virginia fishing license requires an email address. A total of 187,250 unique email addresses were obtained from the Virginia Department of Game and Inland Fisheries. No other information about the anglers was obtained. The sample was limited to those who had fished in the designated waters in the area of interest for this study. A contingency question at the start of the survey determined eligibility. The survey in this study is limited to those who have access to the Internet and an email address. Additionally, the results of this research will be highly geographically specific. The specificity of this research's study area is due to the complexity and possible confusion of the fishing regulations in this area. A small-scale project like this has been done in previous research (Curcione, 1992) and will add to the body of knowledge on the topic, thereby giving a broader understanding of fishing compliance in many different settings.

Definition of Terms

Many of the terms used in this research are atypical of criminal justice research and can vary somewhat in different research projects due to the different operationalization of the terms. The following terms explain the operationalized definitions used in this study:

Anglers- Any person who fishes. This term is interchangeable with the term fishermen.

Biotic species- Any living species.

Catch-and-release- The act of catching a fish and returning it to the water unharmed. The caught fish are not for consumption or economic gain.

Commercial Fishing- Fishing that is for economic gain primarily through the sale of fish. This often occurs in saltwater fisheries.

Creel Limit- The number of fish an individual can catch and keep during a specified period.

Fishing- The act of having a rod (sometimes), line, and hook in the water for catching a fish. Used interchangeably with angling. For this research, this term excludes net fishing and bow fishing.

Fly Fishing- A traditional method of fishing that is highly specialized and involves using a weighted line to propel an unweighted fly (lure) for catching fish.

Lure- An artificial fishing bait that is often weighted and used to attract fish. It may or may not imitate a biotic species.

Poaching- For this study, poaching is any act that is in non-compliance with fishing regulations whether intentional or not.

Possession Limit- The number of fish an individual can have in his or her possession while fishing. The legal definitions for this vary state by state and locality.

Recreational Fishing- Any fishing done by an individual for sport or pleasure. Economic gain through the sale of fish is not a primary motivation.

Spin Fishing- Fishing that is done by using a rod/reel combination where a weighted lure is used to attract fish.

Chapter 2

Literature Review

The Problem of Illegal Fishing

Criminal justice research that has focused on "folk" crimes (crimes that do not typically decrease the offender's social standing), or more specifically, wildlife crimes, has been relatively scant (Aas, Haider, & Hunt, 2000; Curcione, 1992; Eliason, 2004; Forsyth, 2008; Muth & Bowe, 1998). While poaching and other wildlife crimes have gained international attention from many research communities, the criminal justice community has largely ignored the issue. Little interest has been applied to understanding the complexities of wildlife crimes, specifically fisheries crimes, such as the motivations and inter-relationships with wildlife management strategies and regulations. The focus of this study is largely intertwined between criminal justice and fisheries conservation research. Many of the publications discussed in this chapter originate from conservation management literature. However, whether deliberate or not, the articles contain information pertinent to criminal justice theories and applications.

Defining the crime is the first step to understanding the criminal issue. In terms of fisheries compliance, researchers are still trying to define non-compliance and what it includes. Arlinghaus and Cooke (2009), from a conservation standpoint, referred to compliance issues and the lack of research on the issue. They did not provide a definition of non-compliance, but suggested education is necessary to reduce the high levels currently observed. Earlier research from Muth and Bowe (1998) also noted a lack of research on the issue and suggested the need for more research that may aid law enforcement efforts. Their research, however, defined poaching as any intentional taking of wildlife. Eliason (2004) found the intentional poaching definition to be too restrictive and therefore favored a more broadened definition. This research

will define poaching by including unintentional actions and accidental non-compliance. The expanded definition allows for a more accurate representative sample of anglers exhibiting non-compliance because it includes those who may not be aware of regulations or understand them. Additionally, attention must be given to past research completed on different geographical scales to fully define the scope of recreational angler non-compliance.

Accurate levels of non-compliance are hard to come by and often imprecise for several reasons in addition to the lack of a standardized definition. Though it is hard to calculate the exact level of non-compliance of wildlife regulations, research suggests a high level of poaching occurs globally (Smith, Anderson, & Smeltzer, 1989) and in North America (Muth & Bowe, 1998). Research uses any measured level of criminal deviance or non-compliance, including fisheries compliance, and is often plagued by many of the same methodological struggles such as those crimes that are not reported or measured (Solomon, Gavin, & Gore, 2015; Thomas, Gavin, & Milfont, 2015). Another methodological struggle regarding fisheries regulation compliance is identifying a viable population and obtaining an adequate response rate. As with many other crimes types, it is estimated that only a small percentage of fishing violators are caught (Elffers, van der Heijden, & Hezemans, 2003; Keane, Jones, Jones, & Milner-Gulland, 2008), thereby limiting law enforcement and researchers' ability to measure the problem. This problem was illustrated in research by Thomas et al. (2015) concerning non-compliance among recreational anglers. In their study, a viable population was initially hard to identify, and subsequent response rates were low. Despite these methodological issues, numerous research studies have been able to present estimates of the extent of the problem, concluding that non-compliance of wildlife laws, including fisheries regulations, is a significant problem (Eliason, 1999; Gavin, Solomon, &

Blank, 2009; Gigliotti & Taylor, 1990; Muth & Bowe, 1998; Smith, Anderson, & Smeltzer, 1989).

International Research

At the international level, research studying recreational angler non-compliance is incredibly difficult for several reasons (Arlinghaus et al., 2016; Solomon et al., 2015) and is comprised of many of the methodological problems mentioned previously. The difficulty exists primarily during the initial methodological stages when identifying samples for study. Samples are often hard to identify because most angler non-compliance is unknown and only based on wide estimates (Smith et al., 1989), and/or survey populations can be geographically spread across great distances (Arlinghaus et al., 2016).

Furthermore, when a sample is surveyed, a wide range of response rates are common among anglers (Fisher, 1996). Survey response rates in a larger non-compliance study from Nielsen and Mathiesen (2003) averaged 25%, while the response rate for a smaller study by Aas et al. (2000) was 58%, and in a study by Blank and Gavin (2009), the response rate was 82%. More difficulty arises when studying angler non-compliance on a large scale due to the almost endless concentrations within the topic. Research could focus on all recreation non-compliance for trout across North America or non-compliance among commercial shark anglers; the possibilities are almost endless.

For much of the current international research on angler non-compliance the focus has been on commercial fishing as opposed to recreational fishing (Cooke & Cowx, 2004). Research focusing on recreational angler non-compliance typically comes from more localized and species-specific studies (Beard, Cox, & Carpenter, 2003; Blank & Gavin, 2009, Curcione, 1992;

Glass & Maughan, 1984). Despite the difficulties, some research has been conducted on larger scales to provide wide-ranging estimates of angler non-compliance.

Using global statistics, Arlinghaus et al. (2013) estimated that between 220 million and 700 million people participate in recreational fishing each year. If even a small percentage of that range acts in non-compliance with fishing regulations, entire fisheries could become unstable and ultimately collapse according to the researchers. More recent research by Arlinghaus et al. (2016) noted an abundance of evidence that suggested recreational fishing can have a large impact on fish abundance and size. In the research from 2013, Arlinghaus et al. cited an example from Spain where tourist anglers were catching undersized fish and illegally keeping them, an action that had biological and economic consequences on local communities. Biologically, the recreational fishery was in decline from the illegal fishing. The decline in good fishing opportunities hurt the economies of local communities that were reliant upon fishing tourism. In each of the international research articles discussed, large-scale estimates of non-compliance were used based on more localized research.

Localized Research

Studying angler non-compliance at the localized level is more common and easier to do compared to international research for many reasons. Denscombe (2014) noted the ease of data gathering and budget concerns as prime reasons for small-scale social science research. However, research conducted at highly specific levels can also have its own set of problems, primarily, generalizability. Much of the angler compliance/non-compliance research has been completed on localized levels and is often limited to just a few bodies of water. Despite the narrowly focused research, Curcione (1992) found anglers are typically very homogenized in North America and much of the research findings are consistent.

Concerning localized compliance levels, the research has produced mixed estimates. In a localized study measuring non-compliance of limpet (Patella spp.) harvesting in the Azores islands, Diogo et al. (2016) found levels of non-compliance as high as 40%. The compliance levels were collected through roving creel surveys and the observations were then compared to the existing limpet regulations of the area. Research conducted in 1998 by Pierce and Tomcko also noted localized levels of angler non-compliance. In their study of five small Minnesota lakes, compliance of slot length limits for Northern Pike (Esox lucius) was analyzed. The researchers noted a higher than expected level of non-compliance where creel clerks found on average 13% of fish they measured to be undersized, and on average, 19% of fish from voluntary tag returns were also illegal. More localized studies such as those by Schill and Kline (1995) as well as Wilberg (2009) also found moderate to high levels of non-compliance. Levels of non-compliance in the former were as high as 29% and 36% in the latter.

In each of these studies, explanations for the measured non-compliance could not be determined. In the research by Diogo et al. (2016), all observed offenders declined participation in follow-up interviews, limiting the testability of offender motivations and regulation knowledge. However, it was observed and noted that many offenders chose locations that were mostly secluded and away from public viewership, suggesting knowledge of wrongdoing. In despite of the high levels of non-compliance observed in the Pierce and Tomcko (1998) research, only two arrests were made. The arrests were not effects of the research, but instead occurred when conservation officers joined the researchers during the measurement periods. No further explanation was given concerning arrest rates and levels of non-compliance.

Offering a further explanation for the low arrests rates often observed for wildlife violators, Wellsmith (2011) stated that wildlife crimes are often seen as less serious and

enforcement is influenced by more pressing factors. However, arrests rates for conservation-related issues can depend on many variables such as officer discretion or the type of behavior exhibited by the offender (Eliason, 2004). While these explanations are useful for the enforcement of fishing regulations, they do not provide direct explanation for the observed non-compliance levels in the related research.

Recreational poaching. The effects of commercialized poaching are well known; however, recreational poaching has not seen as much attention. Research related to recreational poaching and the topic of this thesis comes from Page and Radomski (2006). In their study, angler awareness of regulations was looked at for 35 Minnesota fisheries. Anglers were asked how much they fished in a year, their awareness of regulations, and if they could recite the regulations for the studied fishery. The researchers found from creel surveys (interviews and catch data) that only a small portion of individuals (14%) did not know the regulations for a measured fishery within Minnesota. The range of unawareness was between zero and 48%. Largemouth bass (Micropterus salmoides) fisheries saw the highest levels of unawareness. The more complex the regulations were, the lower the awareness was; this applied to newly implemented regulations as well. Angler awareness varied greatly by location and targeted species. However, on average, most anglers were well educated in the regulations. Also, contrary to many other studies, the researchers found there was a low level of non-compliance exhibited at the selected study sites. The statistical analysis for the research did find significance at the $P < 0.001$ level in terms of non-compliance and unawareness. The research conducted an odds ratio analysis that revealed a higher tendency for an unaware angler to illegally harvest fish.

Another study concerning regulations and education comes from Martin (1995). While this study did not measure deviance, it did mention the need for regulations to be well

communicated by law enforcement. This corroborates with the findings and suggestions in the Page and Radomski (2006) research. In the two previously mentioned studies, cooperation and education were noted as key conservation and enforcement tools that could benefit the environment as well as lower non-compliance rates, possibly limiting damage to fish species.

