MICHIGAN MUTE SWANS: A CASE STUDY APPROACH TO ETHICAL ARGUMENT ANALYSIS

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ABSTRACT

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The perceived ecological and social threat posed by mute swans (Cyqnus olor) in Michigan has led the Michigan Department of Natural Resources to implement population control strategies. This has been met with opposition and the resulting public debate has become contentious. Appropriate and acceptable mute swan management hinges on concerns for wildlife conservation, mute swan welfare, and public safety. These are value-driven concerns founded upon our notions of a healthy social and ecological system. While science can provide empirical and descriptive information about the system, it cannot tell us if or how we ought to intervene. A systematic analysis of the reasons employed to both defend and critique the proposed management plan can be useful toward this end. For this project I conducted a qualitative content analysis of regional online news articles discussing the mute swan issue to identify recurrent reasons used for and against the management plan. I then developed these reasons into formal arguments to determine the relevance, strength and rigor of each argument. This analysis revealed ethical disagreements and empirical inadequacies, suggesting more work could be done to clarify more reasonable and logical, approaches to address this issue. If we commit to effective and sound argumentation in our address of conservation issues, as we detail with Michigan's mute swan issue, we have the opportunity to craft policy that reflects and responds to diverse stakeholder values in a justified and transparent fashion.

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INTRODUCTION

Development of natural resource management policies requires a combination of what we know about the world with what we value in the world. Although values are inherent in these decisions, rarely do political frameworks acknowledge the ethical dimension of management actions. My research explores the ethical dimension of Michigan mute swan management as a case study and my research aims to demonstrate a systematic tool for incorporating such dimensions into our management frameworks. By implementing management actions in this ethical framework we can work toward understanding which reasons are logical and justified, and if any are not, search for more justifiable reasons to reach a justified conclusion.

Mute Swans in Michigan

In the late 1800s Americans imported mute swans (*Cygnus olor*) from Eurasia to the United States to, in their mind, enhance the appearance of public parks and private estates. In 1919, Mr. George Bruce Douglas brought a pair of mute swans to Lake Charlevoix. The Chicago Club, then later the East Jordan sportsman's club, took care of the swans. The pair of swans eventually became feral and grew to a flock of over 40 birds by the mid-1940s (Wood and Gelston 1972). Mute swans have since become prolific in Michigan and throughout the United States.

Three swan species inhabit or migrate through Michigan: mute swans, trumpeter swans (*Cygnus buccinators*), and tundra swans (*Cygnus columbianus*). The trumpeter swan is native to Michigan and currently listed as a state threatened species. Habitat loss and hunting nearly wiped out the trumpeter swan population in the early 1900s, but the population has since

recovered to a sustainable level (Michigan Department of Natural Resource 2012). Tundra swans are also native to Michigan, but only migrate through the state in the spring and fall, each stopover lasting about a month (Petrie & Wilcox 2003). Mute swans have now become more prevalent than native swan species, with a population size estimated to be over 15,000 in Michigan (MDNR 2012).

The rapid and widespread growth of the mute swan population in Michigan and several other states has resulted in their designation an invasive species in North America. The National Invasive Species Council (ISAC 2006) defines invasive species as, "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health," (p. 1). Many states where mute swan populations have become prolific, including Michigan, have developed management plans to reduce or eradicate the birds, as populations continue to grow and expand (MDNR 2012). The Michigan Department of Natural Resource (MDNR) perceives mute swans to be a severe threat for three reasons: 1) they are aggressive toward humans; 2) they out-compete native wildlife; and 3) they destroy wetland habitat by uprooting aquatic vegetation (MDNR 2012).

According to the MDNR (2011), mute swans have been managed since the 1960s, although it is unclear what methods (e.g. culled, nest and egg destruction) were used to manage the species. Recent management efforts include implementing a ban on rehabilitation of injured mute swans and the release of mute swans back into the wild. Shortly after implementation of this ban, the Natural Resource Commission approved the final draft of the Mute Swan Management and Control Program Policy and Procedures on January 23, 2012. The long-term management goal is to reduce the mute swan population by ninety percent by 2030.

More immediate goals are to reduce mute swan population to zero on Michigan DNR-owned lands and reduce population growth to zero on all other lands in Michigan. The primary method of control includes culling swans by shooting them in the head, although nest destruction and egg addling will supplement population control. The MDNR hopes to achieve these goals with support from conservation groups and private landowners. The MDNR allows private landowners and lake associations to apply for permits to assist with population control. Seventy percent of Lake Association members must approve control before a permit is issued (MDNR 2012).

Stakeholder Participation in Management Decision-Making

Wildlife does not acknowledge human boundaries, such as the division between public and private land. Therefore, management agencies must be able to count on local, private landowners to support management strategies where the agency may not have the resource or jurisdiction to implement them. Without public support and satisfaction of management decisions, management goals are less likely to be achieved (Wooden 2006). Public involvement in and acceptance of policies are crucial for successful policy implementation and long-term success (Endtner-Wada, Blahna, Krannich & Brunson 1998; Garcia-Llorente et al. 2011; Gore et al. 2011; Perry & Perry 2008; Treves & Naughton-Treves 2005; Wooden 2006). Contemporary wildlife management has placed a greater emphasis on stakeholder participation in the decision-making process (Decker & Purdy 1988; Perry & Perry 2008) with hopes that wildlife management becomes more representative of public values, and thus management goals are more likely to be met.

Incorporating the public into the decision-making framework without a sincere understanding and appreciation of their values may delay or prevent implementation of management actions, or it could lead to lawsuits (Hart, Nisbit & Shanahan 2008; Perry and Perry 2008). Maryland mute swan management acts as an example of how democratizing management can still be ineffective at reducing conflict if the underlying values are at odds and not addressed. Initial efforts to reduce mute swan populations in the United States began in the Chesapeake Bay region. The state of Maryland employed the Mute Swan Task Force to identify the issues associated with mute swans on the Chesapeake Bay and develop a relevant management plan. With the exception of one member, the resulting plan was endorsed by the task force, including the Humane Society of the United States (Horton 2001). Still, animal rights activists met these efforts with opposition.

Management was halted when the Fund for Animals and three local residents filed a lawsuit to stop the killing of mute swans. They maintained that mute swans should remain protected under the Federal Migratory Bird Treaty Act, regardless of their non-native status. This Act is an agreement between the United States and Canada that makes it illegal to pursue, hunt, take, capture, kill or sell listed migratory birds. A court ruling in 2001 concluded mute swans were to remain federally protected under the Act and all management actions continue to filter through the United States Fish and Wildlife Service (USFWS) (Maryland DNR 2003; USFWS 2005).

In 2004, the creation of the Migratory Bird Treaty Reform Act excluded non-native species from federal protection. Exclusion from the Act allows state wildlife agencies to manage non-native populations, including mute swans, as they deem necessary (USFWS 2005).

Although federal protection has been removed for mute swans, disagreement ensues over killing them in the Chesapeake Bay and now in Michigan. After the Maryland DNR was reauthorized to cull mute swans, an article published in the *Washington Post* suggests the Mute Swan Task Force was "sharply divided" (Halsey III 2009) and contradicts earlier statements suggesting the task force was mostly in agreement about the management actions. Although Michigan has not faced lawsuits, culling has been delayed in some areas so MDNR officials can further explain to the public why action is being taken to reduce the swan population. Local government and conservation organizations allowed for public hearings on the issue but these did not result in a change of course (Hart 2012).

The MDNR invited sixteen interest groups to participate in the Michigan mute swan forum to develop Michigan's mute swan management policy, including: Ducks Unlimited, Michigan Audubon Society, Friends of the Detroit River, Kellogg Biological Station of Michigan State University, Rouge River Bird Observatory of the University of Michigan, Michigan Lake and Stream Association, Michigan Humane Society, and the Detroit Zoological Society (USDA-APHIS 2012). According to the MDNR (2010), the forum, "agreed that increased actions needed to be taken to reduce mute swan numbers to protect the natural resource of this state," (p.2). However, even with participation from diverse interest groups, the decision to cull a large percentage of the mute swan population has, at times, led to controversy in Michigan (Evert 2011). Animal welfare groups, such as the Humane Society of the United States and "Save Our Swans," challenge the validity and extent of scientific evidence used to support the MDNR's management techniques. Many assert mute swans have a long history in the United States and should remain protected under the Migratory Bird Treaty Reform Act. Several conservation

groups, on the other hand, are in support of the MDNR's plan to eradicate the swans because of the supposed long-term threat they pose to native species and aquatic ecosystems.

Environmental Ethics

Values and ethics underlie the discussion about whether or not, and how, to control mute swans. Ethics help us decide what is good or bad, right or wrong and serve as a guide in our interactions with world around us. Our ethics derive from culture, community, religion, family, or education and may develop over the course of a lifetime. Environmental ethics is a sub-discipline of ethics that guides us in determining what is good or bad, right or wrong in relation to the natural world (Nelson 2002).

People might assign value to elements of the natural world in two ways: intrinsically or instrumentally. Intrinsic value means something is valuable in and of itself; something is good simply because it exists. For example, some might consider a white-tailed deer intrinsically valuable. As it is, a deer is directly good. Instrumental value means something has value as a means to an end, such as its ability to provide something to humans. The same white-tailed deer might also be instrumentally valuable to some. We hunt deer for its meat, thus the deer provides something for us, and because it provides something, it is indirectly good. We extend our moral boundaries of respect and care to the things that we believe to possess intrinsic value (Nelson 2002). This means we generally give the same consideration to those things as we would to ourselves. Elements of the world that possess instrumental value might have indirect moral standing—they have value, but only as a means to an end. Philosophers categorize how we extend our moral boundaries boundaries based on what is worthy of direct moral

standing. These categories include anthropocentrism, zoocentrism, biocentrism, and ecocentrism.

Traditional ethics considered only humans to be intrinsically valuable– meaning only humans deserve direct moral consideration. This traditional moral extension is called anthropocentrism. Through this moral lens, concern for non-human beings and communities is tied to the instrumental value they possess (Goralnik & Nelson 2011). An example of an anthropocentric guided action would be removing mute swans from a lake because flocks crowd lakes, and thus hinder human recreation activities. Conversely, an anthropocentrist might opt to not control mute swan populations because they are enjoyable to look at.

Ethicists and philosophers began to consider extensions to this "moral community" based on the qualities we might share with non-human communities. If we share similar qualities, we also ought to give those non-human communities the same direct moral consideration as we would ourselves. These qualities might be sentience, or the ability to suffer or feel pain. Zoocentrists believe that, in addition to humans, certain non-human individuals count directly. This typically arises from a perceived similarity that these nonhuman individuals and humans possess (Nelson 2002), such as the ability to feel pain. Thus, some might give mute swans direct moral consideration because they perceive swans feel and express pain. A zoocentrist might not extend the same consideration to a mollusk or less "intelligent" species, because it is not sentient or is not perceived to feel pain.

Biocentrists give direct moral consideration to all individual living things. Therefore, all living beings possess intrinsic value (Goralnik & Nelson 2011). In the discussion about mute

swan management, biocentrists might argue against lethal control because as living beings, mute swans deserve direct moral consideration and killing them would be wrong.

Lastly, some might consider "wholes" as worthy of direct moral consideration. This philosophy is referred to as Ecocentrism and guided by an understanding of the context in which non-human entities live. Whereas zoocentrists and biocentrists consider individuals, ecocentrists consider the context in which these individuals live. To an ecocentrist, a population or ecosystem is as relevant and worthy of direct consideration as the individuals within. For individuals to thrive, they require the interactions that compose systems and "wholes". Thus, any threat or disruption to a "whole" or system is wrong. Since mute swans are perceived to be a threat to ecosystem integrity, an ecocentrist might argue it is worth eliminating this threat for the protection of the larger system (Nelson 2002).

A common conflict between stakeholders is an attributed value toward either individuals or a collective (e.g. populations, species, and ecosystems) (Vucetich & Nelson 2007). These values can be described by one's environmental ethics. For example, an ecocentrist might argue it is acceptable to kill mute swans because they negatively impact the larger system. By killing some individuals, there is a greater, positive impact on the natural system. On the other hand, a biocentrist might argue it is not acceptable to kill mute swans because they have value in and of themselves. In this case, value is attributed toward an individual, living being. The individual versus collective value conflict appears to also lie at the heart of the controversy about whether or not mute swans should be killed. Sometimes the good of an individual is in conflict with the good of the group and navigating this conflict

requires us to make hard decisions about which one we prioritize and why, and which one we let go of and when.

Various stakeholders value different things in the natural world, and those values are derived from a variety of places. These values help define interactions with the natural world, and help one to understand what is right or wrong about these interactions. Our environmental ethics shape our approval or disapproval of natural resource policy (Gore et al. 2011). Not all stakeholders in a particular natural resource discussion will identify with the same category of philosophical thinking. If natural resources are a public good, then we ought to consider all stakeholder values and do our best to find common ground at the values level. Understanding how people derive their ethics and values toward the environment can help alleviate underlying disagreement toward natural resource decisions. According to Vucetich, Nelson & Peterson (2012), "common mistakes in dealing with values include ignoring some, having a dismissive attitude about others, or insisting that only one value matters. The appropriate approach is to acknowledge and understand all of the values at stake, and then develop a perspective or position that would least infringe upon that set of values," (p. 127). If we thoughtfully address the ethical dimension of natural resource discussion, we can work toward achieving consensus at the values level.

Science-Guided Management

Science can help us describe the world. It helps us understand what mute swans eat, how many swans are on a lake and how mute swans interact with other wildlife and within the ecosystem. Science, though, cannot tell us why one should or should not value sentient beings or natural systems, or why one might prefer native species in a natural habitat. Science alone,

therefore, cannot prescribe an action in or for a system. Rather, it offers guidance for devising and implementing wildlife management plans (Avery and Tillman 2005). The combination of science and values allows us to make fully-informed and ethically justified management actions (Moore and Nelson 2010).

Science tends to be perceived as a neutral, objective force in guiding policy. However neutral and objective science may be, "agency budgets, pressures from political constituents, ideology and other factors limit the extent to which policy decisions flow directly from scientific findings," (Cox 2006, p. 335). The current perception of science in management frameworks often leaves little room for public opinion or values as components in determining a comprehensive course of action, regardless of the limitations to science. The MDNR employs science-guided management in their mute swan policy development. However, the MDNR has also taken steps to incorporate public opinion and utilizes a statistic-based model that includes values to guide their management (Barb Avers, MDNR Waterfowl Specialist, presentation on September 23, 2011). This model accounts for "biological effectiveness, economic costs and minimizing the total number of swans that ultimately are killed," (Ellis and Elphick 2007, p. 312). The framework put forth in this model is suggested to increase efficiency, efficacy, and acceptability in controlling the swans. However, it does not acknowledge how or why control is acceptable or unacceptable. This may relate to the concept of "wildlife acceptance capacity. "WAC is the maximum wildlife population level in an area that is acceptable to people. WAC is particularly useful for assessing how wildlife population management decisions may affect public opinion," (Decker & Purdy 1988, p. 53). Moreover, Conover (2002) suggests as wildlife populations increase, positive value orientations toward wildlife tend to decrease. The

difficulty with natural resource management is that we tend to be good at understanding wildlife populations, but rarely, if ever consider these natural resource decisions under an ethical lens (Moore & Nelson 2010).

Natural Resources Communication

In addition to the difficulties that may arise with divergent moral philosophies and incorporating values into management frameworks, there are occasional misunderstandings between scientists and non-scientists. The use of science-based methods, although important (Avery & Tillman 2005) in understanding the natural world, has a tendency to get lost in translation to the general public. Many scholars express their concern over the disconnect between scientists and non-scientists, and managers, policy-makers and the public (Lodge & Shrader-Frechette 2003; Perry & Perry 2008; Wooden 2006). Lodge & Shrader-Frechette (2003) suggests scientists, as citizens, are permitted to express their personal judgments of invasive species management. However, in doing so, they must distinguish to the public when they are communicating science or personal judgments.

A more broad concern in natural resource management is the communication and understanding of science. Just as values might be discounted by managers and policy-makers, science might be discounted by stakeholders, particularly if it is misunderstood. Prevot-Julliard et al. (2011) place the responsibility of understanding biodiversity and conservation issues on the public prior to their engagement in the public participation process of management. On the other hand, Wooden (2006) holds scientists responsible for properly communicating science to lay audiences involved in policy discussions. Several complexities stand in the way of effective science communication beyond attributing responsibility to who should understand or

communicate what. The media play a major role in translating management issues and science to the public. Media framing (Cox 2006) of issues can impact how the public understands the science and perceives management actions. Further, jargon and value-ridden language surround invasive species discourse.

There is often a lack of clarity and consistency of terminology used by scientists, managers, public, and journalists when discussing invasive species. The difference between "invasive" and "non-native" species are not readily apparent to those outside the field of ecology and are not always consistently defined even between state and federal agencies. The terms are often used interchangeably by the media, public and managers and each term has a significantly different meaning (Perry & Perry 2008; Davis & Thompson 2011). Some consider the variation of jargon as part of media framing, where the language usage might be intentional to sway people in one direction or another in their perception of invasive species. Davis and Thompson (2011) suggest scientific assessments of the economic or ecological impacts a nonnative species has on the local environment should exist prior to defining a species as "invasive." Without clearly separating the language of "invasive" from "non-native," the interchangeable use of these terms can diminish the scientific meaning of the terms and thus the value placed on management of invasive species (Colautti and MacIsaac 2004). Although seemingly superficial, distinctions such as "non-native" and "invasive" make a huge difference in the legal requirements of an agency to manage them. Colautti and MacIsaac (2004) point out that scientific credibility can also be diminished through divisive and inconsistent language. When science is supposed to be the bottom-line in management policy, this lack of credibility can only hinder wildlife management.

Larson et al. (2005) found that the choice of particular words can shape images of the situation for the public. Larson et al. characterize the variable and inconsistent invasive species terms as "militaristic metaphors". The invasive species lexicon can invoke fear of exotic species or hide the realities of managing invasive species. Mute swans are often characterized by agency officials as "voracious eaters," "overly aggressive," and "aliens." These terms all negatively describe mute swans. Conversely, some members of the public consider mute swans symbolic, graceful and beautiful. The eradication of mute swans is commonly referred to as "culling." According to Larson et al. (2005), the use of such terms may hide the fact an animal is being killed. Several scholars (e.g. Colautti and MacIsaac, 2004; Davis et al., 2011; Sagoff, 2003) advocate for better clarity and consistency in terminology. This, then, might be an initial approach to better communicating science and management to the public.

Additionally, the role of the public in decision-making might be discounted if nonscientists are considered to lack scientific expertise. In reality, the decision-making process should combine scientific expertise with the public's on-the-ground knowledge of and values toward natural resource policy. A problem with this management perspective might lie in the ability to combine science and values into a holistic policy-making process. Many professionals are good at one or the other, and might not know how or when to engage in ethical dialogues. Therefore, steps need to be taken to appropriately address the missing ethical dimension in conservation management. My research moves forward to close this gap in management decision-making by offering a tool that systematically bridges ethical dialogue into current management frameworks.

Conservation Ethics

Ambiguous terminology, the complexity of relaying scientific discourse to the public and underlying philosophical values can diminish the efficacy of management actions. Investing in the effort to understand the conflicting views and values of stakeholders (Vucetich & Nelson 2007) and determine if further discrepancies exist may strengthen the decision-making processes and outcomes (Gore et al. 2011).

My research explored a values-based approach to management decision-making. I use ethical argument analysis, a systematic method of identifying and analyzing arguments (Vucetich & Nelson 2012) to better understand the effectiveness of arguments for and against mute swan management in Michigan. This process defines the discipline of conservation ethics. Ethical argument analysis allows one to transform the reasons used to justify an action, in this case whether or not we should control mute swans, into a formal argument. Laying out an argument premise by premise allows us to strip away the rhetoric to better assess the effectiveness of the arguments being used. Ethical argument analysis identifies both the scientific and ethical information needed to justify an action, and observe if that information is missing, misaligned with the action, or simply untrue. Application of ethical argument analysis to a contentious issue provides an opportunity to illuminate both stakeholder and agency values and develop a systematic approach to achieving consensus at the values level. Although agencies might have the most utility for ethical analysis, stakeholders involved in these discussions may also benefit from an awareness both of the ethical implications of the arguments they employ and the effectiveness or strength of these arguments as vehicles of persuasion and dialogue.

