

ANALYSIS OF DRIVERS OF SPRING ALLIGATOR HUNTING IN TEXAS AND
POLICY IMPLICATIONS

by

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DEDICATION

I would like to dedicate this thesis to my mom and dad, Raegan and Aaron, for always being supportive of my dreams and aspirations, as well as moving me halfway across the country to complete this degree. I would also like to dedicate this thesis to Dr.

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LIST OF ABBREVIATIONS

Abbreviation	Description
ATC	Anti-Termination Coalitions
CWD	Chronic Wasting Disease
HWC	Human-Wildlife Conflict
LDWF	Louisiana Department of Wildlife and Fisheries
PCI	Potential for Conflict Index
PPP	Principal Policy Paradox
TPWD	Texas Parks and Wildlife Department
USFWS	United State Fish and Wildlife Service

I. POTENTIAL FOR CONFLICT AND PRINCIPLE-POLICY PARADOX AMONG SPRING ALLIGATOR HUNTERS

Abstract

Human-wildlife conflict, and more specifically human-carnivore conflict is a matter of particular salience among wildlife decision-makers. As conflict between large carnivores and humans increase with habitat destruction and urbanization, managers are faced with finding a balance between carnivore conservation and human appeasement. Large carnivore hunters are often the hardest group to bring on board new management decisions, as they have the most to lose. Understanding their views, hunting motivations, and acceptability of management actions can provide agencies and managers with the necessary tools to make wildlife policy changes a more seamless process. However, hunter acceptability is often overlooked in the decision-making process. To address this gap, we applied the principle-policy paradox (PPP) and potential for conflict index (PCI₂) to a case study on American alligator (*Alligator mississippiensis*) hunters in non-core counties in Texas. We surveyed 318 spring alligator hunters who had legally taken an alligator within the last five years and asked them to evaluate and indicate the level of acceptability of proposed management actions regarding the spring alligator hunting season. Results indicate that spring alligator hunters strongly oppose the removal of the spring hunting season and alternative management action show a lack of consensus among hunters. These results demonstrate that hunters exhibit a paradox between concern for alligator populations and sustainability, and policy acceptance to help achieve these conservation goals. Hunters obviously want healthy alligator populations so as to be able to continue hunting, but at the same time they may not be in favor of policies that curtail

or limit hunting. We conclude that policy managers, specifically Texas Parks and Wildlife Department (TPWD) should seize this opportunity to work with hunter cognitions of alligators to introduce a policy that has positive impacts on both alligators and future alligator hunters. Future research should further explore human, ecological, climatic, and urbanizing factors and their impact on alligator dynamics as human populations continue to increase in coastal areas inhabited by alligators. Since alligators are one of the few large carnivores that can thrive in a semi-urban and suburban landscape, contemporary management of alligators no longer fits the bill.

Keywords: alligator; potential for conflict index; principle-policy paradox; carnivore; decision-making; coexistence; hunter; human-wildlife conflict; large-carnivore conflict; nuisance

Introduction

Human-wildlife conflict (HWC) is a prominent challenge for managers around the globe (Nyhus, 2016). In the context of rising urbanization throughout the United States and elsewhere, agencies are recording increased HWC, and “nuisance” wildlife are becoming a germane HWC topic (Janes, 2004). The nuisance designation can be traced to HWC occurring in society’s most susceptible spaces such as residential and suburban areas (Hayman et al., 2014). Some wildlife involved in consistent negative interactions with humans are characterized as a nuisance, and the term is of particular salience in urban-large carnivore (carnivores) contexts.

However, managing interactions between nuisance carnivores and humans is often ineffective when conducted as a blanket policy (Treves et al., 2017). For example, the American alligator (*Alligator mississippiensis*), endemic to the southeastern United States, has different population densities, feeding patterns, and behaviors depending on the area they inhabit, the climate they are exposed to, and whether they are located in a suburban, urban, or rural environment (Hayman et al., 2014; Janes, 2004; Langley, 2010). Therefore, because alligators are both apex predators and a keystone species with the ability to dynamically engineer the ecosystems they inhabit (Mazzotti et al., 2009), it is important to mitigate the negative aspects of relationship between humans and alligators with policies that are beneficial for both species.

The alligators’ ability to adapt to new environments with available resources, as well as their dietary plasticity, makes them a prime candidate to be labeled a nuisance (Janes, 2004). Their amphibious behavior can lead to frequent or negative human interactions, while terrestrial activities can increase these interactions in both

environments (Ross, 1989). It is important to elicit viable management options and strategies that mitigate negative encounters between humans and alligators due to these factors (Eversole et al., 2014). Through policy, alligator hunters have been given an influential stake in the species' conservation outcomes (Eversole, Henke, Wester, et al., 2018). In some states, such as Texas, contracted nuisance alligator hunters are contacted to assist with nuisance alligator complaints (Eversole, 2014).

Hunters are an influential stakeholder when it comes to carnivore management and, therefore, managers often consider their views in associated decision making (Salvatori et al., 2002; Treves et al., 2017). Harvests from carnivore hunts sustain the trophy and fur markets as well as help to maintain wild large carnivore populations as much as hunters should desire healthy populations that can persist despite hunting pressure (Salvatori et al., 2002). Additionally, hunters hold divergent motivations for hunting. Some are motivated by harvesting meat, while others may be interested in displaying a trophy, fostering family and friend relationships through hunting, or a desire to be outdoors (Enck et al., 2012; Pettis, 2009; Woods & Kerr, 2010). In sum, alterations to hunting seasons impact hunters' ability to harvest species in different ways, for better (e.g., increased satisfaction [Woods & Kerr, 2010]) or worse (e.g., largest and often the biggest males in the populations are harvested, leaving more juveniles which are also likely to interact with humans [Teichman et al., 2016]).

Policy alterations that threaten or do curtail or ban hunting activities often result in violent conflict. Backlash from disgruntled hunters and policy change advocates can be intense. For instance, attacks (Bonaccorsi, 2014), death threats (Saul, 2014), poaching [Welch, 2014], protests (e.g., clashes with police and storming the British House of

Commons [Alvarez, 2004]), and even murder (IUCN, 2014) have occurred. More commonly, policy conflict is addressed in a democratic arena, and though policy termination may be good for the species and support for species wellbeing exist among hunters, status quo, or close versions of it, and suboptimal policy may remain in place (Darimont et al., 2018; DeLeon, 1978; Serenari et al., 2019). The end result is a principle-policy paradox, where ideals about application of practices contradict one another (C. Smith & Mayorga-Gallo, 2017; Taylor & Parcel, 2019). Allowing the harvest of carnivores is a salient topic of political debate and a main contributor to policy conflict (Nurse, 2017; von Essen & Allen, 2017), yet, little research has explored how carnivore hunters think about and would react to new policy intended to protect the health of species populations by forcing hunters to curtail their activities.

To address this gap in the literature, we examined the perspectives of registered spring season alligator hunters to assess potential for policy conflict among stakeholders concerning modifications to alligator hunting policy (Elsey & Woodward, 2010; Janes, 2004; Kahui et al., 2018). We modeled aspects of hunter decision-making and compared their views about nuisance (e.g., public service) and recreational hunting opportunities. Specifically, we asked: What hunter characteristics influence acceptability of management actions?; How supportive are hunters of terminating the spring hunting season?; What is the potential for conflict in terminating the spring hunting season?; and What cognitive and management factors influence potential for conflict?

Texas provides an excellent opportunity to study this topic because it is the only state that allows for a hunting season during the peak of alligator breeding season. Texas also has two distinct seasonal hunting classifications (core and non-core, in fall and

spring respectively) that vary per county, resulting in comparative data. However, there are no data to support the use of a spring hunting season from a hunting opportunity perspective (J. Warner, *personal communication*, 2020). The major implications of this case study could lead to the permanent cancellation of the spring alligator hunting season in Texas but could also lead to resistance associated with revoking the spring hunting policy.

Principle-Policy Paradox

The principle-policy paradox (PPP), also known as the principle-policy gap and the principle-policy puzzle, is defined as a disconnect between support for a principle and support for a policy supporting that principle. This gap has been used frequently in the sociological context. For example, a term coined the “colorblind ideology” is one of the prime examples of the principle-policy paradox. Colorblind ideology acknowledges that everyone should be treated the same regardless of race but denies the reality of racism. A study by C. Smith and Mayorga-Gallo (2017) explained the gap within the context of a “new racism” by explaining how younger generations support diversity and inclusion from a principle standpoint, but when the policies are put into place to carry out these actions, the support fades. Taylor and Parcel (2019) conducted an extension of this theory, exploring racial diversity in public school assignments in North Carolina. Their findings illustrated that basic views on race were altered and shifted when the policy had a direct effect on the interested party and had a general benefit to minorities. When parents of school-age children were informed of potential affirmative action policies, the responses came out less than positive though said parents claimed to be non-discriminatory.

The principle-policy paradox can be successfully applied to environmental and natural resource management contexts. A prime example of its applicability is to climate change policy. Though, in principle, the critical need to act against climate change and promote resource stewardship have been widely accepted in society, the policies implemented to combat climate change and protect the resources have yet to meaningfully materialize (Kiem & Austin, 2013). In a wildlife management context, a primary disconnect between principle and policy has been seen in the context of wolf reintroduction in North America. The public often agrees that the ecosystem can benefit from reestablishing natural stability by reverting back to historical landscapes, allowing wolves to be reintroduced to their natural range. However, when policies and legislation are passed to said effect, they are met with animosity among some segments of the public and stakeholders (e.g., ranchers) who feel their livelihoods could be threatened (Bruskotter & Shelby, 2010; Creel et al., 2015; Treves et al., 2017). Use of the principle-policy paradox will illuminate a potential disconnect between attitudes towards alligator conservation in principle and those toward policies designed to realize alligator conservation in practice. We employed the principle-policy paradox to address the notion that attitudes towards alligator-specific wildlife policy and conservation in principle do not always match seamlessly in practice. The principle-policy paradox is an appropriate tool to investigate perceptions of alligators in Texas. One of the main reasons we find this framework to be advantageous to this particular study is because it continues to highlight the disconnect between attitudes about large carnivore management and beliefs about policy implications.

Potential for Conflict Index

Anticipating conflict is a beneficial contribution to an often-reactive wildlife policy-making process. In several regions, including North America, hunting is considered part of local and even national culture and overall societal dynamics (Clark & Milloy, 2014; Salvatori et al., 2002), thus, creating a challenging atmosphere for policymakers to create broad and socially acceptable hunting management policy (Treves, 2009). For example, the United Kingdom Hunting Act of 2004 created political uproar among European hunters over the banning of fox hunting, resulting in a battle between public opinion and morality, in addition to associated legal strife (Nurse, 2017). As a diverse group of stakeholders is becoming more vocal about and politically involved in wildlife issues, the expectation to be involved in decision making is ever-growing (Nie & Schultz, 2012), leading to increased likelihood of contested wildlife, specifically carnivore, policy outcomes (Serenari et al., 2018; Serenari & Lute, 2020).