In an example of the environmental consequences due to high levels of non-compliance, Gigliotti and Taylor (1990) designed a study that looked at the effects recreational poaching had on the legal harvesting of four fish species. The results were as expected; as poaching levels increased, legal harvest levels decreased. The levels at which these relationships occurred were frightening from a conservation standpoint. For Brook trout (Salvelinus fontinalis), there was a 72% decline in legal-sized fish caught at a 100% poaching rate. Reductions near this level were seen in two of the other fish species as well. The results of this study clearly show some of the impacts recreational poaching can have on the fisheries resource. However, as noted by Arlinghaus and Cooke (2009), there are no readily available examples where a species has gone extinct due to recreational fishing.

Angler Perceptions of Regulations

Often a topic of interest for criminal justice research is the preferences of offenders. While some research has been conducted on animal poacher preferences and motivations (Beattie, Giles, & Cowles, 1977; Eliason, 2004; Filteau, 2012; Muth & Bowe, 1998), little has been applied to the subset of angler or fishing poachers. Understanding anglers' preferences towards fishing regulations is an important component to developing a complete understanding of non-compliance.

Generally, support for new laws or regulations is heavily debated across a range of subjects (Gray, 2013). Within the culture of fishing regulations, however, support for new

regulations is typically cohesive (Aas et al., 2000; Dawson & Wilkins, 1981). The study by Aas et al. (2000) found that when presented with the possibility of new regulations, there was general support among Norwegian sport fishermen. Additionally, support among fly-fishermen, a group considered more specialized (Bryan, 1977; Chipman & Helfrich, 1988), was higher compared to anglers, who are less specialized and only occasionally fish using techniques such as spin-fishing, which requires less of a learning curve. This finding of more specialized anglers having greater support for new or stricter fishing regulations is not unique. In their study, Chipman and Helfrich (1988), over the course of a year, randomly contacted 544 Virginia anglers through a stratified random sampling procedure that was broken down by different river sections, seasons, and days of the week. Each question was presented as open-ended or as ordinal categories and scored ordinally to indicate a level of specialization. They found that more specialized anglers preferred stricter regulations compared to less specialized anglers. In their studies, Bryan (1977) and Chipman and Helfrich (1988) also found that less-specialized anglers preferred more liberal fishing regulations, yet still preferred some regulations over nothing.

Providing more evidence for anglers' support of fishing regulations, another study that used Virginia and New York anglers conducted by Dawson and Wilkins (1981) found that more than 50% of interviewed anglers favored some regulatory constraints. The majority, 83%, indicated that the new proposed regulations would not affect their participation in fishing. While studying the preferences of anglers and their site selections, Hunt (2005) also found regulations played little into the decision-making process of the anglers. These studies, while older, represent longitudinal support for regulations among anglers. Lastly, current or proposed fishing regulations seem to not dissuade many anglers from future fishing and therefore may not be a motivation in legal or illegal fishing activities.

Explanations for Why Illegal Fishing Might Occur

Despite a general support for fishing regulations, there is a measurable disconnect between that support and regulatory compliance. Research by Curcione (1992) and Eliason (2004) highlighted this point. Research concerning why anglers act in non-compliance can be broken down into intentional and unintentional violations.

Intentional

Regarding motivations, anglers are characteristically intrinsic and are not always at odds with fishing regulations. However, as noted by various research, those motivations can and have often translated into non-compliance with fishing regulations (Curcione, 1992; Dawson & Wilkins, 1981; Eliason, 2004; Walker et al., 2007). Research from multiple authors have found and suggested that violations can be intentional despite regulatory knowledge (Johnson, Arlinghaus, & Martinez, 2009; Muth & Bowe, 1998; Rahel, 2004). This section expands on the issue of intentional non-compliance and the possible explanations behind the deviant acts of anglers.

Motivations. The motivation of anglers' likelihood to comply with fishing regulations has only recently been a topic of research and oftentimes the explanations are relatively basic. Chipman and Helfrich (1988), Curcione (1992), and Eliason (2004) have all looked at angler motivations while including a focus on deviance. In their studies, the primary motivation mentioned by anglers was to enjoy nature and/or be with friends and family. Catching a "sizeable" fish was also listed as a primary motivation of many anglers (Chipman & Helfrich, 1988; Curcione, 1992). Research by Beard, Cox, and Carpenter (2003) found similar results where anglers were more motivated to fish in areas that had higher bag limits based on the false perception that these areas may contain larger fish and more fish overall. Despite these findings,

there were no connections made between the motivations and likelihood of compliance. The use of criminological theories was also not apparent in the studies. The findings are important, however, because they offer a motivational explanation from the angler's point of view that can be used alongside theoretical explanations.

Because many of the articles included in this chapter are from conservation journals, oftentimes there is a lack of theoretical criminology backing the explanations of non-compliance. Research from Keane et al. (2008) and Filteau (2012) are two of the more recent articles that have included criminology theories. The deterrence and defiance theories were the focal point of Filteau's (2012) research. In the researcher's conclusions from interviews with poachers and law enforcement in Maine, a connection was made between the use of discretion and an individual's (poacher) sense of fairness. If individuals felt like they were treated fairly by the officers and/or game regulations, then their levels of defiance decreased. Additionally, the findings suggested that a decrease in the perception of punishment avoidance will lead to greater levels of deterrence among poachers. A warning, however, is stated that these techniques may not work on the most dedicated offenders.

Using the general theory of deterrence, Hunt (2005) found that laws and regulations can be a factor when anglers are choosing a site to fish. These findings were also consistent with deterrence research (Tomlinson, 2016) that laws or regulations generally do not dissuade potential offenders. Research by Walker et al. (2007) found similar results. In their study, the researchers looked at the effectiveness of enforcement and the associated deterrence on illegal angling harvest. The research concerned anglers' perceptions of enhanced enforcement strategies at various popular fishing sites in Alberta, Canada. No attempt was made to establish why anglers broke the law in the first place. However, using interviews, a connection was made in

which anglers did perceive a higher risk of detection with increased law enforcement presence. Nevertheless, angler perceptions were consistently overestimated and were not associated with significantly reduced levels of illegal harvesting. Signs broadcasting information around the popular fishing areas also were tested for their effectiveness in conveying certainty and severity of possible punishments. Yet, no statistical deterrence effect was realized. Despite increased angling perceptions of getting caught for their illegal harvesting, anglers were still motivated enough to violate the law, ultimately undeterred.

From related research about non-compliance, Rahel (2004) studied illegal fish stockings and noted that oftentimes the stockings were a result of individuals who harbored disdain for the government and regulations and/or because they felt specific waterways needed more game fish. Explanations were similar concerning knowledgeable violations with stockings from the research of Johnson et al. (2009) and Ruzycki, Beauchamp, and Yule (2003). In Muth and Bowe's (1998) research, qualitative interviews revealed multiple attitudes of anglers that knowingly violated regulations. Muth and Bowe (1998) created 10 typologies to describe these individuals, with many of them aware they were in non-compliance with regulations. Examples of typologies include poaching as rebellion, poaching as a traditional right, and regulatory disagreement.

While many of the preceding articles only subtly touch on criminal justice issues or theories, the following studies directly concern and contribute to the criminal justice field. Despite studying angler perceptions associated with law enforcement, the previously mentioned study by Hunt (2005) made no attempt to measure potential future deviance. A study by Eliason (2004), however, has studied the motivations of illegal fishermen, but only for past actions. In Eliason's (2004) research, the study population was 33 wildlife law violators and 24 conservation officers in Kentucky. Data were gathered through mail-in surveys and in-depth

interviews. The results reinforced previous studies (Curcione, 1992) in finding support for theoretical explanations of poaching, such as the neutralization theory and differential association.

Techniques of neutralization. The neutralization theory describes motivations or rationalizations by the offender. Sykes and Matza (1957) reasoned that neutralizations may occur before the crime. They created five possible neutralizations. The first is the denial of responsibility in which the deviant claims to lack any responsibility for his or her own actions. This neutralization can be related to fishing deviance where the angler may claim he or she was not aware of the regulations or the regulations are too complicated' therefore, it is not his or her fault. The second technique is the denial of injury. This neutralization downplays the level of harm involved in the deviant act. For anglers who do not understand fisheries management, a denial of harm may be used as an excuse for their actions. This excuse is also related to the third technique of the denial of the victim. If the angler does not perceive the fish or other anglers to be of importance and no harm was incurred by acting in non-compliance, then it is likely the fish or other anglers will not be viewed as a victim. The fourth technique is the condemnation of the condemners. This neutralization occurs when the violators claim their violations are not significant and are perceived to be less important than other, more serious offenses committed by other individuals. This technique was observed in a study by Eliason (1999) when poachers compared their crimes to more organized poachers to try and lessen their own behavior. The last technique is the appeal to higher loyalties where the individual puts social loyalties above societal controls. This occurs when the offender places more importance on loyalty to family or friends, despite the potential for criminal deviance. Research pertaining to fishing and regulatory non-compliance has not used this technique as a potential descriptive for the illegal behaviors.

One of the most comprehensive studies that directly used the techniques of neutralization explanation was conducted by Curcione (1992). This research focused on the deviant behaviors exhibited by individuals on party boats. A party boat is a commercial fishing boat with fishing guides that aim to help clients catch fish. Using interviews with 16 anglers, the researcher found individuals who participated in illegal fishing practices had typically rationalized or neutralized their illegal activity beforehand. This suggested the motivations of anglers breaking the law are a precursor to the act itself. For example, one angler noted his or her main motivation for fishing and potentially illegal fishing was the joy of catching fish regardless of the regulations. This type of fishing is unique because the result of catching a fish is economically guided. As noted in the research, the party boat captains made a living based on their customers' satisfaction through catching fish. The economic drive of satisfying customers sometimes led to illegal fishing behaviors.

More recent research by Eliason (2004) found similar results, which provided further support for Sykes and Matza's (1957) theory. In the research by Eliason (2004), many of the wildlife law violators claimed ignorance of the law as reasoning for breaking the law; this was reiterated by the interviewed conservation officers. The studied individuals would also often try to explain "away" their actions. They would do this by claiming ignorance or mistake. In one example, an individual placed a boat in the water and his son-in-law cast an un-baited line into the water to check his pole. The two were then cited for fishing without a license despite their intentions to later buy one. The two anglers felt as if out-of-staters were being targeted by the conservation officers. Other individuals felt no need to even buy a license because they felt as if they were not really fishing, but just messing around or only briefly fishing.

While it was difficult to determine whether the explanations were true or simply neutralizations, the in-depth interviews that contained open-ended questions offered more conclusive evidence supporting the neutralizations standpoint. From the interview transcripts, many individuals downplayed the severity of their actions and would attempt to excuse their actions for various reasons such as trophy poaching, recreation satisfaction, money/profit, and general ignorance. It was found that often the more serious crimes such as trophy poaching were associated with neutralizations as opposed to minor violations like fishing without a license.