With many emerging management decisions, natural resource managers have the opportunity to use this framework to look more closely at the ethical underpinnings of their actions. Mute swan management presents an ideal case for incorporating such methodologies. This issue is contentious as a result of multiple, conflicting values. The issue is also timely and ongoing, which allows us to understand an issue as it emerges and is implemented. Finally, this research presents an important opportunity to bring ethics fully into the conservation decision-making realm. Although wildlife management decisions are seldom framed as ethical decisions (Gore et al., 2011; Perry and Perry, 2008; Vucetich and Nelson, 2007), doing so allows us to fuse philosophy and ethics, sociology, and wildlife ecology. This fusion, in turn, engages us in a rich and fully interdisciplinary decision-making process.

Thesis Overview

My thesis is organized into two chapters. In Chapter 1 I detail my approach for identifying the reasons for and against mute swan management in Michigan. Using a qualitative content analysis of regional, online news stories I systematically and iteratively identify the values at stake in this issue. I then discuss how the results from this content analysis lead to Chapter 2, where I detail my ethical argument analysis method. In each chapter I explain the rationale for the method and my process, then share results and offer a discussion of these results. In the conclusion I bring together the results from each of these methods to discuss the implications for management.

CHAPTER ONE

DESCRIBING THE DEBATE SURROUNDING MICHIGAN MUTE SWAN MANGMENT USING CONTENT ANALYSIS OF ONLINE NEWS

INTRODUCTION

The questions of whether or not and how to manage mute swans can invoke a multitude of values. The pluralistic nature of the issue is not unique to natural resource management. Currently MDNR managers are faced with divergent values in the dialogues about opening a hunting season for grey wolves in Michigan, using biodiversity as a guiding force in management, and addressing our ever-growing consumption of energy. However, these values are often considered mutually exclusive when determining a course of action and this leads to contentious debates. Michigan's mute swan management policy is similarly contentious and the issue is currently playing out in the news media. Therefore, an analysis of the news coverage of this issue can lend insight into what justifications are used in support of or opposition to management alternatives and at what frequency such justifications are used in this discussion.

I began this research by employing a qualitative content analysis (Hsieh & Shannon 2005) of Michigan online news articles to identify the reasons people used to defend or critique mute swan management policy in Michigan. Reasons are statements that justify a given action or belief, and they are the foundation of arguments. They ground how or why people determine the appropriateness of an action. After determining what reasons occur with the greatest frequency in this discussion, I transitioned into the argument analysis stage of my research to see what arguments (built from reasons) are effective based on their logic,

relevance and rigor. The combination of content analysis and argument analysis allowed me to understand the roots of a contentious issue, such as the values and science at stake, and develop an understanding for how this process might be useful for conservation issues later.

Mass Media Role in Natural Resource Management

How and where the public acquire environmental information might influence attitudes toward management actions. Information might be attained through media, friends, family, school, work and a variety of other outlets that can alter the integrity of the information. One common place people acquire environmental information is from mass media, and news media in particular (Cox 2006). Corbett (1995, p.397) confirmed that, "a frequent and pervasive indirect source of wildlife information is news coverage in the mass media." There are three theories about the role media plays in mediating the public's receipt of environmental information: agenda setting, media framing and cultivation theory. Agenda setting theory suggests media sources, such as the news, provide much of the information people think *about*, rather than *what* to think (McCombs & Shaw 1972). Media framing theories suggest media organize messages in a particular way to "suggest what is at issue," (Cox 2006, p. 199) and may play a role in shaping *how* the public think about this information (Entman 1989). Finally, cultivation theory suggests repetitious messages tend to, "produce agreement with the views contained in those message," (Cox 2006 p. 198).

In the media, focusing events can play a key role in calling attention to a particular issue (Krosnick, Holbrook, Lowe & Visser 2006). Focusing events tend to increase publicity of an issue, resulting in repetitious messages. This repetition of information is considered an important factor for saliency and impact (Chyi & McCombs 2004; Krosnik et. al 2006). Conflicts,

such as human-wildlife conflicts, can enhance the presence of the issues in the media (Protess et al., 1987; Siemer et al., 2007). Furthermore, if readers lack prior knowledge about issues their attitudes may become more susceptible to media influence (Entman 1989; Protess et. al 1987). Changes in coverage, possibly caused by focusing events might also present potential problems, as they may create an unanticipated change in an argument's persuasiveness.

Content analysis is a widely used tool to understand media framing, agenda setting, cultivation theory, and more specifically, it has been used to identify trends, risk and risk perceptions, attitudes and values. My aim was not to *evaluate* the effects of cultivation theory, media frames or agenda setting, but to recognize the various roles of media in the process of natural resource policy development. My research did however, focus on the cultivation theory, and I used this theory to speculate that reasons in support or opposition to mute swan management that occurred most frequency would be most likely to have impact in the discussion.

Evaluation of invasive species control from the social perspective remains a topic that is analyzed in a very broad manner (e.g., invasive species control rather than a specific species control or regional plans). For example, Warren (2007), Davis et al. (2011) and Lodge & Shrader-Frechette (2003) each analyzed and discussed invasive species nomenclature. Few research publications using content analysis have focused on a species and region, and the research that did center on a focal issue has offered more direct contributions to wildlife management (e.g. Gore et al., 2011; Muter, Gore & Riley 2009; Siemer et al. 2007; Webb & Raffaelli 2008). In general, the volume of content analysis research on invasive species management is limited. Prior content analysis strategies focus on assessment of opinions and attitudes toward

management plans (e.g. Houston et al. 2010; Redpath et al. 2004); risk perception and framing (e.g. Muter et. al 2009; Siemer et al. 2007); and values (e.g. Gore et. al 2011; Kellert 1984). Content analysis has been shown as an effective tool to understand ongoing conflicts (Webb & Raffaelli 2008) and highlighting potential conflicts (Bengston & Fan 1999). "Content analysis can help to understand value-driven conflicts over biodiversity issues by clarifying differences between stakeholder groups," (Webb & Raffaelli 2008, p. 1203) and their justifications for decisions (i.e. ethical paradigms) (Gore et al. 2011). Rarely is content analysis used as a tool to simply describe the discussion surrounding a natural resource management issue—who is saying what, where and when.

For this analysis I have employed qualitative content analysis to an emerging issue. My analysis roots out the values within the discussion about whether or not and how to manage mute swans in Michigan. I applied content analysis to a specific case, whereby the specificity of the approach might be more informative for management and provide generalizable results for future natural resource issues. The content analysis formed the basis for the argument analysis by breaking down the rhetoric and surfacing the values at stake.

METHODS

Methodological Framework

The objective of this portion of the study was to develop a descriptive understanding of the mute swan discussion using a grounded theory approach (Glaser & Strauss 1967). This is an inductive approach to research about a phenomenon for which a suitable theory does not already exist. Building on this approach, I employed qualitative content analysis to abstract information from my data sources. Content analysis is widely used in the social sciences as a

means to systematically analyze text. One can employ it in a number of ways, based upon research questions and conceptual or theoretical frameworks. According to Hsieh and Shannon (2005), there are three different approaches to content analysis: conventional, summative and directed. The differences between the approaches lie in how codes are derived, the coding scheme is developed and how reliability is measured (Hsieh and Shannon 2005). Summative content analysis is used to understand the deeper context of the content, typically by coding keywords and using quantitative measures to understand their usage. The directed approach uses theory or preexisting frameworks to guide coding. My explicit interest was to determine the reasons in support of or against the mute swan policy, an objective that could be served with a conventional approach to qualitative content analysis. This approach allows codes to emerge directly from the sources, rather than designating preconceived categories to the data, and thereby limits assumptions and prejudices imposed on the data (Hsieh and Shannon 2005). The conventional content analysis and constant comparison (Glaser & Strauss 1967) methods guided my coding process and analysis. The implications for this portion of the study allowed me to more strategically employ argument analysis to match the on the ground discussion surrounding mute swan management.

Sample and Source Gathering

I chose to analyze online news articles to better understand the reasons associated with Michigan's mute swan management policy (M.S.M.P). With increased accessibility and use of online news resource (Pew Research Center 2012), online news might offer a better representation of what information people received regarding the mute swan discussion in Michigan. Because my research questions focused on a specific case, I chose purposive,

sampling to achieve representativeness (Plano Clark & Creswell 2008). Rather than sampling at random, purposive sampling techniques allowed me to sample based on my specific research objectives-- describing the Michigan mute swan management discussion. Further, I wanted a sample that best represented how the mute swan management discussions are playing out in Michigan, so I sampled to achieve representativeness (Plano Clark & Creswell 2008).

I chose online news as a medium for sampling because I was interested in obtaining the most influential reasons in this discussion. I derived sources from Michigan media, because I was interested in maintaining a sample that best represents Michigan's interests. Michigan news sources are likely to best represent Michigan issues, and most likely to influence Michiganders. The discussion about controlling mute swans is paralleled in other states, including Maryland, Rhode Island and Ohio. Michigan has most recently implemented control measures for mute swans. More importantly, this issue in Michigan is fresh and currently playing out and provided a more timely analysis.

My sample includes only text derived from online news, television and radio outlets. I did not consider blogs, newsletters, and articles on advocacy websites (e.g. Humane Society of the United States and National Rifle Association) for analysis. Although any source might be just as likely to persuade or dissuade, my aim was to find resource that might have the greatest influence. Not only do people tend to receive environmental information from the news (Cox 2006), news sources are perceivably more credible than other online sources. News filters through an editorial process, likely enhancing the credibility and quality of information being published. According to public surveys, news sources tend to rank higher for the credibility of the information (Flanagin & Metzger 2007). Most other online sources lack an editorial process,

thus diminishing the credibility of the information. Additionally, most news sources identify with a region, whereas other Internet sources might not include necessary location information (Metzger 2007). This would potentially take the analysis out of geographic context.

I obtained my sample by conducting two independent manual searches, one in April 2012 and the second in August 2012, and setting a three month automated search for news articles using United States Google search engine. Google ranks articles based on: "how often and on what sites a story appears online, and based on certain characteristics of news content such as freshness, location, relevance and diversity," (Google 2012). For my initial manual search I used the keywords: mute swan, Michigan. The initial search allowed me to better determine what to include or remove from my sample. For example, the first group of articles returned a sample dating from 2004-present and articles generally discussed aspects of mute swan management. Article topics frequently discussed an initial mute swan management policy passed in February 2011. This policy bans wildlife rehabilitation and the release of mute swans in Michigan. Although this presented an important turning point in the management of mute swans, it is a separate issue and would require a separate analysis of arguments. I instead focused on the most recent mute swan management policy, the final Mute Swan Management and Control Program Policy and Procedures, which was approved January 23, 2012. This management decision maintains the wildlife rehabilitation ban and is the long-term policy for managing mute swans in Michigan.

Between April 1 and 31 August 2012 I set a daily "Google Alert" for the key word, "mute swan" to maintain a continuously updated sample, which returns searches for the top ten items using defined criteria (i.e., mute swan). I conducted the second manual Google search to ensure

my sample accurately represented Michigan news sources and coverage of the issue. I again used "mute swan, Michigan." The manual search returned many more articles from smallerstream, local news sources. It was important to include these in the sample, because according to MacCallum et al. (1991, p. 360), "local media are the most pervasive source of environmental information." Information in local news sources was often recycled from larger volume newspapers, such as the *Detroit Free Press*. Although the content was identical, I analyzed all sources to maintain a frequency-based analysis.

The final sample for analysis includes articles from 1 December 2011 to 31 October 2012, which directly pertains to the final 2012 management policy. Prior to 2011, few news articles were published regarding mute swans. Since 2011, almost all mute swan news articles refer to the intended, and now approved, management policy. This time frame allowed me to analyze data immediately leading up to the management decision and after the policy was approved. I chose to end data collection in October because publicity of the mute swan issue almost completely dropped off. At this point my codes were well-grounded in the issue, as well. I maintained a Google alert after October to note if any significant changes occurred in the discussion. As of April 2012, no new articles about Michigan mute swan management have surfaced.

I saved the text of all articles in Microsoft Word to prevent the loss of information if articles were removed from websites. I also recorded descriptive information, such as the number of comments associated with an article, the number of times an article was shared or "liked" via Facebook or Twitter, and the word length of each article (see APPENDIX A). I used this information to observe and summarize general trends in the sample anecdotally. Although

these descriptors might allow me to understand if certain articles or themes produced more conversation, which might be an indicator for impact of the issue, it was not my objective to interpret and incorporate this information in the analysis.

<u>Codinq</u>

I coded by means of the constant comparison method (Glaser & Strauss 1967). This method is applied in the grounded theory approach and combines coding with analysis to systematically generate theory. The constant comparison method of coding is applied in four stages, "1) comparing incidents applicable to each category, 2) integrating categories and their properties, 3) delimiting the theory, and 4) writing the theory," (Glaser & Strauss 1967, p. 105). I met with two committee members to begin the pre-coding process (Saldaña 2009). We cocoded an article together and discussed and shared perspectives on the emerging themes and potential codes. I then independently read through half of the original group of articles (n=7)from the first manual search and used this initial group of articles to observe and notice themes and devise a framework for the coding scheme. I developed the coding scheme using an inductive, open-coding process. I highlighted text relevant to my research questions and noted keywords in the margin of the text that seemed to capture the theme of the highlighted content. I looked for ambiguities, consistencies and inconsistencies between articles that might develop into major themes of the issue. For example, does the incorrect or incorrect use of the word "hunting" (as opposed to "culling" or "control") change the framing of or responses in later published news articles? Across the articles I looked for how mute swans were characterized, reactions to the management plan, and how the issue was presented. I was interested in how the issue was communicated, if there was miscommunication, lack of

communication or if and how people were responding to the intended management and how these might illuminate central themes, such as concerns for animal welfare or ecosystem health. At the heart of the content analysis, my objective was to determine what reasons were being employed and were likely to have impact in the mute swan discussion. Therefore, my main focus was on identifying, categorizing and defining these reasons.

After reading through the initial sub-set of articles I began to devise my codebook. I applied the initial codebook to the entire sample and transitioned to a deductive coding process. I added and removed codes as I went through the first full round of coding as necessary. Miles and Huberman (1994) define codes as words, phrases, sentences, or whole paragraphs, associated with a specific context. I chose to code content at the sentence and multi-sentence level. I defined a code as one connected thought. If this thought was one paragraph then I coded the entire paragraph into the respective code. I chose not to code individual words, as this removed contextual meaning from the quote. Additionally, coding individual words was not in fact helpful in fulfilling the objective of this analysis. Most codes were not mutually exclusive, and I coded content using all appropriate codes. This allowed me to see how themes overlap and to develop more rich descriptions of the content. I organized themes into five major categories: 1) reasons in support of and opposition to the M.S.M.P.; 2) messengers of these reasons; 3) communication of the issue; 4) reactions to the M.S.M.P.; and 5) descriptive information about the articles. Within each of these categories are the specific codes for which I coded text. For the full list of codes please refer to the codebook (see APPENDIX A).

To establish coding consistency I developed guidelines for the study (detailed within these methods) and a codebook (see APPENDIX A) that defines codes and code categories. These guidelines also promote the opportunity for repeatability (Wimmer & Dominick 1994). After I finalized the codebook, I went through the articles a second time to make sure the codebook was effective, thorough, and that no new codes emerged (Miles and Huberman 1994). At this point I incorporated Atlas.ti software to aid in the coding and analysis process. I chose this software because it allowed me to highlight key themes within documents and store data for automated analysis. The second round of coding confirmed my codebook was "saturated," meaning no new themes or codes emerged as I applied the codebook and data fit easily into the defined codes and categories (Miles and Huberman 1994). I used Atlas.ti to view concurring codes and tally each code in the data set to identify the high-frequency reasons. I used these reasons to transition into the next stage of my project, argument analysis.

Coding Precision

I independently coded the data, so I met with a committee member throughout the coding process to peer-debrief and help ensure my process was rigorous and thorough (Lincoln & Guba 1985). Peer-debriefing is a technique to develop coding precision by working with an outside researcher or colleague to discuss emerging themes, codes, and codebook, and generate new perspectives on the data.

Code Analysis and Refinement

I utilized Atlas.ti to display co-occurring codes. This allowed me to collapse and expand upon code categories and determine if codes overlapped. I chose to refine coding categories to

avoid overlap in the topics of the argument analysis. This refinement process is explained in more detail in APPENDIX B.

RESULTS

Occurrence and Distribution of Online News Coverage

Over eleven months I obtained 55 online news articles (see APPENDIX C for descriptive statistics) that discussed the 2012 M.S.M.P. The sample represents both statewide and local news sources, within fifteen counties in Michigan. Oakland and Muskegon Counties are locations where most of the action took place. Public discussions were held in Muskegon County to explain the planned mute swan culls on White Lake. This process received a lot of the coverage, which also branched into neighboring counties, as well. After initially approving mute swans management, the Waterford Township Board of Trustees, requested additional information and later modified their decision to allow mute swan management. This local issue filtered to neighboring counties. Other counties tended to cover the issue more broadly, as a state issue, rather than a local issue. Some newspapers also cover multiple counties, which is why the number displayed in Figure 1 is greater than the sample size.

Four events relevant to mute swan management occurred during the ten-month sample period (Figure 2). The Natural Resource Commission approved the M.S.M.P in January 2012, marking the first major event in this sample. This approval allowed the MDNR to place greater departmental priority on managing mute swans in Michigan. Coverage of mute swan management in the news was stable or increasing through March. Two articles about mute swan management were published in April. In mid-April, an interaction with a mute swan led to

the drowning death of an Illinois man as he attempted to care for a pair of privately owned mute swans (Lawrence 2012). Although this was not directly related to mute swan



Figure 1: Map of Michigan displaying home counties of news sources and respective frequency of Michigan mute swan news coverage. Some newspapers cover multiple counties, which are reflected in these numbers. Four news sources are statewide and not reflected on this map. 1= Alpena, St. Clair, Barry and Kalamazoo; 2- Livingston, Macomb and Montcalm; 3= Ottawa; 4= Kent and Ingham; 5= Wayne; 8= Muskegon; and 19= Oakland.



Figure 2: Bar graph displaying frequency of news coverage per month over data collection period.

management in Michigan, it was occasionally brought up as an anecdote in Michigan newspapers. For example, the *Detroit Free Press* mentioned the incident two months after it occurred: "A man drowned near Des Plaines, III., in April while using a kayak to check on mute swans that were being used to keep geese away from a pond. Authorities have said they believe the man fell into the water when a mute swan attacked him, and he was unable to make it to shore," (Lawrence 2012). Not long after the incident in Illinois, the Humane Society of the United States officially became involved in Michigan's mute swan management discussion. According to the HSUS website, their official involvement began in May 2013, and
was picked up in the news by mid-June. The organization voiced their opposition to the killing of mute swans and requested the MDNR stop killing mute swans until a more "humane" management plan could be developed. Within two months, the MDNR denied this request and publicity of the issue dropped off completely. At this point I cut off data collection and moved forward with analyzing content.

Reasons for Argument Analysis

I identified ten reasons in support of mute swan control and eight reasons opposed to the management plan from the articles I collected during this timeframe. The reasons to control mute swans range from protecting wetland ecosystems to protecting the welfare of humans. During the process of identifying reasons I also determined it was necessary to create a second category of reasons. This second category, rather than supporting or opposing the management plan, deals with what type of control might be appropriate if we determine control is indeed acceptable.

I chose to analyze the six highest-occurring reasons I identified in the content analysis, three in support of and three against Michigan's mute swan management policy. It would be ideal to analyze all reasons as formal arguments, but argument analysis is a lengthy process (Vucetich & Nelson 2012) and it would be unrealistic to achieve that feat in the time available. Moreover, reasons that appear infrequently are less likely to be salient with the public (Chyi & McCombs 2004; Krosnik et. al 2006). Constructing formal arguments from these six reasons will provide a thorough examination of what I hypothesize to be the most influential reasons in this discussion.

Table 1 summarizes the frequency of each code and is a visual display of the refined

codes. After reorganizing codes, I determined that the three highest occurring codes for

arguments in favor of mute swan management and in opposition to mute swan management

would be the most appropriate for the argument analysis piece of the research. I analyzed

these reasons as formal arguments: "Protect Primary Producers (or vegetation)", "Aggressive

Toward Humans", and "Kill." On the opposing end, the codes I analyzed were: "No Kill",

"Science Uncertain", and "Aesthetic Value." Emphasis is added to key words in the quotes to

highlight the relevance to corresponding codes. This refinement is also summarized in Table 1.

Table 1: Reason code categorization ordered by code frequencies (displayed in parentheses). Re-categorization allowed me to analyze a larger scope of arguments, rather than analyzing three codes that fell into the same coding category. Codes that could be grouped under a larger coding category are listed in column 2, sub-codes. * indicates the code categories analyzed as arguments, and if applicable, the † indicates sub-categories I analyzed as arguments.