To address this socio-political trend, Manfredo et al. (2003) introduced the Potential for Conflict Index (PCI). Specifically, PCI describes the likelihood of conflict arising in response to wildlife decisions made. It is a technique that employs a formula paired with bubble graphs to streamlining comprehension and summarization of the three basic summary statistics (central tendency, standard deviation, and shape of the distribution of responses) that are required to fully comprehend distribution information (Cramér, 1951). A bubble graphic approach allows all three summary statistics to be displayed in a single image, indicating the ratio of scoring positively or negatively on a rating scale, simplifying comprehension (Manfredo et al., 2003).

When responses fall entirely to one side (100% of the distribution to one extreme) then the PCI would be 0, meaning there was no potential for conflict. If the distribution of responses is evenly split between the two sides (50% positive, 50% negative, with 0% indicating a neutral response), then the PCI would be 1, meaning there is a strong potential for conflict (Vaske et al., 2006) (Figure 1). The dispersion of the data, or in our case, the extent of conflict potential in terms of acceptability of management actions, is indicated by the bubble size on the graph. Large bubbles have a higher PCI value, leading to more potential for conflict. The central tendency of the data is indicated by the location of the bubble on the y-axis. If the bubble is located in the positive direction, the management action is more acceptable. If the bubble is located in the negative direction, the management action is less acceptable. Skewness of the data is indicated by how far the bubble is from neutral zero. The further the bubble is from neutral zero, the more skewed the variable (Manfredo et al., 2003; Vaske et al., 2006) (Figure 1).

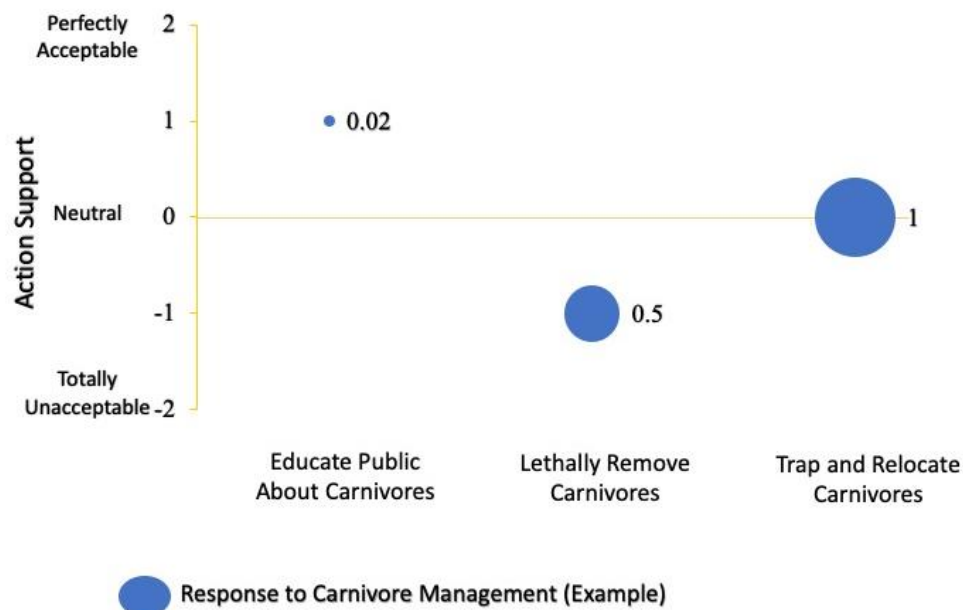


Figure 1. Example PCI Graph. Created with fictional data set to show difference PCI outcomes.

The index is useful to characterize polarizing aspects of carnivore management. For instance, Frank et al. (2015) and Thornton and Quinn (2009) revealed that PCI can help identify salient factors underpinning potential conflict in large carnivore contexts, and inform a quantitative direction for management decisions. PCI has helped in our understanding of the acceptability of lethally controlling large cats. Lute et al. (2018) noted that lethal control is a polarizing issue among conservationist professionals. Engel et al. (2017) employed PCI based on attitudes about jaguars (*Panthera onca*) and pumas (*Puma concolor*) across three scenarios involving human-big cat interactions in Brazil. Though residents generally did not favor lethal control of big cats, the potential for conflict exposed rifts among residents in cases where negative interactions between humans and big cats escalated. Focusing on temporal and experiential elements, Vaske and Taylor (2006) highlighted an increased potential for conflict among local residents and Yellowstone National Park visitors in relation to four progressively more intense wolf management scenarios. Residents preferred active and lethal wolf management more so than did park visitors. Gangaas et al. (2013) employed spatial analysis to conduct a comparative analysis of PCI among residents in Sweden and Norway to reveal large scale patterns of policy conflict. The authors revealed that respondents with high acceptance of illegal hunting live in areas where a high potential conflict between people and large carnivores exists. In sum, PCI studies provide a proactive look into the difficulty of satisfying all stakeholders and interest groups in large carnivore management contexts.

For this study, we specifically used the second generation of the PCI formula presented in Vaske et al. (2010). The PCI₂ formula takes into account unequal intervals in

a scale to better represent likelihood of conflict. For example, a hunter who rates lethal management as extremely unacceptable (-2) will most likely not conflict with a hunter who rates lethal management as unacceptable (-1), despite a one-point difference in their scores. In the same respect, a neutral individual would not be in conflict with either side of the scale (Heneghan & Morse, 2019).

Hypotheses

Support for change in policy and laws is often gained when the change aligns with outcomes desired by hunters and/or other stakeholders (e.g., Cornicelli & Grund, 2011; Miller & Graefe, 2001). Research has noted that hunter characteristics have a strong relationship with hunting participation and acceptance of changes in law regarding hunting, particularly, hunters with more experience have less acceptability (Ericsson & Heberlein, 2003; Schroeder et al., 2014). Previous studies have noted low hunter acceptance of management actions that limit hunting activities (Cornicelli et al., 2011; Engel et al., 2017; Frank et al., 2015; Serenari et al., 2019), particularly bans (Nurse, 2017; Serenari et al., 2018; Strong & Silva, 2020; Von Essen et al., 2015). Studies have also found that hunters unsurprisingly are more likely to oppose ban/termination of policies if they directly benefit from the policy in question (Song et al., 2019). Additionally, the PCI literature demonstrates that hunter cognitions (i.e., attitudes and beliefs about the species they hunt) are instrumental in their support for regulatory change. Specifically for large carnivores, attitudes towards curtailment of hunting activity (Cornicelli et al., 2011; Vaske et al., 2006) and in terms of alligators, beliefs about alligators as a nuisance species (Eversole et al., 2014; Hayman, 2011; Hayman et al., 2014), and knowledge of alligators (Eversole et al., 2014) are important factors to be

considered when conducting a PCI study. Hunter attitudes towards large carnivores have been shown to be more negative than those of the general public (Bruskotter et al., 2015; Schroeder et al., 2018). Hunter's acceptability of management preference has been identified as strongly related to risk and nuisance beliefs (Schroeder et al., 2018). Similarly, knowledgeable hunters have more negative attitudes towards hunting rules/regulations involving large carnivores than even the least knowledgeable individuals of the general public (Ericsson & Heberlein, 2003).

There is insufficient literature on changes in carnivore hunting regulations. Hence, we conducted a literature review and 15 interviews with Texas alligator hunters during business hours from August to October 2020 to elicit cognitive and managerial factors that may drive conflict over alligator management. We coded interview data using thematic analysis (Guest et al., 2006) and situated the data under established and germane PCI themes: management action acceptance, hunting participation, and hunter attitudes. Results from interview coding suggested that hunters would not be receptive to any curtailment of their alligators hunting activities. Additionally, these and similar studies suggest that management approach is central to wildlife policy conflict. Taking the aforementioned findings from coded interviews and literature reviews in aggregate, we posit:

H1. Hunter attributes will predict management preferences.

H1a. Hunters with greater access to hunting lands will find management actions less favorable.

H1b. Hunters with more alligator hunting experience will be more favorable of management actions.

H2. More restrictive management actions will be less favored among hunters than actions that allow hunting freedoms.

H3. Hunters who intend to exercise their hunting privileges in the foreseeable future will have a lower acceptability of changes to the spring hunting season.

H4. Cognitions will play a role in hunter acceptability of management approach.

H4a. Hunter attitudes will be skewed negative towards alligators and their presence in Texas.

H4b. Hunters with negative attitudes will be more likely to characterize an alligator as a nuisance.

H4c. Self-proclaimed knowledgeable hunters will have higher acceptability of management approaches.

Methods

Study Setting

The study focused on Texas counties labeled as non-core counties under the Texas Parks and Wildlife Department (TPWD) regulations for alligator hunting. Non-core counties are all counties in Texas, excluding the following 22 core counties: Angelina, Brazoria, Calhoun, Chambers, Galveston, Hardin, Jackson, Jasper, Jefferson, Liberty, Matagorda, Nacogdoches, Newton, Orange, Polk, Refugio, Sabine, San Augustine, San Jacinto, Trinity, Tyler, and Victoria (Texas Parks and Wildlife Department [TPWD], 2019). These 22 counties are comprised of wetlands, lowland forest, and tend to be more coastal. We focused on non-core counties where an alligator was taken between the 2016-2020 spring season (Figure 2).

In terms of legal take for alligators, alligators may be hunted by firearms only on private property (including private waters) and only in non-core counties. If an alligator is lawfully caught on a taking device (i.e., hook and like [line set], alligator gig) then that alligator can be dispatched by firearm in all counties (TPWD, 2019).



Figure 2. Breakdown of Alligator Hunting Counties in Texas. Core counties in red where alligator hunting takes place in the fall. Non-core counties in yellow and green where alligator hunting takes place in spring. Green counties are where an alligator was taken between the 2016-2020 spring seasons.

The alligator population in the state is approximately 250,000. The majority of these alligators reside in coastal counties creating two subpopulations: coastal and inland alligators. Population estimates of each subpopulation have not been completed since Thompson et al. (1984). As human population has increased in coastal areas, nuisance alligators have become more and more common due to large populations of both humans and alligators inhabiting some of the same areas (Janes, 2004). With tensions rising, a

balance between understanding how to manage the situation, as well as an appreciation for the resilience of alligators as a whole must be achieved (T. Peterson et al., 2006).

In Texas, Johnson et al. (1985) outlined TPWD's nuisance alligator management program. When handling a nuisance alligator call, TPWD has a three-step approach.

First, they conduct an on-site assessment of the situation. Then, they review all alternatives to the situation. Finally, they sequentially implement those alternatives that were deemed reasonable to that particular situation. The study elucidated that TPWD is not the only organization in the state that receives calls about nuisance alligators. The United States Fish and Wildlife Service (USFWS), local animal control, wildlife rescue and rehabilitation organizations also field or respond to nuisance alligator calls and complaints. According to a recent study by Eversole and colleagues (2014), nuisance calls had a large concentration (72%) in 10 Texas counties. The authors noted that top 10 counties with the most nuisance alligator calls were Jefferson, Fort Bend, Matagorda, Brazoria, Harris, Jackson, Orange, Chambers, Calhoun, and Liberty, respectively with Jefferson accounting for 16% of the nuisance alligator calls between 2000 and 2011 and Liberty receiving 3%. This breakdown is what helped establish the difference between core and non-core counties for hunting seasons in Texas. Counties with higher numbers of nuisance calls were labeled as core counties (TPWD, 2019).