The claim of ignorance fits into the neutralization technique of denial of responsibility as created by Sykes and Matza (1957). This, of course, is based solely on qualitative interview data and cannot be linked to whether the claim of regulation ignorance was a neutralization or legitimate cause of the crime. More research is needed in this area. Another finding from the study was that when anglers were asked about deviance, some claimed their actions were motivated by their need for food and/or income. The in-depth interviews with conservation officers found this explanation to be inadequate. Conservation officers were familiar with the excuse, but often cited government food programs as a cheaper and more effective means of obtaining food than poaching.

Differential association. The precursor and foundation of Sykes and Matza's (1957) techniques of neutralization is Edwin Sutherland's theory of differential association. This theory set out to extend the characteristics of the general social learning theories of his time. His theory proposed that criminal behavior can be learned from close interactions between individuals such as illegal fishing. During these interactions, often between friends and family members, certain values and knowledge conducive to crime are shared among the interacting individuals. If generational traditions concerning fishing methods include criminal behaviors, then these

behaviors are likely to be passed down as well. Critics often responded with skepticism related to why many individuals seemingly do not become criminals after brief encounters with criminals. However, as Akers (2006) noted, these criticisms are typically misguided. In his explanation supporting the theory of differential association, Akers noted, that only close and prolonged interactions between individuals are favorable for associations of criminal knowledge and values. Fishing is often a social activity with specific knowledge and experiences shared amongst family members and close friends (Floyd, Nicholas, Lee, Lee, & Scott, 2006). As noted in the next paragraph, these interactions may include knowledge and values that are criminal in nature.

The motivation to catch a "sizable" fish was found to be a primary driver of deviance in the Curcione (1992) study. The researcher's study consisted of interviews and observations of anglers who had violated various fishing regulations as part of their experiences on party boats. These party boats were likened to commercial fishing outfitters where economic factors are the primary motivators. All individuals studied were acquainted. Curcione (1992) found that among the study participants, their exposure to normative values of non-compliance were significant influences on their behaviors. This group learning environment is a direct descriptive result of the differential association theory. The acquainted individuals on the party boats all exchanged stories and ideas as to why their actions were acceptable, leading to the acceptance of definitions favorable to law violation. A few individuals also noted during the interviews that they felt the possibility of getting caught to be minimal and therefore ignored the regulations. This feeling was related to experiences while growing up, where they were told that getting caught was not likely. Many of the individuals also offered explanations that seemed to lower the severity of their actions. This lowering of severity and excuse for non-compliance are also related to the neutralization theory as created by Sykes and Matza (1957).

Another finding was that the consensus of party boat captains in the study felt money played an important role in the purposeful violation of fishing regulations. If customers were not happy with their catches, the party boat operators were not making money, so the need for economic gain outweighed the adherence to fishing regulations. Additionally, the study also noted that many individuals in rural areas often see natural resources, including fish, to be free for the taking as a reason for the non-compliance.

Unintentional

This study is trying to understand the basis for why anglers act in non-compliance. Based on previous research findings, the explanation may be based on unintentional acts from the anglers. Research from Filteau (2012) noted that crimes such as non-compliance with fishing regulations are *mala prohibita*; whereas, the regulations vary greatly (creel limit, size, target species) across areas and even among the same waterways. This large variation leads to potential confusion and/or resentment. In this section, possible explanations of unintentional non-compliance due to lack of knowledge are discussed.

Lack of knowledge. With the ever-increasing blend of natural and social sciences concerning fisheries management (Anderson, 1989), it makes sense to try and apply social science concepts to explain non-compliance among fisheries regulations (Jentoft, 2004). As noted previously, education is a key aspect related to regulatory compliance. In a study by Glass and Maughan (1984), one of the key reasons for larger illegal harvests was a lack of angler knowledge or understanding. Despite this study being limited to Sooner Lake in Oklahoma, the results helped create a picture of compliance and regulatory knowledge. Research from Jentoft (2004) proposed that when a normative set of standards is created and more guidance through knowledge occurs, regulatory compliance should improve. Multiple studies have related

improved education levels to higher levels of compliance (Filteau, 2012; Page & Radomski, 2006; Pierce & Tomcko, 1998; Thomas et al., 2015; Wilberg, 2009). On a more specific level, Wilberg (2009) found non-compliance was due to the anglers' inability to identify fish species as well as an overall lack of regulation awareness. Research from Schill and Kline (1995) found statistically significant associations between awareness of regulations and non-compliance when studying barb versus barbless hook regulations. Anglers from outside of the measured area often exhibited less regulatory knowledge as well. Enforcement officers interviewed in the study suggested about 75% of the violations were accidental, mostly due to lack of knowledge and failure to correctly inspect equipment.

The Current Study

As the prior literature has demonstrated, there is not a full understanding of why anglers act in non-compliance regarding fishing regulations. This study attempted to improve the current understanding by providing more evidence concerning unintentional non-compliance. The researcher of this study hopes to blend the scientific fields of fisheries management and criminal justice. Radomski et al. (2001) made an interesting prediction that future management of fisheries may rely more on social science than the natural sciences. While natural sciences can tell us about the environment, they cannot describe the individuals utilizing the environment. The results of this study may also help law enforcement and conservation agencies improve their ability to effectively communicate fishing regulations to anglers. A better communication method may decrease levels of non-compliance, thus, increasing the sustainability of freshwater fisheries.

Chapter 3

Methodology

The anglers examined in this study are from a list of registered anglers who purchased a Virginia freshwater license or freshwater combination license between July 1, 2016 and September 5, 2017. This time frame was set by the Virginia Department of Game and Inland Fisheries (VDGIF), which provided the information after a Freedom of Information Act request. The state of Virginia has its own version of the Freedom of Information Act, which provides state-level governmental information to citizens upon request. A freshwater fishing license covers the entire state of Virginia with a few exceptions such as special fee use areas. A freshwater combination license can include licenses based on different age ranges, bodies of water, and/or be combined with other licenses such as saltwater. For the present study, the possible fishing licenses included year-long or single-day licenses, and trout licenses. License purchases by out-of-state anglers were also included. A year-long license is the standard timeframe for which a fishing license lasts in Virginia. For non-resident anglers, a one-day fishing license is an option. A trout license in Virginia is a special license required for anglers who intend to fish in any body of water that has been stocked by the VDGIF.

The only identifying information received from the request was angler email addresses. These email addresses were used for communication. The inclusion of an email address is part of the registration process when obtaining a Virginia fishing license. A total of 187,251 unique email addresses were obtained. The researcher's own email was included and then excluded from the sample, bringing the total number of unique addresses down to 187,250.

Data Collection Procedure

The use of an online survey for data collection was selected for this study to provide a larger sample size and decrease data collection time and money. Notably missing from the sample, however, are anglers who did not purchase a fishing license during the provided time frame. Despite their behavior suggesting their willingness to break fishing laws, it was not possible to obtain a sample of this group. The exclusion of these anglers was a necessary research limitation for the timespan of this study. Additionally, the study focus for this research was on individuals who are trying to obey fishing regulations, but may be confused by them and thereby accidentally break the law.

Sampling Error

For this study, a random sample of the provided email addresses was selected for participation. The list of the anglers' email addresses was contained in an Excel spreadsheet. Due to the unknown order of the email addresses, each email was randomly assigned a number using the random number generator function in Excel. The email addresses with the assigned random number were then sorted from least to greatest. A total of 15,000 emails were chosen for participation by conservatively setting the response rate at 10%, so the sample size of 1,500 could be obtained. This was decided to be necessary for two reasons. A sample size this large (1,500) will have a 95% confidence range with low variability attributable to random sampling (Fowler, 2009). In addition, sampling error will only vary slightly (1-2%) across different proportions of the sample; therefore, a sample size larger than 1,500 is not needed.

Increasing Response Rate

Increasing the response rate for any study is a critical part of the methodological development. To increase response rates for this study, multiple contacts with the participants

occurred using the email function in Qualtrics. This function made it possible to send out 15,000 emails at one time. A pre-notice letter explaining the study was sent the day before the survey; this first contact combined with a subsequent contact containing the survey can increase response rates for online/email surveys (Dillman, 2007). The second contact occurred the next day and contained the link to the survey. After a period of 5 days, a third and final contact occurred. The final contact was intended as a thank you to those participants who completed the survey and as a final reminder to participate in the research. Another method for increasing internet survey response rates that was implemented was the friendly design of the survey (direct link to survey within the email) and the short amount of time required to complete the survey.

The survey was created and administered by the online survey company Qualtrics. The survey contained 20 questions and was estimated by Qualtrics to take 7 minutes to complete. Related to increasing response rates using surveys, Fowler (2009) noted that response rates often are higher when the individuals being surveyed have an interest in the subject matter such as this study. The participants in this survey are all registered anglers within Virginia; therefore, they were more likely to have an interest in the topic. He also noted that when recognizable organizations are clear in the initial contact phase, response rates can often increase. Therefore, the pre-notice letter and subsequent contacts were sent containing the researcher's university email address and prominently displayed the Radford University logo.

The Construction of the Questionnaire

The basis for much of the survey came from previous research interests from the researcher's committee chair Dr. Egan Green and a former student of his, Mr. Josh Wheeler. Their initial interest in the topic is what sparked the development of this study and many of the survey questions. While their initial survey questions were used as a starting point, many of the

current questions have been altered to reflect past research findings. Additionally, new variables have been added. The questions that were used in the survey were created based on various research linking angler specializations, knowledge, and perceptions regarding fishing regulatory compliance (Bryan, 1977; Chipman & Helfrich, 1988; Glass & Maughan, 1984; Page & Radomski, 2006). Additionally, many questions were designed specific to fishing regulations concerning the New River and Claytor Lake in Virginia with reference from the Freshwater Fishing and Boating in Virginia guide for 2016 (VDGIF, 2016).

Measures

The survey contained 20 questions in total with eight questions containing multiple parts. These questions were formed to test the hypotheses of this thesis. The full survey, which is located in Appendix B, was designed to measure angler knowledge of fishing regulations, various demographic characteristics, and the likelihood of regulatory non-compliance. A Likert-scale type format, commonly used in social science research, was used for most of the questions to simplify the data gathering process. Additionally, the questions were structured in such a way that the dependent variable questions measuring the likelihood of non-compliance come before the independent variable questions. This order is purposeful, so a truer level of intent and compliance can be measured. If the questions concerning regulatory knowledge came first, the participants' answers concerning the likelihood of compliance may be altered because of an increased awareness concerning the regulations and the possibility of cheating (looking the regulations up) during the survey.

Contingency. The first question on the survey was a contingency question designed to progress the participant forward or end the survey based on the participant's response. This question asked whether the participant had fished in the area where this research is focused. If he

or she had not fished in the area, the rest of the survey did not pertain to that individual due to the specificity of the fishing regulations in the area.

Dependent variables. The dependent variables that captured the likelihood of compliance with fishing regulations were contained in questions 11 and 12. Question 13 measured the number of times in the past that a participant had broken fishing laws. There were multiple scenarios and/or parts for this set of questions. Each question returned ordinal level data and was structured as 5- or 6-point Likert scales.

