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# ASSESSING PUBLIC ATTITUDES TOWARD ENDANGERED FRESHWATER MUSSELS

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**PURDUE UNIVERSITY**  
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Entitled

ASSESSING PUBLIC ATTITUDES TOWARD ENDANGERED FRESHWATER MUSSELS

For the degree of Master of Science

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Date

ASSESSING PUBLIC ATTITUDES TOWARD ENDANGERED FRESHWATER  
MUSSELS

A Thesis

Submitted to the Faculty

of

Purdue University

by

Belyna M. Bentlage

In Partial Fulfillment of the

Requirements for the Degree

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For the Heart of the Tippy

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## ABSTRACT

Bentlage, Belyna M. M.S. Purdue University, August 2015. Assessing Public Attitudes toward Endangered Freshwater Mussels. Major Professor: Linda Prokopy.

The Tippecanoe River, situated in northcentral Indiana, supports five federally endangered and one federally threatened species of freshwater mussels. Past overharvesting and present water quality degradation threaten the survivorship of these mussels. To increase awareness about the imperilment of the mussels, we are designing an outreach and education campaign. The first step of the campaign is to collect baseline data about riparian landowner attitudes toward the federally listed mussels. We surveyed 1804 landowners who own property along the Tippecanoe River. We found significant differences in attitudes among landowners based on their awareness of a conflict that occurred as a result of conservation efforts to protect the mussels. Landowner attitudes also differed significantly based on residency in or out of the town where the conflict occurred. We also found that a majority of our sample is religiously affiliated, specifically with Christian traditions. Some literature suggests that within Christian traditions, Catholics tend to exhibit more positive attitudes toward the environment. Our data do not support this claim. Instead, we found few significant differences across Catholic, Mainline Protestant, and Evangelical Protestant groups.

## CHAPTER 1. INTRODUCTION

Conflicts surrounding endangered species conservation epitomize the challenges of conservation efforts of any kind. The public can be reluctant or resentful in adopting practices mandated by government regulations due to actual and perceived inconveniences (Brown and Shogren, 1998; Brook et al., 2003). Inconveniences occur in terms of cost, time, awareness, and skills. Conservation policies are ineffective when they lack public support and adequate levels of enforcement (Biber, 2002). Ineffective policy can become harmful when the public engages in destructive behaviors as a reaction against the policy. When groups feel victimized by conservation policies, they may become antagonistic toward the conservation object (Brook et al., 2003). How to placate and prevent negative attitudes and destructive behaviors toward endangered species is an area of research that needs further development. This need is especially relevant for noncharismatic invertebrate species, such as freshwater mussels. These animals are neglected in terms of research and federal conservation efforts. There is currently no conservation program that we are aware of in the Midwest that addresses public attitudes toward imperiled freshwater mussels.

The Tippecanoe River, located in northcentral Indiana used to support the world's largest population of northern clubshell mussels (*Pleurobema clava*) (USFWS, 2001). Presently, the clubshell mussel, along with the fanshell (*Cyprogenia stegaria*), rayed bean

(*Villosa fabalis*), sheepsnose (*Plethobasus cyphus*), snuffbox (*Epioblasma triquetra*), and rabbitsfoot (*Quadrula cylindrica*) species, are on the U.S. Fish and Wildlife Service's federal list of endangered and threatened species. The Service conserves and protects endangered and threatened species per provisions in the Endangered Species Act (ESA). Environmental state agencies often work in conjunction with the Service to help recover endangered and threatened species. The Indiana Department of Natural Resources provided funding for the Natural Resource Social Science lab at Purdue University to develop an outreach and educational campaign that raises awareness about these imperiled animals. The first year of the three-year project was spent collecting and analyzing survey data that assessed riparian landowner attitudes toward the mussels in the Tippecanoe River. These data are needed to develop an outreach campaign that addresses the existing public perceptions of the mussels. Literature on noncharismatic and invertebrate species consistently demonstrates that a majority of people has fearful and negativistic attitudes toward such species. Therefore, we expected to find neutral to negative attitudes toward the mussels in the Tippecanoe River.

In addition to the findings in the literature, we also anticipated negative attitudes toward the animals because of land-use conflict originating from ESA regulations. Due to provisions in the Act, a local lake that is formed by a dam on the Tippecanoe River was lowered in August of 2014. Residents along the lake and in the surrounding city were outspokenly upset about the event. Local media sources presented the story throughout the rest of the year and the story continues to receive media attention in 2015.

The objective of this document is to present data that are representative of the riparian landowners along the Tippecanoe River. The groups discussed in this document

are characterized based on survey respondent residence, awareness of the lake-lowering event, and religious affiliation. If attitudes toward the federally listed mussels in the river differ based on the geographic location, conflict awareness, or religious affiliation of riparian landowners, our outreach campaign must include nuanced messages or items for different groups. The second chapter of this document will focus on the groups characterized by residency and awareness of the lake-lowering event. The third chapter centers on group differences based on religious affiliation. These two chapters are similar in that they both address obstacles of endangered species conservation, such as barriers in conservation policy and personal attitudes toward endangered species. The chapters are also similar in data that suggest certain groups are likely to be predisposed to less positive attitudes toward endangered freshwater mussels. These predispositions based on group affiliation mean conservation campaign managers should craft outreach items informed by differences between groups.

The chapters differ slightly in their methods. The second chapter assesses only landowner attitudes toward the endangered mussels in the Tippecanoe River, whereas the third chapter discusses landowner values, cultural cognitions of risk, and behavioral intentions, as well as attitudes. The goal of both chapters is to generate much needed literature on freshwater mussel conservation. In addition to these two chapters, the ensuing sections of this document will provide literature reviews, methods, results, and discussions of our assessment of public attitudes toward the imperiled freshwater mussels in the Tippecanoe River.

## CHAPTER 2. ENDANGERED SPECIES MANAGEMENT: PUBLIC PERCEPTIONS AND CONFLICTS WITH FRESHWATER MUSSEL CONSERVATION

### 2.1 Abstract

Over the past two hundred years, nearly 70% of North America's freshwater mussel species have gone extinct. Water quality degradation due to anthropogenic causes is a driving force for this drastic decline. The peril of pearly freshwater mussels (superfamily Unionoidea) is exemplified in the Tippecanoe River of northcentral Indiana, where six federally listed species of mussels face extirpation. It is theorized that endangered and threatened species benefit from targeted informational campaigns. The literature is sparse on how such campaigns impact noncharismatic species and there is even less literature on noncharismatic invertebrates, such as freshwater mussels. In order for targeted informational campaigns to be effective, public perceptions must first be assessed. We surveyed recreational users and riparian landowners along the Tippecanoe River to assess awareness and attitudes related to mussels. We found that despite their ecological significance and their critical imperilment, many members of the public are unfamiliar with the endangered, native mussels. The majority of recreational users surveyed had not seen a mussel in the river and were unable to correctly identify various photos of mussels. While riparian landowners were more aware of the mussels, they varied in their attitudes towards the mussels and towards mussel conservation efforts. During our original survey

mailing, a local lake was lowered due to Endangered Species Act requirements. After this event, we launched a second survey that contained many of the same questions in the original survey but also addressed issues specific to the lowering of the lake. We found no significant differences in attitudes between respondents from the first and second survey. We did find some significant differences between respondents who are aware of the lake issue and those who were not aware. We also found some significant differences between respondents who live in the city where the lake was lowered and respondents who live elsewhere. Data from these surveys is being used to design a targeted outreach campaign that increases awareness and improves attitudes towards locally endangered mussels. This chapter will present an overview of the significance freshwater mussels, threats to their existence, how the public can assist in conservation efforts, the methods and results of our study, and future directions and improvements.

## 2.2 Introduction

North America is a global hotspot for pearly freshwater mussels (superfamily Unionoidea). Regionally, the Midwest has been a historical haven for mussels, supporting a community of nearly 300 species. (Master et al., 2000). Comparatively, only 158 species are native to Europe, Africa, India, and China combined. Despite impressive regional diversity, freshwater mussels are one of the most imperiled animal taxa in North America (Strayer et al., 2004). About half of the Midwest's species of mussels are extinct or federally listed as endangered, threatened, or of special concern (Stein and Flack, 1997). Midwestern mussels are imperiled because biological hotspots are often epicenters of human activity. The fauna in biologically diverse areas is therefore

vulnerable to accelerated anthropogenic alterations to ecosystems. The Tippecanoe River in northcentral Indiana is one such area.

The Tippecanoe River originates from lakes located in Noble and Whitley counties, flows west-southwest for about 166 miles, ends with the Wabash River near Lafayette, Indiana and drains an area of approximately 1,890 square miles (USFWS, 2001) (Fig. 1). In addition to multiple public access sites, city and state parks, and canoe liveries, there are over 2,000 parcels of residential property along the river. The Tippecanoe River supports a variety of wildlife and is home to six federally listed species of freshwater mussels. Once common throughout every major river in Indiana and in the Midwest, these mussels now face extirpation and eventual extinction due to harmful human activities.

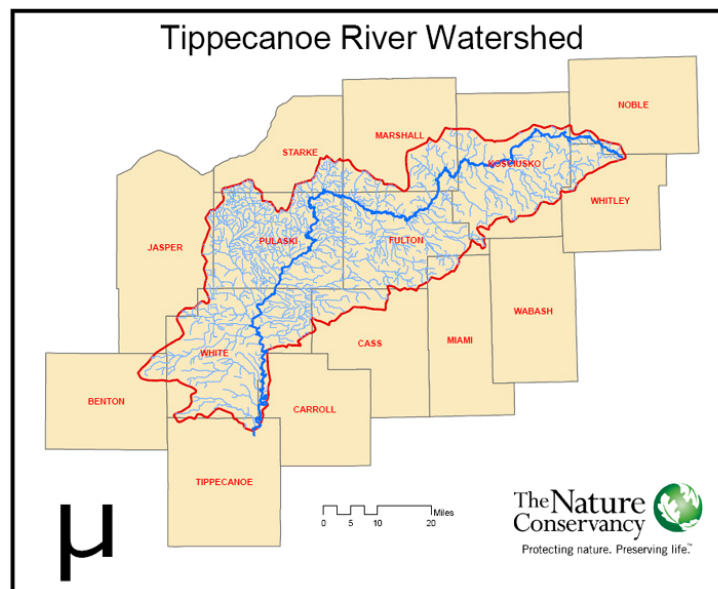


Fig. 1 The Tippecanoe River watershed is approximately the size of Grand Canyon National Park.

<http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/indiana/journeywithnature/fishing-the-tippecanoe.xml>

Protecting freshwater mussels against anthropogenic threats is necessary for many reasons. Mussels are indicator species for water quality (Cummings and Mayer, 1992; Smith and Jepsen, 2008). Healthy mussel populations are indicative not just of clean water, but are also signs of entire ecosystem vitality (Haag, 2012). Freshwater mussels are food sources for riparian mammals and birds such as otters, raccoons, herons, and egrets and the empty mussel shells enhance riparian habitat by providing microhabitats for smaller organisms (Haag 2012; Gutiérrez et al. 2003). The presence of mussels thus demonstrates ecosystem interconnectedness and the absence and decline of mussel populations denotes deteriorating ecosystem health.

## 2.3 Threats to Healthy Mussel Populations

### 2.3.1 Mussel Biology

Detrimental human activities that affect freshwater organisms include degrading habitat, introducing invasive species, and overharvesting native species (Strayer and Dudgeon, 2010). These activities drive the extinction of many freshwater species, including mussels. Certain biological traits (e.g. limited locomotion and filter-feeding mechanisms) make mussels especially vulnerable to human-caused habitat changes. The impacts of anthropogenic water quality degradation combined with these biological traits make building and rebuilding mussel populations very slow compared to many other freshwater taxa (Haag, 2012). Once established, and assuming there is no significant habitat degradation, mussels can live for decades in a river and exhibit stable populations. However, continued water quality degradation of freshwater systems is making stable mussel populations a rare occurrence.



Mussels are sensitive to habitat degradation due to their anatomy, reproductive cycle, and filter-feeding strategy. All mussels belong in phylum Mollusca and class Bivalvia. These taxonomic classifications mean freshwater mussels have a digestive system, a mouth, and two valves (Thorp and Covich, 2009). The two valves are composed of calcium carbonate and other minerals precipitated in an organic matrix to form a hard exterior, protecting the soft interior tissues of the mussel. All mussels possess a posterior muscular foot that allows for locomotion. Mussels can reach their muscular foot out from their valves, grab hold of the substrate, and move slowly across a riverbed. This capability enables mussels to escape slowly changing habitat conditions such as declining water levels. However, the slow pace of this mode of transportation limits mussel mobility and makes mussels susceptible to rapid and harmful habitat changes (Thorp and Covich, 2009; Haag, 2012).

The reproductive cycle of mussels also limits their viability when their habitat becomes degraded. Mussels have a very unique method of reproduction that involves fish hosts and does not involve direct contact between male and female mussels. During the reproductive stage of its life, a male mussel expels sperm into the water column, where the sperm is then filtered and collected by a female mussel (Haag, 2012). Fertilization then occurs and the female mussel produces juvenile mussels, called glochidia (Cummings and Meyer, 1992). The female mussel expels the glochidia into the water column by the thousands, and a few will ideally become attached to the gills of a suitable host fish species (Cummings and Meyer, 1992). Thus begins a parasitic stage for a young mussel glochidium. It should also be noted that some species of mussels require specific species of fish hosts to carry their glochidia (Haag, 2012). During this parasitic stage,

glochidia feed and grow on the fish gills causing little to no damage to the fish (Haag, 2012). Once the glochidia reach a certain size, they fall off of the fish gills and the juvenile mussels establish themselves in the riverbed. This method of reproduction places mussels at risk throughout every stage. First, there must be sufficient numbers of females near males when the males release their sperm. Second, there must be adequate numbers of suitable host fishes in the vicinity of a female releasing the glochidia. Finally, the substrate of the river must be conducive to young mussel survivorship. If a substrate is too soft or muddy, a young mussel may fall off the fish gills only to be immediately buried in the soft sediment.

Throughout all life cycle stages, mussels filter water to obtain nutrients and oxygen. The filter-feeding strategy of mussels also makes them susceptible to habitat degradation. Mussels have two siphons (one incurrent and one excurrent) at the opposite end of the foot (Haag, 2012). To feed, a mussel opens its valves and takes water in through the incurrent siphon. The water passes over the gills, allowing the animal to obtain oxygen. The gills also have cilia that collect and send phytoplankton to the mussel's mouth (Haag, 2012). Once the water has passed through the mussel's gills and the mussel has received oxygen and food, the water is expelled through its excurrent siphon. These unique anatomical and biological features, make mussels susceptible to anthropogenic water quality degradation.

### 2.3.2 Mining

Filtering water keeps rivers healthy, but mussels suffer when water quality is poor. Heavy metal contaminants, such as mercury and PCB's, bioaccumulate in the mussel tissues and cause premature death (Widdows and Donkin, 1992). Mercury and PCB's

enter waterways through runoff from mining and other industrial operations. Mining is one human activity that damages water and mussel health. Acid mine drainage lowers the pH of waterways, which affects survivorship of mussels (Biber, 2002). Effects of low pH and metal concentrations from mining operations impacts freshwater mussels by inducing reproductive failure, temporary to chronic toxicity, hormone disruption in male mussels, and premature death (USFWS, 2001). In a point source assessment study of the Tippecanoe River conducted by the USFWS, low levels of contaminants were detected in sediment chemical analysis. Due to time and budget constraints, further toxicity tests were not conducted. Updated analyses on individual chemicals may reveal toxic levels in the Tippecanoe River today, but, in general, heavy metal contamination mainly affects mussels in Appalachian waterways in states such as Tennessee, Kentucky, and Virginia.

### 2.3.3 Overharvesting

All North American mussel populations, including those in Appalachia and the Midwest, have been affected by historical overharvesting for personal uses such as food and for commercial endeavors. From the mid-1800's to through the late 1900's, mussels were harvested by the millions for the commercial button industry (Cummings and Meyer, 1992; UMCC, 2004). Commercial harvesting peaked in the late 19th and early 20th centuries due in part to the advent of plastic buttons and metal zippers (Biber, 2002). The use of household washers and dryers also helped halt commercial mussel harvest because the high temperatures distorted the shape and color of mussel buttons while plastic buttons and metal zippers were able to retain their form and functionality. Mussels were granted a brief reprieve from overharvesting until the 1950's when markets in Japan and other Asian nations caused another wave of commercial overexploitation (Biber, 2002).

Japan and other nations experienced high demand for cultured pearls. Asian industries purchased American freshwater mussels and used mussel shells as “bead nuclei” to create pearls. (Neves, 1999). This industry ultimately collapsed, but not before sparking another peak harvest in the early 1990’s. The devastation caused by the earlier commercial button industry and the more recent cultured pearl industry inspired many states to enact bans and legislation to protect mussels from harvest, including Indiana. Taking or possessing any live native mussel or shells from deceased mussels, has been illegal in Indiana since 1991.

In the 2000’s, Eric Biber (2002), J.D. Yale School of Forestry and Environmental Studies, interviewed USFWS and conservation biologists specializing in freshwater mussels. Biber (2002) used these interviews, along with his extensive research on how the Endangered Species Act has treated freshwater mussels over the years, to produce a comprehensive review of freshwater mussel conservation in light of ESA policies. The biologists Biber (2002) interviewed are not concerned by commercial harvest threatening freshwater mussels today, despite the 1990’s boom in mussel exploitation. The biologists did acknowledge that past overharvesting is a cause for the low numbers of present populations (Biber, 2002). It is currently unknown whether illicit harvesting remains a threat to mussels.

#### 2.3.4 Invasive Species

A different kind of threat now imperils North American freshwater mussels. Invasive species, specifically zebra mussels (*Dreissena polymorpha*) and quagga mussels (*Dreissena bugensis*), have direct, negative impacts on native freshwater mussels. First introduced in the 1980’s via ships’ ballast waters, zebra mussels have since colonized the

Great Lakes and have changed the ecology of the entire Great Lake system (Biber, 2002; Strayer, 2010). Zebra mussels rapidly multiply. They exist in high densities that can clog intake valves, boat parts, and they have been known to cover any available solid surface, including discarded shopping carts and beer cans. Even native freshwater mussels serve as readily colonized substrates for dreissenids (Strayer, 2010). Zebra mussels cover native mussels like a parasite, but reap no benefits from the native mussel. A single native mussel can be covered in hundreds and even thousands of zebra mussels (Biber, 2002). Once covered, the native mussel is limited in its ability to burrow into the riverbed and in its ability to open and close its valves to feed. As a result, the mussel dies from starvation. Zebra and quagga mussels are found all throughout major U.S. watersheds, including the Mississippi River watershed, which encompasses the Tippecanoe River watershed. The Indiana Department of Natural Resources (IDNR) reports that zebra mussels are present in the Tippecanoe River (IDNR, 2013).

#### 2.3.5 Excess Fine Sedimentation and Nutrient Loading

In addition to biological threats in the form of invasive dreissenids, freshwater mussels are also threatened by abiotic factors. Many USFWS and conservation biologists from Biber's (2002) interviews identified excess siltation as a primary cause for mussel mortality. Dam construction, urban development, agriculture and other activities cause erosion and excess fine sedimentation in freshwater systems (USFWS, 2001; Biber, 2002). Mussels effectively starve to death when a river is inundated with fine sediment. High densities of fine sediment in the water column can also obstruct and fill a mussel's organs. Mussels have adapted to close their valves if they detect elevated levels of particles in the water (Haag, 2012). Though beneficial in the short term, mussels may

starve if they keep their valves closed for extended periods of time due to poor water quality. An abundance of fine sediment can also bury and suffocate mussels directly. This effect not only kills existing adult mussels, it also inhibits juvenile mussel development. After reaching an adequate size, juvenile mussels fall from their fish host and establish into the substrate. If the substrate is not composed of appropriately sized particles and is instead soft with excess fine sediment, juvenile mussels may perish soon after dropping from their fish hosts.

Nutrient loading from effluent discharge can also negatively impact mussel populations. Sewage treatment plants are a common point source of effluent discharge along and near freshwater systems (Biber, 2002). The exact effects of sewage treatment plants and their effluent discharge on mussels is unknown. However, the presence of sewage treatment plants correlates very strongly with low mussel populations (USFWS, 2001; Biber, 2002). High levels of nitrogen and phosphorus from these plants cause eutrophication of waterways, which in turn can cause mussel populations to decline.

Chemicals from sewage treatment plants also impair water quality. Sewage treatment plants often use chlorine as treatment due to its toxic properties. Chlorine in plant discharge can immediately kill microorganisms from which mussels acquire their nutrition (Biber, 2002). Additionally, chlorine can bioaccumulate and poison mussels slowly throughout their lifetime. Bioaccumulation of chlorine and other chemicals can cause direct mussel mortality and can destabilize mussel populations by inhibiting reproduction.

As of 1997, the Tippecanoe River hosts over 65 facilities operating under a National Pollution Discharge Elimination System (NPDES) permit plus 17 (11 active and

six closed) solid waste treatment plants (USFWS, 2001). A biological assessment conducted by USFWS in the late 1990's and published in 2001 investigated point source threats to the imperiled mussels of the Tippecanoe River. Thirty-eight sites were used to assess the effects of point source pollution by comparing upstream and downstream conditions. Overall, researchers found conditions in the Tippecanoe River to be good. Four sites were rated as "exceptional," 18 "good," 11 "fair," and five "poor" (USFWS, 2001, pg. 3.19). A majority of comparisons showed that downstream scores were lower than upstream scores.

Of the five sites rated as "poor," one was downstream from a sewage treatment plant, one was downstream from a closed landfill, and one was downstream from both a sewage treatment plant and a duck farm (USFWS, 2001). The remaining two "poor" quality sites were not associated with a point source. One site lacked mussels and other filter feeders completely. The other site resulted in inaccurate data because samples were buried in sediment. The USFW report suggests that both of these sites are suffering from excess sedimentation most likely caused by non-point source pollution.

One reason that validates the Service's claim is its evaluation of functional groups at these sites. A functional group classifies organisms based on feeding strategies and resource requirements (Merritt and Cummins, 1996). There are four classes of functional groups: shredders, collectors, scrapers, and predators (Merritt and Cummins, 1996). The collector group is split between filtering collectors, e.g. mussels, and gathering collectors, e.g. mayfly larvae (Kummins and Klug, 1979; Merritt and Cummins, 1996). When the ratio of filterers to gatherers is greater than 0.5, a site has a higher than normal amount of fine particulate organic matter suspended in the water column (USFWS, 2001). This ratio

could be a result of nutrient loading or excess sedimentation (USFWS, 2001). Because USFWS found gathering collectors to be the dominant functional group throughout the entire Tippecanoe River watershed, the Service declares excess sedimentation as a significant problem for the river and therefore for the mussels living in the unstable and harmful areas of the river (USFWS, 2001).

### 2.3.6 Agricultural Runoff

The 2001 USFWS report on point source pollution and its effects on the rare mussels of the Tippecanoe River provides evidence that there is a negative association between point source pollution and mussel populations. However, the report failed to provide clear connections and demonstrate causation between point sources and poor water quality (USFWS, 2001). Although impacts of non-point source pollution also lack clarity and causation, it can be reasonably concluded that the Tippecanoe River is adversely affected by agricultural runoff.

The Tippecanoe River was historically described as having three unique sections (Wright, 1932). These sections are still used today and are the upper, middle, and lower Tippecanoe River. The primary type of land use in all three sections is agriculture. Kosciusko and Marshall are the most significant contributing counties that drain into the Upper Tippecanoe. At the time of the USFWS study, 73% of the land in Kosciusko County was farmland and 75% of Marshall County land was farmland (USFWS, 2001). The middle Tippecanoe River drains sections of seven counties. Fulton and Pulaski counties drain most of the middle section of the river. Fulton County was 82% farmland and Pulaski County was 88% farmland at the time of the study (USFWS, 2001). The lower Tippecanoe River is drained mainly by White County, which was 88% farmland at



the time of the study (USFWS, 2001). The lower section of the river also drains small parts of Carroll and Tippecanoe counties, which were 88% and 80% farmland, respectively (USFWS, 2001).

In addition to evaluating the effects of point source pollution on mussel populations, the USFWS report also details the quality of habitat along the Tippecanoe River. The report cites data from a 1992 Gap Analysis Project that shows over 80% of the river's watershed is in "agricultural row crop production" (USFWS, 2001, pg. 2.12).

Similar to the effects of nutrient loading from sewage treatment plant effluent discharge, agricultural runoff can also cause eutrophication (Biber, 2002). Runoff from farms may also contain pesticides that, like chlorine, poison mussels and microorganisms. While it is virtually impossible to prove causation with non-point sources of pollution such as agricultural runoff, due to the watershed's vast coverage by farmland we can safely assume agricultural row crop production is affecting water quality of the Tippecanoe River and the health of its freshwater mussels. Agricultural runoff is a contributing factor to erosion and excess sedimentation, which as discussed above and stated in the USFWS report, is a significant threat to freshwater mussels.

### 2.3.7 Dams

Thousands of miles of U.S. rivers have been altered due to the construction of dams and reservoirs. The Tippecanoe River is dammed in two locations, both occurring in the city of Monticello located in the river's middle and lower sections. Dams create problems for mussels in a number of ways. One way is decreasing flow rates within the river. Mussels that live in rivers have adapted to fast currents (Haag, 2012). When the flow of a river slows, mussels may suffer higher than normal mortality rates and may

become incapable of reproduction (senescent) (Strayer, 2010). Decreased flow rates also mean that silt stagnates and accumulates the waterway. As previously discussed, excess accumulation of fine sediment is both a direct and indirect cause of mussel mortality. Certain fish species may be intolerant of higher silt levels and slower flow rates. Mussel populations may decline if their host fish species decrease in number or become extirpated. Slower rivers also mean less dissolved oxygen is available in deeper parts of the river, especially at the river bottom where mussels live. Because reservoirs and impoundments upstream of dams store water, mussels are threatened with death by desiccation when they live in a river that is directly below a dam (Biber, 2002). Mussels also suffer when water is released from dams. Most dams are “deep release” dams, meaning water released from the dam comes from the bottom of the dam. This water is usually colder than water at the top. While adult mussels can survive in colder temperatures, they develop at slower rates and cease to reproduce, thereby jeopardizing the stability of the population. The effects of damming rivers are epitomized with the Tennessee River during the 1920’s through the 1960’s. During this time period, nearly 68% of the Tennessee River was dammed and the river lost 65% of its freshwater mussel species by 1969 (Biber, 2002).

Broadly, freshwater mussels suffer from water quality degradation. Although the precise mechanisms of how freshwater mussels are affected by anthropogenic threats are unknown, it is clear that freshwater mussel populations are declining due to human activities. Mussel survivorship is threatened by this universal lack of information about the exact causes of death and decline because all wildlife conservation efforts require specific actions linked with specific causes in order to effect change (Conover, 2010).

There must be more research conducted to uncover the underlying mechanisms that negatively impact freshwater mussels. However, it is not the goal of this research to do so. Rather, the goal of this research is to uncover the underlying public perceptions of freshwater mussels in order to design an education and outreach program that effects public concern and advocacy for the imperiled mussels of the Tippecanoe River.

## 2.4 Obstacles to Freshwater Mussel Conservation

### 2.4.1 Policy Bias against Freshwater Mussels

It is undeniably evident that freshwater mussels face a multitude of threats. Conservation efforts must be implemented now in order to prevent further losses. However, because little is known about the specific effects on freshwater mussels from specific threats (Kellert, 1993), many federal recovery efforts have not been very successful (Biber, 2002). The literature on invertebrate conservation suggests that the lack of specificity on how to best achieve successful mussel recovery is due to systematic preferences for vertebrate species research over invertebrate species research (Black and Allen, 2001).

Preference for vertebrate species sounds highly subjective, but the effects are quantifiable. We can look at the International Union for Conservation of Nature's (IUCN) Red List for an example. The Red List is a global resource that provides categories that designate the imperilment status of a species: Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, and Near Threatened. The Red List also provides criteria for those categories (e.g., trends in habitat availability and trends in population size and location). Only one third of the listed species on the IUCN's Red List are invertebrates, despite invertebrates equaling over 90% of global animal species diversity

(Kellert, 1993; Wilcove, 2010). This trend of neglecting invertebrates in international research is evident at a national level when examining the U.S. Endangered Species Act (ESA) relative to freshwater mussel conservation.