On April 1, 2007, Texas created its first annual spring hunting season to offset the demands of rapidly increasing nuisance calls placed upon TPWD in non-core counties. The intent was to allow private citizens take some of the load of nuisance alligators off TPWD while also helping to control populations, thus decreasing human-alligator

conflict in high conflict areas. Texas is the only state in the U.S. that allows a spring alligator hunting season (Hayes & Henry, 2016).

With human-alligator interactions increasing in the U.S., other issues are coming to the surface. Alligators are often struck in roadways by passing vehicles while basking on the hot pavement, creating a serious road hazard and also decreasing alligator populations through “unnatural” causes (Eversole et al., 2014). Also, several alligator farms across the United States have accidentally infected juvenile alligators with West Nile virus dating as far back as 2001 (Hayes & Henry, 2016). As far as the public is concerned, many do not understand that unless a nuisance alligator is large or aggressive, the alligator will remain in the habitat it was found in providing it is not too close to private dwellings (ibid.).

Study Design

We used a mixed methods design for this study. We combined aspects of qualitative and quantitative methods in order to answer our hypotheses. The questions and the categories of the survey were developed partly on the basis of the constituting factors identified in the qualitative data collection phase of the project through phone interviews, completed prior to the development and administration of the quantitative survey. We intend to parse out hunter cognitions, demographics, knowledge of alligators, and the Potential for Conflict, all in relation to the proposed removal of the spring hunting season.

Participants

We collaborated with TPWD to establish a comprehensive sampling frame of spring alligator hunters in Texas who are 18 years-of-age or older (i.e., adults). There are approximately 200 registered hunters who partake in the spring alligator hunting season in Texas per year. The hunters that made up our population had their registration records from the 2016-2020 spring hunting seasons pulled via TPWD. Hunters were excluded if they did not use their license to take an alligator during the 2016-2020 hunting seasons, or they did not provide adequate contact information.

Recruitment

We used a quota sampling design to ensure that a sufficient number of hunters participated in the study. We employed a multi-mode contact approach (phone and email) to boost study participation rates. A total of 318 hunters were contacted. For the quantitative survey, a minimum sample size of 57 valid responses allowed within strata population error estimates of $\pm 10\%$ at a 90% confidence level for the population. We developed a complete sampling frame by drawing a sample of hunters from TWPD records. All research procedures were approved by Texas State's Institutional Review Board on May 11, 2020 (protocol #7240, Appendix C).

Qualitative Interview Administration

Hunters were contacted by phone Monday through Friday during business hours from August to October 2020, and informed that they are a knowledgeable and key part of our study. After explaining the study, including study safeguards (e.g., confidentiality procedures) and terms, hunters were asked if they would be willing to participate in the

study. Hunters agreeing to participate in the qualitative data collection were asked to provide a convenient time to conduct the interview by telephone. We also ensured the location of the phone interview was not of public domain before conducting each interview. We recorded interviews recorded with permission to safeguard data accuracy.

Interview Data Analysis

We first conducted semi-structured interviews with 15 registered hunters using a pre-tested instrument (Appendix A) (Guest et al., 2006). Interviews were conducted until we reached data or theoretical saturation (Patton, 1990). All interviews were transcribed and thematically analyzed with NVivo software (QSR International v. 12.1, Burlington, MA) (Draucker et al., 2007). Themes captured salient factors answering the research questions. Pertinent and relevant sections of the conducted interviews were extracted, organized, and were extended into phrases or sentences that yielded an overarching identifier about the meaning of that particular excerpt (Saldaña, 2016). All other data was considered irrelevant. During this phase, continual movement between data collection and analysis enabled us to evaluate the precision of recorded explanations and encourage the reflexivity that is essential to any explanation of situated social action (Lincoln & Guba, 1985). Informant validation was achieved in several forms, including designing clarification questions into the interview protocol and asking informants to critique conclusions drawn from preliminary analysis. We also achieved triangulation by comparing and contrasting transcripts and the existing carnivore hunting literature. Documenting informants' narratives in their own words, or using preservationist language, and employing other researchers to spot-check coding further limited the

potential for bias. For instance, to ensure reliable and valid coding of the transcripts, a Ph.D. student with experience and proficiency in qualitative data analysis also independently coded segments of select interviews. After coding, we observed and discussed differences in our codes and mitigated any discrepancies to reach 100% agreement to ensure accuracy and inter-rater reliability (Hallgren, 2012). All salient factors found during qualitative interview analysis were used in the creation of the survey instrument. Qualitative data was only used for quantitative survey development and was not analyzed further.

Quantitative Survey Development

We used a quantitative, large-*n* survey design using a cross-sectional strategy (Creswell, 2009). Development of the interview protocol occurred from a standard literature review cross-pollinated with qualitative interview data and informal conversations with TPWD staff to ensure a clear and succinct instrument design. Once the interview questions had been developed in a way that answered all research questions, they were deployed. The results from these interviews informed the design of a quantitative questionnaire used to survey alligator hunters in east Texas. There were 45 items on the questionnaire. The questionnaire investigating the following concepts.

Attitudes toward alligators. The overall attitude measurement included ten items found under the “attitudes” (Table 4) to bring into relief any potential PPP. Hunters indicated where they fall on a seven-point Likert scale ranging from “1 = strongly disagree” to “7 = strongly agree”. An additional question was asked to hunters to report the appropriate areas that alligators can inhabit (Schroeder et al., 2018). The evaluation of reliability for attitudes was conducted through Cronbach alpha. The scale was considered

reliable if $\alpha > 0.80$. All scaled values met and exceeded 0.80 (Table 4). All but two of the “alpha if item deleted” values were less than the overall alpha value of 0.908 for the attitudes scale. Neither of the values exceeded the overall alpha value by more than 0.02, however, and, therefore, all variables were retained (Hayman et al., 2014).

Knowledge about alligators. The knowledge about alligators section was composed of two items. These items measured hunters’ self-proclaimed understanding of alligator ecology, biology, and their populations in Texas. The first item contained a five-point Likert scale ranging from “1 = extremely knowledgeable” to “5 = not knowledgeable at all” where hunters were asked to self-report their alligator knowledge. The second item contained another five-point Likert scale ranging from “1 = far too few” to “5 = far too many” asking hunters to describe the current Texas alligator population. This item also contained an “6 = unsure” option for hunters who could not speak to the current population.

PCI2. Following Vaske et al., (2010), hunters were asked to evaluate the acceptability of three different management actions regarding the spring alligator hunting season. Specifically, the hunters were asked to “please evaluate the acceptability of the following management actions regarding alligators” with the following options: removing the spring alligator hunting season in the non-core counties, implementing a statewide fall alligator hunting season, and removing the spring alligator hunting season in the non-core counties but implementing a statewide fall alligator hunting season. The hunters could rate their acceptability on the following five-point scale, 1 = “totally unacceptable”, 5 = “perfectly acceptable”. Each scale also included numerical representations of each answer in order to determine the powers of distance function. For

example, “totally unacceptable” and “strongly disagree” were assigned the value (-3), while “perfectly acceptable” and “strongly agree” were assigned the value (+3). The neutral options in both cases were assigned a value of (0).

Demographics. We asked hunters to indicate their sex (male/female), age (within specified ranges), place of residence (urban, suburban, exurban, rural), employment type, ethnicity, highest level of formal education completed (ranging from high school or GED to master’s degree or higher), annual household income (within specified ranges), previous experience hunting alligators, hunting location, and wildlife conservation or hunting group organization participation.

Quantitative Survey Administration

On October 1, 2020, we administered a web-based questionnaire to hunters at their convenience using Qualtrics survey software (Qualtrics, Provo, UT). We used a modified version of the Tailored Design Method, following Dillman et al. (2014). We used a 5-callback/email design to encourage hunters’ participation. Hunters who agreed to participate received a link to the self-administrated questionnaire where they first saw an information page explaining the research, explaining the terms of the study, and asking for their participation. We sent four email reminders two weeks apart (Dillman et al., 2014). A paper or phone option was made available by request to individuals who do not have the means to access the online survey.

Quantitative Data Analysis

Questionnaire analysis centered on associations between key variables of interest. Analyses included, but was not limited to, testing how risk, beliefs, rationale, or

knowledge influence perceptions of alligators, management preferences, support for policy, participation, compliance, or communication preferences. Statistical significance of variable associations is at the 0.05 level, meaning that values of less than 0.05 indicated a less than 5% probability that the relationship did not occur by chance (if the study was repeated 100 times). We used R software (version 4.0.4, 2021) for our statistical analysis. To analyze factors influencing management acceptance, we used ordinal logistic regression to test the hypotheses.

Ordered Logistic Regression. We tested the hypotheses with an ordered logistic regression model using hunter characteristics as our independent variable and management acceptance as our dependent variable. This choice was made in comparison with similar studies modeling hunter cognitions and tolerance (Goodale et al., 2015; M. Peterson et al., 2020), as we wanted to discern hunter acceptability of management actions. The use of an ordered regression allowed us to analyze management acceptance on a low to high ordered interval. We analyzed management acceptance intervals as a function of hunter select attributes (e.g., age, income, knowledge, experience), hunter beliefs (hunting importance), and hunting activity. In order to articulate the most parsimonious model, we only reported results that were statistically significant at the 0.05 level. We reported β , standard error, probability, Wald test, and odds ratios from regression outputs.

PCI₂. The Likert scale options were converted to values that correspond with PCI₂ analysis [i.e., strongly disagree (-2) to strongly agree (+2)] in order to conduct Potential for Conflict (PCI₂) analysis (Vaske et al., 2010). Assigning numerical scores to responses allowed us to statistically analyze the information collected in the survey. We

calculated the PCI₂ scores and performed difference tests using the downloadable *Potential for Conflict Index version 2.0* workbook available from the PCI₂ website (Vaske, 2014) through Microsoft Excel for Mac, Version 16.48. The differences were considered statistically significant with $p < 0.05$ if $d > 1.96$. Final approval of the survey instrument was obtained from TPWD prior to survey administration (Appendix B).

Results

Respondent Characteristics Influence Management Acceptability

RQ₁: We recorded 71 valid surveys, yielding a response rate of 22.3%. The majority of hunters were male ($n = 53$, 91%). The mean age category of hunters was 36-45 ($n = 23$, 40%) followed by 46-55 ($n = 13$, 22%). Over half ($n = 34$, 58%) of hunters were from exurban or rural areas, followed by suburban ($n = 15$, 26%) and urban ($n = 9$, 16%). More than three fourths ($n = 42$, 76%) of hunters reported a total household income of over \$100,000, followed by the \$50,000- \$74,999 pay range ($n = 8$, 15%). Almost two-thirds ($n = 37$, 64%) of the hunters stated that they have a bachelor's degree or higher. Almost ninety percent ($n = 51$, 88%) of hunters identified as White (Non-Hispanic). Fifty percent ($n = 29$) of the hunters consider themselves a part of a wildlife organization like Ducks Unlimited, Delta Waterfowl, Texas Wildlife Association, and Costal Conservation Associate, to name a few.