Reasons in support of M.S.M.P.:						
Refined Code	Operational Definition	Sub-Codes	Example			
Categories						
*Aggression (69)	Mute swans characterized as aggressive, either a general characterization or toward wildlife or humans.	†Toward Humans (51)	"Mute swans' aggression toward humans is increasingly dangerous for people in boats and on shore," (Hamling, 2012).			
		Toward Wildlife (27)	"Because of the mute swan's aggression toward native waterfowl, the DNR has long removed mute swans from state game areas," ("Mute swans have become a nuisance" 2012).			

Table 1 (cont'd)			
*Protect Ecosystem (48)	Reasons that suggest we should manage mute swans because they cause harm to an ecosystem component, multiple trophic levels or a system.	Wildlife- Consumers (<i>37</i>)	"Mute swans have been able to outcompete native waterfowl for breeding habitats" (Stickney, 2012).
		Ecosystem (27)	"Over a period of time, it's going to change the ecological makeup of the lake," (Czarnick, 2012).
		Protect Trumpeter Swans (<i>23</i>)	"The mute swan is a threat to the native trumpeter swan, a threatened species in Michigan," (Doty, 2012).
		†Primary Producers (22)	"Mute swans are capable of inflicting significant damage to aquatic habitat, by feeding heavily on aquatic vegetation," ("Mute swans have become a nuisance" 2012).
*Efficient/Effective Methods (<i>16</i>)	Support for the primary method of control- culling.		"The program will utilize a series of measures to control mute swan populations with the main focus being the elimination of adults," ("Meetings to address mute swan cull" 2012).

Table 1 (cont'd)			
Expert Voice	Content suggesting the management decisions are well-founded in science, and endorsed by reputable organizations.	Expertise/ Collaboration (12)	"We're united with hundreds of other groups that support eradication of the mute swan on the landscape," (Meyerson, 2012).
		Science (7)	"'Because of all the data and research we've done, unless there's something that can be shown that will refute that we'll be moving forward,'"(Hart, 2012).
Community Value (1)	This code will reflect a statement that suggests mute swans are diminishing the value of a community.		"It would be a significant setback to the community having done all this work only to have an invasive species take over and endanger native wildlife and destroy wetland habitat," ("Invasive mute swans are target in White Lake habitat restoration" 2012).
Non-nativity (<i>10</i>)	This code specifically represents an interest in killing mute swans for the sake of native species. Species can be waterfowl, plants, etc. as long as "native" is mentioned.		"The DNR has a long way to go to bring mute swan populations to within management goals, but considers it an important step in successfully maintaining other native waterfowl populations – ducks, geese and even other swans," ("Mute swans have become a nuisance" 2012).

Table 1 (cont'd)						
Reasons in opposition to M.S.M.P:						
Refined Code	Operational Definition	Sub-Codes	Example			
Categories						
*Alternative Methods(41)	When people refer to more humane methods, or using alternative methods rather than killing adults, use this code.		"If the species needs to be controlled, then control it in a humane way, such as sterilization, egg removal or piercing, or segregation of the young with same gender pairings," (Luxford, 2011).			
*Distrust Expert Voice	Stakeholder interest in public votes, or a more democratic process for deciding the fate of the swans. Suggestion that the authority of the decisions has a hidden agenda or is	†Science (<i>37</i>)	"The DNR lacks adequate science to support its position," ("Meetings to address mute swan cull" 2012).			
	untrustworthy for other reasons, and/or the evidence to support the plan is inadequate.	Distrust of authority (28)	"Oh, there needs to be a cull all right — of the DNR and bloodthirsty state officials who sleep with the hunting lobby," (Donnelly, 2012)			
		Alternative Expertise (18)	"She wants residents to be able to decide the swans' fate in a state election," (Campbell, 2012).			
*Aesthetic value (25)	Swans have been symbolic for their grace and beauty, and that may be reflective in the arguments opposing the management plan. The birds oftentimes enhance the aesthetics of a body of water, therefore increasing the enjoyment of nature by humans.		"Most people find mute swans awe-inspiring — a bird revered for its majesty and beauty the world over," (Rhodes, 2012).			
Aggression natural (19)	Arguments that aggression is a natural defense to protect young or territory. Additionally, many will argue the aggression is overblown.		"As for their aggressiveness, what would you do to protect your child," (Luxford, 2011)?			

Table 1 (cont'd)					
Humanity	Many will argue that the	"The DNR is lying to the			
greater	problem originates from	public by claiming that			
concern (<i>13</i>)	humans, not swans. This will	swans are ecologically			
	include humans as being the	destructive when it's			
	cause of swan introductions into	humans that wreak the			
	the United States, and humans	most havoc," (Rhodes,			
	creating more damage to	2012).			
	ecosystems than swans.				
Nativity	A large reason for culling mute	"Some say that it is not a			
shouldn't	swans is their non-native,	native species to the United			
matter (5)	invasive status. This code will	State because it was			
	reflect a statement that	brought here in the late			
	questions whether we should	1800s and therefore it			
	make decisions based on the	should not be here. Should			
	origin of a species	that same rule apply to			
		people who have not been			
		a U.S. citizen for over 200			
		years? We are all			
		immigrants," (Luxford,			
		2011).			

I graphed the top six codes in a time-ordered bar graph to observe if any coding trends occurred over time (Figures 3 and 4). Each graph displays the percent time each code appeared over the course of data collection, displayed alongside the percent of articles occurring in each month. The general trend appears to be that most codes increase over the course of data collection. However, the code for killing mute swans actually decreases over time. The overall frequency of this code occurred in comparison to the other codes might explain this discrepancy.



Figure 3: Bar graph displaying monthly frequencies of each code over time.



Figure 4: Bar graph displaying relative code frequency percentage per month.

Messengers

In addition to coding reasons for and against mute swan control, I developed codes to describe how mute swan management is framed in the news media. Messenger codes characterized what people or organizations were being represented in the news and what messages these groups were sending. This information can help identify the stakeholders and what values those stakeholders hold toward mute swan management. Messengers can also play a role in shifting message frames in the media (Cox 2006) and an increase in stakeholders might result in greater contention in the issue over time (Muter et al. 2009). I identified a messenger as a direct informant to the media—someone or some organization telling the media about the situation, rather than the media secondarily gathering information from places like organization websites.

Michigan residents were the primary messengers in this discussion. Many lake residents shared personal experiences, both positive and negative: "We have had problems for quite some time from different swans ... we had multiple attacks,' said a resident of the Middle Straits Lake Association, at the June meeting," (Rath 2012). Another lake resident says, "she enjoys watching the waterfowl on the lake, especially the swans," ("Invasive mute swans are target in White Lake habitat restoration" 2012). Some local residents also voiced their opposition to or support for the management. One resident disagrees with the decision to cull mute swans: "I think it's atrocious. I am very upset about this. I can't understand the reason for it," (Jeltema 2011). Another resident approves of the MDNR's proposal to cull mute swans: "Let's hope the DNR has the wisdom and fortitude to pursue this extermination project," ("Evidence shared for mute swan program" 2012).



Figure 5: Bar graph displaying the percent of media messages by messenger categories.

Local government officials were second to local residents in sharing messages about mute swan management. Local affiliations included: White Lake Conservation District, Waterford Township board of trustees members, White Lake Public Advisory Council, and various Lake Association Board Members, among others. Much of the discussion from local government employees derived from West Bloomfield Township's decision to rescind a previously approved decision to manage mute swans in the area. One official said this about the original proposal, "The board was under the erroneous impression the removal wouldn't involve killing swans," (Lawrence 2012).

Wildlife biologists from local, state and federal agencies shared much of the scientific information about mute swan biology, Michigan ecology and details about the management policy. As expected, MDNR employees were prominent government messengers in the news. The Humane Society of the United States primarily represented non-governmental organizations. The Michigan Audubon Society and Friends of Animals (centered in Washington D.C.) were each represented once in the news articles. Friends of Animals is also the group that triggered the lawsuit in Maryland over killing mute swans.

CONCLUSION

This analysis demonstrates how one might gain a better understanding of natural resource issues. A deeper look at natural resource issues as they play out in the media can be informative as to who is getting the message out, how it is being communicated, and what might be salient based on the prevalence of certain information. In this case, the media messages tended to be from local residents and local government agencies. This might demonstrate that, although this is a statewide issue, coverage focused more on local, private land mute swan management. This is likely so because local mute swan densities, human development, and citizen participation in management vary across spatial scales. This was

reflected in the news I sampled. In White Lake, for example, the issue focused on public meetings to explain why managers were interested in managing local mute swan populations. On the other hand, coverage of mute swan management in West Bloomfield focused on a decision to rescind a resolution that would have allowed lake associations the ability to apply for permits to manage mute swans.

Mute swan management has played out in the news media for over ten months. Understanding how messages play out in the media might inform what messages are effective or ineffective. In this analysis, opponents favored arguments that support alternative control methods. However, agency messages rarely address methods of control, but focus more on the scientific basis for controlling mute swans in Michigan. Examples such as this provide managers with direction for how they might frame or re-frame messages to better respond to opposition. Michigan mute swan management appeared to lose its newsworthiness after October. Publicity of the issue ceased after the MDNR denied the HSUS moratorium request.

This portion of my study only touches on the role media play in natural resources discussion. Future research might allow one to compare how this issue manifests over a greater period of time and space. Research might delve deeper into media framing and effects. Are local citizens influencing the direction of the discussion? Are this science and details of the management plan being accurately portrayed? This portion of my research has allowed me to strategically gather information about the issue and more accurately represent the reasons people use to support or oppose mute swan management in Michigan.

CHAPTER TWO

MICHIGAN MUTE SWANS: A CASE STUDY APPROACH TO ETHICAL ARGUMENT ANALYSIS

Management of natural resources is based on a combination of scientific information and ethical values about natural systems. Science provides information to help us better understand elements of the natural world by describing what species are present and what biological interactions are occurring with an ecosystem, and how these systems influence and are influenced by human communities. Science, though, cannot tell us *why* we should value native species, minimize human-wildlife conflicts, sustainably exploit resource, or improve ecosystem aesthetics. These answers to *why* we should care about resource management are guided by our values and ethics. How we value elements of the natural world, either intrinsically, instrumentally, or both, helps us judge what actions are good or bad, right or wrong, within the context of resource management. Logically, then, management decisions require us to understand and incorporate both the science and the values at stake.

Science provides good information to aide resource management, but rarely do we systematically analyze management decisions through an ethical lens. One way to attend to the ethical dimension of management actions is to understand and assess the ethical arguments being employed by different stakeholders. Although most management decisions are likely based on reasons, seldom do we dedicate ourselves to building logical arguments we might systematically and rigorously analyze. Analyzing arguments on these grounds, then, can distill and clarify the most reasonable, and logical, approaches to address this issue. Social science methods, such as content analyses, can help determine what arguments are likely to persuade

people to one side of an issue or another. Ethics builds on social science methods by telling us which arguments should, or should not, persuade people. If we commit to effective and sound argumentation in our address of conservation issues, as I detail with Michigan's mute swan issue, we have the opportunity to craft policy that reflects and responds to diverse stakeholder values in a justified and transparent fashion.

METHODS

Reasons into Arguments

Identifying the reasons people use to defend or oppose an action is the initial step of argument analysis. In this case I used the content analysis to identify reasons people use in defense of or opposition to the mute swan management policy. We start with reasons because these are the framework of argumentation. Reasons suggest why one might choose to agree with a particular action. I coded reasons in the content analysis, which represent how one might respond to the question, "Should we control Michigan's mute swan population?" I chose to analyze the six highest-occurring reasons I identified in the content analysis: three in support of and three against Michigan's mute swan management policy. It would be ideal to analyze all of the employed reasons as formal arguments, but argument analysis is a lengthy process (Vucetich & Nelson 2012) and it would be unrealistic to achieve that feat in the time available. Moreover, reasons that appear infrequently are less likely to be salient with the public (Chyi & McCombs 2004; Krosnik et. al 2006), so it is not clear if it would be a useful exercise to develop every reason as an argument. Nonetheless, constructing formal arguments from these six reasons will provide a thorough examination of what I theorize to be the most influential reasons in this discussion.

Argument Construction

Argument analysis is the process of identifying, composing, and assessing arguments for their strength and rigor. An argument is a systematic and logical series of statements, also called a syllogism. A syllogism is defined as, "a deductive scheme of a formal argument consisting of a major and a minor premise and a conclusion" (*Merriam-Webster* 2013). A syllogism might look like this:

- P1. All birds have wings.
- P2. Mute swans have wings.
- C1. Therefore, mute swans are birds.

In this simple example, the conclusion is inferred from a set of premises, in this case P1. and P2. Both premises must be true for the conclusion to be true, thus requiring a logical order within the argument. The focus of my analysis is not just any arguments, but ethical arguments. An ethical argument is an example of a syllogism, but it includes both normative and factual premises, rather than just empirical premises like in the example above. An example of an ethical argument might look like this:

- P1. All birds have wings.
- Empirical Premise- description about the way the world is.
- P2. We should protect all animals with wings.
- Ethical Premise- value statement
- C1. Therefore, we should protect all birds.
- Conclusion- expressed as "We should..." (Vucetich and Nelson 2012)

Argument Analysis

After building each argument in the form described above, I assessed them based on the following questions below. I have provided very basic examples of how I worked through this process.

Question 1: "Are all of the premises that would be necessary to arrive at the conclusion present in the argument?" (Vucetich and Nelson 2012, p.5)

For example, consider the following argument:

P1. Mute swans are beautiful birds.

C1. Therefore, we should not kill mute swans.

In this first example at least one premise is missing that would allow one to reach this conclusion, particularly a value statement suggesting we should not kill beautiful things or we should not destroy beauty. In an ethical argument, the fundamental principle of logic requires there be a corresponding ethical premise to reach the conclusion. If the variable is in the conclusion (e.g. "should") it must also be present in at least one of the premises. Question 2: "Are all of the premises true or appropriate?" (Vucetich and Nelson 2012, p.5) For example, consider the following argument:

P1. Mute swans eat people.

- P2. We should eliminate anything that might eat people.
- P3. Eliminating mute swans will prevent them from eating people.
- C1. Therefore, we should eliminate mute swans.

Both common and scientific knowledge tells us P1 of this example is untrue, which invalidates the conclusion. A premise is appropriate if it is true and fits logically into the argument. If it is untrue, the logic of the argument is flawed. Some premises might just not fit into an argument like in the example below:

P1. Mute swans are birds.

P2. Aliens are red.

C1. Therefore, mute swans have wings.

P2. of this example is irrelevant to the conclusion, and is therefore inappropriate to the argument.

Question 3: "Does the argument actually address the concern that originally gave rise to the argument's development?" (Vucetich and Nelson, 2012, p.6)

For example, consider this reason and argument:

Reason statement: "Basically, these birds use their large size as an advantage to chase

the native wetland birds away. This is a real problem that needs to be addressed"

(Grand Haven Tribune 2012).

This reason statement could be formulated into the following argument:

P1. Mute swans are the largest birds in Michigan ecosystems.

P2. Michigan ecosystems cannot handle large birds.

P3. Killing mute swans will remove the largest birds from Michigan ecosystems.

C1. Therefore, we should kill mute swans.

Although the reason discusses mute swan size, this is not necessarily the reason the speaker is using to justify the killing of mute swans. The statement more specifically expresses concern for the behavior of mute swans toward native wetland birds. In everyday conversation people tend not to use formal argumentation to justify an action. Therefore, I had to "fill in" some premises to complete the formal arguments. When possible, I use quotes from the content analysis to ground premises. This helps establish the relevance of each argument to what is actually playing out in the mute swan discussion.

The prior argument examples are basic demonstrations of how I assessed each argument. The arguments in my thesis analysis were much more complex. For this reason, I consulted with two ethicists as I developed and assessed each argument. Because reasons are expressed in a variety of ways, I generalized language whenever possible to make arguments more broadly representative of the reason, and thus the argument might be more likely to apply to a larger audience. Consistent use of terms is important to make the connection between premises (Weston 1987). For example, I used "mute swan population" rather than "population of mute swans" throughout my analysis and discussion.

Argument Assessment

I organized each argument in an "Argument Assessment Table" (see Table 2) to help determine which premises need the most attention. This can help determine the strength of the conclusion. "Kind of Premise" establishes the academic discipline from which each premised is derived. For example, is the premise biological, ecological, sociopolitical or a combination? To assess the "truth" of a premise we must first understand what disciplinary knowledge is necessary to evaluate the evidence. Truth and appropriateness fall into the same column, because although truth can be assessed for empirical premises, it cannot necessarily be assessed for an ethical premise. Ethical premises are more likely to be considered appropriate or inappropriate. A premise is likely to be "controversial" if it is untrue or inappropriate. However, this was not always the case. Sometimes a premise might be true or appropriate, but

disagreement remains over the use of premises to justify a conclusion. My knowledge of the

issue gained from the content analysis allowed me to identify premises likely to be

controversial.

animate strength of a conclusion based on the evaluation of individual premises.							
Primary Argument	Kind of Premise	True/Appropriate?	Controversial?				
P1. Mute swans eat	Social and	Not true	Yes				
people	Biological						
P2. We should eliminate	Ethical	Maybe	Possibly				
anything that might eat							
people							
P3. Eliminating mute	Social and	Maybe	Possibly				
swans will prevent them	Biological						
from eating people.							
C1. Therefore, we should							
eliminate mute swans.							

 Table 2: Example of an Argument Assessment Table. Each category helps determine the ultimate strength of a conclusion based on the evaluation of individual premises.

Any argument is ultimately only as strong as its weakest premise (Vucetich & Nelson 2012; Weston 1987; Toulmin 1969). Controversial premises can be expanded upon in secondary and perhaps tertiary arguments to better understand what is needed to make a robust claim. For example, if Premise 1 is the weakest premise, we can turn that premise into the conclusion of the secondary argument and build the necessary evidence to make that particular claim less controversial or more appropriate. After better establishing the truth or lack of truth of a claim, I can return to the primary argument to complete the assessment. A hypothetical and exaggerated example of a secondary argument might look like this (from table 2):

P1. People are composed of plant material.

- P2. Mute swans eat plants.
- C1(P1). Therefore, mute swans eat people.

In this project I built two secondary arguments from controversial premises. I have included them within the primary argument in the results section. This process of argument analysis allows me to take systematically identified reasons from the mute swan discussion and understand if these reasons are effective as formal arguments.

RESULTS

I employed the content analysis to identify reasons in support of and opposition to the M.S.M.P. This method allowed me to understand how discussion of this issue is playing out in the media and build arguments grounded the actual discussion. Identifying reasons gave me the foundation to build formal arguments, thus allowing me to better understand the effectiveness of the discussion surrounding mute swan management. I identified the most commonly occurring reasons in the content analysis and chose to analyze arguments from reasons that might be having the most impact in the discussion. I began the formal argument analysis process by laying out the two most frequently occurring arguments in support of mute swan control, then two arguments in opposition to mute swan control. Following these four arguments, I transition to another dimension of the discussion. In the final argument analysis section I analyze two conditional arguments that discuss the methods of control.

Arguments in Support of Mute Swan Control

Mute swans are perceived to be aggressive to humans and this concern was the most frequently occurring reason in support of control of mute swans. The second argument revolves around a concern for ecosystem health. I chose to break "ecosystem" down to ecosystem components which makes a clearer connection between mute swans and the impacts they

might have on the larger system. I began with the most frequently occurring reason in favor of mute swan control, which is to limit risks to humans.

1. Aggression Argument

The following statement is a reason employed to support mute swan control because mute swans are aggressive toward humans. Reason-"If we don't do anything to reduce mute swan populations, we could have 24,000 in five years. If we allow this to happen... there would be unacceptable levels of conflict with people," (Donnelly 2012). From this statement and others like it, we can craft an argument like the following:

P1. Incidents of mute swan aggression toward humans are increasing.

P2. We should limit instances of wildlife aggression toward humans whenever possible.

P3. Controlling the mute swan population will limit instances of aggression toward humans.

P4. It is wrong to control mute swans without an adequate reason.

P5. Limiting instances of aggression toward humans is an adequate reason to control the mute swan population.

C1. Therefore, we should control Michigan's mute swan population.

The primary argument might be represented in a variety of ways depending on the context. For example, the context for this specific argument suggests there is not only an issue with mute swan aggression, but an *increasing* amount of aggressive instances toward humans. The concern is that if we do not tend to mute swan population numbers now, threats to human safety will continue to increase. In the reason statement the person uses "conflict", and throughout the discussion other related terms such as "danger" and "aggression" are used. I chose to collapse the variety of terms that might be used in this type of argument under

"aggression." This allows the argument to best represent the language used to describe

negative interactions between mute swans and humans in Michigan.

Table 3: Primary and secondary argument analysis table for reason in support of mute swan
control because mute swans are aggressive.