Effective environmental law and regulation must protect habitat, stop overexploitation/overharvesting, and stop introductions and expansions of non-native invasive species (Wilcove, 2010). Applied to all native species, these are the fundamental goals of the ESA. Unlike the numerous categories and criteria presented in the IUCN's Red List, the ESA only has two categories of imperilment: endangered and threatened. An endangered species is defined as "any species which is in danger of extinction throughout all or a significant portion of its range" (ESA § 1532(6)). A threatened species is defined by the statute as "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range" (ESA § 1532(20)). The ESA grants the authority of listing species as "endangered" or "threatened" to the United States Fish and Wildlife Service (USFWS). Because the ESA's goal is to protect all species and because the Act in its original form provided no guidelines for prioritizing certain species over others, endangered and threatened listings originally occurred with subjective bias, the effects of which are still noticeable today.

Lack of original guidelines and structured prioritizing led to the USFWS Office of Endangered Species listing species that the employees preferred (Brown and Shogren, 1998). Through a 1990 survey, employees demonstrated significant personal preferences for birds and mammals over reptiles, amphibians, and fish (Brown, 1990). These employee preferences correlated to priorities and reflected the actual federal listings (Brown, 1990). Invertebrates have historically been sorely neglected as a result (Metrick

and Weitzman, 1996). This subjective approach to listing species was replaced by a more objective method in the 1980's. Today, federal listing is closely related to the level of imperilment of a species, not its affective qualities or the personal preferences of federal employees (Brown and Shogren, 1998). However, there are still inequalities between freshwater mussels and the plethora of vertebrate species protected by the ESA.

A major provision in the ESA mandates the development of recovery plans for all listed species. There is a discrepancy between the success rates of recovery plans for all species versus the success rates for freshwater mussel recovery plans: 23% of all species plans have completed over one fourth of their objectives (Biber, 2002). Comparatively, as of 2002, only 3% of mussel species recovery plans have completed over one fourth of the objectives (Biber, 2002).

Bias against freshwater mussels is also manifest in conservation effort expenditures. There a drastic difference between freshwater mussel species and all other listed species in terms of funding. Over a span of six years (from 1989 to 1993), USFWS spent an average of \$1,088,220 per species. Average funding for freshwater mussels was a dismal \$136,571 per species during the same time period (Biber, 2002).

Another obstacle for freshwater mussel conservation under the ESA is that many mussel species have populations that are dangerously low, that are not reproducing, and that are located in such degraded water quality conditions that their recovery is not possible under the Act's current provisions (Biber, 2002). There are regulatory gaps in the ESA that suggest Congress wrote the Act with plants, terrestrial vertebrates, and marine species as priorities (Biber, 2002). As is, the statutory language and the regulatory

provisions of the ESA impede effective freshwater mussel and all freshwater invertebrate conservation.

In addition to interviewing Service and non-federal conservation biologists, Biber evaluated twenty USFWS recovery plans for freshwater mussels. He found that most of the plans did not provide remedies for specific threats to freshwater mussels. Biber also notes that many of the mussel recovery plans contained very similar, if not exact, language as other mussel recovery plans (2002). It is also worth mentioning that all twenty plans call for increased research efforts to enhance the recovery of imperiled mussels (Biber, 2002). Biber's findings from the ESA recovery plans demonstrate how the lack of research on threats and their specific impacts on freshwater mussels equates to a lack of knowledge, which in turn leads to policy bias against and ineffective protection for freshwater mussels.

#### 2.4.2 Public Attitudes toward Freshwater Mussels

Effective conservation efforts include engaging relevant stakeholders and applying outreach campaigns targeted towards those stakeholders (McKenzie-Mohr, 2011). Understanding stakeholders' perceived social value of natural resources is integral to the formation of successful protective programs (Zinn et al., 1998). Therefore, we must first identify the public's perceptions of endangered, native mussels before we can effectively advocate for their protection.

Wildlife and conservation literature lacks substantial assessments of public perceptions of noncharismatic animals (Christoffel and Lepczyk, 2012). Noncharismatic species are ones whose aesthetics and personalities are less appealing to humans. The

consequence of these perceived negative traits is that noncharismatic species are often not chosen for conservation efforts (Knight, 2008). In contrast, charismatic species, such as seals, wolves, and cougars, are often more favorable objects for conservation campaigns (Knight, 2008). The literature on public perceptions of noncharismatic species that does exist suggests the public views noncharismatic species as less valuable and less worthy of conservation efforts than charismatic species (Barney et al., 2005; Knight, 2008).

Furthermore, the affective traits of species influence public attitudes toward specific animals more so than their ecological significance (Martín-López et al., 2007). Affective traits relate to facial and emotional expressions whereas ecological significance refers to the services a species provides to an ecosystem. Humans tend to focus on affective traits and prioritize animals that resemble humans in physical and behavioral manners (Martín-López et al., 2007). The trend of positive attitudes based on affective characteristics despite ecological value does not bode well for endangered, freshwater mussels, which are often mistaken for rocks, confused with marine species, or are eclipsed in the media by zebra mussel publicity. It is therefore assumed that the public will possess low levels of awareness and neutral to negative attitudes towards locally endangered mussels. Neutral attitudes and lack of awareness may prove favorable to endangered mussels. Individuals with unformed attitudes towards mussels may be more likely to shift toward positive attitudes as they are presented with more information through an outreach campaign (Reimer et al., 2013).

However, when people have existing opinions and attitudes toward an animal, especially negative or hostile attitudes, it may be harder to persuade those individuals that the animal is deserving of conservation efforts. Given that the freshwater mussels of the

Tippecanoe River are invertebrates, the public may inherently possess negative attitudes towards the mussels. As Stephen Kellert noted throughout the 1980's and 1990's, public attitudes toward the majority of invertebrate species are ones of "aversion, anxiety, fear, avoidance, and ignorance" (Kellert, 1993, pg. 845). These negative attitudes derive from a variety of reasons. One reason is a perceived (and sometimes realized) link between invertebrates and human disease (Kellert, 1993). Invertebrates are also perceived to damage human health and wellbeing by harming the agricultural industry. Invertebrates are sometimes thought of as agricultural pests that damage crops and harm farmers' profits (Kellert, 1993).

While humans can easily relate to charismatic species due to their affective similarities, invertebrates are so anatomically and functionally different from humans that we have a very difficult time relating to them. They are physically smaller and are often hidden from view. Invertebrates such as earthworms and arthropods account for 1000 kg/ha of the global biomass, while humans weigh in at only 18 kg/ha (Pimental, 1980). Their small body sizes compounded with their unseen omnipresence creates a "creepy" factor in the minds and attitudes of humans (Kellert, 1993). The sheer diversity of invertebrates is also difficult for humans to conceptualize. Invertebrates comprise over 90% of earth's fauna (Erwin, 1982; Wilson, 1992). Invertebrates are more diverse than humans and our fellow vertebrates, yet humans assume a sort of "mindlessness" about invertebrates (Kellert, 1993, pg. 845). Kellert writes that the "the apparent lack of a sense of identity and consciousness among invertebrates" disturbs humans and subconsciously influences humans to perceive invertebrates as sub-human and things to avoid (Kellert, 1993, pg. 845).



Kellert conducted surveys among the general public, farmers, scientists, and conservationists. Some of his results may prove beneficial to our study of public attitudes towards freshwater mussels. Based on Kellert's findings, there are opportunities for enhancing the public image of certain invertebrate species if existing negative attitudes can be circumvented or reformed. For example, a majority of Kellert's sample agreed that invertebrates feel pain (1993). This finding indicates that the public is capable of sympathizing with invertebrates. However, respondents only infrequently reported attitudes of affection, moral concern, and scientific curiosity (Kellert, 1993). Respondent attitudes were highest when species were perceived to have "aesthetic value, utilitarian value, ecological value, or outdoor recreational value" (Kellert, 1993, pg. 840). Kellert specifically cites mollusk shells as receiving higher than normal scores for invertebrates due to their outdoor recreational value (Kellert, 1993). Landowners along the Tippecanoe River who recreate in its waters may therefore value the imperiled mussels for their shells. However, because of historical overharvesting and current laws preventing the collection and possession of freshwater mussels in Indiana, recreational value may not be attributed to the mussels in the Tippecanoe River. Kellert also found that the general public and farmers reported they were largely not in favor of spending money or making economic sacrifices for the protection of endangered invertebrates, specifically mollusks and spiders (1993).

Despite these obstacles, mussels do have some attributes that may act as advantages for their conservation compared to other invertebrate species. Mussels are not associated with disease or predation. Mussels are not agricultural pests and they have high ecological value due largely in part to their filter-feeding nature. Kellert concludes

his assessment of public attitudes toward invertebrates by asserting that one of largest obstacles to invertebrate conservation is cultivating a cultural appreciation and concern for invertebrates among the general public.

#### 2.4.3 Landowner Attitudes toward Endangered Species

Cultivating ethics of appreciation and concern for freshwater mussels may prove to be a difficult task based on the literature of landowner attitudes toward endangered species conservation. Reviews of the literature suggest that the most pervasive mindset landowners have towards endangered species on their property is the “shoot, shovel, and shut-up” ethic (Brown and Shogren, 1998; Biber, 2002; Brook et al., 2003). Landowners who value their individual freedom and who place high value on private property rights, often fear regulation and distrust the federal government (Brown and Shogren, 1998; Brook et al., 2003). This type of landowner requires acknowledgement because almost 60% of all land in the U.S. is privately owned and nearly 25% of federally listed species in the U.S. can be found on private land (Wilcove, 2010). This number is most likely much higher than 25% due to landowners denying federal assessment on their property out of distrust and fear of regulation (Brown and Shogren, 1998; Brook et al., 2003 Wilcove, 2010). Thus, landowners who are not willing to abide by ESA regulations have the potential to greatly suppress the success of endangered species conservation.

Landowner distrust of the federal government, specifically the Fish and Wildlife Service, can be traced back to the inception of the ESA. The Act prohibits harm and negative actions toward listed species, but does not provide information on how to actively care for and protect listed species (Brown and Shogren, 1998; Biber, 2002;

Wilcove, 2010). The effects of the ESA's language and regulatory provisions on landowner attitudes is best presented in the words of Eric Biber:

At the worst, the punitive nature of the ESA toward private landowners engenders hostility and fear, which results in efforts by landowners to illegally and surreptitiously eliminate listed species from their property before the Service can enforce the law against them ("shoot, shovel, and shut up"), and a lack of cooperation (or outright anger) by landowners against the biologists seeking to recover the listed species (2002, pg. 141).

Documents that review ESA-landowner conflicts note multiple anecdotal cases of landowners destroying habitat before protective species legislation is passed so to avoid regulation on their property (Brook et al., 2003). These anecdotes often take place on forested property (Brown and Shogren, 1998). It unknown whether landowners engage in the same kind of preventative destruction with aquatic systems as with terrestrial property. Landowners cannot remove a river from their property like they can a tree, but landowners are capable of removing individual mussels from the river and are susceptible to either knowingly or unknowingly polluting waterways that run through or near their properties.

More than mere existence, damage to private property appears to negatively affect landowner attitudes toward wildlife conflict in general. For example, farmers who experienced property and crop damage caused by deer were more likely to believe deer populations were increasing and were also more likely to support deer population reduction than farmers who did not experience deer damage (Decker and Brown, 1982). This same trend could exist with the imperiled mussel situation in the Tippecanoe River due to recent conflict.

#### 2.4.4 Potential Conflict with Imperiled Mussels in the Tippecanoe River

During August of 2014, Tippecanoe River levels were critically low in the section directly below one of the two dams in Monticello, Indiana. Gauges for the southernmost dam, Oakdale Dam, reported flow rates that jeopardized the survivorship of the federally listed species of mussels in the river (USFWS, 2014). In order to avoid “take,” which is defined by the Act as actions that “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct,” the operating company of the dam increased outflow from Oakdale Dam, thereby increasing river levels below the dam (ESA § 1532(19)). An additional consequence of increasing outflow from the dam, was that the impoundment of water above the dam, Lake Freeman, was lowered. If the operating company of the dam, Northern Indiana Public Service Company (NIPSCO), had not lowered the lake, NIPSCO would have been liable under the ESA and subject to criminal charges. Penalties resulting from criminal charges can take the form of severe financial retribution. In 1995, 25% of ESA-related fines ranged from costing convicted parties \$1000 to \$50,000 (GAO, 1995).

As noted previously in this chapter, the vast majority of land along the Tippecanoe River is in agricultural production. However, land use near Oakdale Dam is mainly residential and commercial (USFWS, 2001). Residents living on Lake Freeman and businesses who rely on unaltered lake levels expressed disappointment and anger. Local newspapers, television and radio stations, social media sites, and personal communication all showed the lowering of Lake Freeman as an antagonistic action of the federal government.

The lowering of Lake Freeman, combined with the negative attitudes cited in the noncharismatic species literature, the invertebrate literature, and landowner perceptions toward endangered species conservation literature, lead us to believe that riparian landowners along the Tippecanoe River will possess neutral to negative attitudes toward the federally listed species of mussels in the river. We assume that attitudes toward the mussels will be mostly neutral to negative, that attitudes will be more negative amongst landowners who were aware of the lowering of Lake Freeman versus those who were not aware of the controversy, and that attitudes in Monticello will be more negative when compared to other cities and towns along the river. In his interviews with Service biologists, Biber explicitly noted that all subjects agreed that there is no “significant hostility toward freshwater mussels because of the potential for land-use regulation due to the listing of the species” (Biber, 2002, pg. 149).

## 2.5 Methods

The goal of this study is to assess attitudes related to endangered freshwater mussels in order to design an effective informational outreach campaign targeted in part to landowners. Assessing the existing attitudes toward a conservation object is the first step in designing an effective campaign (Strayer and Dudgeon 2010; McKenzie-Mohr, 2011). Riparian landowners along the Tippecanoe River were surveyed using mail surveys. Survey research was implemented for generalizability and efficiency purposes (Schutt, 2011). The mail survey included questions that assessed general awareness about the endangered and threatened mussels in the Tippecanoe River, attitudes towards the mussels, and specific behaviors that threaten the rare animals. Our original mailing schedule coincided with the lowering of Lake Freeman. In order to measure landowner

attitudes about the recent controversy, we designed and mailed a second survey. The second survey included original survey items as well as statements specific to the Lake Freeman issue. Both mail surveys additionally evaluated wildlife values, cultural values, and religiosity. The theory, methods, and results of that part of the study are presented in the following chapter, “Catholicism and Wildlife Conservation: The Case of Endangered Freshwater Mussels.” The aspects of the mail survey that are addressed in the current chapter are the overall and group-specific attitudes related to the endangered mussels. Three groups are examined in this chapter: Respondents from both the first survey and the second survey, respondents who are aware of the lowering of Lake Freeman in order to protect the mussels versus respondents who are unaware of this event, and respondents living in Monticello where the lake was lowered versus respondents living outside Monticello. In addition to providing information for an outreach campaign, data from the mail survey will enhance the literature related to endangered noncharismatic and invertebrate species conservation and will add to the very sparse literature on the human dimensions of freshwater mussel conservation.

Both surveys mailed during the summer and fall of 2014 and both followed the Dillman method of a five-wave mailing (Dillman et al., 2009). Recipients were first mailed an advance letter that contained information required by Purdue University’s Institutional Review Board, information regarding the purpose of the study, and a link to take an online version of the survey through Qualtrics. The advance letter also notified recipients that if they chose not to take the survey online, they would receive a blue envelope containing a paper survey and a stamped return envelope for their convenience. That second wave was followed by a postcard that reminded recipients to fill out and

return their survey. The postcard also contained the link to the Qualtrics version.

Following the postcard was another blue envelope containing the paper survey and a return envelope. The final wave was the paper survey packet plus a thank you postcard.

The mailing schedule for the first survey was:

July 24: Advance Letter  
 August 5: 1st Survey  
 August 14: Reminder Postcard  
 August 25: 2nd Survey  
 September 4: 3rd Survey and Final/Thank-You Postcard

The mailing schedule for the second survey followed the same protocol with the following dates:

September 24: Advance Letter  
 October 3: 1st Survey  
 October 17: Reminder Postcard  
 October 29: 2nd Survey  
 November 13: 3rd and Final/Thank-You Postcard

We used county GIS websites of the counties through which the Tippecanoe River runs to find riparian landowner addresses. The included counties are Carroll, Fulton, Kosciusko, Marshall, Pulaski, Tippecanoe, and White. Only residential property addresses that touch the river were collected. Lakefront properties were excluded from our collection. Also excluded from our address list were all land trusts, non-farm businesses, club organizations, partnerships, churches, estates, cemeteries, and university related addresses. Our final sampling universe contained 2587 addresses. We drew a random sample of 1048 for the first survey. A large portion ( $n = 295$ ; 28%) of our original surveys were returned as bad addresses. A vast majority of those bad addresses came from Monticello, Indiana. After telephone conversations with Joe Rogers, Director

of the White County Area Plan Department, we learned that the White County GIS website was malfunctioning. When we were assured that the issues with the website were fixed, we recollected and resampled the bad addresses from Monticello. Almost all addresses returned once more as undeliverable. Based on return notifications from the post office, it appears that many residential lots along the Tippecanoe River in Monticello are seasonal properties that are vacant for portions of the year, do not have a mail receptacle, or do not have a forwarding address. The mailing schedule for the resample of Monticello bad addresses was:

September 22: Advance Letter  
October 1: 1st Survey  
October 15: Reminder Postcard  
October 23: 2nd Survey  
November 12: 3rd and Final/Thank-You Postcard

The sample for the second survey was drawn randomly from unsampled addresses in our original universe. A total of 756 surveys were mailed during this round and 212 were returned as undeliverable, again a majority of which were from Monticello. No resampling was conducted with bad addresses from the second survey mailing due to the unsuccessful attempt from the first survey mailing. A total of 1804 surveys were distributed between the first and second mailings.

All surveys were returned via mail to the Natural Resources Social Science (NRSS) lab at Purdue University's Department of Natural Resources in West Lafayette, Indiana or online via Qualtrics. Paper versions of the surveys were entered into Qualtrics. All data were downloaded from Qualtrics as SPSS files. All data remain confidential and are analyzed solely by NRSS lab personnel. Data for this thesis were analyzed with SPSS.



Data for this chapter were analyzed through independent two sample t-tests when comparing means of two groups. T-tests assume homogeneity of variance (HOV) between the two groups. If this assumption is violated, results from a t-test are not accurate. Based on Levene's Test of Equality of Variances, if group variance violated the assumption of HOV, the Welch's t-test was used instead. The Welch's t-test, also known as the unequal variances t-test, is a method used when groups have statistically different variances and therefore violate the t-test assumption of HOV.

Attitudes were assessed by analyzing responses from an 11-item scale that was originally developed for affective attitudinal assessment of pets (Poresky et al., 1988). This scale was used in a previous study conducted by the NRSS lab that evaluated public attitudes toward another imperiled noncharismatic species, the Eastern Hellbender (*Cryptobranchus alleganiensis*) (Reimer et al., 2013; Mullendore et al., 2014). The 11 items from the scale are Good-Bad, Important-Unimportant, Beautiful-Ugly, Friendly-Unfriendly, Active-Passive, Pleasant-Unpleasant, Valuable-Worthless, Clean-Dirty, Hardy-Fragile, Harmless-Dangerous. Responses range from 1-7 based on landowner preference for the aquatic animals. Values closer to 1 indicate positive attitudes, values closer to 7 indicate negative attitudes, and values close to 4 indicate neutral attitudes. Therefore, low scores demonstrate positive affective assessment and high scores demonstrate negative affective assessment.

Three other survey items were used to assess landowner attitudes. These items are the statements, "Government money should be used to protect these mussels," "When necessary, water levels in Lake Freeman should be lowered to increase water levels in the Tippecanoe River to protect mussels," and "I think we as a nation should repeal the

Endangered Species Act.” The latter two statements appeared only in the second survey. The first statement about government money being used for mussel conservation appeared on both survey types. For all three statements, respondents were asked to choose between five options ranging from Strongly Disagree (1) to Strongly Agree (5) that best fit their level of agreement or disagreement with the statement. This statement was included in the second survey because a Congressman (R-IN 4th District) told constituents at a town hall meeting in Monticello in August after Lake Freeman was lowered that he was vehemently opposed to the ESA. The Congressman also asked the constituents if they supported the repeal of the Act. Few members in attendance raised their hands, but the Congressman announced he would return to Congress and fight against the existence of the Act.

## 2.6 Hypotheses

Based upon the literature review of public attitudes toward noncharismatic species, vertebrate species, and landowner attitudes toward federally listed species and based upon the recent events in Monticello, Indiana, we posit the following three hypotheses:

**HYPOTHESIS 1:** Riparian landowners will possess primarily neutral or negative attitudes towards mussels.

**HYPOTHESIS 2:** Riparian landowners aware of the lowering of Lake Freeman to protect federally listed mussels in the Tippecanoe River will have more negative attitudes than riparian landowners who are unaware of this event.

**HYPOTHESIS 3:** Riparian landowners in Monticello will possess more negative attitudes towards the mussels than riparian landowners in other cities and towns.

## 2.7 Results

### 2.7.1 Overall Riparian Landowner Attitudes

The overall landowner affective attitudes towards the imperiled freshwater mussels of the Tippecanoe River are more positive than we hypothesized (see Table 2.1). The average rating for all 11 affective categories from both surveys is a 2.84. Between Survey 1 and Survey 2, the only statistically significant difference in affective attitudes was for the category Good-Bad. Survey 2 results show a significantly higher mean evaluation of the mussels (2.47) than the mean from Survey 1 (2.18).

In terms of overall attitudes as they relate to government funding, a larger percentage of respondents agreed or strongly agreed with the statement “Government money should be used to protect these mussels” (38%) than respondents who disagreed or strongly disagreed (30%) or who were neutral (32%). There were no significant differences between Survey 1 and Survey 2 responses for the government money statement. Based on the low, positive scores for affective attitudinal assessment and based on the relatively high percentage of respondents supporting governmentally funded protection efforts, we can reject our first hypothesis that riparian landowners possess primarily neutral or negative attitudes towards federally listed mussels in the Tippecanoe River.

Table 2.1: T-test results for differences in affective attitudes based on survey type (\*significant at the .05 level)

Affective Category	N		Group Mean		Difference Between Means	Std. Deviation		Std. Error		df	Statistic	P-Value
	Survey 1	Survey 2	Survey 1	Survey 2		Survey 1	Survey 2	Survey 1	Survey 2			
Good-Bad	306	227	2.18	2.47	.29*	1.62	1.63	.09	.11	(1, 531)	4.09	.044
Important-Unimportant	315	228	2.63	2.59	.04	2.09	1.85	.12	.12	(1, 541)	.05	.828
Beautiful-Ugly	301	227	2.76	2.96	.20	1.78	1.68	.10	.11	(1, 526)	1.77	.184
Friendly-Unfriendly	293	221	2.78	2.67	.11	1.75	1.59	.10	.11	(1, 512)	.51	.474
Active-Passive	290	219	3.77	3.57	.20	2.51	2.00	.12	.13	(1, 507)	1.24	.265
Pleasant-Unpleasant	294	226	2.84	2.79	.05	1.76	1.55	.10	.10	(1, 518)	.143	.706
Valuable-Worthless	303	228	2.73	2.83	.10	2.02	1.89	.12	.13	(1, 529)	.31	.576
Clean-Dirty	302	224	2.61	2.75	.14	1.77	1.72	.10	.12	(1, 524)	.88	.349
Hardy-Fragile	292	223	3.29	3.34	.05	1.83	1.83	.11	.12	(1, 513)	.09	.760
Harmless-Dangerous	307	226	1.83	1.96	.13	1.46	1.47	.083	.098	(1, 531)	1.04	.309
Dry-Slimy	289	224	3.47	3.67	.20	1.73	1.70	.10	.11	(1, 512)	1.77	.183

### 2.7.2 Lake Freeman Awareness and Attitudes

Data are reported only from the second survey because only the second survey included the question “Before taking this survey, did you know Lake Freeman was lowered to protect endangered mussels in the Tippecanoe River?” (n = 244). Respondents could have encountered information about the lowering of the lake to protect the mussels in the river through multiple sources, including but not limited to newspapers, television, radio, and/or word of mouth. Most respondents were unaware of the fact that Lake Freeman was lowered to protect the federally listed mussels in the river (61%), but a substantial percentage was aware (39%). Between respondents who were aware Lake Freeman was lowered to protect the mussels and those who were unaware, respondents that were aware scored higher means than unaware respondents in all but two categories (Active-Passive, Hardy-Fragile) (see Table 2.2). Four categories (Good-Bad, Important-Unimportant, Active-Passive, Valuable-Worthless) violated the homogeneity of variance assumption for t-tests. Results from the Welch’s t-test show that of those four categories, only Active-Passive show insignificant differences. Respondents who were aware of the lowering of Lake Freeman reported significantly higher scores than unaware respondents for Good-Bad, Important-Unimportant, and Valuable-Worthless. Of the seven categories available for reliable t-tests (Beautiful-Ugly, Friendly-Unfriendly, Pleasant-Unpleasant, Clean-Dirty, Hardy-Fragile, Harmless-Dangerous, Dry-Slimy), three categories (Beautiful-Ugly, Pleasant-Unpleasant, Clean-Dirty) have significantly different means between aware and unaware respondents. Beautiful-Ugly, Pleasant-Unpleasant, and Clean-Dirty all show significantly higher scores from aware respondents versus unaware respondents.

Table 2.2: T-test and Welch's t-test results for affective attitudes based on Lake Freeman awareness (\*significant at the .05 level; \*\*significant at the .01 level)

Affective Category	N		Group Mean		Difference Between Means	Std. Deviation		Std. Error		df	Statistic	P-Value
	Aware	Unaware	Aware	Unaware		Aware	Unaware	Aware	Unaware			
Good-Bad	90	124	2.83	2.21	.62**	1.78	1.52	.19	.14	(1, 173)	7.26	.008
Important-Unimportant	93	122	3.18	2.16	1.02**	2.15	1.49	.22	.14	(1, 156)	15.55	.000
Beautiful-Ugly	92	122	3.39	2.65	.74**	1.76	1.57	.18	.14	(1, 212)	10.61	.001
Friendly-Unfriendly	87	120	2.85	2.54	.31	1.59	1.56	.17	.14	(1, 205)	1.95	.164
Active-Passive	90	116	3.54	3.56	.02	1.84	2.09	.19	.19	(1, 201)	.00	.954
Pleasant-Unpleasant	91	121	3.13	2.55	.58**	1.61	1.45	.17	.13	(1, 210)	7.71	.006
Valuable-Worthless	93	122	3.25	2.49	.76**	2.06	1.71	.21	.16	(1,177)	8.20	.005
Clean-Dirty	90	121	3.06	2.55	.51*	1.82	1.63	.19	.15	(1, 209)	4.42	.037
Hardy-Fragile	90	120	3.18	3.51	.33	1.83	1.83	.19	.17	(1, 208)	1.67	.197
Harmless-Dangerous	90	122	2.03	1.93	.10	1.50	1.49	.16	.13	(1, 210)	.27	.605
Dry-Slimy	91	120	3.89	3.54	.35	1.64	1.72	.17	.16	(1, 209)	2.21	.139

In general, the group that was aware of the lowering of Lake Freeman to protect the mussels consistently rated the mussels more negatively than the group that was unaware of the lowering of Lake Freeman.

Aware respondents were also significantly less likely to agree with the statements “Government money should be used to protect these mussels” (see Table 2.3) and “When necessary, water levels of Lake Freeman should be lowered to increase water levels in the Tippecanoe River to protect mussels”(see Table 2.4). High values for the statements about government funding and lowering Lake Freeman demonstrate landowner support for federally funded conservation programs and actions. Low values for the ESA statement demonstrate support for the Act. Where 1 = strongly disagree and 5 = strongly agree, aware respondents recorded a mean score of 2.65 for the government funding statement and a mean score of 2.73 for the water levels statement. These means are statistically higher than the mean scores of unaware respondents, which were 3.25 and 3.60. The statistically significant differences can be seen in the percentages of respondents who disagree or strongly disagree with those two statements. In response to “Government money should be used to protect these mussels,” 49% of aware respondents and only 24% of unaware respondents disagreed or strongly disagreed. In response to “When necessary, water levels in Lake Freeman should be lowered to increase water levels in the Tippecanoe River to protect mussels,” 54% of aware respondents and only 7% of unaware respondents disagreed or strongly disagreed.