Most hunters ($n = 57$, 85%) indicated that conservation practices should ideally rely on evidence-based planning, decision-making, and justification for hunting most of the time, if not always. Only one hunter ($n = 1$, 2%) indicated that these factors should never be considered and only a few hunters ($n = 5$, 7%) indicated that the factors should be considered occasionally. Some hunters ($n = 4$, 6%) indicated they did not know if the

factors should be considered or not. Findings revealed that hunters with greater access to hunting lands were more likely to find removing the spring season and implementing a statewide fall season to be less acceptable ($\beta = 0.55, p < 0.05$), supporting H1a (Table 1).

Table 1. Ordinal Logistic Regression Models; Hunter Characteristics (IV), Management action (DV)

	Beta (β)	SE	Probability (p)	Wald	Odds Ratio
<i>DV1: Removing the Spring Alligator Hunting Season in Non-Core Counties</i>					
How important is hunting to the management of alligators in Texas?	-0.94	0.11	0.001	8.66	0.27
<i>DV2: Removing the Spring Alligator Hunting Season in Non-Core Counties AND Implementing a Statewide Fall Season</i>					
Who owns the land where you typically go alligator hunting?	0.55	0.26	0.033	10.33	7.95
How long have you hunted alligators in Texas?	0.43	0.18	0.018	5.59	0.94
How would you rate your level of knowledge about alligators?	0.78	0.48	0.002	8.55	2.85
How important is hunting to the management of alligators in Texas?	-0.65	0.42	0.012	4.59	0.42

RQ2: Hunter Acceptability of Spring Alligator Management Actions

Acceptability. Hunters would be less likely to support changes to the spring alligator hunting season, supporting H2. Specifically, hunters found removing the spring season to be “totally unacceptable” ($n = 36, 63\%$), followed by “slightly unacceptable” ($n = 12, 21\%$), with an overall negative response ($n = 48, 84\%$). Only one hunter said removing the spring season would be “totally acceptable” ($n = 1, 2\%$). Eight hunters (14%) indicated a “neutral” response to removing the spring season (Table 2).

PCI. Management approach influenced hunters’ acceptability of regulatory changes, supporting H2. Overall, the largest Potential for Conflict Index corresponded

with just implementing a statewide fall season (0.47), followed by removing the spring and implanting a statewide fall season (0.32), then just the removal of the spring season (0.06). This means that the largest disagreement among hunters was regarding the implementation of a statewide fall season with some hunters in favor of a statewide fall season and some hunters opposed. Removing the spring season had the most consensus among hunters (Table 3).

Table 2. Texas Alligator Hunters' Ratings of Acceptability of "Removing the Spring Alligator Hunting Season in the Non-Core Counties".

Response scale	Scoring	Frequency	Percent
Totally Unacceptable	-2	36	63
Slightly Unacceptable	-1	12	21
Neutral	0	8	14
Slightly Acceptable	1	0	0
Perfectly Acceptable	2	1	2
<i>Total</i>		57	100

Table 3. Potential for Conflict Indices and Mean Scores for Texas Alligator Hunters' Ratings of Acceptability of Alligator Management Actions.

Management action...	Conflict Index	Mean Score* (μ)
Removing the spring alligator hunting season in non-core counties.	0.06	-1.44
Implement a statewide fall alligator hunting season.	0.47	-0.05
Removing the spring alligator hunting season in non-core counties AND implement a statewide fall alligator hunting season.	0.32	-0.71

*"Totally Unacceptable" = -2, "Slightly Unacceptable" = -1, "Neutral" = 0, "Slightly Acceptable" = 1, "Perfectly Acceptable" = 2.

Potential for conflict indicates distributed responses on either side of the scale, thus causing conflict among respondents. The most controversial management action

among hunters was implementing a statewide fall alligator hunting season ($PCI_2 = 0.47$, $\mu = -0.05$). Responses were more evenly distributed but still trended negatively. Most hunters elicited a negative reaction to the implementation of a statewide fall season ($n = 25$, 43%), followed by a positive reaction ($n = 21$, 36%), then by a neutral reaction ($n = 12$, 21%). Responses were distributed across both sides of the scale, with hunters lacking consensus.

Removing the spring season had the lowest potential for conflict, the most consensus among hunters, and the most negative response ($PCI_2 = 0.06$, $\mu = -1.44$) meaning responses were distributed more on one side of the scale, with the hunters responding in similarity with a strongly negative response. Most hunters recorded a negative reaction ($n = 48$, 84%) to removing the spring alligator hunting season, followed by a neutral reaction ($n = 8$, 14%), then a positive reaction ($n = 1$, 2%).

Finally, removing the spring and implementing a statewide fall season had a moderate potential for conflict, while still eliciting a fairly negative response ($PCI_2 = 0.32$, $\mu = -0.71$). Most hunters indicated a negative reaction to the management action ($n = 36$, 61%) followed by a positive reaction ($n = 11$, 19%), and a neutral reaction ($n = 12$, 20%), meaning responses were distributed more to one side of the scale causing lack of consensus, with several hunters still falling on the opposite side. The majority of hunters responded in opposition of the management action.

Overall, removing the spring alligator hunting season is unacceptable among the hunters due to its low PCI_2 and extremely negative mean score ($PCI_2 = 0.06$, $\mu = -1.44$), while implementing a statewide fall alligator hunting season was more neutrally acceptable with a neutral mean score, even with the least hunter consensus, thus the

highest PCI_2 ($PCI_2 = 0.47$, $\mu = -0.05$) (Figure 3). The PCI_2 difference tests indicated that all possible pairwise comparisons between the values for acceptability of alligator management action were statistically significant ($d \geq 1.96$, $p \leq 0.05$) in all cases.

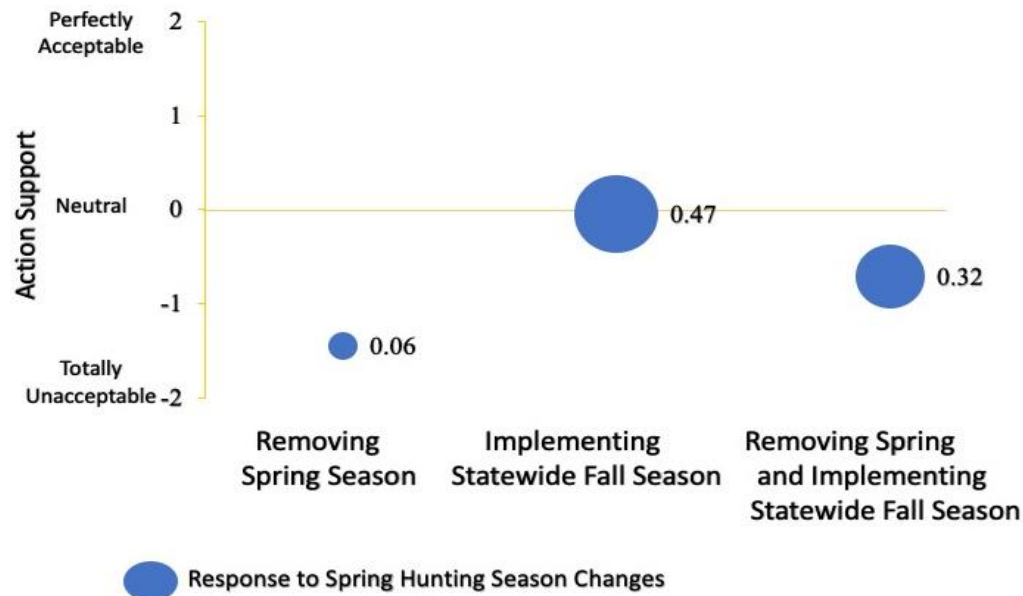


Figure 3. Graphic representation of PCI_2 : Texas Alligator Hunters' ratings of acceptability of alligator management actions. Scores adjacent to each bubble are associated PCI_2 . The center of each bubble is the mean support for each management action. The size of the bubble indicates the degree of potential conflict (i.e., large bubble suggests more conflict).

RQ3: Spring Alligator Hunters' Acceptance of Fall Hunting

Hunters would be less likely to accept changes to alligator management action. Specifically, hunters were less likely to continue hunting alligators in Texas if the spring season was changed, supporting H3 (Table 4).

Table 4. “Potential for Conflict Indices” and Mean Scores for Texas Alligator Hunters’ Ratings of Likelihood of Alligator Hunting with Spring Season Removal.

Hunting action...	Conflict Index	Mean Score* (μ)
I will hunt alligators in Texas in the future.	0.59	0.53
I will apply for a Texas alligator hunting license next year.	0.36	0.9
I will hunt alligators in another state.	0.35	-0.85

*“Extremely Unlikely” = -2, “Somewhat Unlikely” = -1, “Neither Likely nor Unlikely” = 0, “Somewhat Likely” = 1, “Extremely Likely” = 2.

If the spring season is removed, hunter likelihood of fall hunting decreases. When asked if they would hunt alligators in the future, the potential for conflict among hunters was the highest ($PCI_2 = 0.59$, $\mu = 0.53$). Responses were fairly distributed but still trended towards “somewhat likely”. Most hunters elicited a high likelihood response to hunting alligators in the future if the spring season is removed ($n = 38$, 64%), followed by a low likelihood response ($n = 17$, 29%), then by a neutral response ($n = 4$, 7%). Responses were distributed across both sides of the scale, with hunters lacking consensus.

Hunter likelihood of applying for an alligator hunting license in future years if the spring season was removed had a moderate potential for conflict ($PCI_2 = 0.36$, $\mu = 0.90$) meaning responses were distributed more on one side of the scale, with the hunters responding in similarity with a slightly positive likelihood. Most hunters recorded a positive likelihood that they will apply for future licenses ($n = 41$, 69%), followed by a negative likelihood ($n = 10$, 16%), then a neutral likelihood ($n = 8$, 14%). Hunters lacked consensus on the possibility of applying for future licenses, however, the mean response was still slightly positive.

Finally, if the spring season was removed, hunter likelihood of hunting alligators in another state had a moderate potential for conflict ($PCI_2 = 0.35$, $\mu = -0.85$). Most hunters elicited a negative reaction to the possibility of hunting in another state ($n = 38$, 64%) followed by a positive reaction ($n = 10$, 17%), and a neutral reaction ($n = 11$, 19%), meaning responses were distributed more to on the unlikely side of the scale, with several hunters still indicating a likely probability, causing lack of consensus. The majority of hunters are unlikely to hunt alligators in another state upon the removal of the spring season.

Overall, removing the spring alligator hunting season will impact hunter participation in alligator hunting in Texas with hunters having opposing opinions on their future alligator hunting likelihood (Figure 4). The PCI_2 difference tests indicated that all possible pairwise comparisons between the values for likelihood of hunting with spring season removal were statistically significant ($d \geq 1.96$, $p \leq 0.05$), except applying for a license next year.



Figure 4. Graphic representation of PCI₂: Texas Alligator Hunters' ratings of likelihood of alligator hunting with the removal of the spring season. Scores adjacent to each bubble are associated PCI₂. The center of each bubble is the mean likelihood of future hunting situations. The size of the bubble indicates the degree of potential conflict (i.e., large bubble suggests more conflict).