Primary Argument		Kind of Premise		True/Appropriate?		Controver	sial?
P1. Instances of mute swan		Social and	ocial and Possibly tru		e Yes		
aggression toward humans are		Biologica	I				
incre	easing.						
	Secondary Argument	Kind of	True	e/Appropriate?	Con	troversial?	
		Premise					
	P1. Mute swans are aggressive	Social and	F	ossibly true		Yes	
	and toward humans.	Biological					
	P2. This aggressive behavior	Social and		Maybe	F	Possibly	
	toward humans will increase as	Biological					
	the number of mute swans						
	increases.						
	P3. The number of mute swans	Social and		Maybe		No	
	is increasing.	Biological					
	C1. Therefore, instances of						
	mute swan aggression toward						
	humans are increasing.						
Primary Argument		Kind of Pren	nise	True/Appropria	ate?	Controve	rsial
P2. \	We should limit instances of	Ethical		Maybe		Possibl	у
aggr	ession toward humans						
whe	never possible.						
P3. 0	Controlling the mute swan	Social and	b	Maybe		Possibl	у
рори	ulation will limit instances of	Biologica	I				
aggr	ession toward humans.						
P4. It is wrong to control mute		Ethical		Almost always	true	No	
swans without an adequate reason.							
P5. Limiting instances of aggression		Ethical		Maybe		Yes	
toward humans is an adequate							
reason to control the mute swan							
population.							
C1. Therefore, we should control							
Michigan's mute swan population							

The first premise in the primary argument has been identified as both controversial and

potentially untrue. The evidence in the first premise also provides evidence necessary to

support other premises within the argument, so I created a secondary argument to better understand what is needed to improve the truth and controversiality. I address the secondary argument before continuing with the rest of the premises in the primary argument. A secondary argument for P1. might look like this:

Secondary Aggression Argument

P1. Mute swans are aggressive toward humans.

P2. This aggressive behavior toward humans will increase as the number of mute swans increases.

P3. The number of mute swans is increasing.

C1(P1). Therefore, instances of mute swan aggression toward humans are increasing.

Table 3 suggests there is controversy with the assessment of mute swan behavior toward humans. To determine the truth of this premise we might look to the social and biological sciences. The social and biological sciences can help to understand and qualify the extent of interactions between mute swans and humans. I will go through each premise to better assess its individual truth and controversiality.

Premise 1: Mute swans are aggressive toward humans.

The evidence needed to support this claim is both biological and sociological. Biological information will tell us how mute swans interact with other wildlife and humans. Social science information will tell us how this behavior is perceived by humans. Many researchers suggest mute swans are territorial and aggressive (e.g. Bailey, Petrie & Badzinski 2008; Ellis & Elphick 2007; Petrie & Wilcox 2003), but little research has rigorously analyzed this claim. The current data available provide weak or inconsistent conclusions about mute swan aggression toward

waterfowl and none have addressed aggression toward humans. Mute swans tend to "bluff" when protecting their territory during nesting season, meaning they act as if they are going to attack, but stop before making contact with humans or other wildlife. Anecdotes suggest some individual mute swans might be more apt to negatively interact with humans (Conover 2002). Examples of such anecdotes sound like this: "Numerous mute swan attacks on small boaters -canoeists, kayakers, or those on personal watercraft -- have been documented, some resulting in human injury. Mute swans will attack people on land who wander too close to their nests or their young," ("Mute swans have become a nuisance" 2012). These claims tend to be vague in describing the extent and circumstances mute swan aggression occurs. Additionally, the MDNR admittedly lacks the scientific evidence to support this claim: "the DNR is going to work on doing a better job of recording the number of mute swan complaints," (Hopkins 2012).

Wildlife aggression can be assessed both qualitatively and quantitatively. Quantitative assessment might correlate incidents, such as mute swans chasing boaters or biting people, to mute swan numbers and measure any relationships or trends. Qualitative assessments of aggression might ask residents to report incidents and follow a particular protocol for the information they provide—asking what happened, where and what were the circumstances. Currently mute swan aggression in Michigan is assessed qualitatively, and only to an extent. The evidence of aggression comes from individuals who take the time to report such incidents to local MDNR employees. The MDNR Mute Swan Facts Brochure says this about such incidents, "These large birds show little fear of people. Each year the DNR receives reports of mute swan attacks on people in boats and on shore," (MDNR 2011).

The extent to which "aggression" can be defined makes it difficult to validate the truth of this claim. Mute swan aggression is also exaggerated in the discussion about why mute swans should be managed: "They are considered the most aggressive waterfowl species in the world," (Hamling 2012). This premise is potentially true if there is a more rigorous method to identify and record mute swan aggression toward humans. Currently the aggression is anecdotal and circumstantial and the evidence is untrustworthy, hence the controversiality. There are alternatives to killing mute swans that address mute swan aggression and focus more on sociological aspects, such as performing outreach and training residents to better understand mute swan behaviors and how to reduce negative interactions between mute swans and people.

Although recording instances of mute swan aggression help ground the claim in P1., each instance might signify different levels of aggression. For example, there is the potential that mute swans will chase boaters, or there might be more serious acts of aggression, such as the potential for a fatality, for example: "A man drowned near Des Plaines, III., in April while using a kayak to check on mute swans that were being used to keep geese away from a pond," (Campbell, 2012).

I was able to qualify premise 1 as controversial based on the opposition to the claim found from both online sources and the content analysis. An online petition to stop killing mute swans in Michigan suggests there is insufficient evidence to support P1.: "As for human - swan conflict, The DNR claims that the mute swan is aggressive toward humans. The DNR does not have accurate and complete records regarding human-swan conflicts according to the Mute Swan Forum Minutes," (Stamper, 2012). As of March 2013, the Change.org petition had

garnered over 3000 signatures. Many also argue mute swan aggression is a natural behavior used in defense of their territory or young or that humans instigate the aggressive behavior: "Resident Susan Newhoff objected to the description of the mute swan as an aggressive species toward other wildlife and humans, and using that as a reason for reducing numbers by shooting adults. She said that is their nature like other wild animals, and humans shouldn't impede on their habitat," ("Evidence shared for mute swan program" 2012).

The opposition to P1. suggests there is uncertainty about how we define and evaluate aggression. The evidence is both anecdotal and controversial and is likely insufficient to qualify this claim as true.

P2. This aggressive behavior toward humans will increase as the number of mute swans increases.

This premise is both sociological and biological. Again, there needs to be an understanding of population dynamics, from which the biological sciences can offer tools to understand, and how swan populations interact with humans (or vice versa), which can be understood using social science tools. The perceived, increasing instances of aggression appear to be the major concern in this argument, rather than the current perceived levels of aggression. This concern for increasing aggression arises often in the content analysis, as this quote suggests: "So as we see an increase in the species, we are also seeing an increase in reports about mute swan attacks," (Hamling 2012). This quote might suggest there is an acceptable amount of aggression, but it soon will be too much. In this case, we need to better define the concept of "acceptable" amounts or instances of aggression. Human dimensions of wildlife management concepts include "wildlife acceptance capacity" and "social carrying

capacity" can help describe what communities feel are tolerable or acceptable wildlife populations (Decker & Purdy 1988). In this case, however, there are no social scientific studies to quantify or qualify an acceptable level of mute swans.

To understand if this premise is true, we would first need to establish the truth in P1: whether or not mute swans are aggressive toward humans. Second we would need to correlate the aggressive instances with the wildlife population size. Conover (2002) suggests it is beneficial to understand what is driving the conflict, such as determining why mute swans attack. If there is a relationship between population size and aggressive interactions, other variables are likely to confound this relationship, including the proximity of nesting to developed communities and encroachment of humans into wetland ecosystems.

Therefore, more evidence is needed to understand if an increased mute swan population equates to increased instances of aggression toward humans. The effectiveness of this premise also hinges on the effectiveness of P1. Although there is some evidence to assume the truth of P2, we logically cannot support P2 if we are missing the evidence to support P1. Therefore, this premise is untrue as long as P1. is untrue.

Premise 3: The number of mute swans is increasing.

The arbiter of the truth of this premise is wildlife biology. One thing wildlife biology helps us to establish are counts of wildlife populations. Verifiable evidence is available for mute swan population numbers and management agencies have valid and reliable strategies to monitor numbers. The population growth rate of mute swans is estimated to range from 10% to 18% a year in the Great Lakes region (Petrie & Francis 2003). The numbers in Michigan have increased from 6500 in 2003 to currently over 15,000 (MDNR 2003). There appears to be strong

evidence in support of this premise. Therefore, we can conclude P3. is effective, and also uncontroversial.

Conclusion (P1): Therefore, instances of mute swan aggression toward humans are increasing.

In this secondary argument analysis, one agency employee admits the evidence of mute swan aggression toward humans is circumstantial and anecdotal. If management decisions are intended to be guided by science, this argument would benefit from, or perhaps necessitate, more rigorous assessments of aggression. There is general evidence to support an increase in human wildlife conflicts as wildlife populations increase (Conover 2002), so it might be worthwhile to understand if this is true for mute swans. We might assume it is logical to link increasing instances of aggression to increasing mute swan numbers, but if part of the evidence is missing, the logic is flawed. Therefore, in the primary argument, P1. Is possibly true and controversial, as the evidence is not yet available to support its absolute truth. This knowledge allows us to move forward with the rest of the primary argument, but knowing the rest of the argument is likely moot if P1 is untrue. Now that I have better assessed the first premise of the primary argument, I will return to the remainder of the primary argument.

A quick glance at the table reveals there are some premises that are both contentious and potentially untrue. I have already assessed P1. as untrue based on the secondary argument. In order to assess the truth of these claims we should gather evidence from biological, social and ethical disciplines.

Premise 1: Incidents of mute swan aggression toward humans are increasing.

There are two components of the first premise that require evaluation for truth: are mute swans aggressive toward humans? Are aggressive instances increasing? Most importantly,

how do we define aggression or aggressive acts toward humans? I have described this information as possibly true, because the secondary argument is only supported by anecdotal evidence, rather than rigorous scientific evidence.

From the secondary argument we have concluded mute swan populations are increasing, but we have yet to firmly conclude aggressive instances toward humans are also increasing. Therefore, from this information I have concluded the first premise to be potentially true if evaluation of mute swan aggression toward humans aligns with acceptable evaluations of human-wildlife conflicts.

Premise 2:. We should limit instances of wildlife aggression toward humans whenever possible.

A "should" or "ought" implies an ethical premise. Ethics are aligned with a set of values that define how we ought to behave. Ethics is the discipline "dealing with what is good and bad and with moral duty and obligation" (*Merriam-Webster* 2013). This premise is an ethical premise, implying a standalone value for human safety. The evaluation of an ethical premise entails determining if the premise reflects reality- do we actually agree with the value statement? If we are in agreement with the particular value statement, we still need to justify some ethical actions with empirical information. So, is it true that we should limit wildlife aggression toward humans whenever possible? On its own, this premise is likely to be true and uncontroversial. Most people, if not all, will agree we should minimize conflicts between wildlife and humans. However, the consequences—killing mute swans-- of limiting such conflicts trigger the controversiality in this argument.

Premise 3: Controlling the mute swan population will limit instances of aggression toward humans.

This premise requires both social and biological evidence. Biological evidence will tell us if population control is going to limit aggressive instances. By understanding the population dynamics of a species, we can better assess if control is going to work and achieve stated goals. This premise is also sociological because control is being considered a means to reduce aggressive instances toward humans. Once we establish if and how mute swans are aggressive toward humans we can better assess if controlling mute swans will limit these negative interactions. There is a general assumption that reducing wildlife populations will correlate with a reduction in aggression. The effectiveness of lethal control at reducing aggression is also dependent upon wildlife population dynamics. If the population is nearing its biological carrying capacity, natural mortality tends to be high. In this instance, lethal control at a particular level may only replace the natural mortality. Additionally, Conover (2002) suggests the reduction in wildlife conflict or damage depends on why the animals are a problem. It is again necessary to better define if, how and why mute swans are aggressive toward humans to understand if control will limit aggression.

Conover (2002) also suggests three options to minimize wildlife attacks on humans: The first is to remove individuals that display characteristics that might result in a higher probability of attacking people, such as the mute swans that incite direct contact with humans or wildlife. With some species, behavior modification might reduce conflict. For mute swans, this might include deterring them somehow from densely human-populated areas. Alternatively, human behavior modifications might limit these perceived conflicts. Conover also suggests conflict might be reduced if "people have a healthy fear of dangerous animals," (2002, p.53). Perhaps

with this understanding, complete elimination of mute swan populations is not the best, nor the only option for reducing aggressive interactions between mute swans and humans.

This premise also requires an understanding of whether or not control will in fact limit instances of aggression. In general, an evaluation of the effects of lethal control for any species is limited (Warburton & Norton 2009). More importantly, to assess if management objectives are being met, both an assessment of the problem and the solution need to be made. In this case, the knowledge for both is limited. Assumption-based management is likely insufficient evidence to justify control, let alone lethal control. Therefore, this premise is likely untrue. Premise 4: It is wrong to control mute swans without an adequate reason.

The notion in premise 4 will be repeated within all of the arguments I analyzed in this research. This premise is a general ethical principle for how we ought to live and act in the world. Most, if not all, people would agree that we ought to have an adequate reason for performing some action. However, what one might consider an adequate reason is going to vary. This is the same for mute swan management—what one considers an adequate reason to control mute swans will differ among stakeholders and managers. In this discussion about mute swan control, however, there does seem to be some agreement that level and kind of control is acceptable. As noted above, the disagreement comes in the form of how we employ control (e.g. killing). This type of ethical evaluation depends on what people value most in the discussion, and perhaps what people have experienced in regard to mute swan conflicts. Would an attitude toward mute swan control change if someone was directly affected by mute swan aggression? Or would it require multiple acts of aggression to support control? For the MDNR, it appears that the current level of mute swan aggression has surpassed an acceptable

threshold. Therefore, for the MDNR, control is an adequate reason to limit these negative interactions

Premise 5: Limiting instances of mute swan aggression toward humans is an adequate reason to control the mute swan population.

Although most would agree we should limit mute swan aggression toward humans, this premise is ineffective in alignment with an untrue P1. An anthropocentrist might argue that human concerns outweigh our concerns for wildlife's well-being if the two are in conflict. Therefore, controlling mute swans to limit aggressive instances would be appropriate. However, in the case of mute swans, the empirical evidence is limited or non-existent. Although many disagree with the evidence to support this premise, many also disagree that this is an adequate reason to control mute swans. Therefore, the premise is controversial, but it is also moot, since the evidence is not yet available.

Conclusion: Therefore, we should control Michigan's mute swan population.

From this evaluation we know better scientific evaluation is needed to understand how and if mute swans are aggressive toward humans and how control might alleviate these aggressive acts. The effectiveness of the argument hinges on the truth of the empirical claims. Although the ethical claims might reflect what we value, they rely upon effective empirical claims to justify an action. Breaking out the weak premises into secondary arguments is one way to better understand what is needed for an effective conclusion, as I have demonstrated with this argument. For there to be a logical flow to the argument, the effectiveness of P3 and P4 hinges upon the effectiveness of P1. At the moment, we need a better understanding of if

and how mute swans are aggressive toward humans and in this case, if the aggressive instances are in fact increasing.

Separately, it is important to understand if premises are controversial and true. Claims are invalid if they are not backed up with solid evidence. However, in combination, this information can help identify and prioritize research needs to improve the effectiveness of the argument and the intended management actions. This argument is the most frequently used in the discussion about mute swan management and is typically ineffective. Now we know why it is ineffective and what needs to be done to improve the justifications for mute swan management.

2. Ecosystem Argument

The second most common reason to control mute swans is to protect the ecosystem or components of the ecosystem. The content analysis allowed me to understand there are underlying concerns linking mute swans to larger concerns for preserving ecosystem health. I broke the code down into components of the ecosystem, such as primary producers/vegetation, wildlife/consumers and wetland habitat, and built an argument from the bottom of ecosystem processes up. The root of the concern appears to be that mute swan eating habits are damaging ecosystems—they eat too much and they eat in a destructive manner. These characteristics of mute swans result in limited resources for fish and wildlife, and might, then, negatively influence the stability of wetland ecosystems. An example reason for this concern sounds like this: **Reason:** "Mute swans often congregate in large flocks and are capable of inflicting significant damage to aquatic habitat, by feeding heavily on aquatic vegetation that is valuable – as both food and cover – to fish and other species of

wildlife,"("Mute swans have become a nuisance" 2012). Here is what an argument might look like to reflect this reason:

P1. Mute swans consume submerged aquatic vegetation (SAV) in a manner that limits plant regeneration.

P2. Limited SAV in the wetland system reduces resource, thus diminishing diversity of flora and fauna.

P3. A healthy wetland habitat has diverse flora and fauna.

P4. Controlling mute swan populations that reduce SAV will foster a healthy wetland habitat.

P5. We should preserve healthy wetland habitat.

P6. It is wrong to control mute swans without an adequate reason.

P7. Preserving healthy wetland habitat is an adequate reason to control the mute swan population.

C1. Therefore, we should control Michigan's mute swan population.

This argument is much more extensive than the previous aggression argument in that it requires more premises to justify the conclusion. This argument can be further built upon to make a case for how this reason links to the larger ecosystem concerns. However, I chose to focus on one component to demonstrate what is necessary to begin to work toward the larger argument. This argument requires biological, ecological and ethical knowledge to assess the truth. I have assessed each premise for truth and controversiality below.

Table 4: Primary argument analysis table for reason in support of mute swan control because mute swan eating habits negatively affect the ecosystem.

Primary Argument	Kind of	True/Appropriate?	Controversial?
	Premise		
P1. Mute swans consume	Biological and	Possibly true	Yes
submerged aquatic vegetation	Ecological		
(SAV) in a manner that limits plant			
regeneration.			
P2. Limited SAV in the wetland	Ecological	Yes	No
system reduces resource, thus			
diminishing diversity of flora and			
fauna.			
P3. A healthy wetland habitat has	Philosophical	Sometimes	Sometimes
diverse flora and fauna.	and Ecological		
P4. Controlling mute swan	Biological and	Maybe	Yes
populations will foster a healthy	Ecological		
wetland habitat.			
P5. We should protect healthy	Ethical	Yes	No
wetland habitat.			
P6. It is wrong to control mute	Ethical	Almost always true	No
swans without an adequate reason.			
P7. Preserving healthy wetland	Ethical	Maybe	Yes
habitat is an adequate reason to			
control the mute swan population.			
C1. Therefore, we should control			
Michigan's mute swan population			

Premise 1: Mute swans consume submerged aquatic vegetation (SAV) in a manner that limits

plant regeneration.

This concern is expressed in both the scientific literature (e.g. Bailey et al. 2008; Petrie & Francis 2003; Stafford et al. 2012; Tatu et al. 2007) and the content analysis. To determine the truth of this claim we need to understand how and what mute swans eat and if that affects plant regeneration. One person suggests, "Anglers complain that large flocks of swans virtually wipe out aquatic weed beds in some lakes," ("Mute swans have become a nuisance" 2012). Several scientific studies affirm this concern. For example, Stafford et al. (2012) demonstrated a difference in aquatic plant biomass within and outside of exclosures in an Illinois wetland populated with mute swans. Tatu et al. (2007), on the other hand, demonstrated a difference in percent plant cover, density and canopy height within and outside of exclosures in the Chesapeake Bay in areas with mute swan populations. Although these studies begin to add evidence to the concerns, Stafford et al. (2012) confirms more work needs to be done to understand local and long-term impacts of mute swans on aquatic vegetation. Although we know what mute swans eat and how much, we are still learning if these eating habits prevent regeneration that can minimize the ability of mute swans to coexist with other species. This research in the context of Michigan mute swans is also controversial: "the DNR doesn't have a single study or well-documented report to substantiate these claims. Indeed, it seems odd that the birds stay in the same locations year after year if they are depleting all the vegetation," (Douglas 2012). Therefore, this premise is possibly true.

Premise 2: Limited SAV in the wetland system reduces resource, thus diminishing diversity of flora and fauna.

Ecological knowledge is required to understand if this premise is true. This discipline tells us how species interact within an ecosystem. Primary producers play a key role in ecosystem functionality. At the most basic level, plant photosynthesis produces dissolved oxygen and plant decay puts nutrients back into the system (Moore et al. 2004). On a larger scale, plants provide food and shelter for fish and wildlife. Primary producers, such as SAV, are inarguably linked to a thriving ecosystem, which is more likely to support diverse biota. This concern is also mirrored in the discussion about mute swans: "Mute swans feed primarily on water plants reducing the availability of these plants as food for native wildlife and as essential

habitat for native fish. Ultimately the selection of these plants may reduce the carrying capacity of wetlands for native wildlife species including birds, mammals, amphibians and fish," ("Invasive mute swans are target in White Lake habitat restoration" 2012).