Table 2.3: T-test Results for Government Funding Attitudes Based on Lake Freeman Awareness (\*\*significant at the .01 level)

N		Group Mean		Difference Between Means	Std. Deviation		Std. Error		df	Statistic	P-Value
Aware	Unaware	Aware	Unaware		Aware	Unaware	Aware	Unaware			
90	140	2.64	3.25	.61**	1.38	1.21	.14	.10	(1, 186)	12.15	.001

Table 2.4: Welch’s T-test Results for Lake Lowering Attitudes Based on Lake Freeman Awareness (\*\*significant at the .01 level)

N		Group Mean		Difference Between Means	Std. Deviation		Std. Error		df	Statistic	P-Value
Aware	Unaware	Aware	Unaware		Aware	Unaware	Aware	Unaware			
93	137	2.73	3.60	.87**	1.43	.90	.15	.08	(1, 142)	26.91	.000



The statement “I think we as a nation should repeal the Endangered Species Act” yielded no significant differences between the groups. Both groups demonstrate a virtual majority against this statement, with 50% of aware respondents and 52% of aware respondents strongly disagreeing/disagreeing. Based on the results from the significant differences in affective attitudes and based on the significant differences in conservation support statements, we provide evidence supporting our second hypothesis that riparian landowners aware of the lowering of Lake Freeman to protect federally listed mussels in the Tippecanoe River have more negative attitudes towards the mussels than riparian landowners who are unaware of this event.

### 2.7.3 Monticello Attitudes

Based on the same literature cited for our second hypothesis and due to the negative media and political press in Monticello, we hypothesized that landowners in Monticello would have more negative attitudes toward the Tippecanoe mussels than landowners outside of Monticello. Between Monticello and non-Monticello respondents, mean scores from Monticello respondents were higher than the mean scores from outside Monticello for all but one category (Hardy-Fragile) (see Table 2.5). Welch’s t-tests were performed on seven categories (Good-Bad, Important-Unimportant, Active-Passive, Valuable-Worthless, Hardy-Fragile, Harmless-Dangerous, and Dry-Slimy). Six of those seven categories show Monticello landowner scores are significantly different than non-Monticello landowner scores. In the categories of Good-Bad, Important-Unimportant, Active-Passive, Valuable-Worthless, Harmless-Dangerous, and Dry-Slimy, Monticello respondents have higher mean scores than non-Monticello respondents.

Table 2.5: T-test and Welch's t-test results for affective attitudes based on Monticello residency (\*significant at the .05 level; \*\*significant at the .01 level)

Affective Category	N		Group Mean		Difference Between Means	Std. Deviation		Std. Error		df	Statistic	P-Value
	Mont.	Non-Mont.	Mont.	Non-Mont.		Mont.	Non-Mont.	Mont.	Non-Mont.			
Good-Bad	184	342	3.04	1.92	.12**	1.75	1.42	.13	.08	(1, 315)	55.61	.000
Important-Unimportant	195	341	3.63	2.06	1.57**	2.17	1.64	.16	.09	(1, 322)	76.93	.000
Beautiful-Ugly	190	331	3.65	2.41	1.24**	1.74	1.58	.13	.09	(1, 519)	68.49	.000
Friendly-Unfriendly	183	324	3.30	2.44	.86**	1.64	1.63	.12	.09	(1, 505)	32.24	.000
Active-Passive	184	318	4.03	3.51	.52**	1.91	2.06	.14	.12	(1, 406)	8.10	.005
Pleasant-Unpleasant	186	327	3.58	2.40	1.18**	1.70	1.50	.12	.08	(1, 511)	66.19	.000
Valuable-Worthless	191	333	3.72	2.26	1.46**	2.08	1.68	.15	.09	(1, 332)	67.92	.000
Clean-Dirty	188	331	3.31	2.32	.99**	1.83	1.59	.13	.09	(1, 517)	41.96	.000
Hardy-Fragile	184	324	3.31	3.33	.02	1.71	1.89	.13	.11	(1, 412)	.02	.901
Harmless-Dangerous	190	336	2.09	1.78	.31*	1.52	1.42	.11	.08	(1, 370)	5.45	.020
Dry-Slimy	183	323	3.91	3.36	.55**	1.60	1.76	.12	.10	(1, 409)	13.00	.000

The category of Hardy-Fragile did not produce significant differences between the groups and was the only category of all eleven categories where non-Monticello scores were higher than Monticello scores. Of the four remaining categories where t-tests could be performed, there are significant differences between the mean scores from Monticello and from outside of Monticello in all four categories. In the categories of Beautiful-Ugly, Friendly-Unfriendly, Pleasant-Unpleasant, and Clean-Dirty, Monticello respondents have significantly higher mean scores than non-Monticello respondents. In all but one category, landowners in Monticello rate the mussels with significantly higher, more negative evaluations than residents from outside Monticello.

As for the three additional statements measuring support of the government funding conservation programs, the lowering of Lake Freeman when necessary, and repealing the Endangered Species Act, Monticello landowners were statistically less likely to support the first two statements. On a scale where 1 = strongly disagree and 5 = strongly agree, Monticello landowners had a significantly lower mean than non-Monticello landowners for the statement “Government money should be used to protect these mussels” (see Table 2.6). The significant difference between the two groups is evident in the percentage of landowners who agree or strongly agree with government spending money to protect the imperiled mussels: 47% of Monticello respondents disagreed or strongly disagreed with that statement, but only 21% of non-Monticello respondents disagreed or strongly disagreed. There are also significant differences between Monticello and non-Monticello respondents with the results of the statement “When necessary, water levels of Lake Freeman should be lowered to increase water levels in the Tippecanoe River to protect mussels” (see Table 2.7).

Table 2.6: T-test results for government funding attitudes based on Monticello residency (\*\*significant at the .01 level)

N		Group Mean		Difference Between Means	Std. Deviation		Std. Error		df	Statistic	P-Value
Mont.	Non-Mont.	Mont.	Non-Mont.		Mont.	Non-Mont.	Mont.	Non-Mont.			
202	373	2.55	3.34	.79**	1.32	1.25	.09	.07	(1, 573)	50.12	.000

Table 2.7: Welch's T-test Results for Lake Lowering Attitudes Based on Monticello Residency (\*\*significant at the .01 level)

N		Group Mean		Difference Between Means	Std. Deviation		Std. Error		df	Statistic	P-Value
Mont.	Non-Mont.	Mont.	Non-Mont.		Mont.	Non-Mont.	Mont.	Non-Mont.			
78	159	2.37	3.64	1.27**	1.24	.97	.14	.80	(1, 125)	62.98	.000

Again, the statistically significant differences are clear in the percentages between groups: 62% of Monticello respondents versus 9% of non-Monticello respondents disagreed or strongly disagreed with the lowering of Lake Freeman to protect the rare and imperiled mussels. The difference in percentages are less striking, but still notable for the statement “I think we as a nation should repeal the Endangered Species Act.” There were no statistical differences between groups for this statement, but 22% of Monticello respondents and 13% of non-Monticello respondents agreed or strongly agreed with repealing the Act. Large percentages from both groups were not in favor of repealing the ESA: 47% of Monticello respondents and 52% of non-Monticello respondents disagreed or strongly disagreed with removing the ESA from legislation. Based on the results from the affective attitudinal scale and the statements regarding the conservation efforts for the mussels, we provide evidence that supports our third hypothesis. Riparian landowners in Monticello possess more negative attitudes towards the mussels than riparian landowners in other cities and towns.

## 2.8 Discussion

Many critics of the U.S. Endangered Species Act focus on the lack of engagement with citizens, specifically private landowners (Brown and Shogren, 1998; Brook et al., 2003). This critique is due in part to the significant percentage of federally listed species that occur on private land. This critique and its associated complications are difficult to directly apply to freshwater mussels because these rare animals live in almost entirely public spaces, such as lakes, streams, and rivers (Biber, 2002). Instead of suffering from direct harm caused by landowners, freshwater mussels suffer from the collective effects of nonpoint source pollution such as agricultural runoff, nutrient loading, and excess

sedimentation (Brown and Shogren, 1998; Biber, 2002; Brook et al., 2003; Wilcove, 2010). Dams also pose major ecological threats to freshwater mussels, especially the endangered and threatened species in the Tippecanoe River. Conflict arises over the protection of endangered species when federal conservation efforts are imposed upon private landowners (Brown and Shogren, 1998). Maintenance of Oakdale Dam in Monticello, Indiana and federal regulations pertaining to the protection of ESA listed mussels in the Tippecanoe River has led to antagonistic public and political rhetoric on the subject. It is clear from our data that awareness of the lake-lowering conflict is associated with less positive attitudes toward the mussels in the river. It is also clear from our data that residency in Monticello, where the conflict occurred, is also associated with less positive attitudes toward the mussels. Biber's (2002) study revealed that USFWS and conservation biologists did not think any contentious attitudes towards mussels existed due to ESA regulations. The case of federally listed species of freshwater mussels in the Tippecanoe River may be the first documented case of hostile attitudes towards listed species of freshwater mussels due to land-use conflict.

This situation presents a unique opportunity where freshwater mussels, which have historically been neglected in ESA recovery efforts, are at the center of attention in a state-funded conservation campaign. The uniqueness of the situation is furthered by its potential status of being the first documented case of hostile attitudes towards federally freshwater mussels due to land-use conflicts. We found that overall, riparian landowners along the Tippecanoe River possess primarily positive to neutral attitudes towards the protected animals. We also found that attitudes are significantly less positive based on awareness of the lowering of Lake Freeman and landownership in Monticello.

Brown and Shogren (1998) offer the suggestion that “[u]nless the government codifies efforts to make landowners feel like partners in species protection, the prognosis for a reformed Act is not good” (pg. 4). It is beyond the scope of our project to codify such efforts, but we can use our survey data on landowner attitudes to help design an education and outreach program that positively engages landowners and other relevant stakeholders (e.g. anglers, canoers/kayakers, visitors of parks, and youth groups) with the endangered and threatened mussels. With group differences in attitudes based on conflict awareness and residency in the area of conflict, such education and outreach programs should consider if, how, and where to engage with the conflict.

The ESA requires recovery plans for all listed species, but it does not make these plans legal documents. Courts often defer to the expertise of the U.S. Fish and Wildlife Service (USFWS) instead of enforcing the recovery plans through their own judicial powers (Biber, 2002). As they currently stand in the legislative environment, recovery plans are more like guidelines where steps and protocols are suggestions, not laws. Plans are also deemed ineffective because they lack sufficient biological information and often do not link specific actions with corresponding threats.

What we can do to increase the efficacy of mussel conservation efforts is to link specific behaviors to specific audiences through a community-based social marketing campaign (CBSM). CBSM campaigns are designed to promote conservation behaviors through encouraging social norms, providing prompts, and increasing impacts through social diffusion (McKenzie-Mohr, 2011).

The first step in creating a CBSM campaign is to select behaviors for target audiences. Through collaboration with partners at USFWS and Indiana’s Department of

Natural Resources, we have identified three general behaviors: Leave mussels in the river, properly dispose of waste while recreating in and along the river, and carry canoes and kayaks when boating through areas of low water to avoid damaging mussel beds. Based on the results from this part of our study, we conclude that to effectively engage stakeholders, special attention must be paid to the lowering of Lake Freeman event and to landowners in Monticello, Indiana.

People tend to solidify their own values and attitudes when presented with information that they perceive attacks their own perspective (Kahan and Braman, 2006). In order to best engage lake landowners in mussel outreach, we must be careful to tailor messages that address their concerns about property damage, decreased recreational opportunities, and commercial well-being for the city of Monticello. For general mussel outreach and education, our partners at USFWS and Indiana's Department of Natural Resources suggest taking a holistic approach by emphasizing the importance of ecosystem vitality of the Tippecanoe River. However, specific to the lake issue, they recommend a minimalistic approach in terms of outreach. We agree with our federal and state partners that the campaign must maintain neutrality in order to maximize outreach and education efficacy in the Monticello area, but due to the significant differences between Monticello and non-Monticello residents in terms of attitudes toward the mussels, it is worth considering specialized outreach in Monticello and around the lakes to ensure long-term and widespread success of the outreach campaign. The federally listed species of freshwater mussels in the Tippecanoe River present a clear case where, in addition to biological threats from dams and other anthropogenic activities, mussels are also the target of negativistic attitudes due to land-use conflict over ESA listing.



## 2.9 Future Directions

After the outreach and education campaign launches in the summer of 2015, a second round of surveys will be conducted to evaluate the success of the campaign. The surveys will evaluate how successful the campaign was in motivating people to adopt the target behaviors and how, if any, changes in attitudes occurred due to participation in the campaign. A limitation of the current study is that we were unable to capture the effects of lowering Lake Freeman. Due to our mailing schedules, all but 4 surveys were returned before the lake was lowered thereby negating any before/after comparisons. Another limitation of the study is that we did not assess attitudes of landowners living along Lake Freeman. Future studies on landowner attitudes towards freshwater mussels should include assessment of conflict areas.

## CHAPTER 2. CATHOLICISM AND WILDLIFE CONSERVATION: THE CASE OF ENDANGERED FRESHWATER MUSSELS

“Qualitative, humanistic considerations are too often lost in legislative and administrative efforts to adjust or redefine man’s changing relationship to his environment.”

-Senator Henry Jackson (D-WA, 1953-1983)

### 3.1 Abstract

It is widely acknowledged that for outreach campaigns to be successful, they must incorporate and target stakeholder values, attitudes, and behaviors. Environmental outreach campaigns typically target stakeholder groups such as landowners, anglers, school-aged children, and recreational organizations. These commonly targeted groups are in the secular sphere of society. However, a large proportion of the U.S. is religiously affiliated in some capacity. Our goals are to understand if religion influences stakeholder values, attitudes, and behaviors and to understand if there is potential to target environmental outreach campaigns toward religious groups.

We surveyed 1804 riparian landowners along the Tippecanoe River. The Tippecanoe River is located in northcentral Indiana and is home to six federally listed species of freshwater mussels. We asked respondents a variety of questions relating to the mussels in the Tippecanoe River, wildlife in general, and their religious affiliation. We found few differences between religious affiliations and support for wildlife conservation. We conclude that despite insignificant differences between religious groups in terms of

wildlife values, attitudes, and behaviors, religious organizations should be included in educational and outreach programs to increase the efficacy of such programs.

### 3.2 Introduction

Healthy mussel populations are threatened by adverse anthropogenic alterations of freshwater systems. Overharvesting, excess siltation, dams, and runoff have all been shown to negatively impact freshwater mussel populations. Efforts to recover mussel populations have largely focused on these environmental factors. While recovery efforts undoubtedly need to address water quality issues, conservation of freshwater mussels may be enhanced when local stakeholder attitudes are included in conservation campaigns. Public perceptions of natural resources and wildlife are mitigated through cultural influences including religiosity, recreational usage, and relationships with property (Martín-López et al. 2007). For those reasons, we measured the following variables: wildlife values, recreational activities, cultural values, and religiosity.

Religion has been promoted as both an enemy and an ally to the environment. Essayists have been battling in the academic arena over whether we should blame religion, mostly Judeo-Christian traditions, as a cause for the current ecological crisis or whether religion can be utilized as a potential solution. The literature lacks substantial empirical evaluation of religious affiliation and its association with environmental attitudes. The literature that does exist suggests that within Christian traditions, certain denominations are more likely to have pro-environmental attitudes. It has been shown that among Christian groups, Catholics tend to report more favorable environmental attitudes and behaviors than Protestant groups (Greeley et al., 1993; Guth et al., 1995). This study will add to the literature on the relationships between religious affiliation and

environmental orientations. This study is also the first of its kind to investigate associations between religious affiliation, general wildlife value orientations, and species-specific attitudes.

### 3.3 Literature Review

#### 3.3.1 Religion and the Environment: Socio-Political Segregation

Reverend Martin Luther King, Jr. once stated that the most segregated time in the United States is not an era of ages past, recorded in the pages of history books about the days before the American Civil War. Rather, the Reverend said the most segregated time in the U.S. is every Sunday morning at eleven o'clock (Stodghill and Bower, 2002).

Religion is a powerful force that shapes social dynamics in many ways. Religion attracts and bonds like-minded individuals (McPherson et al., 2001). It influences our political affiliations (Bader and Froese, 2005) and it prompts us to consider the extent to which religion should influence civil politics. Religion affects how we interpret and react to social and controversial issues and religion plays a role in our overall satisfaction with life (Lim and Putnam, 2010; Lewis et al., 2010). The Reverend Martin Luther King, Jr. and his colleagues recognized the influences of religion run deep in the U.S. socio-political landscape. Religion provided hope, justification, and momentum to change that landscape into a promised land for the nation's neglected and abused minorities (Smith, 2014). While improved in many ways, the U.S. is still grappling with civil abuses that King and millions of others fought against in the 1960's.

Another topic of socio-political contention that originated in the 1960's remains controversial and unsolved: anthropogenic degradation of the environment. As Americans became more aware of the negative impacts human activities and human-

made materials can have on the environment, citizens rallied to create the environmentalism movement. Environmentalism first gained widespread national attention almost six decades ago with events such as the Santa Barbara oil spill of 1969 and the publication of Rachel Carson's *Silent Spring* in 1962. Americans were outraged that the U.S. would allow such abuse of the natural world. Many saw environmental negligence as unlawful trespass on the fundamental right of all Americans to pursue life, liberty, and happiness. Some scholars have described modern ecological crises as manifesting from humanity's segregation from the environment (Berry, 1999; Brown, 2009). Whether it is civil or ecological segregation, religion is a driving social force whose role must be understood before equality and balance can be achieved.

### 3.3.2 Religion and the Environment: The Lynn White Thesis

Religion shapes the worldviews of its followers. The influences of religion span all spheres of social life. The specific influences of religion on environmental values have been studied sporadically for the past half-century. Influences of religion on denominational values, attitudes, and behavioral intentions relating to wildlife remain unknown and are therefore the goal of this research. It has been asserted and contested since the late 1960's that Christianity has caused the current ecological crisis due to the pervasiveness of the religion's anthropocentric individualistic values (Grasso et al., 1995; White, 1967). Specifically, Western Christianity has been tried and charged by the historian Lynn White to be a malevolent nuisance to the environment.

Lynn White (1907-1987), a professor of medieval history at the University of California, Los Angeles, wrote "The Historical Roots of Our Ecological Crisis" in 1967. Like many scholars and U.S. citizens of his day, White demonstrates awareness of and

antipathy by the recent examples of environmental exploitation. White demonstrates discomfort toward the solutions posed during the time period. White writes that “atavism” and “prettification” were the only solutions proposed during the 1960’s and he describes them as severely inadequate (1967, p. 50). He asserts that instead of regressing to an unknown or unattainable past state of nature or superficially beautifying the national landscape, we must first consider the fundamentals of modern science and technology.

White writes that science and technology abruptly merged in the 19th century (1967). The merger led to the modern iterations of science and technology we see today. White claims that modern science and technology are distinctly Western (1967). He traces the origins of Western domination of science and technology back in time and writes that Western distinction occurred much earlier than the traditional designations of the Scientific Revolution and the Industrial Revolution (White, 1967). The Scientific Revolution is typically described as occurring during the 17th century and the Industrial Revolution is assigned the timeslot of the following century. White asserts that, instead, Western dominance of science and technology occurred hundreds of years earlier in the medieval epoch (1967). It was during the Middle Ages that Western civilization developed superior agriculture, modes of transportation, weapons, armor, and other materials that allowed Western European nations to set sail and conquer the globe (White, 1967).

Agriculture of medieval European communities was a key catalyst in shifting Western land ethic. Agricultural technology, such as the scratch plow instigated a “ruthlessness” toward the earth and therefore promoted an ethic of exploitation, according to White (1967, 51). White cites calendar illustrations as proof of this new

ethic: European Calendars in the Middle Ages depicted men plowing, chopping trees, butchering animals, and harvesting crops (1967). Man had shifted from being a part of the earth to being the master of the earth (White, 1967).

According to White, this shift occurred because of Christianity. Before the advent of Christianity, common cosmologies perceived the world and time in terms of a cycle, repetitive, with no beginning and no end (1967). The Judeo-Christian traditions conceived a new perception of the world and time, a linear framework, one with a clear beginning and a clear end (White, 1967). The Judeo-Christian story of creation is unique. The all-knowing and all-mighty Judeo-Christian God created the earth and all of its resources: land, water, light, plants, and animals. When God created man, He bestowed upon Adam the right to name all of the creatures and resources because everything on earth belonged to Adam and everything on earth was put there to serve him. Adam's dominion of everything on earth made him unambiguously different from all other earthly creation because he was made in the image of God (White, 1967). Because Adam is undeniably special and separate from the rest of creation, Lynn White declares, "Christianity is the most anthropocentric religion the world has seen" (1967, 52). White notes that this anthropocentrism is especially noticeable in the Western form of Christianity (1967).

Before Christianity, animism was a common belief (Bird-David, 1999). It was widely believed that every natural resource, from trees to rocks to fish, had a spirit. Christianity bestowed upon Adam a soul and relegated everything else to a status of mere property (White, 1967). In White's opinion, this segregation of man and earth made it

possible for Westerners to exploit the earth “in a mood of indifference to the feelings of natural objects” (1967, p. 52).

Here it is important to note that White recognizes that there are differences between Western (Latin) and Eastern (Greek) Christianity. White simplifies the difference between Western and Eastern dogma in terms of sin. The difference between how the two groups conceptualize sin is the reason why Western Christianity has been so ecologically devastating while Eastern Christianity has not. Eastern sin was based on ignorance and intellectual stagnation (White, 1967). Western sin on the other hand was based on moral wrongness (White, 1967). Therefore, Eastern Christianity found salvation in intellectual enlightenment and Western Christianity sought salvation in proper action (White, 1967). In sum, the ideal Eastern Christian thinks and the ideal Western Christian acts. Western Christianity’s “arrogance toward nature” has had a greater impact on the environment because it has been linked to action (White, 1967, p. 55).

White was unconvinced that increasing scientific and technologic production was a viable solution to the ecological crisis. He believed that because modern science and technology were distinctly Western and therefore infused with Western Christianity’s ruthless and arrogant ethic toward nature, science and technology are of no use until Christian values are replaced (White, 1967). White understood that to change environmental values, we must first address how humankind interacts with nature and why it interacts with nature in that manner. He asserts that an influential portion of the world interacted with the environment believing that all of creation exists only to serve humanity and until this belief is rejected, the ecological crisis will only worsen (White,



1967). The Lynn White thesis is that because the root causes of modern ecological crises are religious, the remedies must therefore also be religious (1967).

### 3.3.3 General Reactions to White's Thesis

Since White's essay was published, many essayists and scholars have written manuscripts in response. The responses vary in defense or denial of White's controversial claims. For example, some scholars rushed to the defense of Christianity, a few supported White's hypothesis, and others were eager to compare Christianity's environmental ethic to other religions and faith traditions.

Ruth Page, a Scottish expert in divinity, invoked positive aspects of Christianity in her essay "The Fellowship of All Creation" (2006). Page highlights the environmental advocacy of Saint Francis and emphasizes God's immanence, rather than His transcendence (2006). Transcendence, argued by environmental ethicist Clare Palmer is the theological pitfall of Christianity that allows for the desacralization and exploitation of the natural world (2006). Palmer agrees with White that Christianity is anthropocentric and is therefore not conducive for a healthy environmental ethic. She offers pantheistic faith traditions that view God as "in-dwelling" as a remedy to Christianity's destructive perspective towards nature (Palmer, 2006, p. 63).

Robin Attfield, professor of philosophy, disagrees with Palmer's pantheistic silver bullet and her criticism of transcendence. Attfield believes that pantheism implies that there is no creator and therefore no creation (2006). The absence of these two characteristics, argues Attfield, negates the need for a religious perspective on natural resources (2006). Attfield proposes a secular take on stewardship because he attests that

humans are motivated by self-interest and self-promotion rather than by love for God and religious affiliation (2006). Therefore, Attfield promotes an intergenerational perspective on environmental problems (2006).

John Black, a former professor of forestry and natural resources, indirectly contests Attfield's secular salve (2006). Black, along with the majority of ecotheological authors, agrees "dominion over nature is incompatible with long-term sustenance" (2006, p. 93). Contrasting with Attfield, Black cites personal and holy responsibility as a motivator for environmentally friendly behavior (2006). While Attfield claims secular self-interest and anthropocentric responsibility as realistic motivators, Black identifies sacred responsibility and accountability to God as a primary perspective for followers of the Judeo-Christian tradition (2006). Through a brief summary of these five scholars, one can clearly see the effects of Lynn White's essay.

#### 3.3.4 Reactions in Support of White's Thesis

Whether scholars agree or disagree with White's words, it is indisputable that his essay sparked complex commentary on the relationship between religion and the environment. Commentary supporting White's thesis can be found in books such as *Ecology and Religion* by David Kinsley (1995).

In his book *Ecology and Religion*, Kinsley addresses various religious traditions and their relationships with nature (1995). His engagement with Christianity is a two-part saga in which he first acknowledges the prevalence of anti-ecological doctrine in terms of the principles of dominion and transcendence of God. In Christianity, humans are given reign over natural, earthly order (Kinsley, 1995). Like Lynn White's argument, Kinsley states that Genesis 1 introduces the ethic of dominion and gives Christians the

God-given right to exploit nature for their own uses (Kinsley, 1995). In Genesis 1, the Bible cites humankind's right to dominion as this:

God created man in his image; in the divine image he created him; male and female he created them. God blessed them, saying: "Be fruitful and multiply; fill the earth and subdue it. Have dominion over the fish of the sea, the birds of the air, and all the living things that move on the earth." God also said, "See, I give you every seed-bearing plant all over the earth and every tree that has seed-bearing fruit on it to be your food; and to all the animals of the land, all the birds of the air, and all the living creatures that crawl on the ground, I give all the green plants for food" (Gen. 1:27-30).

This recitation of environmental rights is not a single occurrence in the Bible for it is later repeated in Genesis 9 when God repeats His orders to Noah, thereby reinforcing the ethic of dominion.

The dominion ethic is also well documented in the writings of theologians such as Saint Thomas Aquinas. Thomas Aquinas's theology reflects human dominion over nature when he declares that "imperfect" beings, such as plants and animals serve "noble" beings (Kinsley, 1995, p. 109). More explicitly Aquinas asserts, "all corporeal things have been made for man's sake" (Kinsley, 1995, p.109).

The idea of creation only existing for human use continues through medieval times and into the Enlightenment when William Byrd believed that horseflies were put on Earth to test human patience and George Owen thought that lobsters provided humans with food, exercise, and the idea for armor (Kinsley, 1995). Genesis 1 set the foundation for the principle of dominion. It was internalized by early theologians such as Thomas Aquinas, then passed on to philosophers and scientists of the Enlightenment and the Scientific Revolution and eventually to the commercial entrepreneurs and the engineers

of the Industrial Revolution. Kinsley's historical accounts demonstrate additional validity to White's claim that Christianity is the root of the ecological crisis.

Untouched by White's essay, but thoroughly examined by Kinsley and other scholars such as Clare Palmer, is another principle of Christianity that is posited as causing segregation between humanity and the environment: The principle of transcendence.

Aquinas's subordinate view of nature builds upon Neo-Platonism philosophy and the theology of Origen, which diminishes intrinsic values of nature and orients human goals and values upward toward God and toward heavenly salvation. Origen believed The Fall was when rational beings turned from God. God then created nature to catch humankind from falling into complete non-being (Kinsley, 1995). Accordingly, Origen's idea of salvation is for humankind to return to its original spiritual state in the heavens (Kinsley, 1995). Orienting salvation vertically demands that humankind's true home is in heaven, not on Earth, which negates the value of the environment and allows for its degradation. With spirituality trumping physicality, earthly life is seen merely as a setback or an obstacle to spiritual success and fulfillment.

Earth itself is also perceived to be a spiritual setback because God is transcendent from Earth. In Christianity, nature is voided of all gods, goddesses, and spirits (Kinsley, 1995). Devoid of the divine, nature is denigrated by Christians with a clear conscious because Genesis 1 declares dominion. Additionally, the transcendence of God terminates talk of nature as sacred. To exploit nature is expected and justified. To revere nature and the environment as sacred is to sin.

### 3.3.5 Reactions against White's Thesis

Despite being marred by historical inclinations toward the unsympathetic treatment of nature, Christian theology is not wholly whelmed with detrimental doctrine on nature. There is evidence in the Bible and in theological philosophy that humankind is not superior to nature. In Leviticus, instructions advocate for environmental awareness. Humans are instructed to keep a terrestrial Sabbath. The Bible mandates that humans have a day of rest and the land is to have a year of rest (Kinsley, 1995). The land is to be harvested for six years, but it is to be kept fallow on the seventh year (Kinsley, 1995). During this seventh year all that is harvested from the resting land is to be equally shared among the landowner, the tenants, and the animals (Lev. 25:6-7). These lines in Leviticus promote equality not only among socio-economic divisions of humans, but they also promote equality between humans and other parts of creation, specifically animals. Equality between humanity and animals can also be inferred in Psalm 104 (Hiebert, 1996). Line 30 reads, "When you send your spirit, they are created, and you renew the face of the ground." With God sending his spirit to Earth to create, it is safe to infer equality between humanity and animals because God gives life not just to man, but to all creatures. It could also be inferred that God is ever-present in creation and not far away in the heavens. Scriptural superiority of humankind over the rest of creation is then nullified in passages such as Psalm 104, as is the troublesome transcendence of God.