RQ4: Hunter Cognitions Influence Management Action Support

Cognitions influenced Texas hunter acceptability of management approaches, supporting H4. Specifically, findings refute H4a that hunters will hold negative attitudes towards alligators. Hunters were most likely to agree that alligators should be preserved for future generations ($\bar{x} = 5.97$, $SD = 1.54$) and least likely to agree that alligators and humans cannot share the same landscape ($\bar{x} = 2.43$, $SD = 1.50$) (Table 5). Hunters generally disagreed ($\bar{x} = 2.84$, $SD = 1.56$) that alligator populations should only be maintained to minimal viable populations. Hunters were more likely to categorize an alligator as a nuisance if they had negative attitudes about alligators, supporting H4b. Among nuisance belief responses, hunters considered threat to humans the most important nuisance aspect ($\bar{x} = 5.85$, $SD = 1.52$) (Table 5).

Table 5. Attitudes of Spring Alligator Hunters in Texas.

Index and items	Mean (\bar{x})	SD	Alpha if item deleted	Cronbach Alpha
<i>Attitudes*</i>				0.908
I enjoy the presence of alligators in the wild	5.64	1.36	0.888	
Alligators provide an educational opportunity for me or my family	5.64	1.19	0.895	
Alligators are culturally important	5.67	1.14	0.888	
The presence of an alligator is a sign of a healthy environment	5.57	1.2	0.885	
I would like to see more alligators in the wild	4.76	1.38	0.893	
Alligators should be preserved for future generations	5.97	1.25	0.885	
Alligators help other species thrive	4.73	1.54	0.896	
Managers should focus on reducing humans' negative impacts on alligator populations	4.48	1.43	0.895	

**Scale ranged from 1 (strongly disagree) to 7 (strongly agree).*

We gauged hunters' beliefs about the current alligator population in Texas by allowing them to describe the current population. Most hunters indicated that the population was about right ($n = 23$, 32%) or there were a little too many ($n = 28$, 39%) alligators in Texas. Some hunters indicated that there are a little too few ($n = 6$, 8%) alligators in Texas. One hunter indicated that there are far too many alligators in Texas. Several hunters were unsure of the population number ($n = 13$, 18%). When beliefs about the importance of hunting as a management tool were compared to the different management actions, hunting importance significantly predicted acceptability of removing the spring hunting season ($\beta = -0.94$, $p < 0.05$), as well as the acceptability of

removing the spring season and implementing a statewide fall season ($\beta = -0.65, p < 0.05$) (Table 1). More specifically, the negative beta scores for both variables indicate a lack of acceptance among hunters.

We gauged hunters' beliefs concerning which areas are appropriate for alligators to inhabit with the following options: rural areas, urban areas, private lands with domestic animals, private lands without domestic areas, public lands without human activity, and public lands with human activity. Hunters were instructed to check all that apply, and there was a total of 323 responses. Hunters indicated that the most appropriate area for alligators to inhabit are public lands with human activity ($n = 65, 20\%$), followed by rural areas ($n = 63, 19.5\%$). Hunters also indicated private lands without domestic animals ($n = 61, 18.9\%$), public lands without human activity ($n = 58, 18\%$), and private lands with domestic animals ($n = 53, 16.4\%$) and their appropriateness, respectively. The least appropriate area for alligators to inhabit as indicated by hunters was urban areas ($n = 23, 7\%$).

Findings indicate that knowledge levels about alligators was dispersed, supporting H4c, however, hunters who considered themselves knowledgeable had lower acceptability of the removal of the spring hunting season. Over a quarter ($n = 20, 28\%$) of hunters considered themselves to be very knowledgeable or extremely knowledgeable about alligators, with the remaining hunters ($n = 51, 62\%$) falling between slightly and moderately knowledgeable. None of the hunters considered themselves to be not knowledgeable at all about alligators.

To understand hunter beliefs about current management, we asked hunters to rate the top threats that alligators currently face (Table 6). Most hunters stated that

urbanization was the greatest threat to alligators in Texas (n = 34, 49%), followed by public misunderstanding of alligator behavior (n = 13, 19%), and then human population growth (n = 11, 16%). Hunters considered the least important threats to alligators in Texas to be media representation (n = 1, 1%), intensification of agriculture (n = 1, 1%), and energy development (n = 1, 1%) (Table 6).

Table 6. Hunter Indicated Threats to Alligators in Texas.

Top Threat to Alligators	Count (n = 69)	Percentage
Urbanization	34	49%
Hunting	3	4%
Intensification of agriculture	1	1%
Human population growth	11	16%
Energy development	1	1%
Increased interactions with humans	5	7%
Media representation	1	1%
Public misunderstandings about alligator behavior	13	19%
Lack of transparency in alligator decision-making	0	0%

When asking hunters what effect the spring season could have on alligator populations, most hunters generally disagreed with our proposed effects. They were asked to rate the proposed effects with 1 = “strongly disagree” and 7 = “strongly agree”. Hunters were most likely to neither agree nor disagree that the spring season would affect the population by reducing human interactions ($\bar{x} = 4.08$, $SD = 1.28$) and least likely to agree that the spring season would increase infanticide ($\bar{x} = 3.23$, $SD = 1.22$) and reduce juvenile survival ($\bar{x} = 3.23$, $SD = 1.33$) (Table 6). Hunters generally disagreed ($\bar{x} = 3.39$, $SD = 1.31$) that the spring season would disrupt social structure and increase livestock predation events ($\bar{x} = 3.31$, $SD = 1.47$) (Table 7).

Table 7. Hunter Perceptions of Population Effects of Spring Alligator Hunting.

<i>Effect on Alligators*</i>	Mean (\bar{x})	SD	Variance
Increased infanticide	3.23	1.22	1.48
Disrupted social structure	3.39	1.31	1.72
Reduced juvenile survival	3.23	1.38	1.90
Reduced juvenile recruitment	3.27	1.39	1.93
Reduced gene transfer among populations	3.40	1.37	1.87
Reduced human interactions	4.08	1.28	1.64
Increased livestock predation events	3.31	1.47	2.15

**Scale ranged from 1 (strongly disagree) to 7 (strongly agree).*

We gauged hunters' attitudes towards decision making regarding alligators in Texas. Most hunters stated that alligator biology and ecology should factor into decisions to hunt alligators a lot ($n = 23$, 34%), followed by a moderate amount ($n = 20$, 30%), then a great deal ($n = 18$, 27%). Very few hunters felt that biology and ecology should have no influence on the decision to hunt alligators ($n = 2$, 3%). We also asked hunters what alligator specific qualities should factor into their management. Hunters were instructed to check all that apply, and there was a total of 293 responses. Hunters stated age ($n = 46$, 16%), predatory behavior ($n = 44$, 15%), impact on ecosystem structure and function ($n = 42$, 14%), place/space they occupy ($n = 41$, 14%), and health ($n = 40$, 14%) were the most important qualities to consider when discussing management. The least important qualities as determined by hunters were visibility to people ($n = 11$, 4%) and how long they have occupied a place/space ($n = 12$, 4%).

Discussion

This study provides an example of wildlife recreation and alligator populations concurrently meriting conservation focus, creating the potential for policy conflict.

Specifically, a ban on the Texas spring hunting season will influence hunter acceptance and consensus concerning new policy. “Hard” policy interventions that restrict choice such as regulations and bans can stimulate policy conflict between stakeholders and wildlife agencies (Strong & Silva, 2020). Our findings suggest that terminating the spring season to improve the welfare of alligators is not an acceptable legitimization for eliminating hunting, mainly recreational, and will be normatively disputed, particularly in rural Texas and by rural-dwelling hunters. Hunters with micro-level access (e.g., self, family) to hunting lands were less likely to favor management action changes than hunters with meso-level (e.g., purchased a lease from corporation), supporting H1a (Larson et al., 2014). Dissent may undermine policy termination effectiveness (Strong & Silva, 2020). Findings do support coupling termination with a soft policy instrument, such as expanding the spatial extent of fall season, would not entirely restrict hunter choice throughout the year and may “nudge” hunters towards eventual acceptance on moral or informational grounds (Michalek et al., 2016). Future research will need to explore long-term hunter participation and management acceptance of large carnivore policies in conjunction with hunter/agency relationships.

A disconnect between ecological attitudes toward alligators in principle and attitudes toward a policy designed to realize conservation of the species in practice is evident among hunters. Our findings revealed hunters held cognitions that would suggest rejecting unsustainable hunting behavior, yet, found the removal of the spring season to be generally unacceptable despite positive outcomes for alligators. The PPP in this study reveals the difficulty of harmonizing hunting and new sustainable carnivore management paradigms. Specifically, researchers have documented the gap between paradigms

underpinned by human use (i.e., humanism) or humans as separate from nature philosophies and ecosystem management (Stanley Jr., 1995) or prioritizing protecting species for species' sake or species- multi-species-, or population-specific approaches (Marshall et al., 2016).

The paradoxical effects of cognitions (attitudes, beliefs) related to alligator conservation principles and desirable new policies complicate claims that more positively oriented knowledge or attitudes will produce a genuine commitment to holistic alligator conservation (Ericsson & Heberlein, 2003). Our findings also revealed that hunters who believed hunting to be critical to management of alligators and reported high levels of alligator knowledge found management actions less acceptable, supporting H1. Hunter cognitions, knowledge and experience can yield decreased acceptability of management actions like banning hunting-related behaviors (Nilsson et al., 2020; Schroeder et al., 2018). Nie (2004) comments that public sentiment is fickle and cautions against mood or interests alone and a striking a balance is paramount. At a minimum, our findings alert us to two observations. First, that alligator welfare is not enough to legitimate policy termination suggests there are questions concerning the quality and stability of hunter knowledge about the state and role of alligators (e.g., population, ecosystem engineers), and their management. Second, findings highlight the role of science and uncertainty in shaping cognitions, knowledge, and policy support. Science is a service to carnivore management (Wagner, 2006) and a cornerstone of the global wildlife management paradigm (Clark & Milloy, 2014); but, in some cases, scientific uncertainty about social-ecological interactions hinders progress towards resolving policy conflicts (Lute et al., 2020; Marshall et al., 2016). This gap is at the core problem in carnivore contexts where

rival policy contestants or coalitions seize and interpret information differently to advance agendas (e.g., Nilsson et al., 2020; Serenari & Lute, 2020). These particular socio-political dynamics have been exacerbated in a post-truth era where lay persons have argued or gained equal footing with scientists and managers (Lynch, 2020; Sidky, 2018). Future research should investigate narratives of policy conflicts to pinpoint core problem verbiage among hunters, as well as how formal and informal designations, such as a “nuisance” designation, perpetuates manifest cognitions and biases. As noted by research by Serenari (2021), such designations can be counterproductive to carnivore conservation efforts.