Questions 11 and 12 each were derived from fishing regulations in the New River and Claytor Lake. Each question presented multiple scenarios that may be legal. Question 11 contained two scenarios for catches in the New River. The first scenario asked about the likelihood of keeping a 13-inch Largemouth or Smallmouth Bass and the second scenario asked about keeping a 15-inch Largemouth or Smallmouth Bass. Question 12 had six scenarios pertaining to Claytor Lake. The first scenario asked about the likelihood of keeping a 13-inch Largemouth or Smallmouth Bass. The second scenario asked the likelihood of keeping a 15-inch Largemouth or Smallmouth Bass. The third scenario asked about keeping a 19-inch Walleye or Saugeye downstream from Claytor Lake Dam. The fourth scenario asked about keeping a 19-inch Walleye or Saugeye on June 1. The fifth scenario asked about keeping a 19-inch Walleye or Saugeye on May 31. The final scenario asked about keeping an 18-inch Walleye or Saugeye downstream of Buck Dam in Carroll County to Claytor Lake Dam during February.

These scenarios were not marked as legal or illegal. Instead, the participants chose the likelihood that they would or would not keep the specified catches. Each question had an answer range with five options ranging from extremely unlikely to extremely likely. The scenarios were created to closely align with current fishing regulations. However, the scenarios slightly varied

from the defined regulation. This slight variance was designed to capture true knowledge, whereas a wide variance from the true regulation may be too obvious and less accurate. Each scenario used fishing regulations that are implemented in the New River and Claytor Lake with different stipulations to each body of water. A limitation of this question is that true non-compliance was not captured. However, as noted by Piquero and Tibbetts (2012), the use of scenarios to measure the likelihood of later outcomes (crime) has become commonplace in many studies using surveys. Research by Earnhart and Friesen (2013) also used scenarios to try and measure the likelihood of certain behaviors related to crime.

The last dependent variable question came next. Question 13 directly asked whether the participants had accidentally or intentionally broken the fishing laws. The question was broken down by the body of water. The answer scale had the option of "never" and "I don't know." Included in the scale were also number ranges. These ranges were designed to capture potential outliers. The first three options were grouped by fives. The fourth option captured any instance where 16 or more occurrences have happened. This variable was intended to capture cited and un-cited law-breaking; therefore, the use of the words "accidentally" and "intentionally" were used. Some individuals may have felt like their actions were from an accidental perspective despite being cited. Others readily admitted to intentionally breaking the law.

Independent variable. This study had two independent variables. The independent variables were the regulatory knowledge of the participants and their level of fishing specialization. The first variable was collected using non-demographic questions that were designed to test participant knowledge of fishing regulations. The second independent variable, specialization, was determined using a single question that asked the method of fishing the participants utilized most often.

Questions 10, 14, and 15 were designed to test the fishing regulatory knowledge of the research participants directly and indirectly. While not a regulation, question 10 concerned the participants' general knowledge that may be useful for understanding some fishing regulations. Question 10 directly asked which state is upstream from Claytor Lake. This was an important question to include because multiple fishing regulations are dependent on directional awareness and water flow. If an individual does not understand the directional nature of the New River, then he or she may not comprehend a regulation dependent upon that general understanding. Another important note to make is that the New River flows north, which is contrary to many other rivers, potentially causing more confusion. The word upstream refers to the direction of the river's source, which in the case of the New River is south towards North Carolina. Naturally, the term upstream may lead anglers to interpret that as north or in this case towards West Virginia.

Questions 14 and 15 each had multiple parts that tested the participants' knowledge regarding the legality of specific fishing regulations as they relate to certain species and time periods in the New River and Claytor Lake. In total, eight scenarios were presented with half being illegal. Question 14 contained two scenarios that were then broken down by location: New River and Claytor Lake. This question asked whether the scenarios are legal or illegal, respective to the stated location. The first scenario asked about the legality of keeping a 13-inch Largemouth or Smallmouth Bass. The second scenario asked about keeping a 15-inch Largemouth or Smallmouth Bass. There were three answer choices, with two indicating lack of knowledge ("legal," "illegal," and "I don't know"). Additionally, answer choices were cross-checked with the true legal status of each scenario and then quantitatively coded. The response

was coded "1" if the participant had the correct answer; whereas, responses were coded "0" if they were incorrect.

Questions 15 was like question 14 except for the breakdown by location. Instead, question 15 contained four scenarios, each of which was highly specific concerning the time of year and location. The first scenario concerning legality asked about keeping a 19-inch Walleye or Saugeye downstream from Claytor Lake Dam. The second scenario asked about keeping a 19-inch Walleye or Saugeye caught in Claytor Lake on May 31. The third scenario asked about keeping a 19-inch Walleye or Saugeye caught in Claytor Lake on June 1. The final scenario asked about keeping an 18-inch Walleye or Saugeye caught in the New River downstream of Buck Dam in Carroll County or in Claytor Lake during February. This question was also checked for correctness and coded in the same manner as the previous question. For analysis, an index was created for each participant that assigned a knowledge total based on the number of scenarios they identified as correct. The correct answers were tallied, and the knowledge total ranged from 0-6. A 0 indicated no knowledge and a 6 indicated total knowledge of the supplied fishing regulations. This range was later used for correlational analysis.

For the second independent variable, question 5 measured the participants' level of fishing specialization. There were six options for the method of fishing most often used by the participants. The options were spin fishing, bait cast, fly fishing, cane pole, trolling, and other (please specify). The question returned nominal level data that was later coded as "1" for more specialized and "0" as less specialized. Based on previous research, anglers that predominately fly fish are considered more specialized (Chipman & Helfrich, 1998). This method of fishing has a larger learning curve and economic investment. For this study, baitcasting is considered more specialized as it can also have a larger learning curve and anglers that use this method typically

concentrate on a single species of fish. The three methods that were classified as less specialized were spin fishing, cane pole, and trolling. The cane pole and trolling options were added as an answer choice because these fishing methods are still popular in this study's research area. Lastly, the option of "other" was included with a fill-in-the-blank section to capture any other methods predominately used in the area. If other methods were documented, then those methods were determined by the level of specialization after more background research was completed on the methods. The cost, learning curve, and targeted species of those methods factored into determining the level of specialization.

Control variables. The survey consisted of 13 questions that sought to capture demographic data. All demographic questions returned nominal or ordinal level data with one returning ratio level data. The questions were framed as multiple choice, Likert-scale types, or fill-in.

Questions 16-20 were standard demographic questions that are common in many surveys. These questions were placed at the end of the survey to decrease the likelihood of a participant not completing the entire survey due to the private nature of the questions. Question 16 asked the participants their ages and allowed for an exact age to be typed in, which returned a ratio level measurement. The question was formed this way, as opposed to age scales, to increase the quality of the data and to procure the ages at a higher level of data allowing for later grouping of the participants' ages if necessary. Questions 17-20 asked about sex, race, income, and education level. Each of the questions was presented in a multiple-choice format and resembled generic demographic questions from many other surveys. Each of these demographic measures was tested against the dependent variable alongside the independent variable for possible relationships. Additionally, questions 19 and 20, which asked about income and the highest level

of education completed, were analyzed as secondary independent variables. These variables were found to be related to compliance levels in previous research (Bryan, 1977; Chipman & Helfrich, 1998).

Questions 2-4 and 6-9 were designed to capture more background information on the research participants. These questions were included to increase the knowledge about the participants and provided the opportunity for more correlational testing. Question 2 asked how confident the participants were in identifying the upstream boundary of Claytor Lake. The identification of this boundary is essential in delineating your respective location, thus determining which regulations to abide by. This question was presented using a 1-point incremental slide scale ranging from 0-100 with 0 being no confidence and 100 being very confident. Questions 3 and 4 each provided more background information on the participants by asking how they learned to fish and how often they fish. These two questions provided more context regarding the participants and were tested for possible correlations. Question 3 was structured in multiple-choice (all that apply) format and question 4 was structured using a 7-point Likert-scale format. The range of the scale for question 4 had seven options to capture more data types. The question was limited, however, by the instruction to pick which option is closest to the participant rather than an open-ended response. Another question that had not been previously tested for relationships with non-compliance was represented in question 6. This question asked which species of fish the participants tried catching most often. No previous research to this researcher's knowledge had tested this variable before; therefore, the survey benefited from the added data.

The last set of demographic questions that were closely related was questions 7-9. These questions measured the participants' perceptions of regulatory knowledge and feelings about the

regulations and the governing body charged with enforcing the regulations (VDGIF). Using a 5-point Likert-scale, question 7 recorded the participant's level of self-assessed familiarity with the regulations in the New River and Claytor Lake. The next question, also using a 5-point Likert-scale, captured the participant's feelings concerning how well the VDIGF communicates the fishing regulations. This then led to question 9, which used a 3-point scale, that determined what the participant's opinion was concerning the number of regulations in the New River and Claytor Lake. Questions 8 and 9 were included to examine for possible relationships between the central variables. The responses to these two questions also possibly provided the VDGIF with some insight into what anglers think concerning the agency and Virginia freshwater fishing regulations.

Procedure for Treating Data

The use of an online survey was determined to save time and eliminate costs associated with traveling or in-mail surveying. This study is exploratory and many of the variables have not been previously tested. Determining a test population and sample was reliant on the convenience of obtaining contact information through the VDGIF. The survey was designed to minimize inconvenience and required very little time from the participants. Most of the questions returned nominal or ordinal level data, which cannot be parametrically tested compared to interval or ratio level data. However, in the instance of this research's collected data, the variables were treated as parametric through regression analysis. The data required testing methods that can predict the dependent variable from the independent variable. Therefore, an ordinarily least squares regression test was most appropriate.

Establishing Reliability and Validity

Because the survey instrument was never before tested, reliability and validity were heavily dependent upon past research literature and outside guidance. The type of reliability that was established was internal consistency. This was tested by using a Cronbach's alpha test on similar questions. Questions 11 and 12 and questions 14 and 15 were similar and were used for reliability testing.

Initial face validity was determined by the researcher's thesis committee. This was based on the presumption of an in-depth analysis of past literature and the application of those findings into this research. The next step was the establishment of content validity using subject matter experts. Experts from various universities and disciplines such as criminology and natural resources were consulted. The following experts were consulted to establish content validity:

Dr. Bynum Boley: University of Georgia

Dr. Stephen Eliason: Montana State University, Billings

Based on their comments, content validity for this survey was established.

The Process for Analyzing Data

The first step for analyzing the data was to download it from Qualtrics into an Excel spreadsheet and SPSS file. Next, the data were examined and cleaned for any anomalies or missing data. Over 1,500 responses were recorded; however, after the contingency question, only 422 responses were useable. Further narrowing of responses after exclusion of partial completions (did not reach the last question) and instances where age was not specified brought the total analyzed count to 332. Of this total, certain questions, however, registered lower completion counts than the overall completion total. These exclusions were not deemed important to the overall analysis and in total 332 survey responses were used for analysis. A few

variables required coding after completing frequency analysis due to the relative homogeneity of the variables or complexities in the recorded data. Question 3 concerning who taught the respondents how to fish was coded as “0” for no older role models indicated, and “1” as older male role model indicated. While the question had multiple answer choices, the majority (64%) of respondents chose to specify a family member. Another question that was bi-coded was question 5 concerning the specialization level of the respondents. A “0” indicated non-specialized and a “1” indicated more specialized. Answer choices for spin fishing, cane pole, trolling, and all “other” options, unless deemed specialized, were classified as less specialized. The “other” data that included “mostly for trout” or “artificial lures for bass” were coded as more specialized because they indicate the respondents’ pursuit of a single species, a trait of more specialized anglers (Bryan, 1977). Coding the gathered data for question 6 was attempted, but ultimately deemed not useful for further analysis. This data mostly included a wide range of fish species, often multiple species, and did not provide readily noticeable trends. While most responses could be coded into three categories (mostly fish for bass, trout, or a combination of bass and trout), there were many fish species recorded that did not fit into these categories. It was the original intention to corroborate the respondents’ method of fishing with their favorite target species to further determine specialization levels. However, the results gathered did not allow for this.