Theodore Hiebert believes that Christian traditions possess deeper and more intricate insights on how humankind fits into creation other than the dominant dominion ethic from Genesis 1 (Hiebert, 1996). He offers Genesis 2 as a source for positive Christian environmental ethic because it emphasizes the Eden creation story. In Genesis 2,

the Eden creation story is separate from the man-as-master ethic of Genesis 1. The Garden of Eden provides a more localized setting as opposed to the whole world in Genesis 1 (Hiebert, 1996). In the garden, man is created from the land, from arable topsoil (Hiebert, 1996). Not only does this connect and bind man to the land, but it also binds God to the land. Incorporating the message from Genesis 1 that man was made in God's image and if man was made from the land then God has an inherent relationship with the land. This connection remedies the issue of God's transcendence from earth and could potentially re-sacralize the environment. Hiebert takes the translations from Genesis 2 and applies the translated term of "farmer" to Adam, which in turn creates for Hiebert a human vocation of service to the land rather than human right to subdue and dominate it. Genesis 2 therefore constructs an interconnectedness between man and nature.

### 3.3.6 Empirical Studies in Reaction to White's Thesis

Twenty-two years after White's publication, two American researchers, Eckberg and Blocker conducted a study to test White's thesis that Christians have negative environmental orientations (1989). Eckberg and Blocker surveyed a sample population of the Tulsa, Oklahoma metropolitan area. Their survey measured religious affiliation, interpretation/conceptualization of the Bible, and environmental concern (1989). Ultimately, Eckberg and Blocker's data strongly confirmed White's thesis. They found that respondents who self-identified as Judeo-Christians scored lower than respondents who identified as secular on environmental concern indices (Eckberg and Blocker, 1989). Within the Judeo-Christian demographic, participants who interpreted the Bible more literally were less likely to express concern for the environment. This was especially true

for participants who identified themselves as “Conservative Protestant” (Eckberg and Blocker, 1989, p. 516). In their discussion, Eckberg and Blocker identify holes in their study. They did not examine specific religious beliefs or specific environmental attitudes (1989). A later researcher, Andrew Greeley, also noted that Eckberg and Blocker failed to ground their study in any social science theory (1993).

Guth et al. (1995) expanded on the Tulsa study of Eckberg and Blocker (1989). Based upon previous studies, the researchers studied secularists and three main denominational groups: Evangelical Protestants, Mainline Protestants, Roman Catholics (Guth et al., 1995). The distinction between Mainline and Evangelical Protestants is based off of historical and cultural differences and became popular in the sociological study of religion due to its more accurate evaluation of religiosity than broader categories such as “Conservative Protestant.” Evangelical Protestants include denominations that promote personal relationships with Jesus Christ, prioritize the conversion of non-adherents, believe strongly in Biblical authority, and believe that the only path to eternal salvation is through Christ (Woodberry and Smith, 1998). In comparison to Evangelical Protestants, Mainline Protestants tend to focus less on conversion and tend to be more tolerant of social issues, cultural shifts, and of other religious traditions (Kellstedt and Green, 1993). The focus of Guth et al. (1995) was to uncover differences among Mainline Protestants, Evangelical Protestants, Roman Catholics, and secularists and to learn how these differences influence support for environmental initiatives. Of the three religious groups studied (excluding secularists), Roman Catholics were found to be the most environmentally friendly group (Guth et al., 1995).

An earlier study by Greeley (1993) helps to potentially explain why Catholics tend to be more environmentally friendly compared to their Christian counterparts. In agreement with Guth et al. (1995), Greeley found that when compared to three types of Protestantism based upon Biblical interpretation (fundamental, moderate, and liberal), Catholics were statistically more likely to support environmental initiatives. Greeley notes that within Catholicism, those Catholics who have a more “gracious” image of God are also more likely to have positive environmental attitudes (p. 23).

The “Grace Scale” measures an individual’s worldview in the context of graciousness (Greeley, 1993, p. 23). For example, when asked how they conceptualize God, individuals were given Likert scales for four categories of graciousness: “Mother/Father,” “Master/Spouse,” “Judge/Lover,” and “Friend/King” (Greeley, 1993, p.23). Greeley goes on to infer that Catholics tend to possess a more gracious or benign image of God due to a less literal interpretation of the Bible (1993).

Based on the findings of Greeley (1993), Guth et al. (1995), and subsequent studies, Catholics have proven to be a group willing to adopt environmentally friendly behaviors due to their more gracious, communal worldview (Cohen and Hill, 2007). However, Guth et al. (1995) states that “[a]lthough efforts by theologians and church officials to confront environmental challenges have piqued the curiosity of scholars and journalists, there has been no comparable boom in survey research on how religious beliefs, attitudes, and commitment influence public opinion” (p. 366).

### 3.4 An Introductory History of Environmentalism in the Catholic Church

The current Pope, Pope Francis, has declared two of the most environmentally prolific popes as saints. Popes John XXIII and John Paul II both wrote extensively about



the environment, more so than any other Holy Father before them. The writings of Pope John XXIII set the stage for Pope John Paul II to expand and improve Catholic environmental teaching. Throughout his 27 years as pope, Pope John Paul II wrote many environmental statements, participated in global environmental conferences, and often spoke during his travels about the perils of neglecting creation and the joys of environmental stewardship.

The Roman Catholic Church stalled in many ways after the death of Pope John Paul II in 2005. The papacy of Pope Francis, elected in 2013, has so far been a run of revitalization and remodeling for the global Catholic congregation. Pope Francis, the first pope to invoke the spirit of Saint Francis of Assisi, the patron saint of ecology, has issued multiple statements explicitly appealing to Catholics to reorient their environmental attitudes. On June 5, 2013 (World Environment Day), Pope Francis said, “We are losing the attitude of wonder, contemplation, listening to creation. The implications of living in a horizontal manner [is that] we have moved away from God, we no longer read His signs” (Catholic Climate Covenant, 2013). It took just over two decades for researchers to conduct studies testing Lynn White’s thesis. Just as we did in the 1960’s and 1970’s, we still face ecological crises. Issues such as climate change and accelerated species loss are on the forefront of global politics. A global religious leader, Pope Francis, is engaging with the politics surrounding environmental crises and is preaching to Catholics all over the world the importance of immediate environmental reform. The signs of the times point us toward conducting applied research studies focused on Catholics and positive environmental behaviors. First, we should examine the history of environmentalism within the Catholic Church.

### 3.5 The Role of Catholic Social Teaching in Catholic Environmentalism

The origins of environmentalism in the Catholic Church are rooted in Catholic social teaching. David Boileau, a priest and professor emeritus at the Loyola University, New Orleans called Catholic social teaching the “best kept secret” in Catholicism (Aubert and Boileau, 2003). Lacking an official canon of documents, Catholic social teaching is the official Catholic doctrine on social issues (Boileau, 1998; Aubert and Boileau, 2003). Though Catholic social teaching covers all types of social issues, Catholic social doctrine in the United States is understood by the masses narrowly through sexual issues (e.g., birth control, codes of conduct, and homosexuality) (Aubert and Boileau, 2003). There is much room in which to expand the influence of Catholic social teaching on American social issues, specifically on socio-environmental issues. Expanding mainstream Catholic social teaching to include Catholic teaching on the environment and infusing civil politics with Catholic values on the environment has the potential to increase the efficacy of both sacred and secular environmental action. This thesis is supported by an analysis of Catholic social teaching and the National Environmental Policy Act (NEPA) of 1970 conducted by Lucia Ann Silecchia (2004), professor of law at the Catholic University of America, Washington, D.C. Silecchia asserts that Catholic social teaching may be a tool to help implement the principles of the NEPA (2004).

The origins of modern Catholic environmental teaching originate in the Bible. As is acknowledged by Lynn White and successive scholars, Catholic theology as it relates to the environment is born of Old Testament ideology, specifically ideology from the Book of Genesis. The chapters of Genesis establish that all creation is “good” and that

humankind is responsible for the care of creation. Problematically, Genesis also states that humankind has dominion over creation.

There are three main arguments against the existence of pro-environment and pro-conservation ethics in scripture. The first argument claims that Old Testament scripture focuses too much on human-to-human relations rather than human-and-nature interactions (White, 1967; Granberg-Michaelson, 1992; Palmer, 2006). Secondly, the Old Testament is critiqued for placing too much emphasis on dominion over creation, which leads to utilitarian ethics toward the natural world (Kinsley, 1995; Palmer, 2006). The third argument is that scripture emphasizes the transcendence of God rather than in an earthly, imminent manner (Daly et al., 1989; Kinsley, 1995; Palmer, 2006).

Most literature cited up until this point investigated scripture. However, Catholics differ from other Christian groups in that scripture is not the only source of religious rationale. In addition to scripture, Catholics look to the Pope and papal encyclicals for authoritative guidance. Encyclicals are issued by the Pope and therefore carry the most authority any modern Catholic text can. The first encyclical was promulgated by Pope Leo XIII in 1891 and was called *Rerum Novarum* (Of New Things). Since *Rerum Novarum*, all papal encyclicals inform Catholic social teaching (Boileau, 1998; Aubert and Boileau, 2003; Silecchia, 2004).

Silecchia (2004) highlights Pope John XXIII's 1961 *Mater et Magistra* (Mother and Teacher) as the first papal encyclical that explicitly addresses issues of sustainability, albeit in the narrow context of population control. Throughout the document, Pope John XXIII advocates for inter-generational responsibility, urging people to be mindful of the needs of future generations. He praises farmers and their agricultural endeavors and he

praises the beauty of God's creation, the natural world. However, Pope John XXIII goes on to write that God gave the earth natural resources that are "well-nigh inexhaustible" and that God gave humankind the "intelligence to discover ways and means of exploiting these resources for [their] own advantage and [their] own livelihood" (John XXIII, *Mater et Magistra*, p. 189). These statements echo the ethic of dominion about which Lynn White and others warned. John XXIII also states in the encyclical that advances in science and technology will resolve any future environmental problem. He writes that all environmental problems will be solved "in a renewed scientific and technical effort on [humanity's] part to deepen and extend [its] dominion over Nature. The progress of science and technology that has already been achieved opens up almost limitless horizons in this field" (*Mater et Magistra*, p. 189).

This type of faith in science and technology is the kind of thinking White discounted as ineffective. Not to mention the fact that John XXIII was still beseeching his followers to "deepen and extend [their] dominion over Nature" (*Mater et Magistra*, p. 189). It is clear that in the early 1960's Pope John XXIII was following traditional Christian doctrine that Lynn White criticized in the latter parts of the decade.

Following John XXIII's death in 1963, the Second Vatican Council issued *Gaudium et Spes* (Joy and Happiness) in 1965 under the guidance of Pope Paul VI. Silecchia (2004) points out that this document is the first Catholic text that addresses environmental concerns as its own topic rather than as a tangential issue associated with topics such as population and birth control. Pope John XXIII's call for responsibility to future generations still resonates throughout *Gaudium et Spes*, but Silecchia (2004) notes that the latter document provides clearer connections between human relationships with

God and with the natural world. Silecchia (2004) calls this interconnectedness a more “holistic” Catholic environmental teaching, which reappears in later documents that deal more specifically with Catholic environmental teachings (p. 688).

On the 80th anniversary of *Rerum Novarum*, Pope Paul VI wrote *Octogesima Adveniens* (Eighty Years) in 1971. Pope Paul VI wrote about environmental degradation, “This is a wide-ranging social problem which concerns the entire human family. The Christian must turn to these new perceptions in order to take on responsibility, together with the rest of [humankind] for a destiny which from now on is shared by all” (*Octogesima Adveniens*, p. 21). From this encyclical, it is clear that Pope Paul VI understood the global nature of ecological concerns and recognized that solutions must be of appropriate scale. His remarks expand upon President Richard Nixon’s environmental messages in the president’s State of the Union speech one year before the promulgation of *Octogesima Adveniens*. Nixon said of U.S. conservation efforts, “It has become a common cause of all the people of this country” (1970). The connection between Nixon’s civil speech and Paul VI’s religious text demonstrates how the Catholic Church responds to social issues of the day.

After his death in 1978, Pope Paul VI was succeeded by Pope John Paul I who died suddenly, reigning as a pope for only thirty-three days. Pope John Paul II assumed the papacy in the same year. In his 1979 inaugural encyclical, *Redemptor Hominis* (The Redeemer of Man), Pope John Paul II called for humankind to “communicate with nature as an intelligent and noble ‘master’ and ‘guardian’ and not as a heedless ‘exploiter’ and ‘destroyer’” (*Redemptor Hominis*, p. 15).

On the 90th anniversary of *Rerum Novarum*, John Paul II published an encyclical called *Laborem Exercens* (On Human Work) (1981). Silecchia (2004) acknowledges that for the first time with *Laborem Exercens*, a papal encyclical describes natural resources as “limited” (p. 693). This is in sharp contrast with Pope John XXIII’s description of the earth having virtually “inexhaustible” natural resources (*Mater et Magistra*, p. 189). Other encyclicals prior to *Laborem Exercens* exalted the seemingly endless abundance of natural resources and humankind’s right to dominion over creation.

Going along with the new theme of limited resources, Pope John Paul II also condemned the modern culture of excessive consumerism during his papacy. It is through this point in *Sollicitudo Rei Socialis* (On Social Concern) that Pope John Paul II (1988) connects ecology and morality, which is a theme Silecchia (2004) calls the “heart of Pope John Paul II’s environmental teaching” (p. 694). *Sollicitudo Rei Socialis* reminds Catholics of Old Testament limits imposed by God on humankind’s dominion (Silecchia, 2004). When humans ignore God’s limits, the nature rebels (Silecchia, 2004). To avoid nature’s rebellion, *Sollicitudo Rei Socialis* posits three principles outlined by Silecchia:

1. Remember that humans are mutually connected to all living and nonliving things.
2. We cannot use our natural resources as if they were infinitely available.
3. Industrial development directly and indirectly causes environmental degradation (Silecchia, 2004, p. 605-696).

On January 1, 1990, Pope John Paul II verbalized these principles and the messages in his other encyclicals, *Peace with God The Creator and Peace With All of Creation* (1990 Peace Statement). During this statement, Pope John Paul II (1990) called widespread environmental degradation a “profound moral crisis” (pg. 5).

Lynn White passed away in 1987, but he most likely would have been pleased to hear a major Christian leader linking environmental degradation with morality. White most likely would have also been intrigued to know that in preparation for the 2002 United Nations World Summit for Sustainable Development, the leaders of the (Western) Roman Catholic Church and the (Eastern) Orthodox Catholic Church met to discuss global environmental affairs. Pope John Paul II, the leader of the Roman Catholic Church met with Bartholomew I, the Ecumenical Patriarch of the Orthodox Catholic Church to sign the Venice Declaration. In the declaration, both leaders expressed their concern for environmental degradation and how ecological crises reflect moral shortcomings (Silecchia, 2004).

More Catholic environmental progress occurred under Pope John Paul II's reign when he issued a new catechism in 1994. The goal of the new catechism was to reinforce the importance of already established doctrine, not to establish new doctrinal principles. However, the new catechism did clarify and aggregate existing Catholic environmental teachings (Silecchia, 2004). While the issuance of this new catechism is not historically groundbreaking, the inclusion of clearer, more comprehensive environmental teaching is noteworthy. In this aggregated form, official Catholic environmental teaching was made more widely accessible to Catholics around the world in comparison to papal encyclicals, which are read mostly by cardinals, bishops, theologians, and scholars. While bishops are the primary audience of the catechism, all adult Catholic faithful have been encouraged to read and consult the catechism since Vatican II (United States Conference of Bishops, 2015).

In addition to the new catechism and his encyclicals on the environment, Pope John Paul II also participated in international conferences such as the United Nations Conference on Environment and Development in 1992 and the United Nations World Summit for Sustainable Development in 2002. While traveling the world and giving smaller scale speeches, John Paul II regularly infused his communication with environmental messages from his 1990 Peace Statement (Silecchia, 2004). He also reemphasized Genesis II and Pope John XXIII's message of human-ecological interconnectedness and called for respect for all life, with specific emphasis on the dignity of human persons (Silecchia, 2004). Dignity of the individual human is central to Catholic social teaching (Boileau, 1998) so it was logical and appropriate for Pope John Paul II to connect human dignity to Catholic environmental teaching. The connection between the condition of the environment and the condition of human welfare is necessary in promoting pro-environmental engagement within anthropocentric religions (Silecchia, 2004).

Several of Pope John Paul II's ensuing encyclicals raised awareness and concern for environmental issues, but they provide no new themes or courses of action (Silecchia, 2004). The 1994 encyclical *Tertio Millennio Adveniente* (On the Coming of the Third Millennium) provided stagnate environmental messages as well, but Silecchia (2004) points out that this encyclical does something new in that it connects the rituals of Catholic Mass to the cycles of life. By connecting the liturgy with the natural cycles of life, Pope John Paul II connected something very familiar (Mass and religious rituals) with the environment. He made attributes of the environment resonate with religious activity.



When people are able to connect unfamiliar ecological ideas with those that are familiar to them in a religious context, the unfamiliar is better internalized and appreciated (Nardkarni, 2007).

Education can also help cultivate awareness and concern for unfamiliar environmental issues. Environmental awareness must be internalized through formal educational systems in order to effect change (Berry, 1999; Brown, 2009). While simply giving people information is not enough to change attitudes and behaviors (McKenzie-Mohr, 2014), integrating environmental awareness, ecological education, and Catholic environmental teaching could be more effective than traditional informational campaigns. Combining Catholic environmental teaching with ecological education raises awareness about environmental concerns while infusing joy toward creation and optimism about the future (Silecchia, 2004). The infusion of joy and optimism aids in the repulsion of negative, impersonal, and repetitive dialogue that can deter an individual's interest in the subject (Gifford, 2011).

Catholic environmental teaching may also play a role in the political sphere of environmental crises. Catholic Bishops in the United States have issued their own statements and pleas with regards to religion and the environment. The United States Conference of Catholic Bishops (USCCB) wrote "Renewing the Earth: An Invitation to Reflection and Action on Environment in Light of Catholic Social Teaching" (1991) and "Global Climate Change: A Plea for Dialogue, Prudence, and the Common Good" (2001). Both documents expand upon the 1990 Peace Statement and establish American-Catholic doctrine on the environment. The documents also carve out space for religion in the highly politically contested topic of environmental affairs in the U.S. In the 2001

document on global climate change, the Bishops write that American environmental affairs would benefit from “a distinctly religious and moral perspective to what is necessarily a complicated scientific, economic, and political discussion” (USCCB, 2001). The plea for inclusion of religious perspectives harkens back to Lynn White’s claim that our ecological crises cannot be rectified without religion.

Catholic teaching on the environment, in its entirety pleads for intellectual and emotional transformations within individuals so that humans may respect and love all of creation (Silecchia, 2004; Keenan, 2002). More succinctly, Silecchia summarizes current Catholic social teaching in six tenets (2004, p. 733-761):

1. The dignity of human life is the most central consideration within environmental affairs. Respect for human life is the heart of all Catholic social teaching. Catholic environmental teaching would have less doctrinal grounding if it did not prioritize human dignity.
2. Humans shall tend to the environment under an ethic of stewardship, not dominion. Stewards are given rights to property under the assumption that they will abide by given limitations (e.g., the rules set forth in the Old Testament regarding treatment of the land).
3. Responsibility for intergenerational needs must be considered when planning the management of natural resources. This tenet links the first two in that proper stewardship will conserve resources for future generations. Providing for those who come in later generations also demonstrates respect for human life and dignity.
4. Natural resource management must occur at the appropriate level. It is important to recognize when conservation efforts should be targeted at the individual, community, state, regional, national, or global level.
5. Environmental policies must appease the paradox that everyone has a right to own property and that property must be utilized in such a way that it benefits the common good. Silecchia notes that while no Catholic organization offers specific steps to achieve this balance, the USCCB have set guidelines for incorporating moral, religious ethics into a topic that is richly dominated by politics (2004).

6. Ecology and morality are inherently linked and there must be a widespread moral reorientation away from overconsumption and excess consumerism. The final tenet outlined by Silecchia synthesizes the overall trend of Catholic environmental teaching: Caring for the environment is a personal, moral obligation characterized by respectful restraint.

Through these six tenets, one can easily see political implications applicable to U.S. environmental policy. American environmental law follows similar ideals of holding individuals responsible for exercising respect for the environment in terms of the welfare of other citizens and exercising restraint in the use of natural resources.

### 3.6 An Overview of Modern U.S. Environmental Policy

In their book *American Environmental Policy: Beyond Gridlock*, authors Klyza and Sousa (2013) assert that modern American environmental policy is defined by gridlock. Gridlock, according to the authors, refers to legislative gridlock. Legislative gridlock has evolved due to present political partisanship that is the most intense than it has ever been in the nation's history. This extreme partisanship has metastasized throughout all levels of government and is especially evident in Congress. Congressional polarization inhibits the progress of environmental policy. Klyza and Sousa, both professors of politics, provide alternative pathways in achieving the legislative intents of the U.S. environmental statutes (2013). The five proposed alternative pathways to circumvent the gridlock of environmental legislation are appropriation and budget politics, executive politics, judicial politics, collaboration, and state power (Klyza and Sousa, 2013). Note that religion is absent from their solutions in improving the efficacy of American environmental policy. However, there are parallels between the structure of American environmental law and Catholic environmental teaching that may bridge the gap between secular and sacred pathways to environmental sustainability for all citizens. Robert

Bellah, a well-regarded sociologist of religion, even contests that the civil structure of the U.S. and the attitudes and behaviors of its citizens form a type of civil religion (1967).

### 3.7 Similarities between U.S. Environmental Policy and Catholicism

Secularly, U.S. environmental law can be summarized as the formalized, regulatory structures designed and maintained by a specified governing body to prevent or reduce the depletion and degradation of the nation's natural resources (Kubasek & Silverman, 2014). Sacredly, Catholic environmental teaching is the formalized body of work composed of papal promulgations, the Catechism of the Catholic Church, and Scripture that promotes moral stewardship of all creation for present and future generations. These two definitions converge in that U.S. environmental law may legally hold persons responsible for violations and Catholic environmental teaching may motivate adherents to refrain from such violations.

The purpose of both secular law and sacred teaching related to the environment is to reorient incentives and motivations, change consumption habits, and to conserve both renewable and non-renewable resources. The difficulty of U.S. environmental law is that it has been constructed by many people, various presidents, members of Congress, and multiple judges (Kubasek & Silverman, 2014). U.S. environmental law is therefore the product of diverse voices and sometimes conflicting motivations. Organized religion may help ease this complication. In terms of Catholicism, official Church doctrine is promulgated by one person, one voice, one motivation. The Roman Catholic Pope is charged with leading the global Catholic Church and guiding its followers toward moral action, including moral action toward the environment. When the Pope issues a directive there is no dissent because he is the link between all Catholics and God, he is the ultimate

voice on any matter. Although there is variation of emphasis within the Catholic Church, as a whole it is much more homogenous than the pluralistic civil congregation over which U.S. environmental law attempts to reign.

The U.S. Constitution provides the foundation for the nation's environmental law. The Constitution gives all legislative powers to Congress. Congress has the authority to grant agencies, such as the Environmental Protection Agency (EPA) and the United States Fish and Wildlife Service (USFWS), quasi-judicial power through environmental statutes, e.g. the Endangered Species Act. Although the EPA and the USFWS are capable of enforcing environmental statutes and although they may hold formal hearings, agencies cannot convict individuals of crime. The power of conviction always remains within the judicial branch's court system. Agencies may file claims against an individual, but they are constitutionally unable to issue civil or criminal sanctions. The obvious connection here is that the U.S. Constitution is analogous to the Bible (Bellah, 1967). In taking the analogy further, we can relate federal agencies to Catholic churches. Just as the Constitution gives federal agencies the jurisdiction to enforce endeavors specific to their mission, so too does the Catholic interpretation of the Bible in that congregations are responsible for administering Biblical teachings. Also, just as how agencies cannot convict individuals of civil and criminal charges, churches cannot condemn individuals for their sins. The absolute power for both groups remains in the eyes and hands of their judges, literal and transcendental, respectively.

A second type of law governs U.S. environmental policy in addition to Constitutional law. Statutory law is enacted by a governing body, e.g. Congress promulgated the Endangered Species Act in 1970 (Kubasek & Silverman, 2014).

Statutory law is prospective and looks to the future, providing guidance of actions that may vary in terms of time and/or location (Kubasek & Silverman, 2014). There are two types of statutory law: civil and criminal. Civil statutory law governs relationships between individuals and property of those individuals. Criminal statutory law puts limits on the possibilities of individual actions harming an entire community, e.g. homicide (Kubasek & Silverman, 2014). Catholic doctrine in its entirety, as well as papal encyclicals on the environment, place responsibility on the individual to engage in moral behavior with other individuals. The responsibility of the individual is to act morally and to prevent secular civil and criminal charges. In this way, Catholic teaching on the environment is also prospective in that it aims to prevent improper interactions with natural resources for the environment's own intrinsic value and out of respect for human dignity. Catholicism motivates individuals to internalize statutory law and encyclical environmental guidelines.

The most striking difference between U.S. environmental law and Catholic teaching on the environment is the lack of judiciary enforcement in the latter doctrine. The difference in structure between U.S. environmental regulation and Catholic teaching on the environment might be the point at which the latter has more room to improve domestic environmental action.

U.S. environmental regulation is structured as follows: Agencies, like the EPA, are headed by one individual, called the administrator. Administrators are appointed by the President and they therefore act on behalf of the President, who is acting on behalf of the Constitutionally-validated environmental statutes (Kubasek & Silverman, 2014). Most agency decisions are made by people below the administrator and agencies often

have many different offices with varied functions and priorities (Kubasek & Silverman, 2014). To connect this structure to Catholicism, we can view local churches and dioceses as agencies and administrators as individual priests or bishops. The functions of American churches vary individually and regionally. Certain churches may service the homeless while others might focus more on familial outreach. The comparison diverges here: civil agencies are subject to judicial review based on agency action or inaction (Kubasek & Silverman, 2014). That is to say, a court will review whether the agency had the authority to do what it did or did not do, whether the agency followed the proper legal procedures, and whether the agency correctly and fairly interpreted the environmental statute (Kubasek & Silverman, 2014). No such review exists for Catholic authorities with regard to its environmental teaching. Although this deficiency may seem inhibitory, the lack of judiciary review and consequential sanctions may actually promote environmentally friendly behavior within the Catholic Church. Lack of punishment necessitates that the adherents of each church instigate grassroots-type of movements to effect positive environmental action. Community-based action and normalizing pro-environmental behavior is often more effective than a system that includes legal punishments (McKenzie-Mohr, 2011). If there is a catalyst for widespread adoption of environmental outreach sparked within American Catholic churches, the nation could see a revitalization of the environmental movement and a rededication to environmental policy.

Churches could also be likened to states. One of Klyza and Sousa's alternative pathways to environmental legislative gridlock is increased state responsibility (2013). States are closer to the environmental issues and can therefore respond to issues and

crises faster and in a more relevant manner than the federal government (Klyza & Sousa, 2013). The same could be said about individual churches or networks of churches in a given area. Klyza and Sousa even advocate for giving states the power to enact policy, “states have several general advantages as policymakers. These advantages include the ability to customize policy to particular conditions, to better engage citizens in policymaking, and to better work across agency and professional boundaries” (2013, p. 259). One can substitute “states” with “churches” or “dioceses” and the message remains the same. Just as all levels of government are liable under the U.S. Constitution, churches and dioceses should be held accountable for following the official Church teachings on the environment, but they should also have the freedom to enact locally relevant doctrine as well. This statement is supported by one of the themes of Catholic environmental teaching previously outlined by Silecchia. Environmental decision-making and natural resource management should occur at the appropriate level (Silecchia, 2004). It is promising to have large, overarching doctrine on the environment, but just as Klyza and Sousa call for more state power, the broad Catholic doctrine on the environment should serve as the foundation for more localized efforts to best promote positive environmental behavior.

Localized environmental policy is important for both civil and religious recruitment. Policy entrepreneurs are opportunists who pay acute attention to state environmental policies and who take their businesses to states with policies that best benefit the entrepreneurs’ business interests (Klyza and Sousa, 2013). In the religious sector, Americans act in similar ways when choosing and moving between or out of a religious affiliation. The supply of various denominations, churches, and faith traditions



creates a sort of religious marketplace (Finke & Iannaccone, 1993). Since 2001, well over half a million Americans explore the marketplace and land in the religious none category, meaning they do not identify with any religious affiliation (Kosmin et al., 2009). The religious unaffiliated include individuals who identify with “nothing in particular” and those who consider themselves agnostic or atheist (Pew, 2015). From 2007 to 2014 the number of religions “Nones” increased from around 19 million adults to 56 million adults in the U.S. (Pew, 2015). The increasing number of Nones in the U.S. does not, however, represent an increasing decline of religiosity in the nation. Many self-identified Nones believe in a higher power or deity, pray, and do identify with some kind of spirituality (Pew, 2015). Despite the rise of the Nones, the U.S. remains largely a predominately Christian nation, with Catholics representing 20.8% of the U.S. adult population (Pew, 2015).