In the short-term, managers might want to consider altering the policy narrative from one of limitations and exclusive practices to one of compromise and environmental sustainability. Researchers highlight the importance of developing a policy narrative that uses generalizable content and integrates known facts, rules, or problems and confronts myths, misinformation, typecasts, and belief systems about human-alligator dynamics (drawing from (Jones & McBeth, 2010; Sabatier, 1999; Serfass et al., 2014). For instance, our results suggest a need to weave ecological factors, population estimates, and non-lethal management in the broader narrative to prioritize hunting for leisure in the fall (e.g., supported by data that reveals, for example, sport hunting decreases survivorship and transition rates (Chastain & Irwin, 2008), and selective hunting in the spring (e.g., a good fit where the potential to colonize near human settlements or mitigates risk associated with harm to humans, livestock, and pets). Additionally, findings indicate that partnering with conservation organizations may also contribute in this regards.

Policy termination may result in revenue or hunter participation or support declines, but the high cost of continued monitoring of hunter behavior and harvest in the spring to protect alligators may make termination worth it (Treves, 2009). Our analysis revealed there are undetermined implications for economics (Kahui et al., 2018) and, hence, increased policy conflict. Indeed, livelihoods, farming operations are linked to alligators in Texas and elsewhere (Brannan et al., 1991; Joanen et al., 1984). However, because most alligator hunters hunt for leisure, the agency may turn the focus to doing what is best for alligators in this case. Indeed, hunters are an important constituency, but state wildlife agencies must guard against privileging ideas and policy preferences to avoid being perceived themselves as “biased, exclusive, or unrepresentative” of the societal majority, who do not hunt or shoot (Nie, 2004, p.221; Clark & Milloy 2014).

Broadly, this research highlights the limitations of zero-sum (e.g., for/against, yes/no) carnivore policy-making (Nie, 2004) that tries to create policies that align with both utilitarian and preservationist values (Treves, 2009). Writing of a broader environmental paradox, Z. Smith (2017) remarked that paradoxes occur because policies are the result of political outcomes that were not well-suited to address the problem in the first place or evolution of the problem. Resultantly, he concludes, the best approach is unknown, ignored, implemented too late, or imprecise. Societies have been moving towards new conservation paradigms that embrace the philosophy that humans are a part of messy, unpredictable nature rather than garden curators (Büscher & Fletcher, 2020).

Therefore, effective management relies on the understanding of the nexus of alligator and human systems (Eversole, Henke, Turner, et al., 2018). However, more information is needed on these dynamics in Texas and elsewhere as well as how hunting

fits into the pursuit of coexistence. For instance, there is much research exploring the biological aspects of gray wolves (*Canis lupus*) and grizzly's (*Ursus arctos horribilis*), but much less research has explored alligator movements (Ericsson and Heberlein, 2003; Frank et al., 2015; Schroeder et al., 2018) diets (Delany et al., 1999), and predator-prey relations (Marshall et al., 2016). We also lack details on human, ecological, and climatic factors that have or will change alligator dynamics in rapidly developing and urbanizing coastal areas. This is a critical gap in our understandings of human-carnivore coexistence because coastal urbanization is on the rise. As of 2017, about 94.7 million people (29.1% of U.S. population) live in coastal counties in the United States; a 15.3% rise from 2000 (Cohen, 2019). Moreover, coastal areas are experiencing the brunt of climate change (Spalding et al., 2014) and land conversion (Burt et al., 2019), elevating the chances of interactions with alligators in Texas or crocodilians across the globe. There is much uncertainty about how alligators and their ecosystems will change under novel climate and land use change in these areas (Dunham et al., 2014). In aggregate, contemporary alligator management no longer fits into “fences, barriers, and faraway places” paradigm, doing so would be clinging to a discredited myth (Kareiva et al., 2012) and fitting a square peg into a round hole. Alligator managers in Texas have an opportunity to change the narrative moving forward by working with current cognitions of alligators and tailoring a policy to ensure a two-fold positive outcome for both the alligators and the hunters for generations to come.

Conclusions

The purpose of our study was to highlight the challenges large carnivore managers can face when altering policies regarding hunters. The potential for conflict

exposed rifts among hunters in cases where policy impacts between hunters and alligators are misaligned. The principle-policy paradox, though rarely explored in a large carnivore management context, has been shown to be present among spring alligator hunters through the disconnect between acceptability of proposed management actions and hunter cognitions about alligators. We surveyed hunters that participate in a spring hunting season located around the breeding of their targeted species. Our study highlights critical factors that concern hunters when determining acceptability of a proposed management action. Hunters in our study showed a general lack of consensus and negative response when it came to the three proposed management actions. With lack of hunter consensus about various management actions for the spring alligator hunting season, we can imply that some hunters will accept changes to the alligator hunting season more easily than others. While these policies are often created with a purpose to sustain large carnivores through conservation, promoting a policy that ensures a positive outcome for both alligators and hunters is the key to human-alligator coexistence.

II. MODELING HUNTER OPPOSITION TO ALLIGATOR HUNTING SEASON TERMINATION

Abstract

As human populations increase and humans and large carnivores are forced closer and closer together, human-carnivore conflict undoubtedly gains importance in wildlife management policy. Because the American alligator (*Alligator mississippiensis*) is a large carnivore that often inhabits places closest to ours, many individuals have gained a nuisance designation. With human-alligator interactions increasing in coastal areas, coexistence with this large carnivore is becoming ever pressing. Alligator hunters are a key demographic that should be involved in policy making decisions regarding a large carnivore with not one, but two hunting seasons in Texas. As wildlife agencies evaluate alligator populations in Texas, they question if hunting alligators during their spring breeding season is a sustainable practice. Because hunters are also considered a powerful anti-termination coalition, our study sought to flesh out important attributes, motivations, management preferences, beliefs, and hunting activity of spring alligator hunters in order to inform agencies of hunter likelihood to oppose spring season termination. We surveyed 318 alligator hunters who had participated in the spring hunting season within the last five years and asked them to provide their hunting motivations, beliefs, and preferences to proposed management actions. We then used binary logistic regression to determine how salient each factor was in a hunter's likelihood to oppose the termination of the spring hunting season in Texas. Results indicate that spring alligator hunters who considered themselves knowledgeable about alligators, were motivated by using their hunting skills, and put high importance on hunting for alligator management were more

likely to oppose termination. Hunters who planned to continue to hunt alligators during the spring season were also opposed to termination. Hunters with high nuisance designations were also likely to oppose termination. These results demonstrate the importance of having a foundational understanding of hunters, especially when considering policy changes that have a direct effect.

Keywords: alligators; large carnivores; policy termination; anti-termination coalition; motivations; hunter beliefs; management preferences

Introduction

There are several factors that can yield creating or terminating large carnivore (carnivore) hunting policies. One instance is where density-dependent factors and intraspecies competition can regulate carnivores naturally, therefore, eliminating the need for hunter based regulation (Treves, 2009). Another is where social and political arguments validate that hunting is necessary to deter carnivores from establishing territories or activity in close proximity to people or lower population numbers (Salvatori et al., 2002; Treves, 2009).

Alligator hunting seasons and harvest quotas, specifically, appear driven by two primary factors. The first is empirical data collected by field biologists. The scientific management paradigm underpins the contemporary wildlife management institution, guiding policy decisions (Clark & Milloy, 2014). The second is alligator politics. “Political populations (populations with ecological attributes constructed to serve political interests)” suggest that the political value of alligators swings with the policy pendulum (Darimont et al., 2018, p.747). A key attribute of these populations is that commercially valuable species populations are overestimated or underreported to create politically profitable policies (Messmer et al., 2001; Darimont et al., 2018). Hence, existing alligator management policies may not have been re-evaluated for some time; longstanding policies tend to prioritize alligators’ economic value (Brannan et al., 1991; Kahui et al., 2018), focus on atypical alligator behavior (Cavalier et al., 2021), or disregard shifts in public sentiment can stymie agency ability to manage in a sustainable way (Nie, 2004).

A policy instrument (i.e., tool), a nuisance designation can unite alligator hunting seasons and alligator politics. Nuisance wildlife is generally defined as an animal that causes property damage, threatens public safety, or causes an annoyance interfering with general public livelihood (Goodale et al., 2015). Managers have invoked a nuisance designation to cope with the rise of human-alligator interactions in coastal areas and perpetuate the separation of humans and alligators in certain contexts. To better understand the nuisance alligators as a research domain, researchers have explored management practices (Hines & Woodward, 1980; Janes, 2004; Joanen et al., 1984), nuisance cognitions (Eversole et al., 2014; Hayman, 2011; Hayman et al., 2014), and human-alligator conflict (Eversole et al., 2014; Eversole, Henke, Wester, et al., 2018).

For at least three reasons, policies that link nuisance carnivores and hunting seasons would be difficult to terminate. First, nuisance designations are integral to lethal management of alligators. Alligator hunters also respond to nuisance calls. Often, these hunters obtain permits from wildlife agencies to lethally remove alligators (Janes, 2004). Specifically, Texas Parks and Wildlife Department (TPWD) has coined these hunters as *control hunters*, authorized by the agency to harvest alligators designated as a nuisance (TPWD, 2019). Second hunting seasons and nuisance designations are technical policy instruments based on normative and subjective judgements to achieve a desired management outcome (Thomas, 2006). Hence, what is considered an acceptable policy in one spatial, socio-political, or temporal context may differ in another (e.g., Creel et al., 2015). Finally, researchers suggest that hunters' attributes will impact hunter acceptability of management actions and broader policies (Cornicelli & Grund, 2011; Woods & Kerr, 2010). The right combination of attributes can underpin the

existence of an anti-termination coalition (significant political groups opposed to termination [DeLeon, 1978]). For instance, Darimont et al. (2020), Kaltenborn et al. (2013) and others have indicated that hunters' level of policy satisfaction and support is closely linked to their identity (e.g., steward) and motivations (e.g., taking a trophy) to hunt carnivores. Yet, carnivore policy has become a focal point due to the misalignment between hunter values and those of an evolving society (Darimont et al. 2020), as well as conservation goals (Campbell et al., 2015; Treves, 2009). Reconciling this gap means that policies may not just need to be altered but terminated. However, few researchers have investigated the prospects for terminating a hunting season.

We draw from human dimensions of carnivore management research and the field of policy studies to fill this knowledge gap and surveyed Texas alligator hunters concerning the prospect of terminating a hunting season for the long-term benefit of the state alligator population. Specifically, we modeled the likeliness of hunter opposition to season termination as a function of their select demographic and cognitive attributes. Empirically sound management plans and corresponding technical policies are critical to sustain alligator populations, satisfy the public, conform with political agendas, and mitigate negative perceptions of alligators (Janes, 2004). Therefore, this study will inform managers about future policy barriers, as well as suggest alternative instrumentation to nuisance designations.

Background

Alligators in the United States

Originally harvested to prevent livestock loss, societal views about the utility of alligators on the American landscape began to turn in the southern United States around

1855 when alligator hides became a viable commodity in Paris used to make accessories like shoes, belts, and handbags (Chabreck, 1967). Historically, alligator hunting took place opposite the fur trapping seasons in the southern states and hence provided an economic livelihood to trappers during the off season. Alligators typically became dormant in the winter months while trappers were trapping otters and other fur bearers. When temperatures began to warm in the spring, alligator hunting would increase and continue until the next winter fur trapping season. These trends contributed to the rapid decrease in populations and the listing of the species as endangered in 1967 (Giles & Childs, 1949; Moore, 1983). However, recovery of the American alligator has been a success story; protection has firmly reestablished populations, leading to downgrading from endangered to threatened status in 1983 (Webb et al., 2009; Hayes & Henry, 2016).