Coding was also conducted for the independent variable knowledge. This variable was captured using the responses from questions 5, 14, and 15. In total, there were nine scenarios or tests of knowledge presented in these questions. Each respondent received a point for each question that was answered correctly. The scores ranged from 0 (no correct answers and no

knowledge) to 9 (complete knowledge). Answers that were left blank were not counted as right or wrong.

The last coding for the variables involved the sex and race demographic questions. Each of these questions was very skewed towards White males, both representing over 90% of the surveyed population. A code of "0" was given to any response that did not meet this normal criterion. After the final coding, a frequency analysis was conducted followed by a correlation matrix of the variables that produced bivariate relationships. Lastly, an ordinary least squares regression analysis was conducted to determine the predictability between the dependent and independent variables.

Chapter 4

Analysis

The primary purpose of this thesis was to better understand the problem of angler non-compliance with fishing regulations. A secondary focus was the reasons why anglers may not comply due to their knowledge. Fishing regulations from the New River and Claytor Lake region of Virginia that were deemed confusing were used to test anglers' knowledge, which was then compared to the likelihood of respondents' non-compliance.

Study Sample

The survey recorded 1,585 responses, roughly a 10.5% response rate. Due to the contingency question, asking whether the participant had fished the specified area or not, at the start of the survey, only 422 respondents were eligible for participation in the survey. Of the 422 responses, 90 responses were deemed unusable due to partial completion (did not make it to the end of the survey and answered less than half of the questions) or because respondent age was not specified. This resulted in a total of 332 surveys where the respondent made it to the last question. These responses were used for analysis. The completion rate for each question varied throughout the survey, because some respondents did not answer a specific scenario within a question. Part four of question 3 concerning the number of times a respondent had intentionally broken fishing laws in Claytor Lake had the lowest response rate (n = 172). As expected, many similarities were demonstrated among the respondents. However, a degree of variation was evident among some survey questions.

Tables in this section describe the basic demographic characteristics of the survey respondents. As shown in Table 1, the average age of the respondents was around 47 years old. Approximately 68% of the respondents were between the ages of 32 and 62. The respondents

were overwhelmingly male (92.8%) and White (97.6%). Only 7.2% of respondents were female and 2.4% were non-White, indicating a very homogenous sample.

Table 1. *Descriptive Statistics for Demographic Variables*

Demographics	N	Mean	SD
Age	332	47.30	14.80
Male	332	0.93	0.26
White	332	0.98	0.15
Income	320	4.68	1.73
Education Level	331	3.64	1.22

Table 2 shows the frequencies for each income level that respondents indicated. Many of the respondents indicated fairly high income levels. The largest frequency of 22.2% was for the income level $90,000-$149,000. The smallest frequency was for $10,000-$29,999 (3.8%). Over half (53.7%) of the respondents claimed an income level greater than or equal to $70,000. There was no delineation between personal income or family income, however.

Table 2. *Descriptive Statistics for Income Level*

	Income Level (n = 320)		
	Frequency	Percent	Cumulative Percent
Less than $10,000	21	6.6	6.6
$10,000-$29,999	12	3.8	10.3
$30,000-$49,999	47	14.7	25.0
$50,000-$69,999	68	21.3	46.3
$70,000-$89,999	47	14.7	60.9
$90,000-$149,999	71	22.2	83.1
More than $150,000	54	16.9	100.0

The survey respondents were also fairly educated as indicated by Table 3. Most of the sample (59.5%) indicated having a bachelor's degree or higher. Only one individual indicated not having a high school education (0.3%) and 24.4% of respondents stated they had a high

school diploma or GED. Respondents with an associate degree only accounted for 15.7% of the sample.

Table 3. *Descriptive Statistics for Highest Education Level Completed*

	Education Level (n = 331)		
	Frequency	Percent	Cumulative Percent
Less than High School	1	0.3	0.3
High School/GED	81	24.4	24.8
Associate Degree	52	15.7	40.5
Bachelor's Degree	125	37.7	78.2
Master's Degree	47	14.2	92.4
Advanced Degree	25	7.5	100.0

Dependent and Independent Variables

The Tables in this section show the descriptive statistics and frequencies for the dependent and independent variables of each hypothesis. Tables 4 and 5 represent the dependent variables and Tables 6 and 7 are representative of the independent variables. The table for knowledge, Table 6, is also representative of the dependent variable for the second hypothesis.

Table 4 shows the descriptive statistics for each scenario regarding the respondents' likelihood of keeping a specified catch. There was little variability among each scenario, especially for scenarios regarding largemouth or smallmouth bass. For all scenarios, most (73.3%-85.9%) respondents indicated they were extremely unlikely to keep the specified catches regardless of the legality of keeping the catch. The average for each scenario ranges from 1.3 to 1.6, indicating answer choices where the respondent is extremely or somewhat unlikely to keep the catch. For the scenarios regarding bass species, only 3.2% to 7.5% of respondents indicated a likelihood of keeping the catch as somewhat likely to extremely likely. For scenarios regarding Saugeye or Walleye, 9.6% to 11.2% of respondents indicated they were somewhat or extremely likely to keep the catch.

Table 4. *Likelihood to keep the specified catch (Percentages Reported)*

Location and Scenario	Extremely Unlikely	Somewhat Unlikely	Neither Likely nor Unlikely	Somewhat Likely	Extremely Likely	M
New River						
13-inch Largemouth or Smallmouth Bass	84.2	7.5	5.0	2.5	0.9	1.3
15-inch Largemouth or Smallmouth Bass	80.4	7.3	4.7	5.0	2.5	1.4
Claytor Lake						
13-inch Largemouth or Smallmouth Bass	85.9	5.8	5.1	2.2	1.0	1.3
15-inch Largemouth or Smallmouth Bass	81.8	7.8	3.9	4.2	2.3	1.4
19-inch Walleye or Saugeye downstream from Claytor Lake Dam	73.3	6.4	9.0	7.7	3.5	1.6
19-inch Walleye or Saugeye on June 1	75.0	5.2	9.1	7.1	3.6	1.6
19-inch Walleye or Saugeye on May 31	76.5	4.2	9.6	6.4	3.2	1.6
18-inch Walleye or Saugeye downstream of Buck Dam in Carroll County to Claytor Lake Dam in February	76.6	4.2	9.3	6.7	3.2	1.6

Table 5 shows the percentages of respondents that had accidentally or intentionally broken fishing laws in the New River or Claytor Lake. There were three other answer choices (6-10, 11-15, and 16+), which no respondent indicated. Most respondents (ranging from 63.9%-87.6%) indicated they had never accidentally or intentionally broken fishing laws on either body of water or that they did not know how many times they had (ranging from 8.4%-28.2%). The highest percentage of reported crime, a combination of accidental and intentional, was recorded for the New River (17.1%) compared to the Claytor Lake reported crime (9.2%).

Table 5. *Accidentally or Intentionally Broken Fishing Laws (Percentages Reported)*

Location and Scenario	Never	1-5	I don't know	M
New River				
Accidentally	63.9	13.1	22.9	2.3
Intentionally	87.6	4.0	8.4	1.5
Claytor Lake				
Accidentally	65.5	6.3	28.2	2.5
Intentionally	85.5	2.9	11.6	1.6

Table 6 shows the frequency of the respondents' coded knowledge scores. A score of 0 indicated no knowledge of fishing regulations and a score of 9 indicated total knowledge. In general, the respondents were not very knowledgeable about the fishing regulations. Only three respondents scored a 9 (0.9%), whereas 102 (31.3%) scored a 0. Three-quarters of the respondents (74.8%) scored a 2 or below. The mean for the coded knowledge score was 1.64 and the standard deviation was 1.97. The data for the coded knowledge scores were positively skewed due to most of the scores falling closer to 0.

Table 6. *Descriptive Statistics for Coded Knowledge Score*

	Knowledge Score (n = 326)		
	Frequency	Percent	Cumulative Percent
0	102	31.3	31.3
1	117	35.9	67.2
2	25	7.7	74.8
3	36	11.0	85.9
4	17	5.2	91.1
5	8	2.5	93.6
6	4	1.2	94.8
7	10	3.1	97.9
8	4	1.2	99.1
9	3	0.9	100.0

Regarding participants' specialization, as determined by their primary method of fishing, the observed frequencies are reported in Table 7. The fishing methods bait casting and fly fishing were deemed more specialized compared to spin fishing and trolling. The "other" observations were determined on a case-by-case basis; however, they only accounted for 1.5% of the observations. Without incorporating the "other" observations, roughly equal percentages of participants indicated less specialized fishing methods (50.6%) compared to more specialized (47.9%). When incorporating the "other" observations, the frequencies for specialization type did not change significantly: less specialized (51.5%) and more specialized (48.5%).

Table 7. *Descriptive Statistics for Method of Fishing*

	Method of Fishing (n = 332)		
	Frequency	Percent	Cumulative Percent
Spin Fishing	162	48.8	48.8
Trolling	6	1.8	50.6
Fly Fishing	65	19.6	70.2
Bait Cast	94	28.3	98.5
Other	5	1.5	100.0

Control Variables

The Tables in this section showcase the descriptive statistics for the control variables in this research. The frequencies reported in Table 8 pertain to which method the respondents' learned to fish. Most (63.9%) of the respondents' indicated learning from a family member, while 25.9% indicated they were self-taught. Most of the observations that were written in for the "other" category were family members as well. Based on previous literature (Curcione, 1992; Forsyth, 1993), which found relationships between fishing and hunting traditions and practices being passed down from older male role models, this variable was coded into whether the family member was an older male role model and used for the regression analysis. The majority of respondents, 61% (n = 201), indicated learning from an older male role models compared to 38.9% (n = 128) who did not.

Table 8. *Descriptive Statistics for Learning*

	Learning (n = 332)	
	Frequency	Percent
Self-taught	86	25.9
Friend	20	6.0
Family Member	212	63.9
Fishing Guide	8	2.4
Other	6	1.8

The frequencies for how often survey respondents fish is shown in Table 9. Around 83.7% of respondents indicated they fished several times a month or several times a year. Only 12.9% indicated fishing more often, such as several times a week or daily.

Table 9. *Descriptive Statistics for How Often Respondents Fish*

	Level of Fishing (n = 332)		
	Frequency	Percent	Cumulative Percent
Every few years	5	1.5	1.5
Once a year	6	1.8	3.3
Several times a year	154	46.4	49.7
Several times a month	124	37.3	87.0
Several times a week	40	12.0	99.1
Daily	3	0.9	100.0

While not shown in a Table, it was found that 69.6% of the respondents primarily fished for largemouth or smallmouth bass. Additionally, trout anglers accounted for 16.9% of survey responses and any combination of the write-in response, which indicated both bass and trout was 5.4%. Clearly, bass and trout accounted for the fish species largely targeted for the respondents.