Bailey, Petrie & Badzinski (2008) compared the mute swan diet with the diets of other waterfowl species and found an overlap that can lead to competition for resource. The ecological knowledge about the role of primary producers in an ecosystem tells us if SAV is reduced and this resource overlaps with the needs of other wildlife, it is likely diminishing the diversity of wildlife that can cohabitate in this system. Therefore, a reduction in plants may be likely to reduce the diversity within a system, which means this premise is likely true based on our understanding of ecosystem dynamics.

Premise 3: A healthy wetland habitat has diverse flora and fauna.

This premise raises two points: 1) how do we define a healthy wetland habitat, and 2) how is a healthy wetland habitat dependent upon diverse biota. The first is philosophical in nature. We value certain things in an ecosystem and those values are typically reflected in how we protect a system. Is the system healthy because it offers provisional services, such as lumber from trees? Is healthy something untouched by settlement? Or is the system simply healthy because it is able to support life of some sort? These questions are what underlie our actions on behalf of healthy ecosystems and they can often be situational. For example, we might value a "pristine" forest in one area as a quality of health, but value the forest for its provisional services in another area.

Biodiversity is often positively linked with ecosystem functionality (Cardinale et al. 2006). The more diverse the system, the more functions the system can perform. However,
ecosystems are complex, interconnected systems and vary depending on a multitude of factors. Abiotic and biotic components are likely to vary geographically and over time, particularly due to anthropogenic changes. Much research has been dedicated to studying the interactions between biodiversity and ecosystem functions. These studies show, in most cases, there is a positive association between biodiversity and ecosystem function (Cardinale et al. 2006). However, the association is not consistent across ecosystem types, over time and might depend upon study design. This limits our ability to generalize the relationship between a healthy ecosystem and biodiversity. We restore, protect, and preserve for biodiversity yet often we do not fully understand the relationship between each ecosystem and its relative biodiversity.

Many scholars suggest the biodiversity-ecosystem stability relationship is inconclusive (Hooper et al 2005; Huston et al. 1997; Kimmins 1997; Schwartz et al. 2000; Schlapfer & Schmid 1999; Srivastava & Vellend 2006). Much of the work done to understand these complex relationships is theoretical and generally covers terrestrial landscapes (Hooper et al. 2005). This is part of a large and long-standing debate over the link between biodiversity and ecosystem health, stability or function. Michigan mute swan management is only one discussion about biodiversity and ecosystem health. As many scholars suggest, more experimental work needs to be done to understand these relationships, and in this case, as they relate to mute swans.

The question in this case is: *Does a decrease in the plant, waterfowl and fish diversity ultimately impede ecosystem health?* Management would benefit from a better understanding of what we value as a healthy ecosystem, and why, as well as a more definitive answer about if and how wetland biodiversity is linked with wetland habitat functions in Michigan. Therefore, this premise is potentially true. The truth depends on whether or not biodiversity is what we

value in a "healthy" ecosystem, and if biodiversity is in fact linked to ecosystem health. Kimmins (1997, p. 231) expands on this dialogue to discuss our notion of "health": "It is defined as much by the social and economic values people want from their forests as it is by a scientific assessment of forest health." Along with the complexity of biodiversity-ecosystem relationships, many bring in conflicting terminology to further confuse how we ought to manage natural resources.

Premise 4: Controlling mute swan populations will protect healthy wetland habitats.

To understand the truth of this premise we need to understand if mute swans are limiting SAV rejuvenation (see P1.), if the limitation in SAV reduces biodiversity (see P2.), if a reduction in biodiversity reduces the health of the wetland habitat (see P3.), and finally if controlling mute swans will in fact address this issue. Biological sciences can help to understand if controlling mute swans will allow SAV to better survive, however, as we saw with Argument 1, there simply is no evaluation of how lethal control achieves such goals. If SAV plays the major role in a thriving system, and mute swan diets destroy SAV, controlling the swans might assist in restoring the system to a healthy state. However, we could be more confident in our ability to control mute swans if we had more clearly demonstrated the problem. In this example, if there is no assessment of the damage, we cannot assess how the methods meet objectives. Therefore, this premise is functioning on an assumption rather than on solid evidence and can only be considered possibly true pending a more thorough evaluation.

Premise 5: We should protect healthy wetland habitats.

This premise suggests a value statement about how we should interact with wetland systems, and thus we can assess its appropriateness using ethical knowledge. I chose to use

"protect" as the verb in this premise because it mirrors the mission statement of the MDNR¹. However, this verb might be replaced with "restore" or "preserve" depending on the level of degradation to the system. Their mission is based in part on the *protection* of natural resources using ecosystem-based management (MDNR 2013a).

How stakeholders and managers define "healthy" triggers the controversiality of this premise. There are certainly variations of what is considered "healthy", and thus there will certainly be disagreement about what to protect. Many stakeholders value mute swans as part of the landscape and might consider this a healthy wetland relationship. They might suggest protecting a healthy wetland habitat includes protecting the mute swans. This premise is likely to be true for most agencies, but it is untrue for some stakeholders. Therefore, the truth depends on the stakeholder, and it is likely to remain controversial based on how stakeholders value ecosystem "health".

Premise 6: Preserving healthy wetland habitat is an adequate reason to control the mute swan population.

This premise is an ethical premise that further promotes the value of healthy wetland habitats. What appears to underlie the value for healthy ecosystems, and much of this argument, is a value for *native* ecosystems. Although the perceived destruction to aquatic vegetation by mute swans is a concern in and of itself, it becomes a greater concern when it removes resource for native and/or threatened species. I identified the MDNR's value for native species in the content analysis. For example, "The DNR has long removed mute swans from

¹ "The Michigan Department of Natural Resources is committed to the conservation, protection, management, use and enjoyment of the state's natural and cultural resources for current and future generations," (MDNR 2013b).

state game areas, where protecting and enhancing native wildlife is a paramount goal" ("Mute swans have become a nuisance" 2012). According to this statement and many like it, the MDNR might define healthy wetland habitats by the ability of native wildlife to thrive. If mute swan eating habits are limiting the ability of native wildlife to thrive, the MDNR might agree it is justified to remove mute swans for the sake of native species.

Mute swans are non-native and are therefore considered harmful to healthy wetland habitats by some. Thus, if the value of a healthy wetland habitat can be achieved by removing non-native species, then there is some truth to this premise. Upon reflection of the previous premises, we can note that the evidence has not yet supported control. It might be reasonable to justify control if it supported what some consider healthy wetland habitat, but the notion of "health" is normative and a meaningful dialog about its definition has not occurred. For this premise, more evidence should exist to understand mute swan interactions within an ecosystem, and if and how they influence biodiversity and healthy systems. Finally, we should better understand how controlling mute swans promotes the things we value in this argument. Conclusion: Therefore, we should control Michigan's mute swan population.

Although the ecosystem argument is complex, when we break it down into ecosystem components we can see that mute swans might potentially pose a threat, but there is certainly a need for further research to solidify these claims. In addition to addressing the concerns, there should be better evidence to support how the method of control is an adequate solution. In a way, this argument mirrors the aggression argument, in that we need to better demonstrate the problem, and better demonstrate the methods will solve the problem. Although the value people place on ecosystem health might differ, if there is better evidence to

support the need for control, the actions are more justified. A major point of contention is in regard to what matters, or what has value within the ecosystem. If natural resource management actions are to reflect public values, then in situations like this there are several values being overridden and perhaps even unrecognized. Moreover, some stakeholder values are being overridden in the face of uncertainty.

Arguments against Mute Swan Control

The next two arguments shift toward the opposing view of Michigan's mute swans management. The first argument is about the science used to justify management actions—it is perceivably uncertain, misunderstood, or lacking. This reason occurred most frequently in opposition to the management policy. The second argument in this section suggests mute swans bring aesthetic value to lake communities and therefore should not be controlled.

1. Uncertainty of Science Argument

From the content analysis, I found that stakeholders expressed distrust in management agencies and uncertainty about the science used to support management actions. This argument, however, will focus just on the science used to form the M.S.M.P. One opponent to the plan created flyers to garner support against mute swan management. Her flyer states, "the DNR lacks adequate science to support its position," ("Meetings to address mute swan cull" 2012). This is an example reason that represents an uncertainty of science. I developed the following argument from this reason:

P1. Michigan DNR did not use the best available science to guide management actions for the mute swan population.

P2. We should use the best available science to guide management actions.

C1. Therefore, the evidence does not yet support controlling the mute swan population.

Primary Argument Kind of True/Appropriat	e? Controversial?
Premise	
P1. Michigan DNR did not use the Sociopolitical, Possibly true	Yes
best available science to guide biological and	
management actions for the mute ecological	
swan population.	
Secondary Argument Kind of True/Appropriat	e? Controversial?
Premise	
P1. The Michigan DNR did not Ecological Yes	Yes
use mute swan research	
conducted in Michigan to guide	
management actions.	
P2. Mute swan research Biological, Possibly true	Yes
conducted in Michigan is the Sociopolitical,	
best available science for Ecological	
guiding management actions in	
Michigan.	
C1 (P2). Therefore, the	
Michigan DNR did not use the	
best available science to guide	
management actions for the	
mute swan population.	
Primary Argument Kind of Irue or	Controversial?
Premise Appropriate?	Ne
P2. We should use the best Ethical and Yes	NO
available science to guide sociopolitical	
Therefore the evidence does	
C1. Inereiore, the evidence does	
not yet support controlling the	

Table 5: Primary and secondary argument analysis table for reason in opposition to mute swan control because the best available science was not used.

In this argument, we are faced with variable descriptive terms people use to express their feelings about mute swan management. In the reason statement above, the stakeholder suggests the current science is inadequate. Also used throughout the mute swan discussion to describe the science are "insufficient" and "blown out of proportion," among others. Many also question the assessment of mute swans as non-native and invasive. I chose to build this argument using a concept often found in natural resource management discussion: best available science. This phrase encompasses the notions of sufficiency, uncertainty and scientific rigor in applying scientific research to management actions. Using this term will hopefully allow me to represent the variation of concerns surrounding the use of science in mute swan management policy development.

The leading premise of this argument is controversial and possibly true. I chose to break out P1. to understand what it is about the science that stakeholders are concerned about. Here is the secondary argument, built from P1. of the primary argument:

Secondary Uncertainty of Science Argument

"Swan advocates are skeptical about such studies since they have come from Maryland — not from Michigan," (Niemi 2012).

P1. The Michigan DNR did not use mute swan research conducted in Michigan.

P2. Mute swan research conducted in Michigan is the best available science for guiding management actions in Michigan.

C1(P2). Therefore, the Michigan DNR did not use the best available science to guide management actions for the mute swan population.

The primary argument is conditional, meaning people might support management actions *if* the science were better. It is unknown what exactly "better" means. In the content analysis there were various concerns about the science that I identified: 1) the MDNR used science from other states to develop the M.S.M.P.; 2) there is confusion about how species are defined as native, non-native or invasive; and 3) more generally, some stakeholders feel the

science is lacking or overblown by the MDNR. Because much of the science is in fact extrapolated from Maryland research, I grounded the secondary argument using this information.

Premise 1: The Michigan DNR did not use mute swan research conducted in Michigan.

From the content analysis, I identified management agencies acknowledge the science used is derived from studies in Maryland.

Auch agreed that there has not been much research done in Michigan, but the majority of research has been focused on Chesapeake Bay on the Atlantic Coast where the mute swan populations are far greater than in Michigan. That preponderance of research there is valuable before Michigan experiences the larger concentrations of the mute swans, ("Evidence shared for mute swan program" 2012).

The use of Maryland research is also noted in the MDNR Issue Paper for mute swans.

Therefore, this is true, but controversial.

Premise 2: Mute swan research conducted in Michigan is the best available science (BAS) for guiding management actions in Michigan.

There are several laws in the United States that stipulate environmental conservation and management use "best available science" to guide policy (Sullivan et al. 2006). The M.S.M.P. was guided by science from Maryland, so the contention with this argument is Maryland mute swan research is not relevant to Michigan management. To understand the truth of this claim one can use biological, sociopolitical, and ecological knowledge. Management actions are in part informed by science, but also how mangers, stakeholders and policy-makers interpret science and its relevance to management actions. From the other

arguments, we can note that biological and ecological sciences are required to describe what role mute swans play in the ecosystem. What we need to understand now is if there is enough parity between Michigan mute swans and Maryland mute swans to say the science is adequate to justify management in Michigan. Therefore, stakeholders should be in agreement that this is both relevant and rigorous science to justify management actions. In this case, many stakeholders disagree that this was the BAS for Michigan mute swan management. However, this was the science available at the time mute swan management decisions were being made. Although quantitative data about mute swans are generally limited, this was also likely the best research available.

Limited, and likely inconsistent, criteria exist to define "best available science." In this case, is best available science conducted locally? The MDNR can and did use Maryland research to understand general population and ecological trends to take action before things became perceivably worse. However, when animals are being killed is it appropriate to not fully understand the situation in Michigan? How do we know when uncertain science should outweigh future, perceived threats?

According to Sullivan et al. (2006) there are general standards to follow when conducting research, which might contribute to it being the "best available" science. However, uncertainties within science also exist and might need to be taken into account for management decisions. These uncertainties include:

1. Lack of basic biological information, exemplified by natural history or demographics; 2. Lack of information on functional relationships between populations and environmental factors; 3. Unpredictable events, such as the timing of floods and

hurricanes; and 4. High variability associated with key parameter estimates (Sullivan et al. 2006, p. 461).

With this understanding, it might be important to acknowledge ecological and social differences between Atlantic Coast and Michigan populations of mute swans. Research tells us Maryland populations were larger and had higher growth rates. Does this change how research knowledge was applied to Michigan? It is not fully clear how Michigan DNR determines appropriate science and how uncertainties are addressed. Sullivan et al. (2006) suggest agencies are transparent about the uncertainties of the science being used and address any assumptions being made. He suggests scientists, managers and the public engage in an open dialog to discuss the science and its potential uncertainties, as well as a plan for BAS.

Another complexity in discussing the science used to inform management is understanding if and how the public is interpreting the science. The public, or non-scientists, may misunderstand science, particularly if the science is poorly communicated (e.g. Larson et al. 2007), so how does this influence the public's perception of BAS? At this point, the science is unacceptable for some, and not for others. To better approach the truth, one needs to understand what constitutes BAS and how the public perceives and agrees to these standards. Therefore, the premise is possibly true and controversial.

Conclusion (P2): Therefore, the Michigan DNR did not use the best available science to guide management actions for the mute swan population.

It is unclear if best available science is defined by where the science was performed. It is common practice, though not correct practice in all cases, to adapt scientific results for purposes beyond the original research design. However, this issue is controversial and

stakeholders are requesting the MDNR provide more relevant science. Considering cuts to conservation budgets, the BAS might be limited to already published data, regardless of where the studies were conducted. What needs to be determined is if this is acceptable research for Michigan mute swans and who determines the acceptability—stakeholders, MDNR or both. Now that I gained a better understanding of the truth and controversiality of P1., I will return to the primary argument.

The primary argument can be formulated into two premises and the resulting conclusion. Sociopolitical, ethical, biological and ecological knowledge are all required to form this conclusion. How we determine what is appropriate for policy is guided by science, but it is also influenced by values and politics.

Premise 1: Michigan DNR did not use the best available science to guide management actions for the mute swan population.

The secondary argument suggests the controversy of this premise is about how we use research to guide management actions. More specifically in this discussion, there is a concern that research conducted in a different state is not appropriate to guide management actions. The secondary argument suggests ways scientists and managers can attempt to use the BAS, but there are no clear definitions for this concept. Further, it is unclear how well science is translated to the public, and if stakeholders understand the science and its application in management. The truth of this premise is uncertain, but also highly controversial. Therefore, if science is to be used to inform management, it should not only be the best, but the "best" should be clearly defined.

Premise 2: We should use the best available science to guide management actions.

It is likely all stakeholders would agree that management should be guided by sound, relevant science. Although there is little disagreement over using BAS in management, there is likely disagreement in how BAS is defined. For example, does using BAS require we eliminate non-scientific perspectives? Our attempts to eliminate subjectivity from management are often for naught, as there is subjectivity in simply determining what counts as "appropriate" science. Is the role of science in management best defined by scientists? Should stakeholders have a say in what is the BAS? If all stakeholder values are to be acknowledged in the management process, then perhaps these stakeholders should work more closely with scientists to understand the science and define what is best for each management action. I would conclude that this premise is true and uncontroversial, but there is certainly disagreement about how to define BAS for management.

Conclusion: Therefore, the evidence does not yet support controlling the mute swan population.

There are various ways in which stakeholders discuss science. I represented an argument that suggests the science used for mute swans management is not BAS-- a term often employed by agencies. Science can be interpreted differently between scientists, managers, policymakers and stakeholders. When lethal control is involved, these interpretations might vary even more. In fact, the science might not even matter if lethal control is involved. According to Sullivan et al. (2006, p. 462), "Unpopular management decisions often lead to claims of 'poor science' and calls for additional scientific review." Sullivan et al. suggest better articulation of the limits of science when faced with uncertainty. One means to bridge the gap

between the public and managers is to incorporate the public in the discussion about methods and how science is used to inform management.

In this case, if research is being extrapolated from Maryland, perhaps there should also be an understanding if Maryland management was effective in managing for ecosystem health. As of April 2013 there have been no evaluative studies, to my knowledge, to support that management of mute swans has been effective at protecting ecosystem health. Should evaluative studies also be considered in the scientific evaluation of management options? While writing this thesis, an article was published February 2013 that models the efficacy of various management options for mute swan populations. The model concluded that, "removing 60% or more of the non-breeding individuals each year was projected to reduce the population below the level for which grazing conflicts have been previously reported" (Wood et al. 2013, p.1). Further, the researchers suggest this degree of management would need to be sustained, otherwise is it becomes ineffective. They also suggest this type of modeling is only a precursor for a pilot control program. Warburton and Norton (2009) affirm the need for experimental management, particularly when faced with uncertainty about the outcomes. More often than not, lethal control actions are not designed in this way and are fully implemented before it is clear if these actions will reduce the perceived threats. In this debate stakeholders challenge both the science and the methods. Perhaps a more ethical approach would be gain the greatest understanding of the threats, implement experimental or pilot management efforts, and then determine what methods will most likely and appropriately address ecological and sociological concerns.

Ultimately what this argument comes down to is a question of how we define and use science in determining management actions. It is likely that if stakeholders disagree with the science, they will also disagree with the methods for control (or vice versa). Therefore, the truth of this argument is likely to impact the controversiality of other arguments, such as the argument about whether or not to kill mute swans. This argument itself is true for some, but untrue and unacceptable for many others. This argument is also conditional, which suggests if the best available science is acquired, control is potentially acceptable.

2. Aesthetic Argument

Mute swans are considered graceful, beautiful and symbolic to many stakeholders. People like the presence of swans on their local waterways and they often contribute meaningfully to one's "place". The following argument reflects this ethical quality of mute swans. Here is an example reason for this argument: **Reason:** "I think it's atrocious. I am very upset about this. I can't understand the reason for it. They were beautiful on the lake," (Jeltema 2011). From this reason, one might craft an argument similar to the one below:

P1. Mute swan populations contribute to the aesthetic value of Michigan lake communities.

P2. We should preserve the aesthetic value of Michigan lake communities.

P3. Controlling mute swans will diminish the aesthetic value of Michigan lake communities.

P4. Preserving aesthetic value is an adequate reason not to control Michigan's mute swan population.

C1. Therefore, we should not control Michigan's mute swan population

This argument shifts the background knowledge required from biological and ecological to more philosophical and ethical. This argument is expressed in a variety of ways, suggesting

the aesthetic value of mute swans is intrinsic for some and instrumental for others, and

sometimes both. Each aesthetic valuation would result in a different argument; one suggesting

mute swans should remain because they provide something for humans, and the other

suggesting mute swans should stay because of the value they possess independent from

humans. I focused this argument on the aesthetic value that is instrumental. Some might

consider this aesthetic valuation as contributing to one's "sense of place." In a later argument

against killing mute swans, I discuss a variation of the intrinsic value mute swans have.

Table 6: Primary argument analysis table for reason in opposition to mute swan control	ol
because mute swans are aesthetically valuable.	

Primary Argument	Kind of Premise	True/Appropriate?	Controversial?
P1. Mute swan populations	Philosophical	Possibly true	Yes
contribute to the aesthetic value of			
Michigan lake communities.			
P2. We should preserve the	Ethical	Not always	No
aesthetic value of Michigan lake			
communities.			
P3. Controlling mute swans will	Sociological and	Sometimes	No
diminish the aesthetic value of	Philosophical		
Michigan lake communities.			
P4. Preserving aesthetic value is an	Ethical	Sometimes	Yes
adequate reason not to control			
Michigan's mute swan population.			
C1. Therefore, we should not			
control Michigan mute swans.			