Policy Termination

Policy termination is sometimes necessary to undo the wrongs of the past or integral to advance government (Ellis, 1983). Undoing any negative connotations associated with “termination” is a key aspect to adaptive governance (DeLeon, 1978). Pursuit of termination within the policy process allows for the idea that once a policy has completed its objective, the policy no longer needs to be implemented. If a policy is found to be irrelevant, redundant, outdated, or dysfunctional, the ability to terminate the policy should be recognized (Behn, 1978; DeLeon, 1978). Hence, an ability and corresponding willingness to terminate a policy embeds a progressive nature to the policy process.

Termination has hardly been studied by policy researchers due to its high cost and infrequent nature (Bardach, 1976; Frantz, 1997). Several obstacles hinder comprehensive

investigations of termination. Institutional permanence (tendency for institutions to maintain themselves, [Frantz, 1992]), ATCs (DeLeon, 1978), and legal obstacles (administrative procedures and due process) are a few primary reasons that policy termination research is rarely conducted. Additionally, policies involve design, logic, and instruments that operationalize policy and benefit some political constituencies (Jones & McBeth, 2010). Hence, some instruments can become embedded into organizational and societal culture, perpetuating for several generations (DeLeon, 1978).

Termination, however, may be made more difficult if the conditions underpinning a policy are interpreted differently among policy coalitions. Constituents' beliefs about a policy and its intended purpose(s) can be a stumbling block. It is not uncommon for oppositionist-led coalitions to be diverse and have a broad basis for opposition (Bardach, 1976). Anti-termination coalition groups are powerful and their belief systems about a policy can cause strife during the policy termination process (Bardach, 1976; Behn, 1978; DeLeon, 1978). Anti-termination coalitions can be a hinderance to the natural flow of the policy process, one of the loudest voices in the room in general (Ellis, 1983) or natural resource management contexts (Connelly et al., 1992). Oppositionist coalitions are often more diverse and more motivated toward their cause than pro-termination coalitions (Bardach, 1976). Because ATCs are often formed by people directly receiving benefits from the policy or program in question, they often have the most to lose (Kirkpatrick et al., 1999). Hunters have demonstrated to be a powerful ATC involved in carnivore politics, especially if they assume a victim identity associated with a policy decision (e.g., von Essen & Allen, 2017). However, few have studied the underpinnings of an ATC in a crocodilian policy termination context.

Hypotheses

Hunter Attributes

Research exploring hunter characteristics has noted that demographic characteristics have a strong relationship with hunting participation and acceptance of management changes. Specifically, hunters with more experience (Ericsson & Heberlein, 2003; Schroeder et al., 2014), knowledgeable hunters (Ericsson & Heberlein, 2003), and rural hunters (Pettis, 2009). Other studies have shown that demographics like age, gender, and education (Black, 2017; Woods & Kerr, 2010), as well as income, ethnicity, and hunter type (Aiken & Harris, 2006), have an effect on hunter participation in general. Therefore, we hypothesize that hunters with more alligator hunting experience, self-proclaimed knowledge, and more accessible hunting demographic characteristics will oppose termination of the spring season (H1a-c, respectively).

Hunting Motivations

Research has indicated that hunters hunt due to a wide range of motivations. Research suggests that carnivore hunters, specifically, are motivated by skill development, experiences in nature, sportsmanship, and companionship with other hunters (Kaltenborn et al., 2013; Radder & Bech-Larsen, 2008; Reis, 2009). Therefore, we hypothesize that hunters with skill development, nature enjoyment, and companionship motivations will oppose termination of the spring season (H2a-c, respectively).

Hunter Beliefs

Perceptions are foundational to the monitoring and evaluation of conservation governance across scales ranging from individual to global (Bennett et al., 2017). Perceptions of crocodilians research has been emerging due, in part because nuisance calls are on the rise (e.g., Langley 2010, Cavalier et al, 2021) and associated alligator control programs (comprising new processes, budgets, hunting seasons, staff) emerged over the last 40 years (Hines & Woodward 1980). Yet, few studies have targeted hunters. Delany, Hines, and Abercrombie (1986) conducted a seminal study on public perceptions of alligators. They noted that 23% of hunters expressed a fear of alligators. In a similar survey occurring 28 years later, findings revealed that approximately 83% of hunters (n = 98) supported management in state parks and wanted to see the alligator population increase in those areas (Eversole et al., 2014). When asked how they perceived alligators outside of their natural habitat, hunters' positivity decreased. Only 42% supported population increases within a mile of their residence, 93% supported relocation, and 15% supported lethal removal (ibid.). This study suggested that citizens who repeatedly report nuisance alligators often had more negative perceptions of them even though they may recognize their utility as an indicator species. (Teichman et al., 2016). Additionally, research suggest that hunters will view nuisance wildlife as a means to be controlled (Dolsen et al., 1996; Schroeder et al., 2018). Correspondingly, as hunters in Texas respond to these calls, often lethally, we posit that hunters with high nuisance beliefs will hold a less favorable attitude towards alligators and oppose termination of the spring season (H3a). We also posit that hunters who believe the season was created for nuisance control purposes will be less likely to favor termination (H3b).

Management Preferences

Hunter management preferences tend to favor a less limiting policy with more freedom to participate in hunting activities. Specifically, researchers have noted that hunters feel as though large carnivore populations should be less managed by policy and more managed by lethal take (Liordos et al., 2017; Schroeder et al., 2018). Therefore, we posit that hunters who regard hunting as an important management action will be more likely to oppose termination (H4).

Hunting Activity

A few researchers have investigated, to some degree, hunter beliefs about the drawbacks of hunting bans/termination, although in not specifically in carnivore contexts. Hunters affected directly (e.g., activities curtailed) tend to react negatively or oppose alteration (Serenari et al., 2019) and termination (Reed, 2004). For instance, Song et al. (2019) found that hunters who regularly used urine-based scents for deer hunting more often were more likely to oppose the ban/termination of usage. Findings from these studies suggest that hunters in this study will be more likely to oppose termination if they have plans to continue spring alligator hunting after the 2020 season (H5).

Theoretical Model Development

The focal variables in the theoretical model (Figure 5) draw from the findings discussed above suggesting how hunter attributes, hunting motivations, hunter beliefs, management preferences, and hunting activity influence hunter likelihood to oppose termination. The first hypothesis tested recognizes that demographics will influence termination opposition. The second hypothesis tested implies that specific motivations for

hunters to participate in the season will have an effect on their likelihood to oppose termination. The third hypothesis implies that individual hunter beliefs about alligators, termination, and the creation of the spring season will influence termination support. The fourth and fifth hypotheses highlight the possibility that management preferences (H4) and hunting activity (H5) will influence hunter termination, respectively.

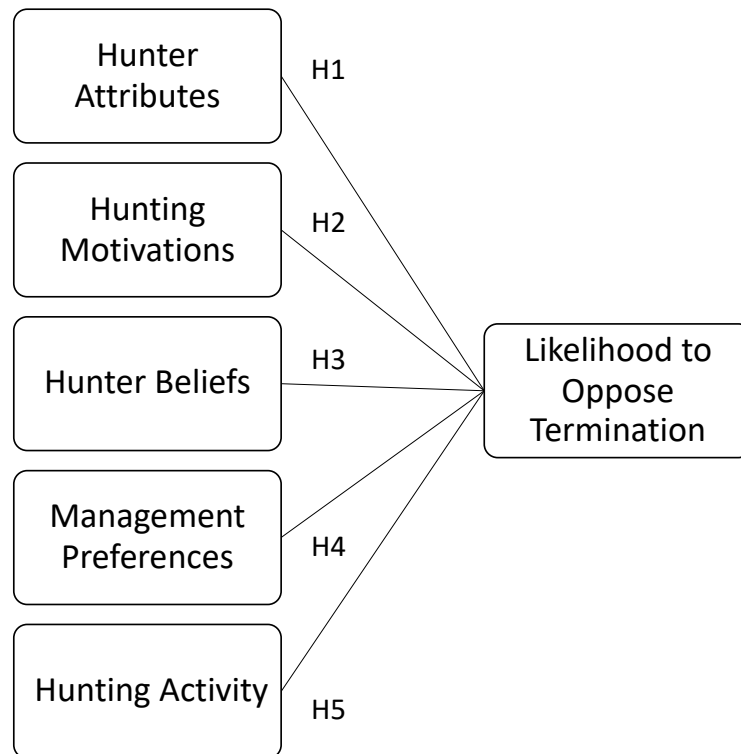


Figure 5. Theoretical model for focal variables on likelihood to oppose termination.

Methods

Study Area

The spring alligator hunting season in Texas was created to help offset the abundance of nuisance alligator calls taken by wildlife agencies, more specifically TPWD (J. Warner, *personal communication*, 2020). According to the Texas Administrative Code, the functional definition of a nuisance alligator is “an alligator that is depredating

[killing livestock or pets] or a threat to human health or safety” (Texas Administrative Code, Title 31, Part 2, Chapter 65, Section 65.352). Encounters with nuisance alligators fall into three categories (Johnson et al., 1985). The first attends to an alligator that is outside of its natural habitat. The second involves an alligator that has come into contact with humans on several occasions and is starting to raise some concerns. The third, and often the most dangerous form of nuisance alligator, is one that has been habituated to humans, often associating humans with a food source. This occurrence is often catalyzed by humans feeding alligators. The first two scenarios are typically solved by relocating the alligator. The third often results in lethal measures (i.e., euthanasia) (Johnson et al., 1985).

Broadly, the governing agency (most often the state wildlife agency) responds to nuisance alligator calls when a citizen files a complaint. Then, authorized personnel can verify the call and determine the best course of action (Janes, 2004). Often, specific regulations regarding nuisance alligator management may exist that dictate outcomes.

In Texas, there were 5,838 nuisance alligator calls between 2000 and 2011 (Eversole et al., 2014). In 2019, TPWD received 1,167 calls, which doesn’t include the calls made to law enforcement or local animal control offices. As urbanization and the nuisance alligator complaints surged, it became apparent to many states that not every nuisance call could be answered (Janes, 2004). Thus, the spring alligator hunting season in Texas was born (Hayes & Henry, 2016).

Study Design

We administered a quantitative survey to Texas spring alligator hunters. We explored hunter attributes, hunting motivations, management preferences, nuisance

beliefs, hunting activity, and likelihood to oppose termination to assist in revealing the drivers and likelihood of hunter opposition to season termination.