Regarding respondents' familiarity with fishing regulations in the target areas, there is a good variation of reported familiarities in Table 10. The survey respondents indicated they were more familiar with fishing regulations for the New River than for Claytor Lake. Only 6.4% (New River) and 2.1% (Claytor Lake) indicated they were extremely familiar compared to respective percentages of 17.9% and 42.8%, which indicated they were not familiar at all. Related, but not shown, in Table 10 is the respondents' self-reported confidence levels for indicating the upper stream boundary for Claytor Lake, an important factor when determining one's location and thus differences in regulations. This variable was recorded by using a scale from 0-100. A total of 258 responses were recorded with a mean of 36.10 and a standard deviation of 32.16. The average for this variable is rather low compared to the observed levels of familiarity as indicated in Table 10.

Table 10. *Familiarity of Fishing Regulations (Percentages Reported)*

	Not Familiar at All	Slightly Familiar	Moderately Familiar	Very Familiar	Extremely Familiar	M
New River	17.9	23.1	31.9	20.7	6.4	2.7
Claytor Lake	42.8	23.2	20.3	11.3	2.6	2.1

Note. N = 329 (New River), N = 311 (Claytor Lake)

Additional information gathered from the surveys but not shown in a table is the respondents' opinions of the VDGIF. These variables were not used for analysis, but may prove useful for the agency that oversees fishing regulations in Virginia.

According to the respondents, the VDGIF does a decent or good job educating the public on fishing regulations for the New River and Claytor Lake. Additionally, most respondents, around 81%, think there are the right amount of fishing regulations for both locations. More than double the respondents thought there were too many fishing regulations rather than too few at the locations. Overall, the data suggest that the survey respondents think positively of the VDGIF and the number of fishing regulations present at the two study locations.

Correlations

The following table shows the correlations for the dependent, independent, and control variables used in the regression analysis for all models. A total of five dependent variables and 12 independent and control variables are represented in Table 11. The correlation analysis revealed there were no significant relationships between the dependent and independent variables. There were 13 significant relationships between various control variables and the dependent variables. These control variables were familiarity with Claytor Lake and New River fishing regulations, confidence in identifying the upstream Claytor Lake boundary, how often respondents fish, age, and whether they were White. Each relationship will be explained individually.

The familiarity of Claytor Lake fishing regulations was significant at the $p < .05$ (intentional violations in the New River) and $p < .01$ levels (intentional violation in Claytor Lake and knowledge). The relationships for the intentional violations at both locations were negative and demonstrated that as familiarity with Claytor Lake fishing regulations increased, the number of intentional violations at both locations decreased. The relationship with knowledge was positive. This relationship indicated that the more familiar the respondents were with Claytor Lake fishing regulations, the more knowledge they had.

The control variable, familiarity with New River fishing regulations, had significant relationships with every dependent variable. The relationships with the number of times accidentally and intentionally for both locations were all negative. Like the previous control variable, the relationship with knowledge was also positive. The same explanations offered for familiarity with Claytor Lake fishing regulations also apply here. It should be noted though, that the respondents were more familiar with New River fishing regulations. As this is related to knowledge, it may be indicative that the respondents fish more often in the New River, thus having better knowledge of those regulations compared to Claytor Lake.

The respondents' confidence in identifying the upstream boundary of Claytor Lake, a crucial part of understanding many fishing regulations for the area, had a significant positive relationship with knowledge. This relationship makes sense, because respondents that are more knowledgeable should have increased confidence in identifying the water boundaries that differentiate what regulations to follow. How often respondents fish was also positively related to knowledge. This indicated that as more time is spent fishing, the respondents were more knowledgeable of the fishing regulations.

The two demographic control variables, age and "White," each had negative relationships. The first was the relationship for the age variable with the number of times respondents accidentally broke fishing regulations at both locations. This relationship indicated that as respondents' age increased, the number of times they accidentally broke fishing laws for both locations decreased. In other words, older respondents were more likely to follow the law and not accidentally break fishing regulations. Lastly, the negative relationship between the "White" variable and the number of times respondents have intentionally broken Claytor Lake fishing regulations indicated that non-White respondents were more likely to intentionally break fishing regulations in Claytor Lake. This is a surprising finding because only 2.4% of respondents were non-White. Further research is needed regarding this relationship to offer an explanation for the relationship.

Table 11. *Correlations of Dependent and Independent Variables*

	Accidental-New River	Accidental-Claytor Lake	Intentional-New River	Intentional-Claytor Lake	Knowledge
Knowledge	.028	-.030	-.096	-.136	--
Familiarity- Claytor Lake	-.010	-.069	-.146*	-.227**	.456**
Familiarity- New River	-.123*	-.224**	-.193**	-.238**	.383**
Identifying Boundary	-.030	-.116	-.057	-.099	.361**
How Often Fish	-.086	-.103	.043	.008	.164**
Older Male Role Model	-.072	.014	-.032	.009	.005
Specialization	-.048	-.070	.023	-.001	-.045
Age	-.136*	-.194*	-.099	-.080	-.025
Education	-.037	-.019	-.012	.023	-.032
Income	-.063	-.100	.074	.053	-.054
Male	-.044	-.112	.040	-.015	.096
White	-.017	-.118	-.019	-.150*	.062

*$p < .05$, **$p < .01$

Reliability

To determine the reliability of the survey instrument, a Cronbach's Alpha for each independent and dependent variable with multiple questions seeking to measure the same variable was performed. For the variable knowledge, the result of the test was .853 and the standardized result was .852. Further reliability testing was conducted to determine if item deletion would increase the Chronbach's Alpha. No significant changes or values above .90 occurred based on item deletions. The results for the likelihood and criminality variables were .831 and the standardized result was .874. Further testing based on item deletion also did not reveal any significant changes or increase the alpha above .90. While these reliability alphas are good, they are not excellent as indicated by alpha levels above .90.

Regression Analysis

A total of five models were used for the regression analysis of this study's two hypotheses. Hypothesis one was comprised of four models and only one model was used for the second hypothesis. The regression results for both locations of the first hypothesis are combined into two tables based on the number of times respondents accidentally and intentionally broke fishing laws. Overall, two of the five models were significant and multiple control variables within the models were also significant. After the conclusion of the regression testing for each model, tests for normality were conducted. No significant outliers or heteroscedasticity, which could significantly alter the outcomes of the models, were present. Each model was determined to be roughly normally distributed.

Knowledge of Accidental and Intentional Rule Breaking

The two tables in this section show the regression results for the four models used to test the first hypothesis: (1) Respondents with less knowledge of the fishing regulations will be less

likely to comply with them. In total, 11 control variables were used for each of the first hypothesis's models. These variables were the respondents' self-identified familiarity with New River and Claytor Lake fishing regulations, their confidence in identifying the upstream boundary of Claytor Lake, how often they fish, whether they learned to fish from an older male role model, their level of fishing specialization, age, education, income, sex, and if they were White.

Table 12 shows the results of the regression test for the number of times a respondent accidentally broke fishing laws in the New River and Claytor Lake. The independent variable for each model was the respondents' coded knowledge score. In addition, a total of 11 control variables were used in the models. The model for the New River was not found to be significant and within the model; the independent variable was not found to be significant. The model for Claytor Lake was found to be significant at the $p < .01$ confidence level and can account for approximately 21.7% of the relationship between the independent and dependent variables. The relationship is a relatively weak one. However, like the New River model, the independent variable was not significant, which does not provide support for the hypothesis.

Table 12. *Regression of Number of Times Accidentally Breaking Fishing Laws in the New River and Claytor Lake on Independent and Control Variables*

	New River			Claytor Lake		
Variables	B	SE	β	B	SE	β
Experience and Knowledge						
Knowledge	.080	.074	.280	.032	.094	.734
How often you fish	-.264	.201	.191	-.115	.294	.696
Older male role model	-.423	.282	.136	-.178	.392	.650
Specialization	.036	.288	.901	-.363	.394	.358
Self-Identified Confidence Level						
Familiarity with Claytor Lake fishing regulations	.087	.164	.597	.220	.232	.344
Familiarity with New River fishing regulations	-.305	.150	.043*	-.660	.202	.001***
Identifying upstream boundary	-.000	.005	.986	-.004	.007	.600
Respondent Characteristics						
Age	-.023	.011	.036*	-.039	.015	.009**
Education	-.003	.132	.984	.020	.182	.914
Income	-.012	.096	.903	-.011	.128	.934
Male	.075	.543	.890	-.518	.728	.478
White	-1.421	1.050	.177	-2.321	1.269	.070
Constant	6.805***	1.612	--	9.502***	2.160	--
Equation F	1.333			2.686**		
R^2	.069			.217		

* p < .05, ** p < .01, *** p < .001

For each model testing the relationship between the respondents' knowledge and the number of times they accidentally broke fishing regulations for both locations, the same two control variables were significant. The control variables were the respondents' familiarity with New River fishing regulations and their age. For the New River model, the significance levels for each control variable was $p < .05$ and for the Claytor Lake model the significance was at the $p < .01$ and $p < .001$ levels. In all instances, the relationships were negative. The negative relationships may be indicating that as the respondents' familiarity with fishing regulations in the New River and age increased, the number of times they indicated accidentally breaking fishing laws in either location decreased. Older respondents and those more familiar with New River fishing regulations had accidentally broken the fishing laws in both locations fewer times. Aside from these two control variables, no other variables were found to be significantly related to accidentally breaking fishing laws in the New River or Claytor Lake.

The regression analysis for the third and fourth models concerning the number of times respondents intentionally broke fishing laws in the New River and Claytor Lake are shown in Table 13. Neither model was significant, nor was knowledge, the independent variable, within the models. Only one control variable, the respondents' familiarity with New River fishing regulations for the Claytor Lake model, was significant. This control variable had a negative relationship, indicating that as familiarity with New River fishing regulations increased, the number of times the respondents intentionally broke fishing laws in Claytor Lake decreased.

Table 13. *Regression of Number of Times Intentionally Breaking Fishing Laws in the New River and Claytor Lake on Independent and Control Variables*

	New River			Claytor Lake		
Variables	B	SE	β	B	SE	β
Experience and Knowledge						
Knowledge	-.005	.046	.911	-.028	.067	.683
How often you fish	-.008	.124	.946	.151	.205	.463
Older male role model	-.103	.174	.556	-.160	.273	.557
Specialization	.231	.178	.195	.094	.275	.733
Self-Identified Confidence Level						
Familiarity with Claytor Lake fishing regulations	-.132	.102	.196	-.134	.163	.413
Familiarity with New River fishing regulations	-.157	.093	.092	-.278	.141	.050*
Identifying upstream boundary	.002	.003	.468	.001	.005	.801
Respondent Characteristics						
Age	-.013	.007	.050	-.016	.010	.124
Education	-.056	.082	.493	-.056	.127	.660
Income	.108	.059	.069	.154	.089	.086
Male	.211	.334	.529	-.255	.506	.615
White	-.735	.647	.257	-1.103	.883	.214
Constant	2.936**	.994	--	3.616*	1.502	--
Equation F	1.709			1.729		
R^2	.088			.153		

* p < .05, ** p < .01, *** p < .001

Specialization and Knowledge

The last model used for the regression analysis is related to the variables for the second hypothesis: (2) The respondents who utilize a less specialized fishing method will be more likely to not know the fishing regulations. The results for this test are shown in Table 14. This model was found to be highly significant. The constant for the model was also significant. However, within the model, the independent variable specialization was not significant. The model can explain roughly 28% of the relationship between the variables and is a very weak relationship. Two control variables for the model were highly significant and had positive relationships. The variable familiarity with Claytor Lake fishing regulations and education each were significant, indicating that as the familiarity with Claytor Lake fishing regulations and education level increases, so does the anglers' regulatory knowledge.