Premise 1: Mute swan populations contribute to the aesthetic value of Michigan lake

communities.

Philosophy can provide the knowledge necessary to understand the truth of this

premise. Environmental aesthetics is a sub-discipline of philosophy dedicated to aesthetic

valuations of the environment. One way to look at environmental aesthetics is to look at how it

might contribute to a person's sense of place. This particular premise suggests mute swans are

part of the landscape, or perhaps the ecosystem. For example, one advocate for not controlling mute swans explains: "most people enjoy the sight of these beautiful birds swimming placidly among the lakes," (Grain 2012). However, not all people would agree that mute swans enhance the aesthetic quality of a lake. Aesthetic value is different for different people and likely dependent on particular kinds of knowledge about ecosystem health, ecology, and our relationships to particular landscapes. Carlson (1984) suggests aesthetic value is driven by an understanding of the natural world. Therefore, a greater appreciation for "native" systems might avert some from appreciating mute swans as an aesthetic quality of lake communities because they are not native. The conflicting concept of an ideal landscape drives some of this conflict. Therefore, this premise is true for some and not true for others.

Premise 2: We should preserve the aesthetic value of Michigan lake communities.

More generally, people will likely agree that we should preserve aesthetic qualities of Michigan lakes to some degree. However, there is again a discrepancy as to what is aesthetically pleasing and how that contributes to what we preserve and how this valuation is prioritized or not when in conflict with other values. Robinson and Elliot (2005) argue that the aesthetic value of the environment is a key value driving environmental ethics concerns. The things we find aesthetically pleasing are the things we prioritize care for. In this case, many prioritize the care for mute swans, perhaps over ecosystem concerns or human safety, because of the aesthetic qualities they possess. These concerns are deeper than perception. They are formed cognitively and emotionally. Therefore, removing mute swans from a lake diminishes more than what one might consider an ideal landscape. For example, one stakeholder says, "swans are part of the area culture and landscape. 'They're something we treasurer and

respect," ("Invasive mute swans are target in White Lake habitat restoration" 2012). Disregarding aesthetic valuation might emotionally detach some from their community. Premise 3: Controlling mute swans will diminish the aesthetic value of Michigan lake communities.

Mute swans are relevant for residents', and perhaps non-residents' aesthetic appreciation of local landscapes. Therefore, removing mute swans diminishes the aesthetic value of these landscapes and communities for certain people. Again, there is likely disagreement with aesthetic valuations based on what people find aesthetically pleasing and how this connection drives their sense of place.

Premise 4: Preserving aesthetic value is an adequate reason not to control Michigan's mute swan population.

This premise suggests not only that an aesthetic value is important to the community, but that it outweighs the perceived threats mute swans pose to the ecosystem and human communities. This is in conflict with the scientifically-driven concept of ecological health, which might drive others' aesthetic appreciation of nature. This premise, and what follows in the rest of the argument, likely displays how some values are often excluded as irrelevant in management actions because they are not driven by science. However, Williams and Stewart (1998) suggest these conflicting values should not be ignored because one is rooted in science and the other is not. Rather, they should each be recognized and appreciated. Although appreciation is one step in the right direction, argument analysis can tease out justified valuations. Evaluation of arguments, like this, can place equal weight among scientifically and non-scientifically rooted concerns. This premise is driven by what one values in nature and thus

will be true for some, but untrue for others. As a result, this premise is just as valid to some as a premise that suggests protection of wetland ecosystems is an adequate reason to control Michigan's mute swans.

Conclusion 1: Therefore, we should not control Michigan's mute swan population

Does it matter if the aesthetic value of mute swans is instrumental or intrinsic? In this case, mute swans are valued because they provide something for people. In other cases, mute swans are valued as part of the landscape, independent of human concerns. Sometimes, and perhaps more often than not in this discussion, mute swans are valued both intrinsically and instrumentally. None of these values are wrong or untrue, but often these types of values are treated as less important than scientifically-driven values when determining a course of action. Therefore, they are often controversial. Although aesthetic values in general might be appreciated, ecosystem health often tends to override such values for natural resource managers. This begs the questions: is killing justified when these other values are compromised?

The Methods Discussion

This analysis revealed there are two divisions of arguments. The first group of arguments discusses whether or not the MDNR should control mute swans. The second group of arguments discusses whether or not killing is acceptable. The heart of the controversy appears to lie in what methods are employed for mute swan control. Although control appears to be generally acceptable, killing is not. The next two arguments represent the justifications both for killing mute swans and for using alternative methods to control mute swans.

1. Argument in Support of Killing Mute Swans

This reason represents why the MDNR chose to kill mute swans as opposed to using other methods of population control:

Overall, the program will utilize a series of measures to control mute swan populations with the main focus being the elimination of adults. Because of high reproductive potential and long life span most of the alternative control methods such as nest and egg destruction are not very effective or efficient in reducing populations, according to the news release, ("Meetings to address mute swan cull" 2012).

This reason suggests killing mute swans is the best option for effective or efficient population control. The reason also implies that other methods will be used, but that these methods will not achieve effective or efficient population control on their own. A corresponding argument might look like this:

P1. Killing mute swans is the most effective and efficient population control method.

P2. We should use the most effective and efficient methods to control Michigan's mute swan population.

P3. It is wrong to kill a living being without an adequate reason.

P4. Effective and efficient population control is an adequate reason to kill living beings.

C1. Therefore, if we control Michigan's mute swan population we should kill them.

This argument suggests killing mute swans is both effective and efficient. I interpreted effective to mean killing is most likely to reduce the population numbers. I interpreted efficient to mean killing is the most cost effective population control method. There is largely disagreement over the value placed on living beings and how we treat them between this

argument and the argument against killing, Therefore, the conflict within this argument lies in

P2-P4, the ethical premises. To better understand the truth of this argument we need

biological, ethical and economic knowledge.

Primary Argument	Kind of Premise	True/Appropriate?	Controversial?
P1. Killing mute swans is the most	Economic and	Possibly	Maybe
effective and efficient population	Biological		
control method.			
P2. We should use the most	Ethical and	Yes	Yes
effective and efficient methods to	economical		
control Michigan's mute swan			
population.			
P3. It is wrong to kill living beings	Ethical	Almost always true	Yes
without an adequate reason.			
P4. Effective and efficient population	Ethical	True for some	Yes
control is an adequate reason to kill			
living beings.			
C1. Therefore, if we control			
Michigan's mute swan population			
we should kill them.			

Table 7: Primary argument analysis table for reason in support of killing mute swans because the method is effective and efficient.

Premise 1: Killing mute swans is the most effective and efficient population control method.

Ideally management actions are effective and efficient, but are these two qualities necessarily interrelated? Although control might operate both effectively and efficiently, these concepts of control are independent. Effective connotes something will work, while efficient means an outcome is achieved using the least amount of resource. Therefore, the reason for this argument might actually be two separate arguments—one about effective methods, and one about efficient methods. A management action could be both effective and efficient, but could also be effective and inefficient (or vice versa). I chose to leave this concept as one argument in reflection of the reason statement. In this case the efficacy of actions is evaluated by eliminating a certain number of swans in a certain amount of time.

Effective control in this argument is evaluated by reducing the mute swan population to a certain level: "The agency won't reach its goal of reducing the swan population to fewer than 2,000 if it stops killing the birds," (Lawrence 2012). This would mean we need biological knowledge to understand how particular methods reduce the population most effectively. According to mute swan biology this is certainly true. Mute swans live an average of 8 years, their annual clutch size can be 4-5 eggs (Ellis & Elphick 2007). Survival greatly increases as a mute swan moves into the adult life phase. According to the MDNR Mute Swan Issue Paper (2003, p. 2), "In Michigan, mean annual mortality rates of fledgling through 3 year old swans ranged from 12-16% a year. From ages 4-8 years, annual mortality decreased to 2-7% per year. At age five, annual mortality averaged only 2%." The goal the M.S.M.P is to reduce the population to 2000 by 2030. The MDNR must limit both the current population and population growth to effectively control the population. Since the current population influences population growth, the current population is the greatest target for control. The biological evidence suggests control is most effective if it is targeted at adults, thus killing is the most effective method.

This premise also states that killing mute swans is efficient. This possibly means killing swans will reduce the labor and money required to implement the management plan: "Oiling eggs and nest destruction helps keep the population in check, but doing that is expensive and a logistical nightmare," (Myerson 2012). Therefore, this premise is also an economic premise, describing how particular actions limit the cost, time and labor used to perform an action. The

M.S.M.P is a twenty-year plan, requiring sustained control efforts and therefore sustained funding and labor for the efforts. This consistency is required to prevent further recruitment and immigration of mute swans into the population. In this case, the MDNR must rely on affiliate organizations and the approval of private landowners to implement and maintain control of mute swan populations. Therefore, this premise might hinge on the condition of persistent and partnered management to maintain the efficiency, and perhaps also the effectiveness, of the actions.

There appears to be sufficient biological evidence to conclude this premise is true within certain parameters. However, considerations should be made for long-term effectiveness and efficiency.

Premise 2: We should use the most effective and efficient methods to control Michigan's mute swan population.

This is an ethical and economical premise asserting a value for efficiency in management. There might be a couple things implied by this premise. The first is that the MDNR is a public agency, supported by public funds, and therefore it has a responsibility to work efficiently. The second implication of this premise is the labor involved in utilizing alternative methods would be greater than killing, which is also indirectly linked to funding. Therefore, it might be in the best interest of both the MDNR and the public to work efficiently at managing wildlife, such as mute swans. It does not appear to be an issue to use effective or efficient control, rather that effective and efficient control might entail killing. This is detailed more in the next premise. It is reasonable to conclude this premise is neither untrue nor controversial.

Premise 3: It is wrong to kill a living being without an adequate reason.

What one might consider an adequate reason to kill a living being is likely to vary. The decision to kill another being might depend on what one considers worthy of moral consideration. For example, an anthropocentrist may argue it is acceptable to kill a living being if it provides food for human consumption. Conversely, a biocentrist may disagree there is any reason to justify killing a living being. In this particular argument, stakeholders and agency officials suggest killing is the most effective and efficient means to control the population and is therefore an adequate reason to use killing as a method of control. This is a controversial premise because an adequate reason will be interpreted differently for different people, but it is a necessary premise to make us think about and consider what an adequate reason might be, and why. If one agrees that efficient and effective animal control is an adequate reason, likely because the harms that may occur from not controlling are more problematic than the discomfort one might feel with control or killing, then this argument is effective. If not, then one will not be persuaded by this argument.

Premise 4: Effective and efficient population control is an adequate reason to kill individual living beings.

This premise requires ethical wisdom to understand how we value individual living beings in relation to our value for effective and efficient management. Often, conservation works to protect ecosystems, and sometimes it is at the expense of individuals (Bekoff 2007). In other words, it might be occasionally acceptable to kill living beings for the sake of the ecosystem. In this case, the MDNR is working to protect wetland ecosystems at the expense of individual mute swans. However, this premise does not actually reflect the philosophy

described here. This premise suggests it is acceptable to kill mute swans if it is the most effective and efficient method. The discussion about killing mute swans is always reflected as a discussion about effective and efficient control. According to the information obtained in the news content analysis, the value for effective and efficient control is greater than the value of individual, sentient beings.

The heart of the controversy about mute swan management lies in the method of control. Many stakeholders place a greater value on sentient beings than on effective and efficient control. However, some stakeholders also seem to agree killing is acceptable only as a "last resort." This might suggest they agree with effective and efficient control if the other methods are not in fact effective. One stakeholder suggests, "I feel that shooting the mute swans should be the last resort in controlling the population," ("Swan song? - not just yet." 2012). However, the agreement of these stakeholders does not relieve the contention. Many will disagree with killing sentient beings regardless of efficiency or effectiveness, and I will discuss this in more depth in the next argument. I would consider this premise sometimes true, yet controversial.

Conclusion: Therefore, if we control Michigan's mute swan population we should kill them.

How we control or manage individual living beings in relation to how we manage for ecosystem health is consistently at the heart of natural resource debates (Vucetich & Nelson 2007). Some stakeholders hold a greater concern for the intrinsic value of nature. Natural resource management often places a greater value on the utility of natural resource over the intrinsic value of natural resource. In such instances, natural resource management places a greater value on instrumental value, rather than the intrinsic value of nature. This argument

suggests the MDNR justifies killing mute swans because it is effective and efficient, however, they have not justified killing mute swans by simply asserting a normative premise. I would speculate that the MDNR might value effective and efficient control, but they would rather argue for humane control as a reason to kill mute swans. This is just not how the values are represented in the news.

The conclusion of this argument is conditional. This means one must first establish it is acceptable to control mute swans, and if it is acceptable, management can move forward to determine how to control mute swans. Therefore, this argument only works if additional information supports control. Such information will be addressed in later arguments. Assuming the additional information supports control, this conclusion is likely acceptable.

2. Argument against Killing Mute Swans

This next argument opposes killing as a method of control because it is inhumane. Many reasons suggest control is acceptable, but killing is not. Therefore, *if* we control mute swans we should employ alternative methods. Here is an example of a reason that reflects this sentiment: "It's one thing moving the eggs, but to outright shoot and kill them," (Shepard 2012)? From this reason an argument might look like this:

P1. Killing mute swans as a method of population control is inhumane.

P2. If we are to control the mute swan population, we should use humane methods.

P3. A method of population control that does not include killing living things is a humane method.

P4. Nest and egg destruction and relocation do not require killing mute swans, and are therefore humane.

C1. Therefore, if we control Michigan's mute swan population, we should only use nest and egg

destruction.

Table 8: Primary argument analysis table for reason in opposition to mute swan killin	g
because the method is inhumane.	

Primary Argument	Kind of Premise	True/Appropriate?	Controversial?
P1. Killing mute swans as a method	Ethical	True for some	Yes
of population control is inhumane.			
P2. If we are to control the mute	Ethical	Yes	No
swan population, we should use			
humane methods.			
P3. A method of population control	Biological and	Mostly true	Yes
that does not include killing living	philosophical		
things is a humane method.			
P4. Nest and egg destruction and	Biological and	Sometimes	Somewhat
relocation do not require killing	Ethical		
mute swans, and are therefore			
humane.			
C1. Therefore, if we control			
Michigan's mute swan population,			
we should only use nest and egg			
destruction.			

This argument suggests killing is inhumane, and therefore the wrong way to manage mute swan populations. This argument is also interesting in that the conclusion is conditional. The conclusion suggests one must first establish that it is appropriate to control mute swans, and then if it is appropriate to control mute swans, nest and egg destruction are the way to do it. However, it is unclear what condition would make any control acceptable. All reasons say, "*if* we control...", but at no point does any reason say why we should control. This might suggest the overarching issue with mute swan management is that killing mute swans is how we control them. Therefore, if killing were taken out of the picture, it seems that many stakeholders would agree with management actions. Yet, it still is unclear what reasons would justify any amount of control, including killing.

Premise 1: Killing mute swans as a method of population control is inhumane.

This premise is ethical and implies that sentient beings deserve humane treatment. On the one hand, as this premise describes, we have people suggesting killing is inhumane and unacceptable. On the other hand, we have people suggesting killing is humane because it limits suffering for the mute swans. For this argument, there is a conflicting ethic regarding what is humane. In regard to humaneness, the USDA-APHIS environmental assessment for mute swans in Michigan (2012) suggests, "One challenge with coping with this issue is how to achieve the least amount of animal suffering while still effectively addressing wildlife damage problems within the constraints of current technology and resource," (USDA-APHIS, 2012, p. 38). Thus, it appears the value for effective control is also sometimes in conflict with the value for humane control. In this case, however, it appears the MDNR's decision to shoot swans both aligns with their position on humane control and their notion of effective control. The problem is that the MDNR definition of humane control includes killing, and killing is just wrong for some people, regardless of circumstance. Therefore, this premise is true for some and untrue for others. This is also highly controversial because it is a discussion about how we treat individual living beings. That treatment is in part or wholly based on what characteristics and beings we believe are worthy of direct moral consideration.

Premise 2: If we are to control the mute swan population, we should use humane methods.

This premise suggests some control is acceptable. "If the species needs to be controlled, then control it in a humane way, such as sterilization, egg removal or piercing, or segregation of the young with same gender pairings. As a last resort thinning the number on a lake, but not wiping out their existence," (Luxford, 2011). However, it would be helpful to understand why

control is acceptable, which is never articulated. As this and other related quotations demonstrate, there is some agreement to control, but disagreement persists as to how we ought to control the mute swan population. This disagreement again is about how we value individual nonhuman others and/or natural systems and how those values translate into action.

This premise, however, simply suggests we should humanely control mute swans. As P1. demonstrates, humane control might be killing for some, or might be alternative methods for others. Therefore, this premise is true, but controversial.

Premise 3: Population control methods that do not include killing living beings are humane methods.

This premise relies on an understanding of what is humane in regard to how we treat living beings. The MDNR also suggests some perceivably humane alternatives may actually be inhumane. Using alternative methods, such as nest destruction, might require some amount of harassment to adult swans, thus inducing undue stress. Also, the MDNR suggests that if we kill fewer swans now, they will continue to reproduce and immigrate into Michigan. Over time, this might result in killing more mute swans to control the population. Lastly, inaction might be humane to mute swans, but it will not reduce the perceived threats to native wildlife and may be thus inhumane to other living beings (USDA-APHIS 2012). Although it might be humane not to kill certain living beings, by not doing so, these actions might become inhumane for other living beings. However, there is no empirical evidence to suggest nest and egg destruction are effective as standalone population control methods. Conversely, there is evidence to suggest eradicating mute swans requires an intensive, sustained effort. Ellis and Elphick (2007, p. 319) found that "spreading the mortality over 20 years," as the DNR intends to do, "would increase

the number of swans that need to be removed by 78%." Still, modeling suggests intensive strategies to cull mute swans result in the greatest likelihood of reducing or eradicating the species. This premise might be acceptable if alternative control options on their own work to control mute swan populations. Although not killing mute swans might be more humane in a certain way, it might be inappropriate or unfeasible to employ these alternative methods to achieve management goals. This premise tells us there is a missing empirical premise needed to justify the conclusion. Therefore, this premise is sometimes true and will likely depend on which alternative methods are employed.

Premise 3: Nest and egg destruction and relocation do not require killing living mute swans, and are therefore humane.

This premise is true, as long as one believes that pre-hatchlings are not alive. Nest and egg destruction do not, in fact, require killing a living mute swan. If one considers killing living beings inhumane, then one is likely to agree with this premise. However, as we saw in P2., there is some disagreement in regard to the humaneness of alternatives to killing mute swans. Conclusion: Therefore, if we control Michigan's mute swan population, we should only use nest and egg destruction.

Agencies acknowledge the suffering of animals must be considered in the decisionmaking process and management actions should consider humaneness of methods. Regardless, the value of living beings is perceived differently for different stakeholders. In this case, stakeholders clearly oppose killing as a method of control, particularly as the primary method of control. For example, one stakeholder believes "that the DNR program inhumanely involves euthanasia, rather than egg removal," (Hopkins 2012). For stakeholders such as this, it seems

for that effective control is less of a priority than humane control—humane apparently meaning any method that does not include killing. The MDNR's definition of humane control is to limit suffering, or the amount of time an animal suffers. A clean shot to the head is likely to limit the duration of suffering, and thus is deemed humane.

There are deeply rooted philosophical differences regarding how we treat living beings and these result in an increased tension over whether or not we should employ lethal control for mute swan management. In addition to these disagreements, both arguments for and against killing mute swans are conditional-- the condition being whether or not we should control mute swan populations. At no point do stakeholders suggest reasons why it might be acceptable to control mute swans, but they do suggest that with limitations, control is acceptable. Then what circumstances allow for some amount of control to be acceptable?

CONCLUSION

Reasons identified in the content analysis that are opposed to mute swan control, or killing, are centered on the obligations humans have to individual sentient beings and how people aesthetically value mute swans as part of the landscape. Reasons in support of management, or killing, tend to be centered on the perceived values for native ecosystems and limiting negative interactions between mute swans and humans.

The arguments used in support of mute swan control often display a high degree of consequentialism, wherein the rightness of an action is determined by the outcome of the action (Nelson & Vucetich 2012). There is concern that if action is not taken now, the mute swan population will continue to increase, and thus the perceived threats mute swans pose to humans and ecosystems will also increase. This line of thought aligns with what some scholars

refer to as the Precautionary Principle: "an appeal to caution or prudence before taking a step that might prove harmful later," (Cox 2006, p. 270). Both arguments in favor of mute swan control evoke the consequentialist, precautionary thinking. The action of killing mute swans is appropriate, as long as it mitigates future concerns. This tends to be in disagreement with arguments that oppose mute swan control. Most opposing arguments are deontological; wherein the motivation for an action is judged as right or wrong, rather than the outcome of the action (Nelson & Vucetich 2012). Herein lies much of the conflict in if and how we ought to

manage mute swans.