Though increased state responsibility and localized policy sounds promising in theory, Klyza and Sousa highlight some limitations: “unevenness” in the variation from state to state, funding, state-level legislative gridlock, and trans-state boundary issues (2013, p. 260). A benefit of instilling environmental policy within organizations such as Catholic churches is that although there is local variation from church to church, the structure of the Roman Catholic Church allows for overall evenness. Unlike state statutes, local church doctrine may not deviate from Church doctrine as it is formalized in the Catechism of the Catholic Church. Funding would not restrict churches to the extent it limits state progress. Churches would only enact policy that is within the means and ways of the church. A diocese would not be able to punish a parish if it were unable to fund a specific project. As for deciding on what types of projects to promote and fund, churches

often experience gridlock, but not to the extent that the federal or state-level governments do. Churches are typically filled with like-minded and similarly goal-oriented individuals (McPherson, 2001). There may be superficial disagreement, but churches are equipped to handle conflict resolution and a solution will be found that satisfies deeper values (Crowfoot and Wondolleck, 2012). States may experience inter-state conflict over regulation, but churches are much less likely to experience inter-church conflict within the Church. Catholic churches are already normalized to prioritize different Catholic ministry, e.g. aiding the poor, developing the family, educating the youth, or caring for the elderly. All Catholic churches share the same core values, but prioritize different ministries. No church would conflict with another church over an emphasis of minimizing consumerism instead of focusing on intergenerational responsibility. All tenets of Catholic teaching on the environment follow the same theme that creation is good, humans have a moral obligation to care for it now and for future generations. There can be no inter-church conflict because no church can deviate from the theme of Catholic environmental teaching. Despite challenges, localizing environmental policy must be the next step for both U.S. and Catholic environmental behavior.

Localizing environmental policy first gained traction in the mid-1990s (Klyza and Sousa, 2013). Administrative reformers called for “accountable devolution” in the context of federal environmental regulation (Klyza and Sousa, 2013, p. 232). Under President Bill Clinton’s administration, the EPA developed a response to this call for the delegation of power to the states in the form of the National Environmental Performance Partnership System (NEPPS), which in turn advocated for “results-oriented policy” (Klyza and Sousa, 2013, p. 232). The goal of NEPPS was overall environmental

improvement and enhanced natural resource planning. States that performed well under NEPPS would be rewarded with more freedoms of state action. Although NEPPS was implemented with good intentions, it was not very successful and was critiqued as another frustrating attempt of top-down, command and control federal environmental regulation (Klyza and Sousa, 2013). Similarly, Catholic environmental teaching could be expanded to include “results-oriented” programs while avoiding the known pitfalls of enacting such programs from the top-down. To avoid such failures, programs could come from secular institutions, such as land grant universities who send extension specialists into the surrounding communities to promote research that betters people’s lives. Extension programs could be conducted at Catholic churches or Catholic organizations, such as the Jesuit Volunteer Corps. In order for environmental programs to have the most impact, the programs need to reach as many individuals as possible. Individuals may feel satisfied about their own environmental contributions and stewardship efforts, but Catholic organizations and churches need to effect group-level change in order for religion to truly, positively impact environmental conservation and preservation. Just as civic environmentalism uses non-regulatory mechanisms, such as social norms and informational prompts (McKenzie-Mohr, 2011; Klyza and Sousa, 2013), Catholic environmentalism uses religious norms and scriptural prompts to promote positive environmental behavior.

Catholic churches and organizations have an advantage over states in that state-level success is limited by a lack of federal policy in the problem area, e.g. a lack of federal climate change policy hinders state policy on the same problem (Klyza and Sousa, 2013). Catholicism requires official, top-level policy on specific environmental issues.

Following Bellah's comparison of the U.S. Constitution and the Bible, federal environmental policy can be analogous to papal encyclicals or the catechism. The Roman Catholic Church has had historical involvement with the environment: Passages in scripture, saints such as Saint Francis and Saint Clare, papal encyclicals, speeches, and participation in global conferences on the environment, and writings on the environment by bishops. In addition to the five alternative pathways, Klyza and Sousa also suggest private pathways as potential solutions to legislative gridlock (2013). The authors do not mention religious groups, but do cite secular land trusts and private environmental groups such as The Nature Conservancy as private protectors of the environment. It is clear through the similarities in principles and structure that Catholic environmental teaching supplements and in some circumstances has the advantage over civil politics. Combining the strengths and goals of Catholic environmentalism with U.S. environmental policy would benefit both secular and religious programs and all members of American society.

Augmenting U.S. environmental policy with Catholic teaching on the environment is proposed here because of the similar goals, the potential for increased efficacy through internalizing moral obligations to the environment, Lynn White's call for a religious solution, and the fact that federal U.S. policy has become less effective than it was in previous decades. We can think of U.S. environmental policy as epitomized in the National Environmental Policy Act (NEPA), which President Richard Nixon signed on January 1, 1970. By enacting NEPA on New Year's Day of 1970, Richard Nixon ushered in what he called the "Environmental Decade" in the U.S. (Andrews, 1999). At the time of its inception, NEPA was heralded as "the environment's Magna Carta" and "The Ten Commandments" (Lindstrom, 2000). Despite its lofty political promises,

NEPA's success as a statute has been heavily contested (Houck 2000; Lindstrom 2000; Klyza and Sousa, 2013). Critics of NEPA say it is too broad, lacks clear instruction on how to attain the goals stated within the statute, and provides no clear method of enforcement (Houck 2000; Lindstrom 2000; Silecchia, 2004; Klyza and Sousa, 2013). Lack of action can also be seen in Catholic environmental teaching. It has been over a half-century since the first papal encyclical touched on environmental values within the Catholic Church, yet there remains a lack of operationalized programs based on Catholic environmental teaching. Global sea levels are warming and rising, extreme weather events threaten the safety of millions, global food security is uncertain, species of all classes and orders are rapidly disappearing, yet both U.S. policy and Catholic teaching languish in progress. Lynn White endorsed a religious response to modern ecological crises, whether we classify it as religious or not. Considering the current state of U.S. environmental policy in light of Catholic social teaching, Lucia Ann Silecchia agrees with White. It does her position no justice to paraphrase. She writes:

The time is...ripe for a greater openness to considering the contribution that religious values may make to creating and shaping that secular/legal perspective. In a legal system that prides itself on the separation of church and state, there is a danger in becoming too eager to dismiss ethical principles that have a religious belief at their base while adopting, perhaps, the exact same principles if they are justified on neutral, non-religious grounds. In an area so fraught with ethical choices as environmental policy, however, it seems inevitable that people of good will, will of necessity, consult their religious views for guidance. If this be so, it seems wise to openly acknowledge that reality, and allow for the honest introduction of religious principles into debate *as* religious principles (2004, 781).

To introduce religion into environmental policy, specifically into wildlife conservation efforts, we must first scientifically test the findings of Greeley (1993), and Guth et al. (1995). Are Catholics actually more likely to support wildlife conservation

efforts? We seek to answer this question by gathering data to justify Silecchia's provocative concept of including religious values in environmental policy.

### 3.8 Catholics and Freshwater Mussel Conservation in Indiana

Engaging religious groups into targeted environmental outreach potentially increases the effectiveness of the campaign (Nardkarni, 2007; Osmond et al., 2010). From a national perspective, Catholicism is the largest denomination in 34 states (Polis Center, 2013). Catholicism is the most common religious affiliation in Indiana (Polis Center, 2013). Of the seven counties (Carroll, Fulton, Kosciusko, Marshall, Pulaski, Tippecanoe, and White) in which we conducted our study, four are predominantly Catholic (Carroll, Pulaski, Tippecanoe, and White) (Polis Center, 2013). To best include religious groups into environmental outreach, we must first assess if and how religiosity influences wildlife values, attitudes, and behaviors. Integrating Greeley et al.'s (1993) findings that Catholics are the most supportive of environmental initiatives into the wildlife-specific initiatives, we would expect to find that Catholics have more positive wildlife values, attitudes, and behavioral intentions in comparison to Mainline and Evangelical Protestants due to more gracious and communitarian worldviews.

### 3.9 Values, Attitudes, and Behaviors

Values in this context are defined by the cognitive framework of the Reasoned Action Approach, developed by Fishbein and Ajzen (2010). The Reasoned Action Approach is the most recent iteration of Fishbein and Ajzen's Theory of Planned Behavior. Both frameworks are based on the concept of cognitive hierarchy (Fig. 1). Cognitive hierarchy is structured as follows: Values are fundamental cognitions that are few in number, stable, and slow to change (Ajzen and Fishbein, 2010).

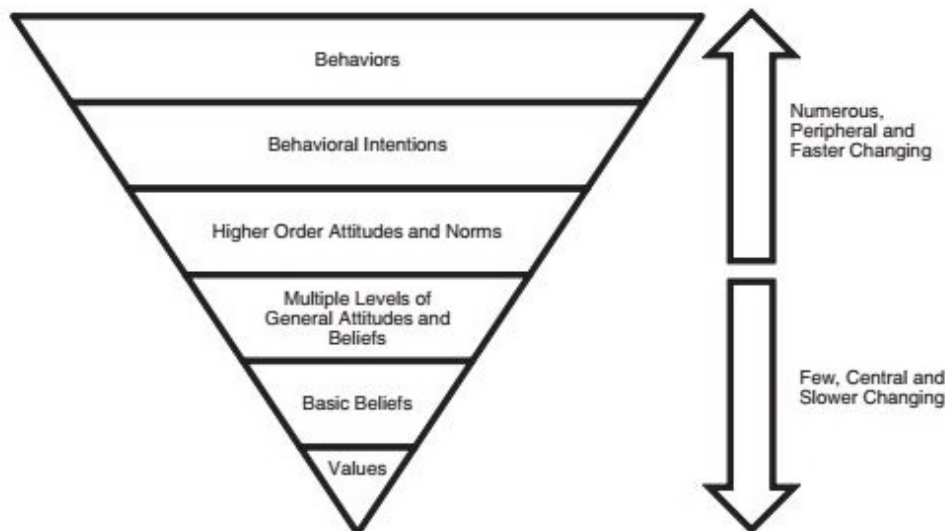


Fig. 1 Cognitive Hierarchy Framework (Perry-Hill et al., 2014)

Functionally, values reflect a person's ideal worldview and desired codes of conduct (Fulton et al., 1996). Values inform attitudes, which in turn shape behavioral intentions. Behavioral intentions are also shaped by social norms and perceived behavioral control (Ajzen and Fishbein, 2010). In the Reasoned Action Approach (Fig. 2), social norms refer to both the actual, descriptive behaviors of a group and the perceived, idealized injunctive norms of a group (Ajzen and Fishbein, 2010). Perceived behavioral control refers to the degree to which an individual believes they have the mental, physical, and autonomous capacities to perform such a behavior (Ajzen and Fishbein, 2010). Perceived behavioral controls were not explicitly examined in this study because it was assumed that every individual has equal perceived control over their behaviors and interactions with freshwater mussels. In other words, we did not anticipate any significant differences in perceived behavioral controls based on religious affiliation. We are most concerned with negative behaviors, individual actions that cause direct harm to mussels, such as removing mussels from rivers, collecting shells, or killing mussels. These

behaviors are very much in the control of individuals unlike environmental problems, such as climate change, where an individual's perceived behavioral control tends to be very low due to the global nature of the problem and the diffuse effects of individual action (Gifford, 2011). Social norms were also not observed explicitly in this study because we used religious affiliation as a proxy for measuring social norms as they relate to the environment (Tuomela, 1995). We instead focused on attitudes towards endangered freshwater mussels as predictors of behavioral intentions. We prioritized attitudes because the human dimensions of wildlife literature lacks attitudinal assessment of these animals (Christoffel and Lepczyk, 2012).

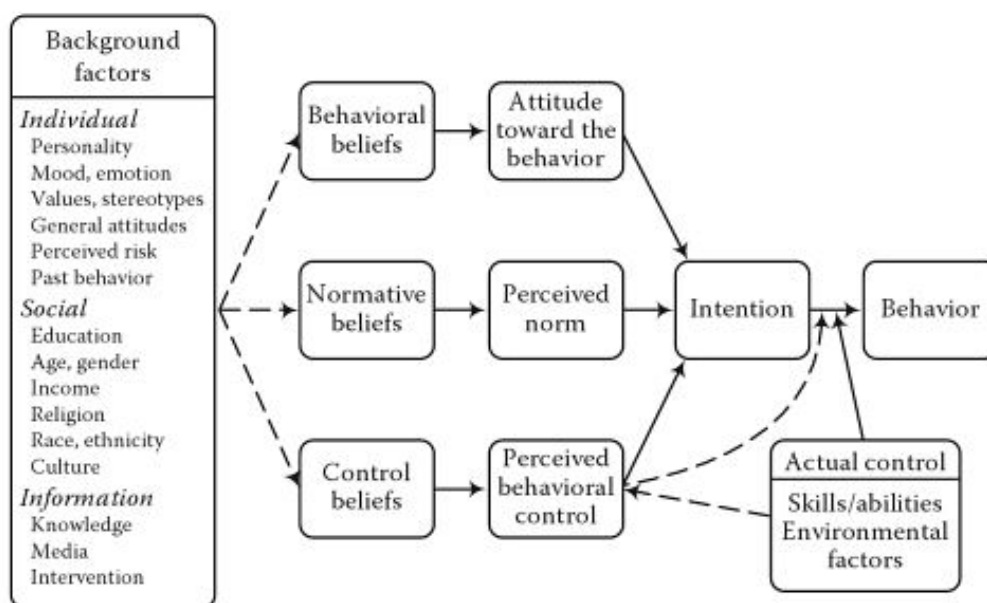


Fig. 2 The Reasoned Action Approach (Azjen and Fishbein, 2010)

Behavioral intentions ultimately produce actual behaviors. In the Reasoned Action Approach, the most distance exists between behaviors and values. Due to this distance, the correlation and therefore the predictive capability between values and behaviors is not very strong. Despite their lack of predictive power in regards to



behaviors, values are still relevant at both theoretical and practical levels. At a practical level, public values help natural resource planners and managers maintain natural resources in ways that the public supports (Perry-Hill et al., 2014).

For this study, we are interested in the theoretical advancement of wildlife value orientations and religiosity. Wildlife value orientations are a specialized group of values that arise from assessing basic wildlife beliefs (Fulton et al., 1996) (Fig. 3). Wildlife value orientations have been and are still currently used to assess public values toward specific wildlife activities such as hunting, fishing, and wildlife viewing in order to best conserve wildlife with the interest and support of the public. We specifically evaluated wildlife value orientations toward the use, rights, existence of, and education about mussels. More anthropocentric and utilitarian wildlife values are associated with negativistic attitudes and harmful behaviors (Barney et al., 2005). Based on wildlife value orientation theory, we anticipate that positive wildlife values will correlate to positive attitudes and non-detrimental behaviors towards mussels. We are looking for associations between religion and wildlife values and whether certain religious groups tend to possess more positive values toward wildlife in general and more positive attitudes toward specific endangered species of freshwater mussels.

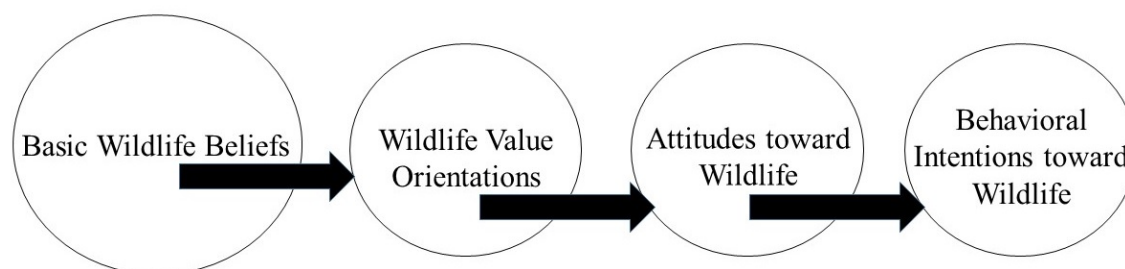


Fig. 3 Adapted from Fulton et al. 1996

Though values are still relevant for long-term planning goals, attitudes and behaviors are often more applicable in specific conservation efforts than values (Fulton et al., 1996). Targeted education and outreach campaigns incorporate stakeholder attitudes and behaviors (McKenzie-Mohr, 2011). The effectiveness such campaigns is enhanced by the inclusion of relevant stakeholder attitudes and behaviors (Zinn, et al., 1998). Therefore, baseline evaluation of existing attitudes and behaviors must occur before a campaign is developed and implemented. Typically, attitudes and behaviors towards the conservation object (e.g., an endangered species or an imperiled ecosystem) are assessed. The literature in the fields of conservation biology and the human dimensions of wildlife management lacks assessment of attitudes and behaviors across religious groups in the United States.

### 3.10 Cultural Cognition of Risk and Cultural Worldviews

Through the study of the cultural cognition of risk, Kahan et al. (2006; 2010) explores the reasons why U.S. adults remain divided on issues such as climate change that are typically well agreed upon in the scientific community. The cultural cognition of risk is a theory developed to explain why individuals assign different amounts of risk to issues that are validated by science (Kahan et al., 2006). The researchers posit that public perceptions of risk are mitigated through their own personal worldviews, psychological predispositions, and idealized ways of life much more so than scientific evidence (Kahan et al., 2010). These cultural values influence perceptions of risk at an individual level and characterize an individual's cultural worldview along two spectrums: Hierarchy-egalitarianism and Individualism-communitarianism (Kahan et al., 2010). For our study, we focused on the latter spectrum. Measuring where an individual fits on the

Individualism spectrum involves finding out how that individual feels about government power and involvement with public lives. This type of assessment aligns with the study of endangered species management more so than the Hierarchy scale, which identifies an individual's attitudes towards societal roles defined by sex, race, and socio-economic class. On the Individualism scale, a respondent whose scores indicate a communitarian worldview tends to be more receptive to governmentally funded projects than respondents who score more towards the individualistic worldview (Kahan et al., 2010).

### 3.11 Hypotheses

Based upon the theoretical foundations of the Reasoned Action Approach, wildlife value orientations, and enviro-religiosity, we pose the following three hypotheses:

**HYPOTHESIS 1:** Catholics are more likely than Mainline Protestants and Evangelical Protestants to have a communitarian worldview.

**HYPOTHESIS 2:** Catholics are more likely than Mainline and Evangelical Protestants to have more positive wildlife value orientations.

**HYPOTHESIS 3:** Catholics are more likely than Mainline and Evangelical Protestants to have more positive attitudes towards the federally listed freshwater mussels.

### 3.12 Methods

#### 3.12.1 Mail Survey

The target population of this study is riparian landowners along the Tippecanoe River. Riparian landowner addresses were identified by county GIS websites. All names and addresses were recorded into an Excel file. From that file, a random sample was drawn to create the sampling frame. Elements within the sampling frame were given a unique, four-digit code that was used only for determining which elements responded to the

survey. All information provided by respondents remains confidential. Respondents were contacted through a five-step mail survey design. We implemented two different versions of the survey. One was an original version and the second version included many of the original survey items plus additional items that measured responses to the lowering of a lake to protect the federally listed mussels. The five steps of the mail survey were the same procedure for each version and were conducted as follows: advance letter, first survey, reminder postcard, second survey, and final survey with thank-you postcard (Dillman et al., 2009). The mailing schedules are below. The first five dates are the original version's schedule, followed by the five dates for the second version.

July 24: Advance Letter  
August 5: 1st Survey  
August 14: Reminder Postcard  
August 25: 2nd Survey  
September 4: 3rd Survey and Final/Thank-You Postcard

September 24: Advance Letter  
October 3: 1st Survey  
October 17: Reminder Postcard  
October 29: 2nd Survey  
November 13: 3rd and Final/Thank-You Postcard

With each mailing, recipients were given the option to take the survey online through Purdue University's Qualtrics account. Respondents also had the option of completing the paper survey and mailing it back to our lab at Purdue. All data was analyzed at Purdue University through the statistical software package SPSS. A limitation to the mail survey is that the majority of addresses in the sampling frame are listed under male names.

In order to counter underrepresentation of females in the survey, we asked on the cover page that the person who interacted most with the river take the survey. This request allowed for the direct recipient to pass the survey on to other adult members of the household.

### 3.12.2 Wildlife Values

Wildlife values were assessed using Fulton et al.'s (1996) wildlife value orientation scale. Fulton et al. (1996) divide wildlife value orientations into eight dimensions: Wildlife Use, Wildlife Rights, Recreational Experiences, Bequest and Existence of Wildlife, Hunting, Residential Experiences, Wildlife Education, and Fishing. These eight dimensions are grouped into two domains consisting of four dimensions each: Wildlife Benefits/Existence and Wildlife Rights/Use (Fulton et al. 1996). To reduce respondent burden, included value statements from a total of four dimensions, two from each domain in our surveys. We chose the four dimensions of Wildlife Use, Wildlife Rights, Bequest and Existence, and Wildlife Education. The latter two dimensions assess values related to conservation priorities (e.g., the importance of humans to ensure the existence of viable wildlife populations or the importance of learning about wildlife). The other two dimensions evaluate the intrinsic value of wildlife. Respondents were asked to choose an option from a five-point scale, ranging from strongly disagree (1) to strongly agree (5), which best fit their preference for the given statement. High values for use statements indicate utilitarian/anthropocentric values toward wildlife, demonstrating a dominion ethic. High values for the statements about wildlife rights indicate intrinsic and egalitarian values toward wildlife. High values for the bequest and existence statements

demonstrate values toward intergenerational responsibility. Lastly, high values in the dimension of education show value learning about wildlife.

### 3.12.3 Cultural Worldviews

To incorporate wildlife values of Catholics, Mainline, and Evangelical Protestants into broader cultural cognition theory, the mail survey also asked respondents to indicate their attitudes towards collective welfare, individual interests, and governmental power (Kahan et al., 2010). The survey included a set of six statements introduced by the following: “People in our society often disagree about far to let individuals go in making decisions for themselves. How strongly do you agree or disagree with the following statements?” (Kahan et al., 2010). On the same type of five-point scale discussed above, from strongly disagree (1) to strongly agree (5), respondents were given six statements: “a. The government interferes too much in our everyday lives;” “b. Sometimes the government needs to make laws to keep people from hurting themselves;” “c. It’s not the government’s business to try and protect people from themselves;” “d. The government should stop telling people how to live their lives;” and “e. The government should do more to advance society’s goals, even if that means limiting the freedom and choices of individuals” (Kahan et al., 2010). Statements b., e., and f. were reverse coded in analysis so that for all statements high scores (closer to 5) indicate individualistic orientations while low scores (closer to 1) indicate communitarian worldviews.

### 3.12.4 Attitudes toward Freshwater Mussels

Attitudes towards the endangered mussels were assessed on an 11-item scale. This scale was used in previous studies that assessed public attitudes toward the endangered Eastern hellbender, a giant salamander found in Southern Indiana (Reimer et al., 2013).

The scale originated from a study that measured affective attitudes towards pets (Poresky et al., 1988). The 11 items were Good-Bad, Important-Unimportant, Beautiful-Ugly, Friendly-Unfriendly, Active-Passive, Pleasant-Unpleasant, Valuable-Worthless, Clean-Dirty, Hardy-Fragile, Harmless-Dangerous. Respondents were asked to circle the number from 1-7 that best fit their preference for the animals. Lower values closer to 1 indicate more positive attitudes, higher values toward 7 indicate more negative attitudes, and values near 4 indicate neutral attitudes.

Attitudes were also measured by asking respondents to respond to the statement, "Government money should be used to protect these mussels." Again, respondents were asked to choose an option from the five-point scale, from strongly disagree (1) to strongly agree (5). High values indicate high support for government funding of mussel conservation programs, while low values indicate strong opposition to such programs.

### 3.12.5 Behavioral Intentions toward Freshwater Mussels

Behavioral intentions were assessed by providing respondents with ten specific behaviors and an "other" option. Respondents were asked to choose all options that best fit their preference for the scenario "If I caught one of the mussels pictured on the previous page while fishing or during some other outdoor activity, I would (please check all that apply)." Negative behavioral intentions were "Take it home alive," "Keep it to use its shell," "Throw it on the river banks," "Eat it," "Take it home dead," "Skip/throw it across the water like a rock or stone," and "Kill it." Positive behavioral intentions were "Put it back where I found it," "Throw/place it in the river if I found it on the river banks," and "Call a resources professional (IDNR/Extension)." Behavioral intentions were analyzed by descriptive statistics.

### 3.12.6 Religious Affiliation

Religious affiliation was assessed by asking respondents the question “Are you a member of a religious organization?” in the demographics section of the survey. Options for religious affiliation were given in order of highest to lowest prevalence in Indiana: Catholic, Methodist, Christian nondenominational, Baptist, Jewish, and Other (please specify). Respondents were also given options of “No Affiliation” and “Prefer Not to Answer.” The latter category was excluded from analyses of religion and the various dependent variables. Respondents who identified as having no affiliation were coded as Nones. Respondents who identified as Catholic were analyzed as Catholic. The two Protestant groups were created through the most recent and most accepted classification scheme.

To create the categories of Evangelical and Mainline Protestant, we followed the classification scheme developed by Steensland et al. (2000). Methodists were included in the Mainline Protestant category as were “other” affiliations that matched groups identified by the Steensland classification scheme as Mainline Protestant denominations. Denominations from the Other category that matched Mainline Protestant classification were Episcopal, Lutheran, Lutheran & Presbyterian, Presbyterian, Reformed Church of America, and United Presbyterian Church. Baptists and Christian nondenominational were included in the Evangelical Protestant group as were Other affiliations if they matched groups identified by the Steensland classification scheme as Evangelical denominations. Denominations from the Other category that matched Evangelical Protestant classification were Amish, Brethren, Church of God, Confessional Lutheran, Evangelical Presbyterian, First Christian, Lutheran Missouri Synod, Mennonite,



Nazerene, and Pentecostal. Affiliations that were excluded in the Mainline and Evangelical categories were Taoist, Swedenborgian, Nature, L, Jehovah's Witness, Druid, and Christian.

### 3.13 Results

#### 3.13.1 Religious Affiliation

Out of 1804 total surveys distributed, 647 unique cases returned via mail or online through Qualtrics (50% response rate). Of the 647 cases, 107 were Catholic (17%), 112 were None (17%), 92 were Mainline Protestant (14%), and 138 were Evangelical Protestant (21%) (see Table 3.1). In terms of demographics (see Table 3.2, 3.3, 3.4, and 3.5), all four groups are predominately male and are around 60 to 64 years old. Politically, the three religious groups tend to be conservative to moderate. The Nones tend toward those direction as well, but they also have the highest percentage of liberals out all four groups. The highest levels of education across all four groups tend to be either a high school diploma or a 4-year college degree.

Table 3.1: Results from survey question “Are you a member of a religious organization?”