Table 14. *Regression of Angler Regulatory Knowledge on the Independent and Control Variables*

Variables	B	SE	β
Self-Identified Confidence Level			
Familiarity with Claytor Lake fishing regulations	.613	.145	.000***
Familiarity with New River fishing regulations	.197	.137	.154
Identifying upstream boundary	.009	.005	.067
Experience and Knowledge			
How often you fish	.437	.183	.018*
Older male role model	.003	.260	.991
Specialization	-.162	.264	.541
Respondent Characteristics			
Age	-.007	.010	.473
Education	.328	.119	.006**
Income	-.056	.088	.525
Sex	.269	.499	.591
White	-.214	.967	.825
Constant	-2.942*	1.471	--
Equation F	7.677***		
R^2	.280		

* p < .05, ** p < .01, *** p < .001

Summary

The results of this study indicated that the independent variables for each of the two hypotheses were not significantly related to the dependent variables. Only control variables were found to be related. One out of four models was significant for the first hypothesis and the relationship was very weak. For the second hypothesis, the regression model was significant. However, as previously stated, the independent variable was not significant. Based on the results of this study, the null hypothesis for each hypothesis cannot be rejected. Despite the fact that there is no statistical evidence to support either hypothesis, it should be noted that the vast majority of the sampled respondents were not familiar or knowledgeable about the specified fishing regulations.

Chapter 5

Summary and Conclusions

Fishing regulations can often be confusing for anglers. These regulations are often arbitrary in nature, but can sometimes be based on biological findings to help protect aquatic species. If anglers do not have a clear understanding of the fishing regulations, they are liable to break them and possibly receive criminal punishments or harm the aquatic life. Thus, having the correct knowledge of fishing regulations is necessary for adhering to the law and protecting aquatic species. While some fishing regulations are understandably simple and easy to comprehend, others are more complex and unclear. This study used some of the more complex and ambiguous fishing regulations for the New River and Claytor Lake in Virginia to test Virginia-permitted freshwater anglers' knowledge, specialization, and the likelihood of regulatory compliance.

Only a scant amount of previous literature has adequately covered the topic of angler non-compliance or measured the variable of angler knowledge. The importance and alarming trends of angler non-compliance have been highlighted in research from Arlinghaus and Cooke (2009), Muth and Bowe (1998), and Nielson and Mathiesen (2003). However, these studies rarely found reasons why the non-compliance levels were so high especially from the angler knowledge perspective. The studies did, however, mention that anglers may disregard the regulations due to content, but not confusion or lack of knowledge. Research from Page and Radomski (2006) did find links between angler awareness of regulations and compliance. The study did not, however, measure the anglers' knowledge of fishing regulations. In their results, there were relationships between newer and more complex regulations and angler awareness, which possibly indicates a relationship between angler knowledge and compliance. Similarly, it

was the goal of this thesis to explore whether Virginia freshwater anglers were likely to act in compliance when the regulations were more complex or ambiguous. Additionally, this research tested the relationship between angler specialization and knowledge.

Based on the lack of prior literature, this thesis research is mostly exploratory and seeks to fill a gap in natural resource-based criminal justice research. While there are other studies that have briefly touched on similar topics or variables for measurement, major differences in this study and previous ones exist. For example, the closest related study to this one, from Page and Radomski (2006), never measured angler knowledge. Without measuring this variable, there is no way to compare the anglers' regulatory knowledge and the possibility they may be accidentally breaking fishing regulations based on their confusion of the regulations. This study did measure the knowledge of anglers. Additionally, much of the previous literature related to this topic comes from conservation professionals, thus, limiting their understanding of criminal justice theory. Without the practical knowledge of criminal justice theory and principles, a proper explanation of the possible relationships between angler knowledge and compliance may be lacking.

To examine the possible relationship between fishing regulations and angler compliance in Virginia, an online survey was administered to a sample of registered Virginia freshwater anglers. The survey sought to capture the regulatory knowledge of anglers, their level of fishing specialization, and their likelihood of compliance with fishing regulations for the study area of the New River and Claytor Lake in Virginia. Additionally, demographic data were recorded. A total of 332 completed surveys were used to conduct descriptive statistics and regression analysis.

Hypotheses

This thesis is an exploration of the relationship between fishing regulations and angler compliance in Virginia. Based on two hypotheses below, a total of five regression models were developed and tested for significance.

1. Respondents with less knowledge of the fishing regulations will be less likely to comply with them.

   (Null Hypothesis) There will be no difference among respondents' likelihood to act in compliance and their knowledge of the fishing regulations. The lack of knowledge is an operationalization of confusion or ignorance of the fishing regulations for the area of study.

2. Respondents who use less specialized fishing methods will be less likely to know the fishing regulations for the area under examination.

   (Null Hypothesis) There will be no difference among the respondents' fishing method and their knowledge of fishing regulations. Specialization of fishing methods ranges from a highly specialized method such as fly fishing for targeted species to a less specialized method such as spin fishing or cane pole fishing for non-targeted species.

Findings of Hypotheses

After the data collection ceased and the initial analysis started, it was obvious that a flaw in the survey questioning was present. The scenarios in questions 11 and 12 were intended to capture the likelihood of compliance among the survey respondents. Each of these questions was comprised of scenarios, some illegal, in which respondents were to identify the likelihood of keeping the specified catches. However, upon inspection of the data, it was discovered that there was no way to determine whether the respondents were practicing catch-and-release. The survey

questions only offered a range of likelihood as answers, assuming that the catches were going to be kept or released based on the anglers' knowledge that keeping the catch would be illegal. However, around 72%-86% of the respondents indicated for all scenarios that they were extremely unlikely to keep the specified catches. This aroused the suspicion that the respondents may have never intended to keep the catch in the first place, legal or not. While this may be an accurate representation, it is impossible to know what percentage of the respondents were simply never going to keep the specified catch in the first place. Because of this lack of certainty of the observed responses, these questions and scenarios were not included in the models for the first hypothesis.

Hypothesis One

This hypothesis was tested using four regression models. The models were constructed based on the number of times anglers accidentally or intentionally broke fishing regulations and for each location (New River and Claytor Lake). Of the four models, only one was significant. The model that was significant predicted the number of times an angler would accidentally break fishing laws in Claytor Lake. However, within the model, the independent variable knowledge was not significant.

Of the only significant relationships within the model, both were control variables. In a surprising finding, the respondents' self-identified familiarity with New River fishing regulations was correlated with the number of times an angler may accidentally break fishing laws in Claytor Lake. The respondents' age was also found to be significant. These two variables help predict that the less familiar with New River fishing regulations and younger anglers are, the more likely they are to accidentally break fishing laws in Claytor Lake.

To explain these relationships, it is likely that as anglers' age increases, so does their knowledge and familiarity with fishing regulations. In other words, more fishing experience can lead to increased knowledge and thus lower the chances of accidentally breaking fishing laws. The relationship found between the respondents' familiarity with New River fishing regulations and accidentally breaking fishing laws in Claytor Lake is difficult to explain because any level of increased knowledge for fishing regulations specific to one location should apply to other bodies of water, especially those next to each other (or part of the same water system) such as the New River and Claytor Lake. However, this relationship may be due to the complexity concerning fishing regulations for the studied area.

The regulations included in the survey were chosen because they completely differed for the New River and Claytor Lake. Due to the complexities and differences, anglers may only be learning or knowledgeable about a certain body of water's fishing regulations rather than both areas. If anglers who are more familiar with New River fishing regulations are less likely to accidentally break Claytor Lake fishing laws, it may be due to anglers practicing catch-and-release fishing in the body of water that they are not as familiar with, thus, lowering their chances of accidentally breaking the fishing laws. Additionally, when the familiarity with New River fishing regulations is decreased, then the more likely it is anglers will accidentally break fishing laws in Claytor Lake. This may be related to a general understanding of fishing regulations and can explain why familiarity with fishing regulation is important regarding general compliance.

While the significance of one model provides evidence of a good fit among the variables, no significant relationship was found between the independent and dependent variables for this

hypothesis. Therefore, there is no evidence to support the hypothesis and reject the null hypothesis. Further research is needed to explore this hypothesis and determine its validity.

Hypothesis Two

The respondents for this research were roughly equal regarding their level of specialization, with slightly more respondents being less specialized. An initial correlation test between the level of specialization and knowledge provided no significance. When control variables were added to the model, significance was observed for the entire model. However, the independent variable specialization was not significant within the model. Only three of 10 control variables were found to be significant: familiarity with Claytor Lake fishing regulations, how often the anglers fish, and education. Each of these relationships was significant at the $p < .001$ level and positive. The level of specialization was not found to be significant regarding regulatory knowledge and the null hypothesis can be accepted.

The relationship between familiarity with Claytor Lake fishing regulations, how often respondents fish, and education level with the anglers' regulatory knowledge makes logical sense. As familiarity with Claytor Lake fishing regulations, how often respondents fish, and education level increase, so does the anglers' regulatory knowledge. In relation to New River fishing regulations, Claytor Lake fishing regulations are specific to only the lake area, whereas fishing regulations for the New River cover the most geographic territory. This may possibly indicate that anglers who are more familiar with lake fishing regulations have an increased level of regulatory knowledge. What is interesting, though, is the lack of a relationship between the respondents' ability to identify the upstream boundary of Claytor Lake. The ability to do so is very important for the anglers' sake because the regulations are dependent upon knowing where the anglers are fishing within a body of water. If anglers are unaware of their location within the

New River, for example, they may actually be within Claytor Lake boundaries and be regulated under different fishing standards. The reason these two bodies of water were chosen for analysis was because they are comprised of the same system, the New River, and have a boundary that is indiscriminate. There is no sign within the New River that indicates you are now in what is considered Claytor Lake, and for miles towards the area that more closely resembles a lake, you are still within what could easily be mistaken as the river.

As expected, respondents who fish more often are also likely to have more regulatory knowledge. This research statistically supports this assumption. The more time spent fishing, the more likely an angler will take the time to learn the fishing regulations, or as anglers begin to fish more often, it becomes necessary to learn the fishing regulations, minimizing their chances of breaking the law.

The relationship between the respondents' level of education and their regulatory knowledge was also significant, though the relationship was weak to moderate at best. This relationship indicates that anglers who are more educated also have an increased fishing regulatory knowledge. The respondents for this study were highly educated for the most part, which may be due to general interest in fishing-related research. However, this depth of education seemed to be related to an increase in regulatory knowledge as well. With close to 60% of the respondents having an associate degree or higher, it is logical to expect they would also have the ability to learn and comprehend fishing regulations.