Table 9: Argument assessment overview displaying the strength of conclusions based on the weakest premises of each argument. For interpretation of the references to color in this and all other figures, the reader is referred to the electronic version of this thesis.

We should control Michigan's mute	Conclusion:	We should NOT control Michigan's	Conclusion:
swan population to:		mute swan	
		population because:	
Protect aquatic	Possibly true- pending	The science is	Possibly true- pending
vegetation	effects of mute swans	insufficient	how we define BAS
	on local vegetation,		
	define ecosystem		
	health		
Limit instances of	Possibly true- pending	It will diminish the	True for some-
aggression toward	further analysis of	aesthetic value of	depends on one's
humans	aggressive instances	lakes	perception of
			aesthetic value

We should kill mute	Conclusion:	We should NOT kill	Conclusion:
swans as a method		mute swans as a	
because:		method because:	
It is effective and	True for some-	It is inhumane	True for some-
efficient	depends on how one		depends on how one
	values individual		values individual
	living beings		living beings

This analysis revealed ethical disagreements and empirical inadequacies. All of these arguments have weaknesses in either empirical or ethical justifications, or both. Therefore, the conclusions that are reached are also weak. So, should we kill mute swans to limit future threats? Or should we build more evidence to the case prior to moving forward? In Table 9, I have given an overview of the argument analysis results. I summarized the strength of each argument's conclusion using information from the argument's weakest premise.

Three arguments are described as "true for some," which indicates these arguments will likely rely on an ethical consensus to be more robust arguments. For instance, the arguments for and against killing mute swans suggest a deeply-rooted ethical disagreement about how we value living beings. Valuing effective and efficient control is not wrong per se, but when this argument is placed alongside an argument for humane control the rationale for killing mute swans seems insensitive. Although the MDNR likely values humane management (i.e., management that considers harms to individual living animals), the value for effective population control currently outweighs the value for humane control according to the content analysis results. In response to a request by the Humane Society of the United States' to not kill mute swans, an MDNR official wrote, "lethal control is currently the most effective and efficient method for population reduction'" (Wolffe 2012). The MDNR official goes on to suggest the HSUS conduct a pilot study to determine the effectiveness of alternative control methods, which ironically is something the MDNR have not done themselves for lethal control methods. Additionally, the MDNR official repeatedly said, "both lethal and non-lethal methods will be used," (Wolffe 2012) which seems to be their appeal to incorporate humane alternatives. By understanding management actions in this ethical framework, these values

become explicit. This process allows us to understand which reasons are logical and justified, and if any are not, search for more justifiable reasons to reach a justified conclusion. Although the MDNR rarely discuss the humaneness of killing, they do express concern for humanely managing mute swans in official documents. They recognize suffering as a measure of humaneness and consider shooting mute swans as a means to limit suffering. Perhaps a more ethical reason to kill mute swans is that this method is, at least perceivably, a more humane method than either taking no action at all or destroying nests and eggs.

The other three arguments in Table 9 are described as "possibly true", meaning they will likely rely on some additional empirical information before the conclusion is logical. Ethical argument analysis purposefully draws attention to the ethical dimensions of wildlife management. However, this does not mean science becomes excluded in the process – not at all. Science is crucial to the process of logic and robust ethical argumentation and it is necessary to justify empirical claims. An ethical argument requires both empirical and ethical premises. A conclusion cannot be supported solely on ethical claims. The conclusion of the aggression argument, for instance, was limited by its empirical premises. There is no strong scientific evidence to suggest mute swans are in fact aggressive toward humans, and what aggressive acts entail if they are. Therefore, the ethical premise "limiting instances of mute swan aggression toward humans is an adequate reason to control mute swans" is ethically unjustified. If the premise is unjustified, then the conclusion to control mute swans becomes problematic because stakeholder values are likely being disregarded to limit an ungrounded claim.

In this analysis, there is an argument that directly opposes and draws upon the uncertainty of the science used to inform management actions. It is common for there to be various levels of uncertainty prior to taking action in natural resource management, which leads to adaptive management processes (Stankey et al. 2005). But what amount of uncertainty is acceptable, how do we address uncertainty, and at what point is adaptive management misused because the initial actions are unjustified? The intentions of adaptive management are to design experimental management strategies and base future management on the outcomes. Whole scale management policies, such as statewide mute swan eradication, are not necessarily designed to be adaptive. Argument analysis is a first step for management, and highlights areas of uncertainty and offers guidance for what research is most needed. It does not excuse uncertain premises – rather, it is a way to identify uncertainty and work to address it.

Globally, natural resource managers have been working against the invasion of exotic species. It has become much easier for species to be introduced into to habitats because of globalization. More recently, agencies have focused greater attention to the prevention of exotic species introductions and establishment. However, identifying whether a species will become invasive or not is difficult, and eradication becomes the second best option (Clout & Veitch 2002). The effectiveness of lethal control at minimizing conflict is not always well understood prior to implementing such management efforts. Warburton and Norton (2009) suggest lethal control ought to be experimental to understand if it will work before moving forward with larger-scale implementation. Not only does experimental methodology limit unnecessary killing, it limits misuse of public funding for conservation. If we know it works, our

money is likely well spent. Many of the arguments I assessed reveal the inadequacies of making such decisions. Either the science does not demonstrate the problem, the science does not support the control method, or values are being ignored in favor of inadequate science. If the justifications for killing mute swans are inadequate, as some of these arguments demonstrate, killing mute swans becomes an inappropriate and unethical use of public dollars, as well as an unjustified way to manage wildlife.

Characteristics of Michigan mute swan management are unique, in that the species of interest is perceived by some as charismatic, symbolic, and graceful. Others perceive the swans as a major threat to both ecosystem health and human safety. Although certain features of this issue are unique, underlying concepts parallel many other natural resource issues. Take for example the ongoing consideration of whether or not the gray wolf should be listed as a game species in Michigan. Although the issue itself is markedly different, there are similar values at stake in determining how we ought to manage wildlife. Wolves are often perceived as a cultural icon, and many stakeholders feel wolves have intrinsic value and should remain protected. Yet, reducing the wolf population is perceived by others to protect livestock and deer populations, so reducing wolf populations is perceived by some as importantly instrumental to human interests. The conflict arises with an underlying difference between how we value individual living beings, for their intrinsic or instrumental values, or both. The decision to list wolves as a game species also requires an understanding of the role wolves play in the ecosystem and if and how that role is perceived to contribute to ecosystem health. On the surface wolf and mute swan management differ significantly, but the underlying arguments require similar consideration for what we value with respect to the natural world and how those values

translate into management actions. I used the Michigan mute swan case study as a means to demonstrate how, although there are unique features to the case, larger concepts exemplify what we see with many natural resource conflicts. Ethical argument analysis offers insight into how a contentious issue might become less contentious using logic and reason.

There are many models, methods and theories guiding management. Rarely, however, do these frameworks acknowledge the ethical dimensions of conservation management actions. Ethics are inherent in the choices we make to manage wildlife (Decker, Shanks, Nielson & Parsons 1991) and how we choose to carry out our management decisions on the ground. Ethical argument analysis provides a systematic means for combining stakeholder values and science to make decisions guided by rigorous argumentation.

Conservation managers ought to move forward with ethical discourse and encourage diverse stakeholders to participate in the discussion. Ethical discourse is often vacant from everyday interactions. Certain skills are required to navigate and allow this process to be effective. One must have an understanding of the process to begin-- argument analysis requires an understanding of argument formulation and ethical evaluation. Crafting and assessing arguments is a lengthy and sometimes iterative process, requiring patience and dedication. As the mute swan case study demonstrates, knowledge is pulled from multiple disciplines; therefore experts from multiple fields, including ethics, are helpful in achieving robust outcomes and assessing and the knowledge necessary to make justified decisions. Stakeholders and agency officials need to be transparent about what they value in a group argument analysis effort. This process also requires empathy, intellectual honesty and consideration of other viewpoints and values (Vucetich & Nelson 2012). These characteristics promote an open,
ethical dialogue between stakeholders, managers and policy-makers, all working toward common ground at the values level. Vucetich and Nelson (2012, p. 25) worded it best when they wrote: "ethical discourse is not about defeating anything; it is about discovery." This process of ethical discovery can reveal the most reasonable, and logical, approaches to address a conservation issue. If we commit to logical and sound argumentation in our address of conservation issues, we have the opportunity to craft policy that reflects and responds to diverse stakeholder values in a justified and transparent fashion. APPENDICES

APPENDIX A: Mute Swan Management Plan Content Analysis Codebook

SECTION A: DOCUMENT IDENTIFICATION – This section provides the descriptive information for each document.

DT: Document ID

Each document receives a unique ID number, identifying the document type and source. Documents will be coded in their file name as [source]-[type (if not news)]-[n], using the guide below for document types. Example: Mlive-01. Document numbering is specific to the source—three Mlive articles will be numbered 01-03.

Document Type

[source]-[n]: General news article [source]-LE-[n]: Letter to the Editor [source]-OP-[n]: Opinion piece

LD: Length of document

Record the number of words in each document. This information includes the bulk of the document- title, body and picture captions. Document length does not include public commentary, author, date, etc. This can be done with the help of the word count feature in Microsoft Word.

LD-(#)

SECTION B: ARTICLE REACTION – This section quantifies reader reaction by summarizing how many comments, shares, and/or "likes" the article had. Social media and commentary forums allow readers to engage in discussion and expand the reach of the news that is important to them. As Facebook and Twitter are the two mainstream social media networks, these will be the only networks coded.

COM: Comments

Coder will record the number of comments associated with document. This number will be finalized thirty days after the publish date of the article. For example, and article published August 1 will code comments through August 30. See below for coding replies to comments.

COM-0 = No Comments, but outlet exists COM-1 = 1 Comment COM-2 = 2 Comments COM-(n) = (n) Comments COM-NA = No outlet for commenting exists

REP: Replies to comments

In addition to coding comments, coder will record the number of replies to comments. This information will be used to determine the extent of conversation sparked from the article topic. This information will again be finalized thirty days after the article publish date.

REP-0 = No Replies REP-1 = 1 Reply REP-2 = 2 Replies REP-(n) = (n) Replies REP-NA = not applicable

FB: Facebook

A common feature of online news articles is to recommend or "like" an article via Facebook. Many news distributors display the number an article has been recommended using this tool. This code will reflect that number, with a final count to be made at the conclusion of analysis (September 1, 2012).

FB-0 = 0 recommends via Facebook
FB-[n] = Number of recommends via Facebook
FB-NA = Not applicable
FB-UNK= Facebook button exists, but no count for shares/likes

TW: Tweets

Another social media feature is "tweeting", using the Twitter network. Similarly to Facebook recommendations, the number of "tweets" about an article is displayed in the online interface. This code will reflect that number, with a final count to be made at the conclusion of analysis (September 1, 2012).

TW-0 = 0 tweets TW-[n] = Number of tweets TW-NA = Not applicable TW-UNK= Twitter button exists, but no count for shares/likes

SECTION C: REASONS OPPOSING MUTE SWAN MANAGEMENT- The primary purpose of this research is to understand the arguments used in favor of and opposition to the Michigan DNR's mute swan management plan. To understand the arguments, we must understand the reasons for arguments. In this section, coders will look for clearly stated reasons an individual or organization opposes the mute swan management plan. Key words to look for are bolded.

RO-AES: Aesthetic Value

Swans have been symbolic for their grace and beauty, and that may be reflective in the arguments opposing the management plan. The birds oftentimes enhance the aesthetics of a body of water, therefore increasing the enjoyment of nature by humans.

Coders will identify statements that suggest opposition to the management plan because of an aesthetic or utilitarian value. Key words to look for are, "beautiful", "graceful", "enjoyment", etc.

Example: "Most people find mute swans awe-inspiring — a bird revered for its **majesty** and **beauty** the world over," (Rhodes 2012).

RO-AGG: Aggression is natural

The MDNR argues that mute swans pose a threat due to their aggressive nature. However, opponents to the plan tend to argue the aggression is natural defense to protect young or territory. Additionally, many will argue the aggression is overblown. This code will be used for both scenarios.

Example: "As for their **aggressiveness**, what **would you do to protect your child**? I don't blame the swan for attacking Jet Skiers when they maliciously drive at the swan with the intent of killing them and their young," (Luxford 2011).

RO-NO KILL: No Kill

When people refer to more humane methods, or using alternative methods rather than killing adults, use this code. This will only be used in the context that killing is inappropriate. MDNR comments often mention egg addling/nest destruction as supplementary to the killing- these comments will not fall into this code. Note any underlying reasons for why a person is interested in alternative methods (i.e. more humane).

Example: "If the species needs to be controlled, then **control it in a humane way**, such as sterilization, egg removal or piercing, or segregation of the young with same gender pairings," (Luxford 2011).

RO-DIS: Distrust Expert Voice

This category has three sub-codes that identify the more specific source of distrust.

RO-DIS: Distrust of Authority

This code refers to statements that suggest the authority of the decisions has a hidden agenda or is untrustworthy for other reasons.

Example: "Oh, there needs to be a cull all right — of the **DNR and bloodthirsty state** officials who sleep with the hunting lobby," (Donnelly 2012).

RO-DIS-EXP: Alternative Expertise

Often, groups or individuals opposing the mute swan management plan are interested in public votes, or a more democratic process for deciding the fate of the swans. This code represents a desire to have public participation in the process of determining the fate of mute swans.

Example: "Karen Stamper of Walled Lake, who is leading the charge, said she wants **residents to be able to decide** the swans' fate in a state election," (Campbell 2012).

RO-DIS-SCI: Science is Inadequate/Uncertain

Much of the MDNR's management plan is, "based off sound science." However, when an issue becomes contentious, even sound scientific arguments may be questioned. This code will suggest that the opponent to the management plan questions the science behind the plan's development. Comments may include a question of how we define native, invasive, etc.

Example: "Stamper's flyer challenges the DNR's position that the mute swan population in the state needs to be reduced. She writes that the DNR **lacks adequate science** to support its position," ("Meetings to address mute swan cull" 2012).

RO-HUM: Humanity is the Problem

It is suggested that mute swans in Michigan originated from a pair brought to Charlevoix to increase the aesthetics of a pond. Therefore, many will argue that the problem originates from humans, not swans. This will include humans as being the cause of swan introductions into the United States, and humans creating more damage to ecosystems than swans.

Example: "The DNR is lying to the public by claiming that swans are ecologically destructive when **it's humans that wreak the most havoc**," (Rhodes 2012).

RO-NAT: Nativeness Should Not Matter

A large reason for culling mute swans is their non-native, invasive status. This code will reflect a statement that questions whether we should make decisions based on the origin of a species (i.e. we should not kill mute swans simply because they are not native). This opinion suggests a biocentric view.

Example: "Some say that it is not a native species to the United State because it was brought here in the late 1800s and therefore it should not be here. Should that same rule apply to people who have not been a U.S. citizen for over 200 years? We are all immigrants," (Luxford 2011).

SECTION D: REASONS IN SUPPORT OF MUTE SWAN MANAGEMENT

RS-AGG: Aggression

Swans are often characterized as aggressive, with the potential to harm humans, children, native species, etc. Aggression can be defined in a variety of ways—hissing, chasing, biting or killing. The code has three sub-categories: aggression as a general

characterization, aggression toward humans, and aggression toward wildlife. This code will reflect aggression as a reason for controlling the species.

RS-AGG

Example (general characterization): "They are considered the **most aggressive waterfowl** species in the world," (Hamling 2012).

RS-AGG-H

Example toward humans: "Mute swans' aggression toward humans is increasingly dangerous for people in boats and on shore," (Hamling, 2012).

RS-AGG-W

Example toward wildlife: "Because of the **mute swan's aggression toward native waterfowl**, the DNR has long removed mute swans from state game areas," ("Mute swans have become a nuisance" 2012).

RS-KILL: Killing as Primary Method of Control

The primary method for mute swan management is lethal control. Opponents to the mute swan plan suggest the use of alternatives to killing adult swans. However, this is often refuted as ineffective for the long term goal. This code will represent that view.

Example: "The program will utilize a series of measures to control mute swan populations with the **main focus being the elimination of adults,**" ("Meetings to address mute swan cull" 2012).

RS-COM: Protect Community Value

This code will reflect a statement that suggests mute swans are diminishing the value of a community.

Example: "It would be a significant **setback to the community** having done all this work only to have an invasive species take over and endanger native wildlife and destroy wetland habitat," ("Invasive mute swans are target in White Lake habitat restoration" 2012).

RS-ECO: Protect Ecosystem

Reasons that suggest we should manage mute swans because they cause harm to multiple trophic levels or a system. This code has five sub-codes and some may often overlap.

RS-ECO: Ecosystem

Example for multi-level concern: "They devour underwater **vegetation**, leaving no **food** for other **waterfowl a**nd no **protective habitat** for **fish**," (Donnelly 2012).

RS-ECO-VEG: Primary Producers

Example for primary producers: "Mute swans... are capable of inflicting significant damage to aquatic habitat, by **feeding heavily on aquatic vegetation**," ("Mute swans have become a nuisance" 2012).

RS-ECO-WC: Wildlife/Consumers

Example for wildlife/consumers: "Mute swans have been able to **outcompete native waterfowl** for breeding habitats," (Stickney 2012).

RS-TRU: Trumpeter Swan

Example: "Mute swans are also hindering Michigan's efforts to restore its native trumpeter swan population," (Meyerson 2012).

RS-BAL: Balance

This code will be used to identify a theme related to environmental balance. Statements may range from discuss an "appropriate" level of swans for environmental sustainability. Many statements will suggest a consequentialist view of the issue.

Example: "Our intent is not to annihilate the population, but we would like **just 100 on the lake**,'" (Meyerson 2012).

RS-EMP: Empathy

This code is particularly for statements that refer to a need to shift empathy for mute swans to something else (i.e. Trumpeter swans) or the authority of the decision empathizes with the public

Example: "we need to shift our emotional attachment, not from swans to pigs, but from mute swans to trumpeter swans, the species native to Michigan," (Meyerson 2012).

RS-EXP: Expert Voice

This code has two sub-categories.

RS-EXP: Expertise/Collaboration

The collaborative effort of this plan offers additional support for its validity. Not only is the science supportive of the plan, but the authority and experts add an extra confirmation that this is what we should do.

Example: "We're united with hundreds of other groups that support eradication of the mute swan on the landscape," (Meyerson 2012).

RS-SCI: Sound Science

This code will more generally refer to the plan as being supported by sound scientific evidence, assuming it is therefore a valid decision.

Example: "'The public opinion piece is a tough one,' he said. 'Because of all the data and research we've done, unless there's something that can be shown that will refute that ... we'll be moving forward,'" (Hart 2012).

SECTION D: MESSENGER- Reference in the document to a stakeholder group or individual who is sending the message of a coded statement (reasons, communication themes, etc.). The essence of this question rests in the identification of who is sending the messages within the document, or who is making particular claims. Codes should not overlap, therefore, coders will have to match messenger to the most appropriate code category. Within an article, each individual or organization will only be coded for once. For example, if the MDNR is mentioned, then an MDNR official is quoted within the same article, MDNR will only be coded once for the article. However, if two individual agency employees are mentioned in the article, MDNR will be coded twice. If five different local citizens are quotes within an article, the article will then have 5, M-L-CIT coded for each individual.

M-L-GOV: Local Government Agency

Local will be defined as an agency below the state level, local to where the issue is taking place. Examples include White Lake Conservation District for the issue on White Lake, Lake Associations, City Council.

M-S-GOV: State Government Agency

Use this code only when it is noted or apparent that a DNR representative is making a statement within the article or the fact is sourced by a DNR agency or representative. This is a general agency code, not specific to a state.

M-F-GOV: Federal Government Agency

Local and state agencies will be more prevalent, but this code is to be used if a federal agency, such as USDA-APHIS, comes up as the messenger of information.

M- N-NGO: National Non-governmental Organization

This code will refer to an NGO that is communicating a message, but may not be local to where the issue is taking place. For example, the Humane Society of the United States has interest in the issue, but they are not necessarily focusing on a local area, rather their focus is on larger picture.

M-L-NGO: Local NGO

Local NGO will be defined as an organization within the state of Michigan. It is assumed that these organizations may have more control over the issue

M-L-CIT: Local citizen

Local citizen code is defined by a person who lives in the area being discussed in the article. For example, if the main article is about White Lake, a resident must be from White Lake.