<b>Denomination/Affiliation Given (n)</b>			
<b>Catholic</b>	107	<b>Jewish</b>	3
<b>None</b>	112	<b>Prefer Not to Answer</b>	100
<b>Christian Nondenominational</b>	101		
<b>Baptist [unspecified]</b>	22	<b>Methodist [unspecified]</b>	71
<b>Other*</b>			
<b>Evangelical Protestant (EP)</b>	<b>EP (n)</b>	<b>Mainline Protestant (MP)</b>	<b>MP (n)</b>
Amish	3	Episcopal	2
Brethren	3	Lutheran	8
Church of God	2	Lutheran & Presbyterian	1
Confessional Lutheran	1	Presbyterian	8
Evangelical Presbyterian	1	Reformed Church of America	1
First Christian	1	United Presbyterian Church (UPC)	1
Lutheran Missouri Synod	1		
Mennonite	1		
Nazarene	1		
Pentecostal	1		
<b>Total EP Other</b>	15	<b>Total MP Other</b>	21
<b>Total EP</b>	138	<b>Total MP</b>	92

Table 3.2: Catholic Demographics

Catholic Demographics		
	n	%
<u>Gender (n=107)</u>		
Male	74	69
Female	33	31
<u>Average Age (yrs) (n=108)</u>		
	64	-
<u>Highest Education Completed (n=106)</u>		
Some Formal Schooling	2	2
High School Diploma	32	30
Some College	17	16
2-Year College	14	13
4-Year College	23	22
Graduate Degree	18	17
<u>Political Affiliation (n=103)</u>		
Very Conservative	5	5
Conservative	44	43
Moderate	46	45
Liberal	6	6
Very Liberal	2	2

Table 3.3: Mainline Protestant Demographics

Mainline Protestant Demographics		
	n	%
<u>Gender (n=90)</u>		
Male	60	67
Female	30	33
<u>Average Age (yrs) (n=92)</u>		
	62	-
<u>Highest Education Completed (n=91)</u>		
Some Formal Schooling	1	1
High School Diploma	23	25
Some College	20	22
2-Year College	6	7
4-Year College	28	31
Graduate Degree	13	14
<u>Political Affiliation (n=85)</u>		
Very Conservative	7	8
Conservative	39	46
Moderate	38	45
Liberal	1	1
Very Liberal	0	0

Table 3.4: Evangelical Protestant Demographics

Evangelical Protestant Demographics		
	n	%
<u>Gender (n=136)</u>		
Male	103	76
Female	33	24
<u>Average Age (yrs) (n=135)</u>		
	62	-
<u>Highest Education Completed (n=135)</u>		
Some Formal Schooling	10	7
High School Diploma	35	26
Some College	25	19
2-Year College	15	11
4-Year College	29	21
Graduate Degree	21	16
<u>Political Affiliation (n=129)</u>		
Very Conservative	18	14
Conservative	64	50
Moderate	43	33
Liberal	4	3
Very Liberal	0	0

Table 3.5 Religious None Demographics

None Demographics		
	n	%
<u>Gender (n=111)</u>		
Male	89	80
Female	22	20
<u>Average Age (yrs) (n=108)</u>		
	59	-
<u>Highest Education Completed (n=112)</u>		
Some Formal Schooling	7	6
High School Diploma	48	43
Some College	26	23
2-Year College	11	10
4-Year College	11	10
Graduate Degree	9	8
<u>Political Affiliation (n=109)</u>		
Very Conservative	4	4
Conservative	38	35
Moderate	43	39
Liberal	18	17
Very Liberal	6	6

When possible, one-way ANOVAs were performed to find significant differences between the means of the four groups. If significant differences were found, multiple comparisons were performed with a Tukey HSD post hoc analysis. In some cases, ANOVAs were unable to be performed due to violations of the ANOVA assumption of homogeneity of variance (HOV). To be performed and to produce reliable results, ANOVAs require equal (or very similar) variance between groups (McDonald, 2009). In cases where the HOV assumption was violated in the data, we used Welch's ANOVA. The Welch method is applicable in data where group variance is significantly different and ANOVAs cannot be reliably performed (McDonald, 2009). If a Welch test produced statistically significant results, a Games-Howell multiple comparison post-hoc test was performed to assess which groups differed significantly from each other. The Welch method is less powerful than one-way ANOVAs, but the method does produce more accurate results than ANOVAs when the HOV assumption is violated.

Descriptives are also discussed below. Frequencies and percentages are often more appropriate and meaningful metrics of comparison for some social science data (Hoffrage et al., 2000; Trafimow & Marks, 2015). Some researchers and journals reject the notion of null hypothesis significance testing procedure (NHSTP). Advocates against NHSTP claim that the procedure lacks validity due to its failure to produce probabilities for existence of the null hypothesis (Trafimow & Marks, 2015). Despite this deficiency, we still used NHSTP and will report its results along with descriptives.

### 3.13.2 Cultural Worldviews

All four categories of the independent variable of religion (Catholic, Mainline Protestant, Evangelical Protestant, and None) score neutrally in overall cultural values,

demonstrating a lack of strong preferences for individualistic or communitarian worldviews. Evangelical Protestants score the highest with an overall mean of 3.40. Catholics are the next highest with an overall mean of 3.18. Mainline Protestants and Nones score the lowest with overall means of 3.07 and 3.18, respectively. All four categories are within the neutral range, with Evangelical Protestants closest to the individualistic side and Mainline Protestants and Nones closest to the communitarian side of the spectrum. There are no statistically significant differences between individual group means for each of the six cultural cognition statements. However, in terms of percentages, Catholics have the lowest percentages out of all four groups for agreeing and strongly agreeing with five out of the six individualistic statements. Although there are no statistically significant differences between group means, Catholics agree and strongly agree with individualistic statements less frequently than both Mainline and Evangelical Protestants. Hypothesis 1, that Catholics are more likely than Mainline Protestants and Evangelical Protestants to have a communitarian worldview is not supported by our data.

### 3.13.3 Wildlife Value Orientations

#### 3.13.3.1 Use

Overall means for all four groups are again very similar for the wildlife use value orientation. The trend of Nones scoring the lowest overall mean (3.29) and Evangelical Protestants scoring the highest overall mean (3.56) holds true again for the wildlife use category. Catholics and Mainline Protestants are virtually equal with overall means of 3.45 and 3.44, respectively. ANOVAs were not performed for the first three wildlife use statements (a, b, and c) due to violation of the homogeneity of variance assumption of

ANOVA. Each Welch test for the first three statements show statistically significant difference between the groups. For the first statement, “a. Humans should manage wild animal populations so that humans benefit,” the Games-Howell post-hoc test shows that the mean for the Evangelical group (3.28) is significantly higher than the means for both the Mainline group (2.89) and the None group (see Tables 3.6 and 3.7). The mean for Evangelicals (3.68) in the second statement, “b. The loss of some individual wild species is acceptable if the population of animals is not jeopardized,” is again significantly higher than the Nones (3.21) (see Tables 3.8 and 3.9). For the third Use statement, “c. If animal populations are not threatened, we should use wildlife to add to the quality of human life,” both Evangelical and Mainline Protestant means (3.82 and 3.77, respectively) are significantly higher than the None mean (3.45) (see Tables 3.10 and 3.11).

Table 3.6: Welch’s t-test results for wildlife value orientation Statement “a. Humans should manage wild animal populations so that humans benefit.”  
(\*\*significant at the .01 level)

<b>Religious Affiliation</b>	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Std. Error</b>	<b>df</b>	<b>Statistic</b>	<b>P-Value</b>
Catholic	102	3.16	1.11	.11	(3, 227)	4.45	.005**
Mainline Protestant	90	2.89	.98	.10			
Evangelical Protestant	131	3.28	.91	.08			
None	110	2.89	1.14	.11			

Table 3.7: Significant differences from Games-Howell multiple comparison post-hoc test for wildlife value orientation statement a. (\*significant at the .05 level;\*\*significant at the .01 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Evangelical Protestant	Mainline Protestant	.39	.13	.015**
	None	.39	.14	.021*

Table 3.8: Welch's t-test results for wildlife value orientation statement "b. The loss of some wild animals is acceptable if the population of animals is not jeopardized." (\*\*significant at the .01 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	df	Statistic	P-Value
Catholic	101	3.48	1.03	.10	(3, 221)	4.34	.005**
Mainline Protestant	90	3.46	1.03	.11			
Evangelical Protestant	131	3.68	.81	.07			
None	108	3.21	1.17	.05			

Table 3.9: Significant differences from Games-Howell post-hoc test for wildlife value orientation statement b. (\*\*significant at the .01 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Evangelical Protestant	None	.47	.13	.003**



Table 3.10: Welch's T-test Results for Wildlife Value Orientation Statement "c. If animal populations are not threatened, we should use wildlife to add to the quality of human life."  
(\*\*significant at the .01 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	df	Statistic	P-Value
Catholic	102	3.69	.82	.08	(3, 230)	4.22	.006**
Mainline Protestant	90	3.77	.72	.08			
Evangelical Protestant	131	3.82	.74	.07			
None	109	3.45	.89	.09			

Table 3.11: Significant Differences from Games-Howell Post-Hoc Test for Wildlife Value Orientation Statement c. (\*significant at the .05 level; \*\*significant at the .01 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Mainline Protestant	None	.32	.11	.030*
Evangelical Protestant	None	.37	.11	.004**

ANOVA for the fourth statement, "d. It is important to manage the populations of wildlife" shows no statistically significant differences between the groups. Therefore, we turn to percentages to compare groups. Evangelical Protestants score the highest percentage of agree/strongly agree responses. For wildlife values in terms of using wildlife for human benefits, Evangelicals appear to have most utilitarian values than the other three groups. Means for each group are largely neutral and for all four statements, Nones have the lowest means. Catholics are the only religious group that does not differ significantly from the Nones in any of the statements.

## 3.13.3.2 Rights

Evangelical Protestants again have the least positive results, scoring the lowest overall mean for wildlife rights with a value of 2.13. Also consistent with the theme from the two previous sections is the Nones scoring most positively with an overall mean of 2.83. Catholics are the group with the next most positive wildlife rights, with an overall mean of 2.48. Mainline Protestants rank third with a value of 2.32. ANOVA results show statistical differences between groups for all three wildlife right statements. Catholics, Mainline Protestants, and Evangelical Protestants have statistically lower group means (2.9, 2.7, 2.54, respectively) than Nones (3.31) toward the statement “e. The rights of wildlife are more important than human use of wildlife” (see Tables 3.12 and 3.13). There is no statistically significant difference between Catholics and Mainline Protestants or Mainline Protestants and Evangelical Protestants, but there is a significant statistical difference between Catholics and Evangelicals.

Table 3.12: ANOVA results for wildlife value orientation statement “e. The rights of wildlife are more important than human use of wildlife.” (\*\*significant at the .01 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	df	Statistic	P-Value
Catholic	102	2.90	1.02	.10	(3, 425)	12.64	.000**
Mainline Protestant	89	2.70	.98	.10			
Evangelical Protestant	130	2.54	1.03	.09			
None	108	3.31	.98	.10			

Table 3.12: Significant differences from Tukey HSD multiple comparison post hoc test for wildlife value orientation statement e. (\*significant at the .05 level; \*\*significant at the .01 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Catholic	Evangelical Protestant	.36	.13	.033*
	None	.41	.14	.016*
Mainline Protestant	None	.62	.14	.000**
Evangelical Protestant	None	.78	.13	.000**

This pattern is the same for statement “f. Animals should have rights similar to the rights of humans.” All three religious group means are significantly lower than the Nones (see Table 3.13). There is no statistical difference between Catholics and Mainline Protestants or between Mainline Protestants and Evangelical Protestants. However, there is a significant statistical difference between Catholics and Evangelicals, where Catholics have a higher group mean than Evangelicals (see Table 3.14).

Table 3.13: ANOVA results for wildlife value orientation statement “f. Animals should have rights similar to the rights of humans.” (\*\*significant at the .01 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	df	Statistic	P-Value
Catholic	102	2.45	1.04	.10	(3, 427)	13.07	.000**
Mainline Protestant	89	2.29	.99	.11			
Evangelical Protestant	131	2.05	1.00	.09			
None	109	2.88	1.11	.05			

Table 3.14: Significant differences from Tukey HSD multiple comparison post hoc test for wildlife value orientation statement f. (\*significant at the .05 level; \*\*significant at the .01 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Catholic	Evangelical Protestant	.40	.14	.020*
	None	.43	.14	.015*
Mainline Protestant	None	.59	.15	.000**
Evangelical Protestant	None	.83	.14	.000**

The only significant difference between groups for statement “g. I object to hunting because it violates the rights of an individual animal to exist,” is between Evangelical Protestants and Nones (see Tables 3.15 and 3.16). Evangelical Protestants scored the lowest means for all three wildlife rights statements and were the only group to be significantly different from the high-scoring Nones in all three statements. Hypothesis 2, Catholics are more likely than Mainline and Evangelical Protestants to have more positive wildlife value orientations, is partially supported in terms of Catholics having higher values toward wildlife rights than Evangelical Protestants.

Table 3.15: ANOVA results for wildlife value orientation statement “g. I object to hunting because it violates the rights of an individual animal to exist.” (\*\*significant at the .01 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	df	Statistic	P-Value
Catholic	102	2.10	1.01	.10	(3, 428)	4.41	.005**
Mainline Protestant	89	1.98	1.01	.11			
Evangelical Protestant	132	1.80	1.07	.09			
None	109	2.29	1.17	.05			

Table 3.15: Significant differences from Tukey HSD multiple comparison post hoc test for wildlife value orientation statement g. (\*\*significant at the .01 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Evangelical Protestant	None	.49	.14	.002**

### 3.13.3.3 Bequest and Existence

All four groups have similar overall means for statements regarding the bequest and existence of wildlife. Once more, the Nones have the highest overall mean (4.41) and the Evangelicals have the lowest overall mean (4.16). Catholics score slightly above Mainline Protestants with a mean of 4.23 over 4.20. Despite these differences, all groups are in agreement that it is important for future generations to have abundant wildlife in the state.

There are statistically significant differences between groups for three of the five statements. Catholics, Mainline Protestants, and Evangelical Protestants have lower group means than the Nones for statement “h. It is important that Indiana always have abundant fish and wildlife” (see Tables 3.16 and 3.17). Evangelical Protestants score significantly lower than the Nones for statements “k. It’s important for me to know that there are healthy populations of wildlife in Indiana” (see Tables 3.18 and 3.19). and “l. It’s important to maintain fish and wildlife so that future generations can enjoy them” (see Tables 3.20 and 3.21).

Table 3.16: ANOVA results for wildlife value orientation statement “h. It is important that Indiana always have abundant fish and wildlife.” (\*\*significant at the .01 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	df	Statistic	P-Value
Catholic	102	4.12	.82	.08	(3, 429)	5.37	.001**
Mainline Protestant	91	4.01	.95	.10			
Evangelical Protestant	131	4.08	.72	.06			
None	109	4.40	.60	.06			

Table 3.17: Significant differences from Tukey HSD multiple comparison post hoc test for wildlife value orientation statement h. (\*significant at the .05 level; \*\*significant at the .01 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Catholic	None	.29	.11	.037*
Mainline Protestant	None	.39	.11	.002**
Evangelical Protestant	None	.83	.14	.000**

Table 3.18: ANOVA results for wildlife value orientation statement “k. It’s important to me to know that there are healthy populations of wildlife in Indiana.” (\*significant at the .05 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	df	Statistic	P-Value
Catholic	102	4.23	.77	.08	(3, 429)	3.25	.022*
Mainline Protestant	91	4.18	.80	.08			
Evangelical Protestant	131	4.11	.67	.06			
None	109	4.39	.69	.07			

Table 3.19: Significant differences from Tukey HSD multiple comparison post hoc test for wildlife value orientation statement k. (\*significant at the .05 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Evangelical Protestant	None	.29	.09	.013**

Table 3.20: ANOVA results for wildlife value orientation statement “l. It’s important to maintain fish and wildlife so that future generations can enjoy them.” (\*significant at the .05 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	df	Statistic	P-Value
Catholic	102	4.30	.78	.08	(3, 429)	2.65	.048*
Mainline Protestant	91	4.31	.71	.07			
Evangelical Protestant	131	4.25	.62	.06			
None	109	4.50	.69	.07			

Table 3.21: Significant differences from Tukey HSD multiple comparison post hoc test for wildlife value orientation statement l. (\*significant at the .05 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Evangelical Protestant	None	.25	.09	.037*

Of the two statements, i. and j., lacking statistical differences between all groups, all four groups have similar percentages of agree and strongly agree responses for “i. Whether or not I get out to see wildlife as much as I’d like, it’s important to know that they exist in Indiana” (see Table 3.22). Mainline Protestants have the highest percentage agree and strongly agree responses for “j. We should be sure future generations of

Indiana will have an abundance of fish and wildlife” (see Table 3.23). Hypothesis 2 is not supported in Catholic values toward the bequest and existence of wildlife.

Table 3.22: Percentages for wildlife value orientation statement “i. Whether or not I get out to see wildlife as much as I’d like, it’s important to know that they exist in Indiana.”

<b>Religious Affiliation</b>	<b>Disagree/Strongly Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree/Strongly Agree (%)</b>	<b>Mean (n)</b>
Catholic	2	8	90	4.25 (102)
Mainline Protestant	3	3	93	4.24 (91)
Evangelical Protestant	1	10	89	4.17 (131)
No Affiliation	3	5	92	4.34 (108)

Table 3.23: Percentages for wildlife value orientation statement “j. We should be sure future generations of Indiana will have an abundance of fish and wildlife.”

<b>Religious Affiliation</b>	<b>Disagree/Strongly Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree/Strongly Agree (%)</b>	<b>Mean (n)</b>
Catholic	3	13	84	4.25 (102)
Mainline Protestant	2	6	92	4.25 (91)
Evangelical Protestant	0	6	88	4.21 (131)
No Affiliation	2	9	88	4.43 (108)



## 3.13.3.4 Education

Overall, the four groups have similar means and all groups agree that wildlife education is enjoyable and important. ANOVA could only be used for the final statement. Welch tests were used for the first two statements. There is no significant difference between groups for the first statement “m. I enjoy learning about wildlife.” Turning to percentages for statement m. (see Table 3.24), Catholics have the lowest percentage of agree and strongly agree responses (76%). Evangelicals have a higher percentage of agree and strongly agree responses (86%) than both Catholics and Mainline Protestants (85%). Nones have the highest overall percentage of agrees/strongly agrees for this statement (88%).

Table 3.24: “m. I enjoy learning about wildlife.”

<b>Religious Affiliation</b>	<b>Disagree/Strongly Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree/Strongly Agree (%)</b>	<b>Mean (n)</b>
Catholic	4	20	76	4.10 (102)
Mainline Protestant	2	13	85	4.12 (91)
Evangelical Protestant	2	12	87	4.08 (131)
No Affiliation	0	12	88	4.25 (109)

The Nones also outscored the other groups for the second statement, “n. It’s important that all Indiana residents have a chance to learn about wildlife in the state.” There is a statistical difference between group means for this second statement (see Tables 3.25 and 3.26). Games-Howell post hoc analysis shows Evangelicals have a

significantly lower group mean (4.03) than Nones (4.25). There is another statistically significant difference between Evangelical Protestants and Nones on the final statement, “o. It’s important that we learn as much as we can about wildlife”, according to Tukey HSD post hoc analysis (see Tables 3.27 and 3.28). The None mean for this statement is 4.20 and the Evangelical Protestant mean is 3.91. Catholics again score slightly above Mainline Protestants with a mean of 4.08 over a mean of 4.01, but this is not a statistically significant difference. While all groups favor wildlife education, the Nones have higher percentages of agree and strongly agree responses for all three statements. Hypothesis 2 is not supported by the data.

Table 3.25: Welch results for wildlife value orientation statement “n. It’s important that all Indiana residents have a chance to learn about wildlife in the state.” (\*significant at the .05 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	df	Statistic	P-Value
Catholic	102	4.10	.85	.08	(3, 223)	2.71	.046*
Mainline Protestant	91	4.02	.86	.09			
Evangelical Protestant	131	4.03	.62	.05			
None	109	4.25	.64	.06			

Table 3.26: Significant differences from Games-Howell multiple comparison post hoc test for wildlife value orientation statement n. (\*significant at the .05 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Evangelical Protestant	None	.22	.08	.042*

Table 3.27: ANOVA results for wildlife value orientation statement “o. It’s important that we learn as much as we can about wildlife.” (\*significant at the .05 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	df	Statistic	P-Value
Catholic	102	4.08	.88	.09	(3, 429)	2.89	.035*
Mainline Protestant	91	4.01	.88	.09			
Evangelical Protestant	131	3.91	.71	.06			
None	109	4.20	.70	.07			

Table 3.28: Significant differences from Games-Howell multiple comparison post hoc test for wildlife value orientation statement o. (\*significant at the .05 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Evangelical Protestant	None	.29	.10	.022*

### 3.13.4 Attitudes

Affective attitudes across all groups were positive with overall means ranging from 2.59 to 3.01. Catholics claim the highest overall mean (3.01) and the Nones have the lowest overall mean (2.59). Both Protestant groups are very similar with Evangelicals having a slightly lower overall mean of 2.84 compared to the Mainline overall mean of 2.88. There is a statistically significant difference between the groups for only two of the eleven categories. According to Games-Howell comparisons, Catholics have a statistically higher mean (2.99) than Nones (2.14) for the Important-Unimportant category (see Tables 3.29 and 3.30). As a result of Tukey HSD comparisons, Mainline Protestants have a significantly higher mean than Nones for the Friendly-Unfriendly category (see Tables 3.31 and 3.32). Results from the remaining categories without

statistically significant differences are expressed by the percentage of respondents from each group who marked “1,” the most positive response for any given category (see Table 3.33). For all but two categories, Catholics have the lowest percentages of “1” responses. Catholics scored the lowest in Good-Bad, Active-Passive, Pleasant-Unpleasant, Valuable-Worthless, Clean-Dirty, Hardy-Fragile, Harmless-Dangerous, and Dirty-Slimy. Nones score the highest percentage of “1”s for those same categories, except Active-Passive. Evangelicals have the highest percentage of “1”s for that category. The only category where Catholics have the highest percentage of “1”s out of the three religious groups is the Beautiful-Ugly category. Hypothesis 3, that Catholics are more likely than Mainline and Evangelical Protestants to have more positive attitudes towards the federally listed freshwater mussels, is not supported by the affective attitudinal results.

Table 3.29: Welch’s t-test results for Important-Unimportant (\*significant at the .05 level)

<b>Religious Affiliation</b>	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Std. Error</b>	<b>df</b>	<b>Statistic</b>	<b>P-Value</b>
Catholic	92	2.99	2.25	.23	(3, 209)	3.17	.025*
Mainline Protestant	81	2.60	1.80	.20			
Evangelical Protestant	117	2.73	2.02	.19			
None	101	2.14	1.83	.18			

Table 3.30: Significant Differences from Games-Howell Post-Hoc Test for Important-Unimportant (\*significant at the .05 level)

<b>Religious Affiliation (I)</b>	<b>Religious Affiliation (J)</b>	<b>Difference Between Means</b>	<b>Std. Error</b>	<b>P-Value</b>
Catholic	None	.85	.30	.024*

Table 3.31: ANOVA Results for Friendly-Unfriendly (\*significant at the .05 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	df	Statistic	P-Value
Catholic	87	2.89	1.70	.18	(3,635)	2.86	.037*
Mainline Protestant	73	3.00	1.73	.20			
Evangelical Protestant	111	2.62	1.48	.14			
None	98	2.34	1.71	.17			

Table 3.32: Significant Differences from Tukey HSD Multiple Comparison Post-Hoc Test for Wildlife Value Orientation Statement b. (\*significant at the .05 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Mainline Protestant	None	.66	.25	.045*

Table 3.33: Percentage of “1’s” marked for affective attitudinal categories

	<b>Catholic</b>	<b>Mainline Protestant</b>	<b>Evangelical Protestant</b>	<b>No Affiliation</b>
<b>Good-Bad</b>	45	53	47	57
<b>Important-Unimportant</b>	42	44	43	61
<b>Beautiful-Ugly</b>	30	27	28	42
<b>Friendly-Unfriendly</b>	32	29	35	47
<b>Active-Passive</b>	19	21	24	22
<b>Pleasant-Unpleasant</b>	26	32	29	40
<b>Valuable-Worthless</b>	37	42	39	58
<b>Clean-Dirty</b>	38	40	36	45
<b>Hardy-Fragile</b>	17	26	23	29
<b>Harmless-Dangerous</b>	58	68	65	76
<b>Dry-Slimy</b>	14	20	13	22

All three religious groups are statistically less supportive of government money being used to protect the endangered mussels of the Tippecanoe River than the religiously unaffiliated (see Tables 3.34 and 3.35). Catholics have the highest percentage of agree and strongly agree responses to the statement “Government money should be used to protect these mussels.” Catholics and the two Protestant groups have means that suggest group neutrality on the subject. The Catholic mean of 2.95 is closest to neutral 3. Mainline Protestants and Evangelical Protestants are close as well with respective means of 2.92 and 2.90. Nones have the highest mean of 3.57. Hypothesis 3 is not supported by the results from attitudes towards government spending on freshwater mussel conservation programs.

Table 3.34: ANOVA Results for “Government funding should be used to protect these mussels.” (\*\*significant at the .01 level)

Religious Affiliation	N	Mean	Std. Deviation	Std. Error	Statistic	P-Value
Catholic	100	2.95	1.37	.14	6.21	.000**
Mainline Protestant	81	2.91	1.31	.15		
Evangelical Protestant	124	2.90	1.35	.12		
None	106	3.57	1.30	.13		

Table 3.35: Tukey HSD Results for “Government funding should be used to protect these mussels.” (\*\*significant at the .01 level)

Religious Affiliation (I)	Religious Affiliation (J)	Difference Between Means	Std. Error	P-Value
Catholic	None	.62	.19	.006**
Mainline Protestant	None	.65	.20	.006**
Evangelical Protestant	None	.67	.18	.001**

## 3.13.5 Behavioral Intentions

“Put it back where I found it” and “Throw/Place it in the river if I found it on the banks” are by far the most popular behavioral intentions indicated by all respondents (see Tables 3.36 and 3.37). For both statements, the Nones have the highest percentage of respondents with 83% reporting they would put the mussel back and 41% would throw or place mussel back in the river if they found one on the banks. Only 67% of Evangelical Protestants would put a mussel back where they found it. More Mainline Protestants, 80%, than Catholics, 78%, would put a mussel back where they found it while recreating. A higher percentage of Mainline Protestants also reported that they would throw or place a mussel in the river if they found on the riverbanks (40%). Catholics and Evangelicals reported similar percentages, 33% and 35%, respectively. Zero respondents from all four groups said they would take a mussel home alive if they found one while recreating.

Table 3.36: Percentages for behavioral intention “Put it back where I found it”

<b>13. and 8. If I caught one of the mussels pictured on the previous page while fishing or during some other outdoor activity, I would (please check all that apply):</b> [option: Put it back where I found it]			
	<b>Frequency (n)</b>	<b>Percent of Total Denomination (%)</b>	<b>Percent of Total Sample (%)</b>
<b>Catholic</b>	83	78	13
<b>Mainline Protestant</b>	74	80	11
<b>Evangelical Protestant</b>	93	67	14
<b>No Affiliation</b>	93	83	14
<b>Total</b>	343	-	53



Table 3.37: Percentages for behavioral intention “Throw/Place it in the river if I found it on the banks”

<b>13. and 8. If I caught one of the mussels pictured on the previous page while fishing or during some other outdoor activity, I would (please check all that apply):</b> [option: Throw/place it in the river if I found it on the banks]			
	<b>Freq (n)</b>	<b>Percent of Total Denomination (%)</b>	<b>Percent of Total Sample (%)</b>
<b>Catholic</b>	36	34	6
<b>Mainline Protestant</b>	37	40	6
<b>Evangelical Protestant</b>	48	35	7
<b>No Affiliation</b>	46	41	7
<b>Total</b>	167	-	26

### 3.14 Discussion

Lack of substantial and consistent statistical differences prevents us from strongly supporting our hypotheses. Our lack of statistically significant results may be due in part to the fact that there appears to be general support for the conservation of the imperiled Tippecanoe River mussels. Overall positive evaluations of the mussels and of wildlife could be a result of the fact that our target population lives on the Tippecanoe River and these individuals could have a strong sense of place with respect to the ecology of the river.

Lack of significant variation amongst groups could also be a result of imprecise measures. Steensland et al. (2000) suggest religiosity be measured by asking survey

respondents to write in the specific name of the church they attend in order to more precisely measure religious affiliation by denomination. Steensland et al. (2000) also suggest asking respondents to identify where they fit on a religiously conservative-liberal spectrum. Another effect might be the increasing variation within Evangelical and Mainline Protestant groups (Pew, 2015). Our data do not support the previous findings of Guth et al. (1993) and Greeley et al. (1995), which is to be expected due to the increased variation within Protestant groups since the 1990's. Frequency of religious service or church attendance might also affect results. We suggest future studies of religion and wildlife follow the Steensland et al. (2000) instructions on studying religion.

Descriptive results from the cultural worldview assessment do suggest that Catholics are more willing to accept governmental interference and regulation. Of the three religious groups, Catholics are the most supportive of spending government money to protect the mussels. The data also show that Catholics living along the Tippecanoe River are slightly more communitarian than the two Protestant groups. This difference is associated with more tolerance of government intervention (Kahan, 2010).

In terms of wildlife values, all four groups demonstrate a desire to learn about wildlife. How to educate the groups about the environment and how to best tailor conservation messages may vary based on the results from the other categories of wildlife value orientations. Evangelical Protestants appear to have the most anthropocentric and utilitarian values toward the use of wildlife. Catholics did score the highest percentage of agrees and strongly agrees for the statement "Humans should manage wild animal populations so that humans benefit," showing a dedication to the old ethic of dominion. Despite this result, Catholics do demonstrate positive values toward the rights of wildlife.

Of the three religious groups, Catholics are statistically more supportive of putting wildlife rights above human usage of wildlife than Evangelical Protestants. Catholics are also statistically more supportive of animal rights being equal to those of human rights than Evangelical Protestants. Evangelicals are significantly less supportive of wildlife rights than both Catholics and Mainline Protestants. These results suggest that Catholics and Mainline Protestants would be receptive of conservation programs that promote the rights of wildlife, while less egalitarian messaging might be more effective with Evangelical audiences.