Limitations

One of the major limitations of this research is the exclusion of a contingency question asking whether the respondents practiced catch-and-release fishing. This question is important because it eliminates respondents who cannot act in non-compliance regarding keeping their

catch. Questions 11 and 12 were created to be used as the independent variable for the likelihood that respondents would act in compliance. However, since the collected data were highly skewed and indicated the respondents would never keep the specified catches, it was not a good representation of their likelihood of compliance. It is unknown how many respondents simply practiced catch-and-release and therefore would have never kept their catch, thus, eliminating their potential to act in non-compliance.

Another limitation of this research is the lack of variation in the scenarios presented in the regulatory questions. Though dependent on fishing regulations for the studied area, questions that are more varied may have provided a better representation of respondents' knowledge of the regulations by further testing their knowledge with more scenarios. Additionally, a question should have been added concerning the respondents' number of times they had previously been cited for breaking fishing laws. Including this question would have provided a base for the level of known non-compliance among the surveyed sample.

Like much social science research, the use of an online survey can prove limiting. A survey only allows pre-determined responses. In the case of this research, the use of an online survey may have led to cheating. Because certain questions were testing the respondents' knowledge, respondents may have used the Internet to help answer regulatory questions. Based on the level of performance from the respondents, indicating lower levels of regulatory knowledge, this is unlikely to have had major consequences on the analysis. An in-person and onsite survey technique may have provided more accurate data.

Despite having the potential for quite a large sample size, only 15,000 individuals were chosen for participation in this research. Of that number, only 10% chose to participate, which was further reduced due to the contingency question regarding the location of the research.

While this and related research areas typically limited to certain bodies of water or geographic areas, small sample sizes typically plague the research. This research had the potential to survey over 180,000, but it was decided to calculate a sample size based on response rate calculations. Ultimately, this was a mistake and led to a relatively small sample size of just over 300. The small sample size was also very homogenous for many of the variables. A larger sample size and the inclusion of another contingency question regarding catch-and-release fishing may have had different outcomes and relationships among the variables.

Recommendations for Future Research

Future research using a similar instrument as used in this research should have more scenarios for each question and delete questions that were not used in the analysis. The probing questions concerning respondents' attitudes towards the VDGIF, while helpful, were not used in any of the analyses. Additionally, the question regarding which fish species respondents fished for most often proved useless. This question was presented as an open-ended answer and received too many variations to properly categorize the data.

Other suggestions for future research are to expand the research focus area to other bodies of water, include more questions testing respondents' regulatory knowledge, and include a contingency question for catch-and-release anglers. These changes will improve the validity of the research. Additionally, the coded knowledge score in future research may benefit from being coded as a ratio of questions attempted and how many were correct. For this research, a tally was used and potentially affected due to some respondents only attempting to answer a few of the scenarios. A ratio may provide a more accurate representation of the respondents' regulatory knowledge.

Lastly, this research was met with some negative backlash from individuals contacted regarding the study. These individuals were concerned about their privacy and how their information was obtained. While the study was designed and communicated to be completely anonymous and protect all participants' information, many individuals were upset they had been contacted. One individual even contacted the VDGIF concerned about the research and privacy rights. While the VDGIF provided the personal information used to contact participants, the agency was not alerted when the survey was sent out. If the VDIGF had been alerted, this may have eased some fears and confusion regarding the research and privacy concerns. Future research using online surveys should be prepared to deal with any potential backlash. Increasing the sample size, while a recommended change, will only exasperate this problem.

Conclusion

This thesis attempted to explain why fishing regulatory non-compliance is so high, a problem highlighted by many previous researchers (Arlinghaus & Cooke, 2009; Muth & Bowe, 1998; Nielson & Mathiesen, 2003), by focusing on one possible explanation, angler knowledge. A few prior studies (Page & Radomski, 2006; Pierce & Tomcko, 1998) have discussed the possible relationships between anglers' level of understanding and knowledge, but only briefly, each believing a possible relationship exists. However, the results of this research do not provide any empirical evidence for the relationship between anglers' knowledge of regulations, specialization, and compliance.

Based on previous literature and the assumptions of this research, a relationship should exist between the amount of knowledge anglers have concerning fishing regulations and their level of compliance with those fishing regulations (Page & Radomski, 2006; Pierce & Tomcko, 1998; Schill & Kline, 1995; Wilberg, 2009). This research took the stance that the level of

knowledge may be affected due to the regulations being hard to understand. Nevertheless, if no relationship exists between these variables, then something else must affect the levels of non-compliance historically and currently observed. A possible explanation may be apathy or sheer disregard for fishing regulations. Previous research has only provided varying explanations for different populations of anglers (Eliason, 2004; Nielson & Mathiesen, 2003).

While the results of this research do not help explain why non-compliance levels are so high, they still provide a level of empirical understanding previously unknown for the topic. Additionally, several research limitations may be the cause of the limited results of this study and should be addressed in any future related research.

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Appendix A

Survey Letter

You are invited to participate in a research survey, entitled "A study of the relationships between fishing regulations and angler compliance in Virginia". The study is being conducted by Dr. Egan Green and Mr. Matthew Spencer of Radford University Criminal Justice Department CHBS Building, Room 5038A, 1-540-831-5995, ekgreen@radford.edu and mspencer1@radford.edu. The purpose of this study is to examine relationships between anglers' knowledge of fishing regulations and compliance with those regulations. Your participation in the survey will contribute to a better understanding of fishing regulations and compliance. We estimate that it will take about seven minutes of your time to complete the questionnaire. You are free to contact the investigator at the above address and phone number to discuss the survey. Risks to participants are considered minimal. There will be no costs for participating, nor will you directly benefit from participating. No IP addresses will be recorded. Dr. Egan Green and Mr. Matthew Spencer will have access to the data during data collection.

Your participation in this survey is voluntary. You may decline to answer any question and you have the right to withdraw from participation at any time without penalty. If you wish to withdraw from the study or have any questions, contact the investigator listed above. If you have any questions, please call Dr. Egan Green at 1-540-831-5995 or send an email to ekgreen@radford.edu. You may also request a hard copy of the survey from the contact information above. This study was approved by the Radford University Committee for the Review of Human Subjects Research. If you have questions or concerns about your rights as a research subject or have complaints about this study, you should contact Dr. Laura J. Jacobsen, Interim Dean, College of Graduate Studies and Research, Radford University, ljacobsen@radford.edu, 1-540-831-5470. If you agree to participate, please press the next button at the bottom right of the screen. Otherwise, use the X at the upper right corner to close this window and disconnect. Thank you.

Appendix B

Survey Questions

1. Have you ever fished Claytor Lake or the New River in Virginia?
    a. Yes
    b. No
2. How confident are you in identifying the upstream boundary of Claytor Lake?
3. How did you learn how to fish? Check the most influential option.
    a. Self-taught
    b. Friend
    c. Family member (please specify which one)
    d. Fishing guide or business
    e. Other (please specify)
4. How often do you fish? Choose the answer that is closest for you.
    a. Never
    b. Every few years
    c. Once a year
    d. Several times a year
    e. Several times a month
    f. Several times a week
    e. Daily
5. Which method of fishing do you do most often?
    a. Spin fishing
    b. Bait cast
    c. Fly fishing
    d. Cane pole
    e. Trolling
    f. Other (specify)
6. What species of fish do you try catching most often?

7. How familiar are you with the fishing regulations in the New River and Claytor Lake?

	Not familiar at all	Slightly familiar	Moderately familiar	Very familiar	Extremely familiar
New River	○	○	○	○	○
Claytor Lake	○	○	○	○	○

8. How well of a job do you think the VA Department of Game and Inland Fisheries does of making the fishing regulations for the New River and Claytor Lake known?

	Poor job	Bad job	Decent job	Good job	Excellent job
New River	○	○	○	○	○
Claytor Lake	○	○	○	○	○

9. With regards to fishing regulations in the New River and Claytor Lake, there are _____ (of) fishing regulations.

	Too few	The right amount	Too many
New River	○	○	○
Claytor Lake	○	○	○

10. Which state is upstream from Claytor Lake?

a. North Carolina

b. West Virginia

11. How likely are you to keep the specified catches in the New River?

	Extremely unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Extremely likely
Keep a 13-inch Largemouth or Smallmouth Bass	○	○	○	○	○
Keep a 15-inch Largemouth or Smallmouth Bass	○	○	○	○	○

12. How likely are you to keep the specified catches in Claytor Lake?

	Extremely unlikely	Somewhat unlikely	Neither likely nor unlikely	Somewhat likely	Extremely likely
Keep a 13-inch Largemouth or Smallmouth Bass	○	○	○	○	○
Keep a 15-inch Largemouth or Smallmouth Bass	○	○	○	○	○
Keep a 19-inch Walleye or Saugeye downstream from Claytor Lake Dam	○	○	○	○	○
Keep a 19-inch Walleye or Saugeye on June 1	○	○	○	○	○
Keep a 19-inch Walleye or Saugeye on May 31	○	○	○	○	○
Keep an 18-inch Walleye or Saugeye downstream of Buck Dam in Carroll County to Claytor Lake Dam during February.	○	○	○	○	○

13. How many times have you accidentally or intentionally broken fishing laws in the New River and Claytor Lake?

	New River						Claytor Lake					
	Never	1-5	6-10	11-15	16+	I don't know	Never	1-5	6-10	11-15	16+	I don't know
Accidentally broken fishing laws	○	○	○	○	○	○	○	○	○	○	○	○
Intentionally broken fishing laws	○	○	○	○	○	○	○	○	○	○	○	○

14. Mark whether or not the following scenarios are legal or illegal for the New River and Claytor Lake.

	New River			Claytor Lake		
	Legal	Illegal	I don't know	Legal	Illegal	I don't know
Keeping a 13-inch Largemouth or Smallmouth Bass	○	○	○	○	○	○
Keeping a 15-inch Largemouth or Smallmouth Bass	○	○	○	○	○	○

15. Mark whether or not the following scenarios are legal or illegal.

	Legal	Illegal	I don't know
Keeping a 19-inch Walleye or Saugeye downstream from Claytor Lake Dam	○	○	○
Keeping a 19-inch Walleye or Saugeye caught in Claytor Lake on May 31	○	○	○
Keeping a 19-inch Walleye or Saugeye caught in Claytor Lake on June 1	○	○	○
Keeping an 18-inch Walleye or Saugeye caught in the New River downstream of Buck Dam in Carroll County or in Claytor Lake during February	○	○	○

16. What is your age?

17. What is your sex?

    a. Male

    b. Female

18. What is your race?

    a. White

    b. Black or African American

    c. American Indian or Alaska Native

    d. Asian

    e. Native Hawaiian or Pacific Islander

    f. Other (specify)

19. What is your income?
    a. Less than $10,000
    b. $10,000-$29,999
    c. $30,000-$49,999
    d. $50,000-$69,000
    e. $70,000-$89,000
    f. $90,000-$149,999
    g. More than $150,000
20. What is your highest level of education you have completed?
    a. Did not complete High School
    b. High School/GED
    c. Associate's Degree
    d. Bachelor's Degree
    e. Master's Degree
    f. Advanced Degree (J.D. or Ph.D.)