M-NL-CIT: Non-local citizen

Use this code to identify messengers that do not have an agency affiliation, and if they do not reside on a lake affected by the mute swan management plan.

M-UNI: University

Code messengers who belong to a university or college.

M-NA: Unknown

Use this code if it is unclear what affiliation the messenger has.

Section E: Communication- The following codes are of an interpretive thematic nature. That is, the researcher is considering the content beyond what is actually written.

C-A-LAN- Literature has suggested terminology to be a hindrance for successful outreach, and therefore management. Interchangeability can create confusion in what managers actually intend to do. Terms of interest are listed below and each word should be its own (i.e. native=native, remove=remove). This code is for an overall inconsistency or ambiguity in the language expressed throughout the article. This code will likely be less common than C-LAN code, which refers to ambiguity within a sentence or paragraph.

Non-Native, Exotic, invasive, immigrant, Remove, cull, kill, hunt, control, euthanize, Reduce, etc.

C-LAN- This code is to be more specifically used for a statement or paragraph that is ambiguous in its content or inconsistent in the language.

Example: "Another letter writer compared the swan hunt to abortion, ethnic cleansing and the clubbing of baby seals. And he supported the hunt."

C-CHA: Characterization

This section helps identify how mute swans are characterized by the authors, messengers, etc. This information will help us determine how media portrays the animals, and perhaps the mute swan management plan. This code will represent how authors set up the story by characterizing the animals.

Example: "This charismatic creature is the symbol of elegance and romance, star of opera and ballet, long admired for its grace and beauty," (Donnelly 2012).

C-GEN: Generalizing a group of people

Code when an individual or agency makes a claim that another group will generally agree with (i.e. Michigan residents are right to be appalled by the Department of Natural Resource' devious plan to annihilate mute swans, which are described as "voracious" and "aggressive"") This code makes it seem as though Michigan residents as a whole agree with this statement. Example: "Michigan has approximately 15,500 mute swans. That worries a lot of people today," (Meyerson 2012).

C-MIS: Miscommunication

When it is clear that the issue was miscommunicated, this code shall be utilized.

Example: "The White Lake controversy provides a rare glimpse into what happens when word of a swan hunt leaks out early. The view isn't pretty," (Donnelly 2012).

SECTION F: REACTION TO PLAN

RE-DIS: Dispute, discontent or disagreement over plan

An open expression of discontent with the mute swan management plan- disagreement falls into this code category.

Example: "The district, local towns and elected officials have been inundated with phone calls from residents crying murder most fowl," (Donnelly 2012).

RE-PROP: New proposal (formal or informal proposals)

This code is for an active approach to modifying the current mute swan management plan by proposing new actions. The HSUS petitioning the DNR for a moratorium on killing swans, for example, would fall into this category.

Example: "Since the policy of reducing the bird's numbers was announced last year, the Humane Society of the United States has become involved, urging Michigan's Department of National Resource to issue a moratorium on its mute swan policies," (Hopkins 2012).

RE-NO: Proposal Rejection

When a new proposal is submitted to the DNR or affiliate agency, and formally rejected.

Example: "They initially asked for a moratorium on the killings until the DNR adopted new techniques, but the department said it will continue its efforts," (Jacobs 2012).

RE-OUT: Reactive Outreach

Attempts by agencies to educate the public on management plan, particularly to subside doubts over the plan, and to reach a greater level of social acceptance. The outreach suggested by this code is in reaction to disapproval of the plan, not as a preventative measure. Preventative outreach will fall under the code "PLAN".

Example: "The hunt has been delayed until district officials meet with residents to explain their reasoning," (Donnelly 2012).

RE-DEL: Delayed implementation

Miscommunication, lack of education and disagreements over the plan may lead to delayed implementation of control.

Example: "A cull was originally planned for January, but the conservation district put the plan on hold after receiving negative feedback about the idea of shooting the swans," (Hart 2012).

SECTION G: DETAILS

This section contains mostly miscellaneous codes that describe the situation.

FACT?: Questionable Fact

Coder should have a strong understanding of the arguments used in this controversy. With that said, oftentimes facts are skewed to potentially sway the other side. This code is mostly interpreted by the coder as a questionable fact or statistic.

PLAN: M.S. Management Plan

Details to the management plan are important, and particular methods may be a source of contention. However, the sources of contention are further pinpointed in the reasons. This code identifies the details to the management plan.

DESC: Description of problem

This code may be confused with arguments if taken out of context. This code will tend to occur at the beginning and end of articles, setting up the scene and adding detail to the problem.

APPENDIX B: Justifications for Code Refinement and Consolidation

Reason in support (RS)-Aggression:

The aggressive nature of mute swans topped the list of reasons to support controlling the population. The remaining question was: aggressive toward whom? An analysis of this code revealed aggression toward humans was mentioned 44 times, while aggression toward wildlife was mentioned 27 times. "Aggressive" was also used to characterize the swans 9 times without naming a category of victims of the aggression. Examples of human-targeted aggression might be direct contact with people: "Every year, we get reports of **attacks on humans**. Personally I get dozens. The Southfield DNR office gets them, too. In April, an Illinois man in a kayak drowned in the pond at an apartment complex following an altercation with a swan. When one of the swans swam toward him, the kayak flipped over and the fully clothed man fell out and drowned," (Hopkins 2012). Other examples include indirect contact with people: "Numerous mute swan **attacks on small boaters** -- canoeists, kayakers, or those on personal watercraft -- have been documented, some resulting in **human injury**" ("Mute swans have become a nuisance" 2012). I used this information to craft and analyze an argument that we should control mute swans to protect the safety of humans from mute swan aggression.

RS-Protect Ecosystem:

I developed a code for content that suggested we should control mute swans to protect the ecosystem. The code covered a broad scope of concerns related to ecosystem stability, from native species protection to wetland habitat protection. Crafting an argument about ecosystem stability requires a more narrow focus, which can then be built upon to demonstrate the interconnectivity within an ecosystem and how mute swans are perceived to threaten that.

An argument analysis must either demonstrate the link between mute swans and the ecosystem or focus on one component of the system.

I further scrutinized the quotes coded as "Protect Ecosystem" to determine if there was a particular ecosystem component of concern. Threats to wildlife, which includes the trumpeter swan, dominate the quotes coded in this category. Mute swan eating habits tended to be the greatest concern to ecosystem stability. I used this information to analyze an argument that we should control mute swans because of the damage they inflict on submerged aquatic vegetation. Here are examples of quotes representing this reason: "Mute swans eat underwater plants. They uproot them, eating far less than what they grab. That destroys the habitat for native species, especially the fish," (Hamling, 2012). Another example looks like this: "Mute swans often congregate in large flocks and are capable of inflicting significant damage to aquatic habitat, by feeding heavily on aquatic vegetation that is valuable – as both food and cover - to fish and other species of wildlife," ("Mute swans have become a nuisance" 2012). The complex nature of an "ecosystem" likely means there are several versions of this argument. Reviewing the quotes under this code allowed me to build an argument that represents an initial link between mute swans and the larger concern for ecosystem stability. I named this sub-code "Protect Primary Producers (or Vegetation)."

RS-Kill

The final code category I analyzed as a formal argument in support of the M.S.M.P is a reason for using particular methods of control. This code was the second highest-occurring code category (see below for explanation of the "Balance" code). Killing mute swans answers the questions of *how* we should control, rather than *"should we control mute swans.* Examples

might look like this: "Oiling eggs and nest destruction helps keep the population in check, but doing that is **expensive and a logistical nightmare**," (Myerson 2012). Another example looks like this: "Avers said the agency **won't reach its goal** of reducing the swan population to fewer than 2,000 if it stops killing the birds. Other techniques, such as destroying nests and spraying eggs with corn oil to smother the developing birds inside, also are included in the management plan," (Campbell 2012). It indirectly counters an argument that we should not kill mute swans as a method of control. Although this code answers a different question than other codes, it allowed me to analyze two opposing arguments and provided depth and diversity to the analysis. This code did not require any reorganization or consolidation with other categories. **RS-Balance:**

I created a code called, "Balance," which I used when a messenger described a desire to achieve the right balance of something pertaining to the mute swan decision. Balance almost always referred to a desirable number of mute swans in a lake, the state or both. Both quotes below represent the code "balance". As suggested in the examples below, these quotes use terms suggesting a certain number of swans is acceptable, although the current population at the local and state level is unacceptable. An examples of the code "balance" looks like this: "Michigan, and particularly White Lake, has a **disproportionate** number of mute swans, the DNR reports" ("Meetings to address mute swan cull" 2012). Another variation of the "balance" code looks like this: "We're not out to decimate the entire population, just bring it to a **manageable level**, and that's the state's goal as well," (Campbell 2012).

While I was analyzing codes I noticed "balance" and "protect ecosystem" repeatedly cooccurred, which likely means when people refer to balance, it is often in reference to

ecosystem balance. As I considered appropriate consolidations, I initially thought these could be combined. However, balance is truly an overarching reason for protecting the ecosystem. This code might also reveal there are an "acceptable" number of mute swans in Michigan, though it is unclear what that number is. This code acts as a descriptor for what is ideal. For example, there is an ideal ecosystem which, for some, might not include mute swans or might be an appropriate balance of mute swans and other wildlife. This means we can better understand what is out of balance or what needs to be done to improve the balance by building arguments under the ecosystem code. Although the concept of balance is interesting in and of itself, it is not a reason to support or oppose the management policy.

Reasons to Oppose (RO)-No Kill

The suggestion that the MDNR ought to use or investigate methods other than killing mute swans topped the list for reasons opposed to the management policy, or rather opposed the methods of control. To analyze this reason in an argument, I had to conclude these individuals agree that IF we are to control mute swans, we should do it in a particular manner that does not include killing. I reviewed all "no kill" codes and all of the statements suggest the "if" factor, but never state a reason why they support the "if." Examples of this code look like this: "If the species needs to be controlled, then **control it in a humane way**, such as sterilization, egg removal or piercing, or segregation of the young with same gender pairings. As a last resort thinning the number on a lake, but not wiping out their existence" (Luxford, 2011). Another example might look like this: -"Opponents believe **shooting adult swans is too severe** a measure," ("Muskegon Conservation district hosts public meetings regarding swan cull" 2012). This code did not require any reorganization or consolidation with other categories.

RO-Science Uncertain:

The code "RO-Science" refers to the uncertainty of the science used to guide the management decisions and ultimately became a sub-code in a new category, "Distrust Expert Voice". Other sub-codes in this category were "Distrust of DNR" and "Alternative Expertise". Of the three sub-codes, "Distrust Science" occurred most frequently. The examples below provide evidence of the consolidation because of the connection between the science and the agency providing the science: "The **DNR is lying** to the public by **claiming** that swans are ecologically destructive when it's humans that wreak the most havoc," (Rhodes 2012). In this first example, the individual being quoted appears to distrust the DNR and their scientific "claims." In another example, one appears concerned about the amount of evidence provided by the DNR: "However, the **DNR doesn't have a single study or well-documented report to substantiate these claims**. Indeed, it seems odd that the birds stay in the same locations year after year if they are depleting all the vegetation," (Douglas 2012).

The MDNR is the authority who supplies the scientific evidence, and when individuals are uncertain about the MDNR's science, they are uncertain of the MDNR's reasons for making those decisions. Therefore, I consolidated these codes into one category. Consequently, RO-Science Uncertain was the highest underlying code in this new category so I analyzed this as a formal argument.

RO-Aesthetic Value

The final code I analyzed as a formal argument against the M.S.M.P is the aesthetic and enjoyment value mute swans provide. Quotes varied a bit under this category. For example, this person refers more specifically to the bird' beauty and symbolic nature: "Most people find

mute swans awe-inspiring — a bird revered for its **majesty** and **beauty** the world over,"(Rhodes 2012). The next example refers more to an instrumental value derived from their beauty: "There are several White Lake residents who have stated they **enjoy seeing the birds** on their lakes and lawns, along with the geese, and that they are against the killing of the birds," (Tajer & Ryan 2012).

The two quotes above demonstrate variations in how this code is represented. Mute swans can be considered beautiful, symbolic or an object of enjoyment. I chose to lump all of these under "aesthetic" because they suggest that beauty might promote a variety of other values, such as the enjoyment of natural resource. I chose to analyze this argument from the instrumental value standpoint, as another argument I analyzed addresses mute swans' intrinsic value (RO-Killing), which is another way we might understand the kind of intention people invoke when they refer to aesthetic value.

APPENDIX C: Descriptive Statistics for Content Analysis Sample

Article ID	Primary	Article Type	Article Title	Article	Words
	News			Date	
WZZM13-	Kent and	News-	Wildlife workers	14-Dec-11	186
01	Lakeshore	TV/Online	trimming Mute Swan		
			population		265
Wood IV-	Kent,	News-	Mute swans culled on	14-Dec-11	365
01	ottawa	i v/Onine			
	Kalamazoo				
The Daily	Montcalm	News-	Swan cull makes way for	15-Dec-11	551
News-01	Wolfceam	Print/Online	native species at Lincoln	15 000 11	331
		-,	Lake		
The Daily	Montcalm	Letter to the	Wiping out Lincoln Lake	28-Dec-11	602
News-LE-		Editor	swans was unnecessary		
01					
The News	Lapeer	News-	Mute Swans have	23-Jan-12	1016
Herald-01		Print/Online	become a nuisance		
White Lake	Muskegon	News-	Invasive mute swans are	23-Jan-12	999
Beacon-01		Print/Online	target in White Lake		
M/bita Laka	Muskagan	Nowc	Swap cong2 not just yet	20 Jan 12	716
Beacon-02	wuskegon	Print/Online	Swall solig? - not just yet	20-Jd11-12	/10
White Lake	Muskegon	News-	Meetings to address	13-Feb-12	910
Beacon-03		Print/Online	mute swan cull		
Lansing	Ingham	Letter to the	Michigan's mute swans	26-Feb-12	105
State		Editor	deserve better		
Journal-LE-			protection		
01					
Oakland	Oakland	News-	Waterford Township	28-Feb-12	213
Press-01		Print/Online	board votes not to allow		
			mute swan eutnanasia		
Sninal	Oakland	News-Online	Waterford souttles	29_Eeh_12	/132
Column-01	Cakianu	News-Onnie	nronosed mute swan	29-160-12	452
			resolution		
Detroit	Wayne	News-	West Michigan lake's	2-Mar-12	1069
News-01		Print/Online	swan cull now a global		
			flap		

Table 10: Descriptive statistics for content analysis sample.

Table 10 (con'td)						
Grand Rapids Press-01	Kent	News- Print/Online	Michigan plans demise of thousands of mute swans	9-Mar-12	712	
White Lake Beacon-04	Muskegon	News- Print/Online	Muskegon Conservation district hosts public meetings regarding swan cull	12-Mar-12	395	
Detroit News-LE- 01	Wayne	Letter to the Editor	Save the Swans	16-Mar-12	118	
White Lake Beacon-LE- 01	Muskegon	Letter to the Editor	Human Safety vs. Feathered Friends	18-Mar-12	516	
White Lake Beacon-05	Muskegon	News- Print/Online	Evidence shared for mute swan program	19-Mar-12	824	
Mlive-01	Statewide	News- Print/Online	Montague City Council votes on mute swan cull on White Lake	19-Mar-12	282	
Oakland Lakefront- 01	Oakland	News	Debate over mute swan population controls in Oakland, state rages on	28-Mar-12	1316	
Great Lakes Echo-01	Ingham	News- Print/Online	Michigan takes aim at mute swans; 13,500 to be eliminated	23-Apr-12	1241	
Michigan NBC-01	Statewide	News- Print/Online	Killer mute swans a problem in Michigan	30-Apr-12	386	
The Voice- 01	Macomb and St. Claire	News	DNR thinning out population of mute swans near Harsens Island	1-May-12	618	
White Lake Patch-01	Muskegon	News-Online	Talk about Town: Will you get a permit to kill mute swans?	9-May-12	476	
Hartland Patch-01	Livingston	News	Will you get a permit to kill mute swans	11-May- 12	520	
Spinal Column-LE- 01	Oakland	Letter to the Editor	The Killing of Mute Swans	11-May- 12	368	
Brighton Patch-01	Livingston	News-Online	Talk about Town: Will you get a permit to kill mute swans?	14-May- 12	669	

Table 10 (con'td)						
Examiner-	Oakland	News-Online	Should the Mute Swans	16-May-	1168	
01			in Michigan be killed?	12		
Hastings	Barry	News	Middleville council hears	17-May-	415	
Banner-01			about overpopulation of	12		
			mute swans			
Spinal	Oakland	News-Online	Humane Society wades	18-Jun-12	727	
Column-02			into mute swan debate			
			with plan			
Spinal	Oakland	News-Online	Removal of mute swans	20-Jun-12	419	
Column-03			OK'd by WB board			
WLAJ-01	Ingham	News-TV	Mich.'s plans to kill mute	25-Jun-12	136	
			swans draw opposition			
WZZM13-	Kent and	News-	Activists against culling	25-Jun-12	1311	
02	Lakeshore	TV/Online	of mute swans			
Detroit	Wayne	News-	Activists speak out	25-Jun-12	1335	
Free Press-		Print/Online	against culling of			
01			Michigan's mute swans			
Spinal	Oakland	Letter to the	Halt mute swan rules	27-Jun-12	280	
Column-LE-		Editor				
02						
Huffington	Wayne	News-	Mute swan killing policy	27-Jun-12	308	
Post		Print/Online	in Michigan upsets			
Detroit-01			animal rights activists		4.67	
Alpena	Alpena	News-	State plans to kill off	28-Jun-12	165	
Now-01	Ochland	Radio/Online	swans seen in Alpena	20 1 . 12	C 4 7	
C and G	Oakland	News-	WB to revisit mute swan	28-Jun-12	617	
News-01		Print/Online	issue alter concerns,			
Masamb	Macamb	Nour	Concerns visited over	2 1.1 12	1221	
	Macomp	News	Concerns voiced over	2-JUI-12	1221	
	Oakland	Nows-	Concerns voiced over	2_lul_12	1102	
Tribune-01	Canana	Print/Online	mute swan policy	2-JUI-12	1192	
Spinal	Oakland	News-Online	West Bloomfield may	3-101-12	115	
Column-04	Carlana	News Online	hacknedal on mute	5 JUI 12	443	
column of			swans			
Oakland	Oakland	News-	Humane Society submits	12-Jul-12	152	
Press-02		Print/Online	proposed changes to			
			state's mute swan policy:			
			read here			
West	Oakland	News-	Board to Reconsider	16-Jul-12	201	
Bloomfield		Print/Online	Mute Swan Cull			
Patch-01			Resolution			

Table 10 (con'td)						
Oakland Press-03	Oakland	News- Print/Online	West Bloomfield	19-Jul-12	147	
11000 00			resolution			
West	Oakland	News-	Mute Swans Safe for	20-Jul-12	427	
Bloomfield		Print/Online	Now, Township Board			
Patch-02			Rules			
Examiner-	Oakland	News-	Alien swans create	21-Jul-12	390	
02		Online?	controversy in Michigan	0.0.10	2244	
Spinal	Oakland	News-Online	New voice enters fray:	8-Aug-12	2344	
Column-05			Organization seeks			
Grand	Ottawa	Νοως	Mute swans a concern	11_Διισ_12	500	
Haven	Ottawa	110003	for state wildlife experts	11-Aug-12	500	
Tribune-01			for state what experts			
WLAJ-02	Ingham	News-TV	Michigan DNR Rejects	13-Aug-12	138	
	0		Request On Mute			
			Swans Plan			
Muskegon	Muskegon	News-	There's got to be a	13-Aug-12	612	
Chronicle-		Print/Online	better way to control			
01			mute swans			
Michigan	Statewide	News-	DNR turns down request	13-Aug-12	201	
Radio-01		Radio/Online	for moratorium on mute			
			swan killings			
WWMT-01	Statewide?	News-	DNR to proceed with	13-Aug-12	91	
		TV/Online	mute swan plan			
CBS	Wayne	News-	Michigan DNR Rejects	13-Aug-12	227	
Detroit-01		TV/Online	Request On Mute			
Cningl	Ookland	Lattar to the	Swans Plan	22 444 12	240	
Spillai Column LE	Uakianu	Editor	wisguided editorial	ZZ-Aug-1Z	240	
		Luitoi				
Grand	Ottawa	News	No swan song	24-Διισ-12	228	
Haven	Ottawa	i i civis	No Swan Song	24 //08 12	220	
Tribune-						
OP-01						
Oakland	Oakland	News-	Humane Society	3-Oct-12	883	
Press-04		Print/Online	questions killing of			
			swans			

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