Despite statistically significant differences in means and descriptive differences in percentages for values toward to wildlife bequest and existence, all groups support future healthy populations of wildlife. This support across all groups shows that environmental messaging directed towards intergenerational responsibility would be well-received by Catholics, Mainline Protestants, Evangelical Protestants, and Nones. It is slightly surprising that Catholics did not report more supportive scores for the statement “We should be sure future generations of Indiana will have an abundance of fish and wildlife” because of the Church’s multiple statements on intergenerational responsibility.

Differences between Catholic environmental teaching and our survey data might suggest that official Church doctrine about the environment is not impressively influential in the values of Catholics living along the Tippecanoe River. Papal encyclicals may preach the prescribed values Catholics should have toward the environment, but the messages from the Vatican may not reach many congregations and individual Catholics. Local values in the homilies delivered by local priests are possibly more impactful on individual Catholics than documents issued by the Pope.

Attitudes are far more positive than anticipated. It is curious that for all the doctrine on creation being “good” that Catholics did not score higher than the Protestant groups. Regardless of between-group variation, the positive evaluation of affective attitudes towards the mussels indicates that all four groups will be receptive to conservation programs for the mussels. However, the groups do differ in their willingness to support government spending on mussel conservation efforts. Our data does support Guth et al.’s (1995) finding that Catholics are more willing to support environmental initiatives. This could be due to the difference in metrics. Guth et al. (1995) assessed willingness to support environmental initiatives in broader terms, whereas we focused narrowly on government spending and endangered freshwater mussels.

The fact that all three religious groups are statistically less supportive of government spending on mussel conservation programs than the Nones should be taken into consideration when designing outreach materials. For example, Nones might be more willing than the religious groups to donate financial resources to conservation efforts. It is a limitation of this study that we did not ask respondents whether or not they personally would fund freshwater mussel conservation programs.

Assessing behavioral intentions through mail surveys is difficult due to social desirability bias (Schutt, 2012). Respondents were informed that the mussels discussed in the survey are federally endangered species. Though it is never stated in the survey, respondents most likely inferred that reporting negative behavioral intentions such as killing or moving a mussel would be less socially desirable than putting it back where the animal was found. Although results may be influenced by the social desirability bias,

Lynn White's hypothesis that Christians are more directly destructive to the environment due to a Western emphasis on action is not supported in the behavioral intention data.

### 3.15 Future Directions

The American cultural landscape is religiously diverse and politically polarized. Local, state, and national security is threatened by ecological crises such as climate change and biodiversity loss through rapid, mass species extinction. Because humans cause these ecological crises, they are inherently social and therefore "wicked problems" with no single solution, and attempted solutions often cause various other types of problems (Rittel & Webber, 1973). U.S. environmental policy was effective during the 1960's through the 1980's. Since the 1990's, however, U.S. environmental policy has become increasingly ineffective through legislative gridlock, a product of extreme political partisanship (Klyza and Sousa, 2013). U.S. environmentalism is desperate for revitalization. The formalized social networks of churches, the social, financial, and material resources of parishes, and the willingness to conserve creation of religious adherents offer private alternative pathways to solving public ecological crises. The increasing category of religious Nones demonstrates more positive values and attitudes towards wildlife. As a group, Nones undoubtedly need to be included in conservation efforts. However, conservation efforts already target secular groups such as anglers, boaters, park visitors, and recreators of all kinds. There has been no widespread, organized effort to include religious groups in conservation programs. This is a potential limitation to the success of conservation programs because U.S. citizens are more intensely involved with religious organizations than any other type of voluntary organization (Steensland et al., 2000). Utilizing the networks and resources available

through religious organizations may enhance the overall effectiveness of conservation outreach and education programs. As our outreach campaign for the federally listed species of freshwater mussels in the Tippecanoe River continues, we will attempt to utilize the motivational and mobilizing power of religious organizations to spread our conservation messages. Our mail surveys included a section for respondents to list any organization, including churches and other religious groups, which the respondent thought would assist in our campaign. We will contact the organizations listed in the data to gauge their interest in promoting our campaign. We hope that by including religious organizations with secular groups such as anglers, boaters, and park visitors, we will be able to reach a wider range of audiences that will learn the importance of and engage in freshwater mussel conservation efforts.

## CHAPTER 4 CONCLUSION

The “wicked problem” of ecological crises first caught the American public’s attention in the late 1960’s. The environmental problems and the related public concerns in the 1960’s and 1970’s were tempered by legislative solutions. For a period of time these legislative solutions were effective, but due to the “wickedness” of environmental problems, more conflict arose that is not currently mitigated by the environmental statutes that originated in the during the 1960’s and 1970’s. For example, the “Endangered Species Management: Public Perceptions and Conflicts with Freshwater Mussel Conservation” chapter of this document describes some literature that shows some of these statutory regulations may motivate landowners to engage in the opposite behaviors promoted in the statutes, such as the Endangered Species Act (ESA). In order to supplement the provisions and goals in the ESA, conservation and natural resource managers can employ the use of community-based social marketing and other outreach and education strategies that engage the public and relevant stakeholders.

These strategies recognize that humans are the drivers of destructive environmental changes. The entirety of humanity is outside the scope of governmentally funded programs, including our study funded by the Indiana Department of Natural Resources. We focused on a single issue (federally listed species of freshwater mussels) within a bounded geographic area (the riparian land along the Tippecanoe River). This

relatively narrow focus is beneficial in effecting behavioral change at the community level (McKenzie-Mohr, 2011). Within the community, we can identify target groups that interact most with the Tippecanoe River and therefore also impact the health of the river's federally listed freshwater mussels. These groups include anglers, canoers and kayakers, children, and visitors of parks. These types of groups are not unique to the Tippecanoe River and can be viewed as groups traditionally targeted in outreach and education programs. In addition to these traditionally targeted audiences, we also acknowledge the need for specialized outreach materials and behaviors specific to the conservation issue within a geographic area (e.g., groups that are opposed to freshwater mussel conservation when it conflicts with land-use around lakes). Based on our data, we know that awareness of a conservation conflict and residence in that area of conflict are negatively associated with attitudes toward endangered mussels. This finding can be applied to other conservation efforts for imperiled species. When conservation of an imperiled species involves issues with private land-use, outreach specialists should be aware of negative attitudes in that area. They may need to adjust outreach materials or strategies. It might also be advisable to not draw unnecessary attention to the conflict, as awareness of the conflict may be associated with negative attitudes.

We also recognize that involving religious organizations with outreach programs can potentially increase the amount of people campaign information and behaviors reach. The more people involved with a specific religious organization, the more likely that there are landowners and resource users within that organization. Christian organizations in particular involve many Americans nationwide. A majority of our sample, around 60%, reported some type of Christian affiliation. This is lower than the national percentage of



Christians, which is around 70% (Pew, 2015). Depending on where an outreach campaign is implemented, churches and other religious spaces could be effective places to distribute educational materials. Churches and other religious spaces could also serve as places where individuals could be recruited for outreach activities. We believe wildlife conservation efforts promoted through community-based social marketing campaigns can be improved by involving all relevant stakeholder groups, including local religious organizations and antagonistic groups. There will always be land-use conflict over natural resource conservation, but we can increase the success of conservation by assessing attitudes of relevant stakeholder groups and by including these groups in outreach and education campaigns.

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## APPENDICES

## Appendix A Overall Affective Attitude Results

7. Please circle the number that best describes your opinion of the animal pictured above (1-7)									
(%)									
	1	2	3	4	5	6	7		Mean (n)
<b>Good</b>	51	12	10	19	4	4	4	<b>Bad</b>	2.3 (n=553)
<b>Important</b>	48	13	9	14	4	3	9	<b>Unimportant</b>	2.61 (n=543)
<b>Beautiful</b>	34	12	16	25	5	2	6	<b>Ugly</b>	2.84 (n=528)
<b>Friendly</b>	35	14	10	29	5	2	4	<b>Unfriendly</b>	2.74 (n=514)
<b>Active</b>	22	9	12	25	8	9	13	<b>Passive</b>	3.69 (n=509)
<b>Pleasant</b>	32	17	12	26	7	2	4	<b>Unpleasant</b>	2.82 (n=520)
<b>Valuable</b>	42	12	11	16	7	4	8	<b>Worthless</b>	2.77 (n=531)
<b>Clean</b>	40	13	13	22	6	3	5	<b>Dirty</b>	2.67 (n=526)
<b>Hardy</b>	25	11	15	26	9	9	6	<b>Fragile</b>	3.31 (n=515)
<b>Harmless</b>	64	12	7	12	2	1	2	<b>Dangerous</b>	1.89 (n=533)
<b>Dry</b>	18	11	12	36	9	7	7	<b>Slimy</b>	3.56 (n=513)

## Appendix B Affective Attitudes Based on Lake Freeman Awareness

<b>12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).</b>								
<b>Good-Bad (%)</b>								
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>Mean (n)</b>
<b>Aware</b>	39	8	9	31	8	0	6	2.83 (90)
<b>Unaware</b>	52	11	13	18	4	0	2	2.21 (124)
<b>Total</b>	46	10	11	23	6	0	4	2.47 (214)

<b>12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).</b>								
<b>Important-Unimportant (%)</b>								
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>Mean (n)</b>
<b>Aware</b>	40	5	7	24	6	9	11	3.18 (93)
<b>Unaware</b>	53	15	8	10	4	.8	2	2.16 (122)
<b>Total</b>	47	11	7	21	5	4	6	2.60 (215)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Beautiful-Ugly (%)								
	1	2	3	4	5	6	7	Mean (n)
Aware	22	8	18	38	3	2	10	3.39 (92)
Unaware	35	15	16	24	6	2	3	2.65 (122)
Total	30	12	17	30	4	2	6	2.97 (214)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Friendly-Unfriendly (%)								
	1	2	3	4	5	6	7	Mean (n)
Aware	33	9	12	38	3	2	2	2.85 (87)
Unaware	32	12	10	20	6	.7	1	2.54 (120)
Total	37	12	12	30	6	1	2	2.67 (207)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Active-Passive (%)								
	1	2	3	4	5	6	7	Mean (n)
Aware	23	4	13	37	7	7	9	3.54 (90)
Unaware	25	12	11	22	8	9	14	3.56 (116)
Total	24	9	12	28	7	8	12	3.55 (206)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Pleasant-Unpleasant (%)								
	1	2	3	4	5	6	7	Mean (n)
Aware	24	13	13	33	11	2	3	3.13 (91)
Unaware	33	21	14	22	7	.8	.8	2.55 (121)
Total	24	9	12	28	7	8	12	2.80 (212)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Valuable-Worthless (%)								
	1	2	3	4	5	6	7	Mean (n)
Aware	33	9	13	18	9	9	10	3.25 (93)
Unaware	45	12	16	14	9	.8	4	2.49 (122)
Total	40	10	14	16	9	4	7	2.82 (215)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Clean-Dirty (%)								
	1	2	3	4	5	6	7	Mean (n)
Aware	31	11	12	29	7	3	7	3.06 (90)
Unaware	41	12	15	19	8	2	3	2.55 (121)
Total	37	12	14	23	7	2	4	2.77 (211)



12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Hardy-Fragile (%)								
	1	2	3	4	5	6	7	Mean (n)
Aware	28	12	13	27	7	8	6	3.18 (90)
Unaware	22	11	14	23	16	9	6	3.51 (120)
Total	24	11	14	24	12	9	6	3.37 (210)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Harmless-Dangerous (%)								
	1	2	3	4	5	6	7	Mean (n)
Aware	60	10	7	18	2	2	1	2.03 (90)
Unaware	62	12	9	9	4	.8	3	1.93 (122)
Total	61	11	8	13	3	1	2	1.97 (212)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Dry-Slimy (%)								
	1	2	3	4	5	6	7	Mean (n)
Aware	13	3	18	40	7	13	7	3.89 (91)
Unaware	19	11	8	38	11	7	6	3.54 (120)
Total	17	7	12	39	9	10	6	3.69 (211)

## Appendix C Affective Attitudes Based on Monticello Residency

<b>12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).</b>								
<b>Good-Bad (%)</b>								
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>Mean (n)</b>
<b>Monticello</b>	28	14	12	31	7	.5	7	3.04 (184)
<b>Non-Monticello</b>	62	11	9	13	3	.3	2	1.92 (342)
<b>Total</b>	50	12	10	19	4	.4	4	2.32 (526)

<b>12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).</b>								
<b>Important-Unimportant (%)</b>								
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>Mean (n)</b>
<b>Monticello</b>	25	13	11	19	7	8	17	3.63 (195)
<b>Non-Monticello</b>	60	12	9	11	3	.9	5	2.06 (341)
<b>Total</b>	47	13	10	14	4	3	9	2.63 (536)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Beautiful-Ugly (%)								
	1	2	3	4	5	6	7	Mean (n)
Monticello	15	10	18	36	6	3	12	3.65 (190)
Non-Monticello	44	13	15	19	4	2	2	2.41 (331)
Total	34	12	16	25	5	2	6	2.86 (521)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Friendly-Unfriendly (%)								
	1	2	3	4	5	6	7	Mean (n)
Monticello	20	14	10	41	6	3	6	3.30 (183)
Non-Monticello	45	14	11	22	4	.6	4	2.44 (324)
Total	36	14	10	29	5	2	4	2.75 (507)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Active-Passive (%)								
	1	2	3	4	5	6	7	Mean (n)
Monticello	15	7	13	30	8	10	15	4.03 (184)
Non-Monticello	26	10	12	22	9	8	13	3.51 (318)
Total	22	9	12	25	9	9	14	3.7 (502)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Pleasant-Unpleasant (%)								
	1	2	3	4	5	6	7	Mean (n)
Monticello	16	11	14	36	10	4	8	3.58 (186)
Non-Monticello	40	19	11	21	5	.9	2	2.40 (327)
Total	31	16	12	27	7	2	4	2.83 (513)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Valuable-Worthless (%)								
	1	2	3	4	5	6	7	Mean (n)
Monticello	23	10	13	22	9	7	16	3.72 (191)
Non-Monticello	52	14	10	12	5	2	4	2.26 (333)
Total	41	13	11	16	7	4	8	2.79 (524)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Clean-Dirty (%)								
	1	2	3	4	5	6	7	Mean (n)
Monticello	22	14	16	29	5	4	10	3.31 (188)
Non-Monticello	49	12	11	18	6	2	2	2.32 (331)
Total	39	13	13	22	5	3	5	2.68 (519)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Hardy-Fragile (%)								
	1	2	3	4	5	6	7	Mean (n)
Monticello	22	11	17	31	7	7	5	3.31 (184)
Non-Monticello	27	11	14	24	9	10	6	3.33 (324)
Total	25	11	15	26	9	9	6	3.32 (508)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Harmless-Dangerous (%)								
	1	2	3	4	5	6	7	Mean (n)
Monticello	56	12	9	17	2	1	3	2.09 (190)
Non-Monticello	68	12	6	9	2	1	2	1.78 (336)
Total	64	12	7	12	2	1	3	1.89 (526)

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Dry-Slimy (%)								
	1	2	3	4	5	6	7	Mean (n)
Monticello	10	7	15	40	10	9	8	3.91 (183)
Non-Monticello	17	11	8	26	7	5	5	3.36 (323)
Total	18	11	12	36	9	7	7	3.56 (506)

## Appendix D Affective Attitudes Based on Religious Affiliation

<b>12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).</b>								
<b>Good-Bad (%)</b>								
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>Mean (n)</b>
<b>Catholic</b>	45	15	9	18	10	1	2	2.46 (89)
<b>Mainline Protestant</b>	53	13	13	16	3	0	3	2.12 (77)
<b>Evangelical Protestant</b>	47	12	11	23	4	0	3	2.37 (114)
<b>No Affiliation</b>	57	12	7	15	3	1	5	2.18 (100)
<b>Total</b>	50	13	.1	18	.1	.5	3	380

<b>12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).</b>								
<b>Important-Unimportant (%)</b>								
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>Mean (n)</b>
<b>Catholic</b>	42	15	4	11	7	8	13	2.99 (92)
<b>Mainline Protestant</b>	44	10	14	17	7	3	5	2.60 (81)
<b>Evangelical Protestant</b>	42	16	7	15	5	3	10	2.73 (117)
<b>No Affiliation</b>	61	10	10	8	1	3	7	2.14 (101)
<b>Total</b>	48	13	9	13	5	4	9	391

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Beautiful-Ugly (%)								
	1	2	3	4	5	6	7	Mean (n)
<b>Catholic</b>	30	13	13	25	7	4	7	3.05 (92)
<b>Mainline Protestant</b>	27	12	21	27	5	3	6	3.05 (78)
<b>Evangelical Protestant</b>	28	14	15	29	7	2	4	2.96 (113)
<b>No Affiliation</b>	42	13	16	19	3	0	6	2.53 (97)
<b>Total</b>	32	13	16	25	6	2	6	380

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Friendly-Unfriendly (%)								
	1	2	3	4	5	6	7	Mean (n)
<b>Catholic</b>	32	13	13	30	6	3	3	2.89 (87)
<b>Mainline Protestant</b>	29	16	8	32	8	4	6	3.00 (73)
<b>Evangelical Protestant</b>	35	14	13	32	4	0	2	2.62 (111)
<b>No Affiliation</b>	47	18	9	18	0	1	6	2.34 (98)
<b>Total</b>	36	15	11	28	4	1	4	369

<b>12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).</b>								
<b>Active-Passive (%)</b>								
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>Mean (n)</b>
<b>Catholic</b>	19	9	14	26	9	8	15	3.83 (86)
<b>Mainline Protestant</b>	21	15	10	21	10	21	14	3.71 (73)
<b>Evangelical Protestant</b>	24	9	16	23	11	7	9	3.47 (108)
<b>No Affiliation</b>	22	12	11	21	8	9	17	3.75 (97)
<b>Total</b>	21	11	13	23	10	9	14	364

<b>12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).</b>								
<b>Pleasant-Unpleasant (%)</b>								
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>Mean (n)</b>
<b>Catholic</b>	26	19	16	19	9	6	5	3.01 (88)
<b>Mainline Protestant</b>	32	18	11	29	7	1	3	2.75 (76)
<b>Evangelical Protestant</b>	29	16	13	34	5	0	4	2.86 (112)
<b>No Affiliation</b>	40	18	14	18	4	1	5	2.52 (97)
<b>Total</b>	32	18	13	25	6	2	4	373



12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Valuable-Worthless (%)								
	1	2	3	4	5	6	7	Mean (n)
<b>Catholic</b>	37	15	11	10	11	7	9	2.97 (91)
<b>Mainline Protestant</b>	42	9	9	21	9	4	7	2.84 (77)
<b>Evangelical Protestant</b>	39	10	15	15	6	5	10	2.95 (113)
<b>No Affiliation</b>	58	10	5	15	3	1	8	2.31 (99)
<b>Total</b>	33	11	10	15	7	4	8	380

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Clean-Dirty (%)								
	1	2	3	4	5	6	7	Mean (n)
<b>Catholic</b>	38	16	12	1	6	6	6	2.77 (90)
<b>Mainline Protestant</b>	40	13	10	27	5	0	4	2.60 (77)
<b>Evangelical Protestant</b>	36	13	15	23	8	3	2	2.70 (111)
<b>No Affiliation</b>	45	11	11	20	4	2	6	2.57 (97)
<b>Total</b>	40	13	13	19	6	3	4	375

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Hardy-Fragile (%)								
	1	2	3	4	5	6	7	Mean (n)
<b>Catholic</b>	17	17	16	23	12	10	5	3.44 (87)
<b>Mainline Protestant</b>	26	9	17	27	8	5	8	3.29 (77)
<b>Evangelical Protestant</b>	23	11	23	22	10	10	3	3.26 (111)
<b>No Affiliation</b>	29	12	5	25	12	9	8	3.40 (96)
<b>Total</b>	24	12	15	24	10	9	6	371

12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).								
Harmless-Dangerous (%)								
	1	2	3	4	5	6	7	Mean (n)
<b>Catholic</b>	58	17	6	11	3	1	3	2.02 (91)
<b>Mainline Protestant</b>	68	4	5	17	3	0	4	1.96 (79)
<b>Evangelical Protestant</b>	65	14	8	11	2	0	0	1.71 (114)
<b>No Affiliation</b>	76	9	6	4	0	2	2	1.60 (98)
<b>Total</b>	67	12	7	11	2	.8	2	382

<b>12. and 7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).</b>								
<b>Dry-Slimy (%)</b>								
	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>Mean (n)</b>
<b>Catholic</b>	14	14	14	33	10	7	8	3.66 (87)
<b>Mainline Protestant</b>	20	5	16	36	9	8	5	3.55 (75)
<b>Evangelical Protestant</b>	13	12	11	42	9	6	6	3.68 (110)
<b>No Affiliation</b>	22	17	12	31	6	9	4	3.25 (96)
<b>Total</b>	17	12	13	4	9	7	6	368

## Appendix E Support of Government Funding to Protect Mussels Results

<b>14. and 9. Please answer the following questions while thinking about the animal pictured on the previous page. g. Government money should be used to protect these mussels.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Aware</b>	30	18	23	18	12	2.64 (95)
<b>Unaware</b>	11	13	36	22	19	3.25 (140)
<b>Total</b>	18	15	31	20	16	3.00 (235)

<b>14. and 9. Please answer the following questions while thinking about the animal pictured on the previous page. g. Government money should be used to protect these mussels.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Monticello</b>	31	16	29	14	10	2.55 (202)
<b>Non-Monticello</b>	12	9	33	24	22	3.34 (373)
<b>Total</b>	19	12	32	20	18	3.07 (575)

<b>14. and 9. Please answer the following questions while thinking about the animal pictured on the previous page.</b>						
<b>g. Government money should be used to protect these mussels.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	22	14	27	21	16	2.95 (100)
<b>Mainline Protestant</b>	18	19	31	20	13	2.92 (85)
<b>Evangelical Protestant</b>	23	14	31	18	15	2.90 (124)
<b>No Affiliation</b>	11	6	29	23	31	3.57 (109)
<b>Total</b>	20	13	28	22	19	395

## Appendix F Attitudes toward Lowering Lake Freeman

<b>15. When thinking about the lowering of Lake Freeman, how strongly do you agree or disagree with the following statements?</b>						
<b>j. When necessary, water levels in Lake Freeman should be lowered to increase water levels in the Tippecanoe River to protect mussels.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Aware</b>	24.7	29.0	9.7	21.5	15.1	2.73 (93)
<b>Unaware</b>	3.6	3.6	35.8	43.1	13.9	3.60 (137)
<b>Total</b>	12.2	13.9	25.2	34.3	14.3	3.25 (230)

<b>15. When thinking about the lowering of Lake Freeman, how strongly do you agree or disagree with the following statements?</b>						
<b>j. When necessary, water levels in Lake Freeman should be lowered to increase water levels in the Tippecanoe River to protect mussels.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Monticello</b>	30	32	17	15	6	2.37 (78)
<b>Non-Monticello</b>	4	4	31	42	18	3.64 (159)
<b>Total</b>	13	14	26	33	14	3.22 (237)

## Appendix G Attitudes toward Repealing the Endangered Species Act

<b>15. When thinking about the lowering of Lake Freeman, how strongly do you agree or disagree with the following statements?</b>						
<b>g. I think we as a nation should repeal the Endangered Species Act.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Aware</b>	25.0	27.2	28.3	6.5	13.0	2.55 (92)
<b>Unaware</b>	24.8	25.5	36.5	8.8	4.4	2.42 (137)
<b>Total</b>	24.9	26.2	33.2	7.9	7.9	2.48 (229)

<b>15. When thinking about the lowering of Lake Freeman, how strongly do you agree or disagree with the following statements?</b>						
<b>g. I think we as a nation should repeal the Endangered Species Act.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Monticello</b>	20	31	31.2	7	16	2.71 (77)
<b>Non-Monticello</b>	27	24	35	9	5	2.39 (157)
<b>Total</b>	25	25	34	8	8	2.50 (234)

## Appendix H Wildlife Value Orientations: Use

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>a. Humans should manage wild animal populations so that humans benefit.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	10	18	27	39	7	3.16 (102)
<b>Mainline Protestant</b>	4	36	31	24	4	2.89 (90)
<b>Evangelical Protestant</b>	2	16	41	34	8	3.28 (131)
<b>No Affiliation</b>	11	31	24	27	7	2.89 (110)
<b>Total</b>	7	24	31	31	7	433

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>b. The loss of some individual wild species is acceptable if the population of animals is not jeopardized.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	8	8	21	55	8	3.48 (101)
<b>Mainline Protestant</b>	4	17	18	51	10	3.46 (90)
<b>Evangelical Protestant</b>	1	10	19	31	9	3.68 (131)
<b>No Affiliation</b>	12	15	21	44	8	3.21 (108)
<b>Total</b>	6	12	20	53	9	430



<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>c. If animal populations are not threatened, we should use wildlife to add to the quality of human life.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	2	7	22	60	10	3.69 (102)
<b>Mainline Protestant</b>	4	27	57	12	12	3.77 (90)
<b>Evangelical Protestant</b>	2	2	22	61	13	3.82 (131)
<b>No Affiliation</b>	3	12	29	49	6	3.45 (109)
<b>Total</b>	3	5	25	57	10	432

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>d. It is important for humans to manage the populations of wildlife.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	2	10	31	47	10	3.53 (102)
<b>Mainline Protestant</b>	2	7	28	51	12	3.64 (90)
<b>Evangelical Protestant</b>	2	7	27	53	11	3.46 (132)
<b>No Affiliation</b>	3	8	23	56	10	3.62 (108)
<b>Total</b>	3	8	27	52	11	432

## Appendix I Wildlife Value Orientations: Rights

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>e. The rights of wildlife are more important than human use of wildlife.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	9	25	40	21	6	2.90 (102)
<b>Mainline Protestant</b>	8	39	33	16	5	2.70 (89)
<b>Evangelical Protestant</b>	18	32	32	18	2	2.54 (130)
<b>No Affiliation</b>	2	19	39	28	13	3.31 (108)
<b>Total</b>	10	28	36	21	6	429

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>f. Animals should have rights similar to the rights of humans.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	16	45	22	14	4	2.45 (102)
<b>Mainline Protestant</b>	6	56	17	6	6	2.29 (89)
<b>Evangelical Protestant</b>	34	37	18	8	2	2.05 (131)
<b>No Affiliation</b>	6	39	23	22	9	2.88 (109)
<b>Total</b>	19	44	20	13	5	431

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>g. I object to hunting because it violates the rights of an individual animal to exist.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	28	49	15	4	5	2.10 (102)
<b>Mainline Protestant</b>	36	42	16	2	5	1.98 (89)
<b>Evangelical Protestant</b>	49	34	10	1	7	1.80 (132)
<b>No Affiliation</b>	28	38	20	7	7	2.29 (109)
<b>Total</b>	36	40	15	4	6	432

## Appendix J Wildlife Value Orientations: Bequest and Existence

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>h. It is important that Indiana always have abundant fish and wildlife.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	1	3	14	48	34	4.12 (102)
<b>Mainline Protestant</b>	4	2	11	53	30	4.01 (91)
<b>Evangelical Protestant</b>	1	2	13	59	26	4.08 (131)
<b>No Affiliation</b>	0	0	6	49	46	4.40 (109)
<b>Total</b>	1	2	11	52	34	433

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>i. Whether or not I get out to see wildlife as much as I'd like, it's important to know that they exist in Indiana.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	2	0	8	51	39	4.25 (102)
<b>Mainline Protestant</b>	1	2	3	58	35	4.24 (91)
<b>Evangelical Protestant</b>	1	0	10	60	29	4.17 (131)
<b>No Affiliation</b>	1	2	5	47	45	4.34 (108)
<b>Total</b>	1	1	7	54	67	432

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>j. We should be sure future generations of Indiana will have an abundance of fish and wildlife.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	1	2	13	40	44	4.25 (102)
<b>Mainline Protestant</b>	1	1	6	56	36	4.25 (91)
<b>Evangelical Protestant</b>	0	0	12	54	34	4.21 (131)
<b>No Affiliation</b>	1	1	6	40	52	4.43 (108)
<b>Total</b>	1	1	9	47	41	435

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>k. It's important to me to know that there are healthy populations of wildlife in Indiana.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	1	1	12	47	39	4.23 (102)
<b>Mainline Protestant</b>	1	3	8	53	35	4.18 (91)
<b>Evangelical Protestant</b>	0	1	15	57	28	4.11 (131)
<b>No Affiliation</b>	1	0	6	44	49	4.39 (109)
<b>Total</b>	1	1	11	50	37	433

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>1. It's important to maintain fish and wildlife so that future generations can enjoy them.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	1	3	5	47	44	4.30 (102)
<b>Mainline Protestant</b>	1	1	4	53	41	4.31 (91)
<b>Evangelical Protestant</b>	0	0	10	55	35	4.25 (131)
<b>No Affiliation</b>	1	0	6	36	58	4.50 (109)
<b>Total</b>	1	1	7	48	44	433

## Appendix K Wildlife Value Orientations: Education

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>m. I enjoy learning about wildlife.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	1	3	20	38	38	4.10 (102)
<b>Mainline Protestant</b>	1	1	13	54	31	4.12 (91)
<b>Evangelical Protestant</b>	0	2	12	63	24	4.08 (131)
<b>No Affiliation</b>	0	0	12	51	37	4.25 (109)
<b>Total</b>	.5	1	14	52	32	433

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>n. It's important that all Indiana residents have a chance to learn about wildlife in the state.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	1	3	17	44	35	4.10 (102)
<b>Mainline Protestant</b>	1	4	15	50	30	4.02 (91)
<b>Evangelical Protestant</b>	0	0	18	62	21	4.03 (131)
<b>No Affiliation</b>	0	0	11	53	36	4.25 (109)
<b>Total</b>	.5	2	15	53	30	433

<b>23. and 17. Thinking about wildlife in general, please indicate your level of agreement or disagreement with the statements below.</b>						
<b>o. It's important that we learn as much as we can about wildlife.</b>						
	<b>Strongly Disagree (%)</b>	<b>Disagree (%)</b>	<b>Neutral (%)</b>	<b>Agree (%)</b>	<b>Strongly Agree (%)</b>	<b>Mean (n)</b>
<b>Catholic</b>	1	3	20	40	36	4.08 (102)
<b>Mainline Protestant</b>	1	4	18	46	31	4.01 (91)
<b>Evangelical Protestant</b>	0	2	23	57	18	3.91 (131)
<b>No Affiliation</b>	0	1	14	50	36	4.20 (109)
<b>Total</b>	20	3	19	49	30	433



## Appendix L Original Mail Survey

## Your Views on Mussels in the Tippecanoe River

Dear Tippecanoe River Resident,

Historically, the Midwest has supported the most diverse community of freshwater mussels in the world. Presently, about 70% of mussel species are extinct or threatened. Some species of mussels that used to thrive in the Tippecanoe River are no longer found there. Others that used to be common are now very rare. The Tippecanoe River is home to six endangered species of mussels.

Researchers at Purdue University are investigating people's perceptions of the mussels in the Tippecanoe River. Your insights as a local resident are particularly important to us. We would greatly appreciate your participation in a survey to help us learn how we might best protect these rare species of mussels. This is your chance to be heard.

There are two ways to complete our survey. The most convenient way is for you to provide your responses securely online by entering the following website address into your web browser:

<http://tinyurl.com/MusselsOutreach>

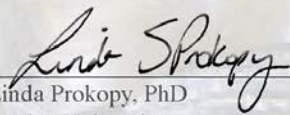
If you choose to complete the survey online, you will need to enter the following code:

This lets us know that you have completed the survey so that we will stop sending reminders. We have also enclosed a paper version with a postage-paid return envelope if you prefer to respond by mail. **The information you provide is confidential and will never be linked to your name**, only to this code, which will be used only for the purpose of knowing who has responded.

**We ask that this survey be completed by the person in your home who interacts most with the Tippecanoe River and who is at least 18 years old.** The survey should take approximately 15-20 minutes to complete.

Your voluntary participation in this survey is very important to ensure that we understand your thoughts and concerns about mussels in the Tippecanoe River. If you have any questions about the survey, please contact Linda Prokopy at Purdue University at (765) 494-0825. Thank you in advance for your help!

Sincerely,



Linda Prokopy, PhD  
Purdue University

**PLEASE READ BEFORE BEGINNING THIS SURVEY:**

The survey must be completed by an adult member of your household who is 18 years of age or older. Please mark all answers clearly, in pen or pencil, as indicated below:

Example "A"

Example "B"

**1. During the last 12 months, how often did you do each of the following activities?**

	Never	Once	2 to 5 times	More than 5 times
a. Fish in the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Hike along the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Motorized boating in the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Bird watch along the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Hunt along the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Camp along the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Swim in the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Float trip in the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Ride an ATV in/through the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. Ride a horse in/through the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**2. With whom do you primarily recreate in the Tippecanoe River?**

- My family, mostly children
- Adult friends
- My family, mostly adults
- Myself alone

**3. Why do you fish? (check all that apply)**

- For food
- To catch smaller fish for bait
- For sport/to get a trophy mount
- Other \_\_\_\_\_
- For fun/to enjoy the outdoors
- I do not fish

- 
- 
4. When motorized boating, how concerned are you about oil spills or other fuel leaks?
- Not at all
  - Slightly
  - Moderately
  - Very much
  - I do not boat
5. When canoeing/kayaking, how often do you carry your canoe/kayak over shallow water areas?
- Never
  - Sometimes
  - Always
  - I do not canoe/kayak
6. After canoeing/kayaking/boating, how often do you check your vehicle and/or equipment for invasive species?
- Never
  - Sometimes
  - Always
  - I do not canoe/kayak/boat
7. When recreating in the Tippecanoe River, how do you access the river? (check all that apply)
- From my house
  - From a public access point (please specify where) \_\_\_\_\_
  - I do not recreate in the Tippecanoe River
  - Other (please specify where) \_\_\_\_\_
8. Do you recreate in Lake Freeman or Lake Shafer?
- No
  - Yes, only Lake Freeman
  - Yes, both
  - Yes, only Lake Shafer



These are freshwater mussels. There are **six endangered species of mussels** found in the Tippecanoe River. Mussels like the ones pictured here were once found in every major river of Indiana. Mussels, also known as freshwater clams, have disappeared from many of our rivers, but the Tippecanoe River remains home to a diverse range of freshwater mussels.

Please answer the following questions while thinking about the animal in the pictures above. We are interested in your “gut reaction” to this animal, so please respond even if you have never seen one before.

9. Have you seen a **live freshwater mussel** in a river?
- No
- Yes, in the Tippecanoe River (most recent time/place) \_\_\_\_\_
- Yes, in another river (most recent time/place) \_\_\_\_\_
10. Have you seen a **dead freshwater mussel or an empty mussel shell** in a river?
- No
- Yes, in the Tippecanoe River (most recent time/place) \_\_\_\_\_
- Yes, in another river (most recent time/place) \_\_\_\_\_
11. Have you seen a **live freshwater mussel on the banks** of the Tippecanoe River?
- No
- No, but I've seen a dead freshwater mussel or an empty mussel shell on the banks of the Tippecanoe River
- Yes

12. Please circle the number in each row that best describes **your opinion of the mussels** pictured above (1-7).

Good	1	2	3	4	5	6	7	Bad
Important	1	2	3	4	5	6	7	Unimportant
Beautiful	1	2	3	4	5	6	7	Ugly
Friendly	1	2	3	4	5	6	7	Unfriendly
Active	1	2	3	4	5	6	7	Passive
Pleasant	1	2	3	4	5	6	7	Unpleasant
Valuable	1	2	3	4	5	6	7	Worthless
Clean	1	2	3	4	5	6	7	Dirty
Hardy	1	2	3	4	5	6	7	Fragile
Harmless	1	2	3	4	5	6	7	Dangerous
Dry	1	2	3	4	5	6	7	Slimy

---

**13. If I caught one of the mussels on the previous page while fishing or during some other outdoor activity, I would (please check all that apply):**

- |   |  |
|---|--|
| <input type="checkbox"/> Put it back where I found it                                 | <input type="checkbox"/> Call a resource professional (IDNR/Extension)       |
| <input type="checkbox"/> Throw/place it in the river if I found it on the river banks | <input type="checkbox"/> Skip/throw it across the water like a rock or stone |
| <input type="checkbox"/> Take it home alive   | <input type="checkbox"/> Take it home dead                                   |
| <input type="checkbox"/> Keep it to use its shell                                     | <input type="checkbox"/> Kill it   |
| <input type="checkbox"/> Throw it on the river banks                                  | <input type="checkbox"/> Other (please specify) _____                        |
| <input type="checkbox"/> Eat it   |  |

**14. Please answer the following questions while thinking about the mussels pictured on the previous page:**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. If I saw these mussels, I would catch or touch them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. I would like to keep one of these mussels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. These mussels are valuable for their shells.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. I think these mussels are good bait to use while fishing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. These mussels help to improve water quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. These mussels harm local ecosystems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Government money should be used to protect these mussels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. I would try to find/hunt more of these mussels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. These mussels are important to the Tippecanoe River ecosystem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

- 
- 
15. Before taking this survey, had you heard anything about the **six endangered species of mussels** in the Tippecanoe River?
- No
- Yes, please specify where \_\_\_\_\_
16. Is it legal or illegal to remove a **live, endangered mussel** from the waters of Indiana?
- Legal
- Illegal
- Don't know
17. Is it legal or illegal to remove a **dead, endangered mussel or its empty shell** from the waters of Indiana?
- Legal
- Illegal
- Don't know
18. Is it legal or illegal to remove **ANY native, live mussel** from the waters of Indiana?
- Legal
- Illegal
- Don't know
19. Is it legal or illegal to remove **ANY native, dead mussel or its empty shell** from the waters of Indiana?
- Legal
- Illegal
- Don't know
20. Have you heard anything about **zebra mussels** in the Tippecanoe River or in any bodies of water in Indiana?
- No
- Yes

**21. People in our society often disagree about how far to let individuals go in making decisions for themselves. How strongly do you agree or disagree with each of these statements?**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. The government interferes far too much in our everyday lives.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Sometimes the government needs to make laws to keep people from hurting themselves.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. It's not the government's business to try and protect people from themselves.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. The government should stop telling people how to live their lives.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. The government should do more to advance society's goals, even if that means limiting the freedom and choices of individuals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. The government should put limits on the choices individuals can make so they don't get in the way of what's good for society.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**22. Please indicate your level of agreement or disagreement with the statements below.**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. The way I care for my yard or farm can influence the water quality of the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. It is my personal responsibility to help protect water quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. It is important to protect water quality even if it slows economic development.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. My actions have an impact on water quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. I would be willing to change the way I care for my yard or farm to improve water quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. The quality of life in my community depends on good water quality of the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. I would be willing to pay more to improve water quality (e.g. recreational fees, local taxes, etc.).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Government money should be used to support a variety of wildlife in the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. When necessary, water levels of Lake Freeman and Lake Shafer should be lowered to increase water levels of the Tippecanoe River to protect mussels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

23. Thinking about **wildlife in general**, please indicate your level of **agreement or disagreement** with the statements below.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Humans should manage wild animal populations so that humans benefit.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. The loss of some individual wild animals is acceptable if the population of animals is not jeopardized.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. If animal populations are not threatened, we should use wildlife to add to the quality of human life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. It is important for humans to manage the populations of wild animals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. The rights of wildlife are more important than human use of wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Animals should have rights similar to the rights of humans.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. I object to hunting because it violates the rights of an individual animal to exist.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. It is important that Indiana always have abundant fish and wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Whether or not I get out to see wildlife as much as I'd like, it's important to know that they exist in Indiana.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. We should be sure future generations of Indiana will have an abundance of fish and wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k. It's important to me to know that there are healthy populations of wildlife in Indiana.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l. It's important to maintain fish and wildlife so that future generations can enjoy them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
m. I enjoy learning about wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
n. It's important that all Indiana residents have a chance to learn about wildlife in the state.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
o. It's important that we learn as much as we can about wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



**24. People get information about wildlife from a variety of sources. To what extent do you trust each organization listed below as a source of information about wildlife?**

	Not at all	Slightly	Moderately	Very much	Am not familiar
a. Neighbors/Friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Natural Resource Conservation Service (NRCS)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. U.S. Fish and Wildlife Service	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Purdue University Extension	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Indiana Department of Natural Resources (IDNR)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Indiana Department of Environmental Management (IDEM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Environmental groups (Sierra Club, Natural Resource Defense Council, The Nature Conservancy, etc.)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. County Soil and Water Conservation District (SWCD)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Canoe liveries/rental facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. Local school teachers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k. Conservation officers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l. Naturalists at parks and forests	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**25. Where are you likely to seek information about wildlife? (check all that apply)**

- |   |   |
|---|---|
| <input type="checkbox"/> Newsletters/Brochures/Fact sheets                          | <input type="checkbox"/> Internet             |
| <input type="checkbox"/> Conversations with others                                  | <input type="checkbox"/> Radio                |
| <input type="checkbox"/> Social media (Facebook, Twitter, Instagram, etc.)          | <input type="checkbox"/> Local library        |
| <input type="checkbox"/> Workshops/Public meetings                                  | <input type="checkbox"/> Newspapers/Magazines |
| <input type="checkbox"/> Exhibits or displays at State Parks or other natural areas | <input type="checkbox"/> Other                |

- 
- 
26. What **type of land** do you own along the Tippecanoe River? (check all that apply)
- Residential
  - Agricultural
  - Commercial
27. Do you have a **septic system**?
- No (skip to #29)
  - Don't know
  - Yes, it was installed in \_\_\_\_\_ (year)
28. **Within the last five years, have you had any of the following problems with your septic system?** (check all that apply)
- |  |  |
|--|--|
| <input type="checkbox"/> Slow drains                         | <input type="checkbox"/> Sewage flowing to ditch |
| <input type="checkbox"/> Sewage backup in house              | <input type="checkbox"/> Other                   |
| <input type="checkbox"/> Bad smells near tank or drain field | <input type="checkbox"/> None                    |
| <input type="checkbox"/> Sewage on the surface               | <input type="checkbox"/> Don't know              |
29. Do you have **livestock and/or horses** on your property along the Tippecanoe River?
- Yes, livestock
  - Yes, livestock and horses
  - Yes, horses
  - No, I do not have livestock or horses (skip to #31)
30. Do your **livestock and/or horses have access** to the Tippecanoe River?
- Yes, my livestock have access to the river
  - Yes, my livestock and horses have access to the river
  - Yes, my horses have access to the river
  - No, neither my livestock nor my horses have access to the river
31. Are there **trees, shrubs, or other vegetative buffers** between your property and the Tippecanoe River?
- No
  - Yes, a few
  - Yes, many

- 
- 
32. How long have you lived along the Tippecanoe River? \_\_\_\_\_ years
33. What is your gender?  
 Male  Female
34. What is the highest grade in school you have completed?  
 Some formal schooling  
 High school diploma  
 Some college  
 2 year college degree  
 4 year college degree  
 Graduate degree
35. In general, how would you describe your political views?  
 Very conservative  
 Conservative  
 Moderate  
 Liberal  
 Very liberal
36. In what year were you born? 19\_\_\_\_\_
37. Are you a member of a religious organization?  
 Catholic  Jewish  
 Methodist  Other (please specify) \_\_\_\_\_  
 Christian nondenominational  No affiliation  
 Baptist  Prefer not to answer
38. How often do you attend religious services or events?  
 Never  
 Once or twice a year  
 Once a month  
 Once a week  
 Several times a week

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39. **My organization would be willing to support (e.g. put up signs, host events, etc.) that promote and protect the six endangered species of mussels in the Tippecanoe River (please check all that apply and specify what group).**

- Watershed group \_\_\_\_\_
- Local gym \_\_\_\_\_
- Hunting club \_\_\_\_\_
- Church \_\_\_\_\_
- School club \_\_\_\_\_
- Social organization/club \_\_\_\_\_
- None \_\_\_\_\_

***Thank you*** for your time and assistance!

Please return your completed questionnaire in the postage-paid envelope provided.

Please use the space below for any **additional comments** about this survey, wildlife, or natural resources in your community.

## Appendix M Second Mail Survey

## Your Views on Mussels in the Tippecanoe River

Dear Tippecanoe River Resident,

Historically, the Midwest has supported the most diverse community of freshwater mussels in the world. Presently, about 70% of mussel species are extinct or threatened. Some species of mussels that used to thrive in the Tippecanoe River are no longer found there. Others that used to be common are now very rare. The Tippecanoe River is home to six endangered species of mussels.

Researchers at Purdue University are investigating people's perceptions of the mussels in the Tippecanoe River. Your insights as a local resident are particularly important to us. We would greatly appreciate your participation in a survey to help us learn how we might best protect these rare species of mussels. This is your chance to be heard.

There are two ways to complete our survey. The most convenient way is for you to provide your responses securely online by entering the following website address into your web browser:

<http://tinyurl.com/MusselsLE>

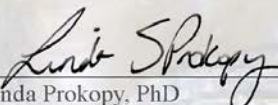
If you choose to complete the survey online, you will need to enter the following code:

This lets us know that you have completed the survey so that we will stop sending reminders. We have also enclosed a paper version with a postage-paid return envelope if you prefer to respond by mail. **The information you provide is confidential and will never be linked to your name**, only to this code, which will be used only for the purpose of knowing who has responded.

**We ask that this survey be completed by the person in your home who interacts most with the Tippecanoe River and who is at least 18 years old.** The survey should take approximately 15-20 minutes to complete.

Your voluntary participation in this survey is very important to ensure that we understand your thoughts and concerns about mussels in the Tippecanoe River. If you have any questions about the survey, please contact Linda Prokopy at Purdue University at (765) 494-0825. Thank you in advance for your help!

Sincerely,

  
Linda Prokopy, PhD  
Purdue University

**PLEASE READ BEFORE BEGINNING THIS SURVEY:**

The survey must be completed by an adult member of your household who is 18 years of age or older. Please mark all answers clearly, in pen or pencil, as indicated below:

Example "A"

Example "B"

**1. During the last 12 months, how often did you do each of the following activities?**

	Never	Once	2 to 5 times	More than 5 times
a. Fish in the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Hike along the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Motorized boating in the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Bird watch along the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Hunt along the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Camp along the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Swim in the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Float trip in the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Ride an ATV in/through the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. Ride a horse in/through the Tippecanoe River	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**2. When recreating in the Tippecanoe River, how do you access the river? (check all that apply)**

- I do not recreate in the Tippecanoe River     From my house  
 From a public access point (please specify where) \_\_\_\_\_  Other (please specify where) \_\_\_\_\_

**3. Do you recreate in Lake Freeman or Lake Shafer?**

- No                                       Yes, only Lake Freeman  
 Yes, both                                 Yes, only Lake Shafer



These are freshwater mussels. There are **six endangered species of mussels** found in the Tippecanoe River. They are federally protected under the Endangered Species Act. Mussels need a specific level of water to survive. When river levels get too low, Lake Freeman is lowered to put more water into the Tippecanoe River. In the summer of 2012 and in early August of this year this happened. The event has received widespread media attention.

Please answer the following questions while thinking about the animal in the pictures above. We are interested in your “gut reaction” to this animal, so please respond even if you have never seen one before.

4. **Have you seen a live freshwater mussel in a river?**
  - No
  - Yes, in the Tippecanoe River (most recent time/place) \_\_\_\_\_
  - Yes, in another river (most recent time/place) \_\_\_\_\_
  
5. **Have you seen a dead freshwater mussel or an empty mussel shell in a river?**
  - No
  - Yes, in the Tippecanoe River (most recent time/place) \_\_\_\_\_
  - Yes, in another river (most recent time/place) \_\_\_\_\_
  
6. **Have you seen a live freshwater mussel on the banks of the Tippecanoe River?**
  - No
  - No, but I've seen a dead freshwater mussel or an empty mussel shell on the banks of the Tippecanoe River
  - Yes

7. Please circle the number in each row that best describes your opinion of the mussels pictured above (1-7).

Good	1	2	3	4	5	6	7	Bad
Important	1	2	3	4	5	6	7	Unimportant
Beautiful	1	2	3	4	5	6	7	Ugly
Friendly	1	2	3	4	5	6	7	Unfriendly
Active	1	2	3	4	5	6	7	Passive
Pleasant	1	2	3	4	5	6	7	Unpleasant
Valuable	1	2	3	4	5	6	7	Worthless
Clean	1	2	3	4	5	6	7	Dirty
Hardy	1	2	3	4	5	6	7	Fragile
Harmless	1	2	3	4	5	6	7	Dangerous
Dry	1	2	3	4	5	6	7	Slimy

- 8. If I caught one of the mussels on the previous page while fishing or during some other outdoor activity, I would (please check all that apply):**
- |   |  |
|---|--|
| <input type="checkbox"/> Put it back where I found it                                 | <input type="checkbox"/> Call a resource professional (IDNR/Extension)       |
| <input type="checkbox"/> Throw/place it in the river if I found it on the river banks | <input type="checkbox"/> Skip/throw it across the water like a rock or stone |
| <input type="checkbox"/> Take it home alive   | <input type="checkbox"/> Take it home dead                                   |
| <input type="checkbox"/> Keep it to use its shell                                     | <input type="checkbox"/> Kill it   |
| <input type="checkbox"/> Throw it on the river banks                                  | <input type="checkbox"/> Other (please specify) _____                        |
| <input type="checkbox"/> Eat it   |  |

**9. Please answer the following questions while thinking about the mussels pictured on the previous page:**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. If I saw these mussels, I would catch or touch them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. I would like to keep one of these mussels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. These mussels are valuable for their shells.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. I think these mussels are good bait to use while fishing.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. These mussels help to improve water quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. These mussels harm local ecosystems.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Government money should be used to protect these mussels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. I would try to find/hunt more of these mussels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. These mussels are important to the Tippecanoe River ecosystem.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. Nature will take care of the mussels, therefore we don't need to protect them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k. Mussels in the Tippecanoe River indicate that the river is healthy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



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10. Before taking this survey, had you heard anything about the **six endangered species of mussels in the Tippecanoe River?**

- No  
 Yes, please specify when and where (e.g. newspapers, television, DNR, etc.) \_\_\_\_\_

11. Before taking this survey, had you heard anything about the **lowering of Lake Freeman?**

- No  
 Yes, please specify when and where (e.g. Herald Journal, WLFI, Journal and Courier, word of mouth, etc.) \_\_\_\_\_

12. Before taking this survey, did you know **Lake Freeman was lowered to protect endangered mussels in the Tippecanoe River?**

- No  
 Yes

13. **Who do you think is responsible for the lowering of Lake Freeman?**

- |   |   |
|---|---|
| <input type="checkbox"/> Northern Indiana Public Service Company (NIPSCO) | <input type="checkbox"/> Shafer & Freeman Lakes Environmental Conservation Corporation (SFLECC) |
| <input type="checkbox"/> Federal Energy Regulation Commission (FERC)      | <input type="checkbox"/> City of Monticello   |
| <input type="checkbox"/> U.S. Fish & Wildlife Service (USFWS)             | <input type="checkbox"/> Other (please specify) _____   |
| <input type="checkbox"/> Indiana Department of Natural Resources (IDNR)   | <input type="checkbox"/> Don't know   |

14. When thinking about **quality of life in Monticello**, how strongly do you **agree or disagree** with the following statements?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Quality of life depends on Lake Freeman economics.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Quality of life depends on Tippecanoe River economics.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Quality of life depends on local water quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Local water quality and local economics are linked together.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Seasonal economics are more important than water quality of the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

15. When thinking about the **lowering of Lake Freeman**, how strongly do you agree or disagree with the following statements?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Business in Monticello is adversely affected when Lake Freeman levels are lowered.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Recreation opportunities are reduced when lake levels are lowered.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Recreation in Lake Freeman is more important than protecting endangered mussels in the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. There should be advance warning when lake levels are lowered.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Mussels in Lake Freeman suffer when lake levels are lowered.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. The federal government is out of touch with local priorities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. I think we as a nation should repeal the Endangered Species Act.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. It is unfair to local business owners when lake levels are lowered.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. It is unfair to boaters when lake levels are lowered.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. When necessary, water levels of Lake Freeman should be lowered to increase water levels in the Tippecanoe River to protect mussels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k. Nature will take care of river levels without us lowering lake levels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l. I think there should be another solution to protecting the endangered mussels in the Tippecanoe River other than lowering Lake Freeman levels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
m. I think people who live on Lake Freeman are overreacting about the lowered lake levels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
n. Before lowering Lake Freeman, government officials should take local events (e.g. bass tournaments) into consideration.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
o. I personally lose money when Lake Freeman levels are lowered.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**16. When thinking about water quality of the Tippecanoe River, how strongly do you agree or disagree with the following statements?**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. The way I care for my yard or farm can influence the water quality of the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. It is my personal responsibility to help protect water quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. It is important to protect water quality even if it slows economic development.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. My actions have an impact on water quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. I would be willing to change the way I care for my yard or farm to improve water quality.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. The quality of life in my community depends on good water quality of the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. I would be willing to pay more to improve water quality (e.g. recreational fees, local taxes, etc.).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Government money should be used to support a variety of wildlife in the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. There is often raw sewage in the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. Agricultural tiles contribute to excess flooding of the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k. Over the years, I have noticed a decrease of fish in the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l. I think the Tippecanoe River is too dirty to recreate in.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
m. Agricultural runoff (e.g. fertilizers, pesticides) pollutes the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
n. Over the years, I have noticed a decrease of wildlife in and along the Tippecanoe River.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Your Views on Local Water Resources

17. Thinking about **wildlife in general**, how strongly to you **agree or disagree** with the following statements?

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. Humans should manage wild animal populations so that humans benefit.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. The loss of some individual wild animals is acceptable if the population of animals is not jeopardized.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. If animal populations are not threatened, we should use wildlife to add to the quality of human life.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. It is important for humans to manage the populations of wild animals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. The rights of wildlife are more important than human use of wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Animals should have rights similar to the rights of humans.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. I object to hunting because it violates the rights of an individual animal to exist.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. It is important that Indiana always have abundant fish and wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Whether or not I get out to see wildlife as much as I'd like, it's important to know that they exist in Indiana.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. We should be sure future generations of Indiana will have an abundance of fish and wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k. It's important to me to know that there are healthy populations of wildlife in Indiana.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l. It's important to maintain fish and wildlife so that future generations can enjoy them.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
m. I enjoy learning about wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
n. It's important that all Indiana residents have a chance to learn about wildlife in the state.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
o. It's important that we learn as much as we can about wildlife.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**18. People in our society often disagree about how far to let individuals go in making decisions for themselves. How strongly do you agree or disagree with each of these statements?**

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. The government interferes far too much in our everyday lives.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Sometimes the government needs to make laws to keep people from hurting themselves.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. It's not the government's business to try and protect people from themselves.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. The government should stop telling people how to live their lives.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. The government should do more to advance society's goals, even if that means limiting the freedom and choices of individuals.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. The government should put limits on the choices individuals can make so they don't get in the way of what's good for society.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**19. Do you own or rent the property to which this survey was sent?**

- Own  
 Rent (skip to #21)

**20. What type of land do you own along the Tippecanoe River? (check all that apply)**

- Residential  
 Agricultural  
 Commercial

**21. How long have you lived along the Tippecanoe River? \_\_\_\_\_ years**

**22. Are there trees, shrubs, or other vegetative buffers between your property and the Tippecanoe River?**

- No  
 Yes, a few  
 Yes, many

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23. Do you own property on **Lake Freeman**?

- No  
 Yes

24. What is your **gender**?

- Male  Female

25. In what **year** were you born? 19\_\_\_\_\_

26. What is the **highest grade in school** you have completed?

- Some formal schooling  
 High school diploma  
 Some college  
 2 year college degree  
 4 year college degree  
 Graduate degree

27. In general, how would you describe your **political views**?

- Very conservative  
 Conservative  
 Moderate  
 Liberal  
 Very liberal

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28. Are you a member of a **religious organization**?

- |  |   |
|--|---|
| <input type="checkbox"/> Catholic                    | <input type="checkbox"/> Jewish                       |
| <input type="checkbox"/> Methodist                   | <input type="checkbox"/> Other (please specify) _____ |
| <input type="checkbox"/> Christian nondenominational | <input type="checkbox"/> No affiliation               |
| <input type="checkbox"/> Baptist                     | <input type="checkbox"/> Prefer not to answer         |

29. How **often** do you attend religious services or events?

- Never
- Once or twice a year
- Once a month
- Once a week
- Several times a week

30. **My organization would be willing to support (e.g. put up signs, host events, etc.) that promote and protect the six endangered species of mussels in the Tippecanoe River (please check all that apply and specify what group).**

- Watershed group \_\_\_\_\_
- Local gym \_\_\_\_\_
- Hunting club \_\_\_\_\_
- Church \_\_\_\_\_
- School club \_\_\_\_\_
- Social organization/club \_\_\_\_\_
- Other \_\_\_\_\_
- None

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***Thank you*** for your time and assistance!

Please return your completed questionnaire in the postage-paid envelope provided.

Please use the space below for any **additional comments** about this survey, wildlife, or natural resources in your community.