Hunter Attributes. Hunter attributes were broken up into several factors: sex, education, income, race, age, area where hunter lives, hunting experience, area where hunters hunt, knowledge of alligators, and type of hunter. Hunter sex was measured on a two-point scale, “1 = male” and “2 = female”. Hunter education was measured on a “highest level completed” scale where “1 = high school or GED”, “2 = vocational, technical, trade school, or certificate program”, “3 = Associate’s Degree”, “4 = Bachelor’s Degree”, and “5 = Master’s Degree or higher”. Hunter income and age were both measured on five-point range scales with hunter age ranges being “1 = 18-25”, “2 = 26-35”, “3 = 36-45”, “4 = 46-55”, and “5 = 56+”. Hunter income was based off total household income in 2019 from all sources, before taxes, and were broken into “1 = less than \$24,999”, “2 = \$25,000-\$49,999”, “3 = \$50,000-\$74,999”, “4 = \$75,000-\$99,999”, and “5 = \$100,000+”. Hunter race was broken into seven categories where hunters were instructed to choose the category they most identified with: “1 = White (Non-Hispanic)”, “2 = White (Hispanic)”, “3 = Black or African American”, “4 = Asian”, “5 = American Indian or Native Alaskan”, “6 = Native Hawaiian or Pacific Islander”, and “7 = Other”. Hunter residential areas were classified as “1 = urban”, “2 = suburban”, “3 = exurban”, and “4 = rural”. Alligator hunting experience was also broken into ranges: “1 = never/first-timer”, “2 = 1-2 years”, “3 = 3-5 years”, “4 = 6-8 years”, “5 = 9-11 years”, and “6 = 12+ years”. Hunter type was identified by how hunters consider themselves with “1 = contracted hunter through TPWD”, “2 = sport/recreational hunter”, and “3 = other”. For hunting area, hunters were instructed to identify who owns the land they typically

hunt alligators on with “1 = self”, “2 = family”, “3 = friend”, “4 = corporation”, “5 = leased property” and “6 = other”. Hunter knowledge of alligators was a self-proclaimed level of knowledge statement where “1 = extremely knowledgeable”, “2 = very knowledgeable”, “3 = moderately knowledgeable”, “4 = slightly knowledgeable”, and “5 = not knowledgeable at all”.

Hunting Motivations. We measured hunter motivations for spring alligator hunting with ten items measuring “motivations” (Table 9). We asked hunters how important each motivation was to their participation in the spring hunting season. We employed a five-point Likert scale ranging from “1 = not important at all” to “5 = extremely important”.

Management Preferences. We evaluated hunter preferences for alligator management by first asking questions on the importance of management and the concern for overhunting. Hunters were asked to rate the level of importance hunting has on alligator management with “1 = not at all important” and “5 = extremely important”. They were also asked to rate their concern for the potential of overhunting alligator in Texas on a four-point scale, “1 = not at all concerned” to “4 = extremely concerned”. Hunters were then prompted to rate the level of acceptability of the three actions (listed in Table 10) with “1 = totally unacceptable” and “5 = perfectly acceptable”. The three management action responses were then aggregated to create a composite variable reflecting a normative gradient of tactical policies used in carnivore management (tolerance, relocation, trapping, lethal control, [Serenari, 2021]). A higher score indicated that hunters preferred more intensive management of alligators.

Hunter Beliefs. Hunter beliefs were measured in three ways. First, nuisance beliefs section was composed of ten items (Table 11). All ten items contained a seven-point Likert scale ranging from “1 = strongly disagree” to “7 = strongly agree”. Four items measured specific threat scenarios involving humans, hunting dogs, livestock, and pets. The other four items gauged situational factors common in nuisance alligator complaints. Three additional questions were asked to gauge at what point the hunters consider alligators a nuisance in terms of humans, livestock, and hunting dogs and/or pets (Schroeder et al., 2018) (Table 12). Second, we asked hunters to rank the top benefits and drawbacks of moving the spring season to a statewide fall season to further understand hunter beliefs about the realities of terminating of the spring season. They were asked to rank the benefits from “1 = most important” to “4 = least important”. If they did not support the move, they were still asked to rank the other options (Table 13). They were then asked to rank the drawbacks from “1 = most important” to “7 = least important” (Table 14). If there were no drawbacks and they supported the move, they were still asked to rank the other options. Finally, we measured the ideological underpinnings of the spring season with an eight-item section (Table 15) where hunters were instructed select all that they thought applied to the creation of the spring alligator hunting season.

Hunting Activity. Hunting activity was measured by a three-part question asking hunters to indicate their likelihood of participation in alligator hunting in Texas if the spring season was terminated (Table 16). The prompts were gauging hunters’ likeliness to hunt alligators in Texas in the future, apply for a Texas alligator hunting license next year, and hunt alligators in another state. All three questions were measured on a five-point scale ranging from “1 = extremely unlikely” to “5 = extremely likely”.

Hunter Recruitment

We were provided a list of spring alligator hunters ($n = 893$) by TPWD. We developed a complete sampling frame by combining spring alligator hunting records from 2016-2020 from TPWD records. After eliminating duplicated and non-working numbers, hunters who did not provide any form of contact information, and invalid emails, we contacted a total of 318 hunters by email and phone.

Survey Administration

We administered the survey with the goal of achieving a minimum sample size of 57 valid responses between October 2020 and November 2020. We collected data using Qualtrics survey software (Qualtrics, Provo, UT). We employed a 5-email design to recruit hunters, following Dillman et al. (2014). Hunters who agreed to participate received a link to the self-administrated questionnaire. Agreeing to the study terms was assumed if hunters began the survey. We sent three email reminders two weeks apart and a final reminder email six weeks after the initial wave (Dillman et al., 2014). A phone option was made available by request to individuals who do not have the means to access the online survey or required other accommodation.

Analysis

We used R software (version 4.0.4, 2021) for our statistical analysis. To compare factors influencing hunter responses for and against termination, we used binomial logistic regression to test the theoretical model.

Likelihood to Oppose Termination. We summed three statements focusing on nuisance designations of alligators in terms of humans, livestock, and pets/hunting dogs

into a multi-item variable referred to as likelihood to oppose termination. Because these statements instructed hunters to “select all that apply,” the combination of scores were added together to get a composite score. The range of scores was 6 to 35. The average likelihood to oppose score for hunters was 21.5. The composite scores were then collapsed into a binary variable in order to run a binomial logistic regression. Since the midway point for total possible opposition to termination score was 17.5, any score 18 or above was considered “likely to oppose termination = 1” and any score 17 or below was considered “unlikely to oppose termination = 0” as all hunter scores were whole numbers.

Binary Logistic Regression. We tested the theoretical model with binary logistic regression model. This choice was made in comparison with similar studies modeling hunter behavior (Hayman et al., 2014; Needham et al., 2004; Serenari, 2021), as we wanted to discern if hunters were in support of or opposed to termination, leaving us with a dependent variable with only two outcomes, using an indicator variable to represent support and opposition. The use of a binary regression allowed us to analyze the likelihood to oppose termination (whether hunters were likely to oppose termination or unlikely to oppose based off binary coding) as a function of hunter select attributes (e.g., age, income, knowledge), hunting motivations, management preference (intensive vs non-intensive), hunter beliefs (nuisance, termination, and logic underpinning spring season), and hunting activity. In order to articulate the most parsimonious model, we only reported results that were statistically significant at the 0.05 level. We reported β , standard error, R^2 , probability, and odds ratios from regression outputs (Serenari, 2021).

Nonresponse Bias Check

We used the continuum of resistance model to evaluate potential for nonresponse bias. The continuum of resistance is based on the assumption that the level of effort required to elicit a response is indicative of the proclivity of individuals to respond and the underlying assumption is that late respondents are comparable to non-respondents on the continuum of resistance (Kypri et al., 2004). We divided respondents into three waves based on whether they submitted an early response (after the first contact attempt), an intermediate response (after the first reminder and before the final reminder), or a late response (after the final reminder). We compared differences between response waves for critical questions. We first conducted a test for normality by using the Shapiro-Wilk test using the `shapiro.test` function in R from the ‘car’ package (Fox & Weisberg, 2019). We found that our data did not meet normality assumptions, so we transformed our data using the `normalize` function, also found in the ‘car’ package (Fox & Weisberg, 2019). In addition to skewed data, we also have a small sample size, so we used a non-parametric statistical test. We used the Mann-Whitney-Wilcoxon test to determine non-response bias. Since none of the chosen factors for the Wilcoxon test were statistically significant, we can assume the absence of nonresponse bias. The data acquired for this study was based off voluntary, opt-in surveys. Not all surveys distributed were submitted back for analysis. We attempted to remedy this by having more than one mode of contact (online survey and phone interviews), however, there was an expectation for no response of survey.

Table 8. Wilcoxon Rank Sum Test Results for Non-Response Bias Check. First wave: response after first contact attempt from October 1, 2020 – October 7, 2020. Intermediate wave: response between October 8, 2020 and November 10, 2020. Final wave: response after November 11, 2020 until November 20, 2020 (end of survey distribution).

Items and index	W	<i>p</i> -value
Composite Scores of Management Preferences Among Hunters	135.5	0.944
Age	148	0.665
Spatial Distribution	77	0.109
Years of Hunting Experience	127.5	0.899
Self-Proclaimed Knowledge About Alligators	95	0.267

Scale Reliability

We evaluated the reliability for the motivations scale, management preferences, hunter beliefs, and hunting activity with Cronbach’s alpha. The motivations scale was considered acceptably reliable if $\alpha > 0.80$. All scaled values met and exceeded 0.80. For motivations, all “alpha if item deleted” values were less than the overall alpha value of 0.990 meaning all variables were kept (Table 9). Cronbach’s alpha test indicated an unacceptable reliability score of 0.698 for the management preferences scale (Table 10) and 0.416 for hunter activity (Table 16), but we note that these scores are arguably not meaningful at this stage as each item represents part of an intensity gradient, measuring different strategies. Therefore, all items were kept. The hunter nuisance beliefs scale was also considered reliable if $\alpha > 0.80$. All scaled values met and exceeded 0.80 (Table 11). Under beliefs, only one of the “alpha if item deleted” values was greater than the overall alpha value of 0.932, however, it did not exceed the overall alpha value by more than 0.02, so the variable was retained (Hayman et al., 2014).

All research procedures were approved by Texas State’s Institutional Review Board on May 11, 2020 (protocol #7240, Appendix C).

Results

Hunter Attributes

We recorded 71 valid surveys, yielding a response rate of 22.3%. The majority of hunters were male ($n = 53$, 91%). The mean age category of hunters was 36-45 ($n = 23$, 40%) followed by 46-55 ($n = 13$, 22%). More than three fourths ($n = 42$, 76%) of hunters reported a total household income of over \$100,000, followed by the \$50,000- \$74,999 pay range ($n = 8$, 15%). Almost two-thirds ($n = 37$, 64%) of the hunters stated that they have a bachelor's degree or higher. The majority of spring alligator hunters had previous experience hunting alligator prior to the 2020 spring alligator hunting season. Few hunters considered themselves first timers ($n = 12$, 17%). Over half ($n = 40$, 57%) of hunters had between one and five years of experience. A handful of alligator hunters could be considered veterans with 12+ years of experience ($n = 6$, 9%). Most hunters considered themselves sport/recreational hunters ($n = 64$, 91%) with a few hunters hunting alligators for job related purposes like nuisance management ($n = 3$, 4%) and hunting guides ($n = 2$, 3%). Over half ($n = 40$, 57%) of hunters hunted on land owned by themselves or a personal connection (i.e., friends or family). The remaining hunters hunted on land owned by corporations ($n = 11$, 16%), lease property for hunting ($n = 14$, 20%), or other locations ($n = 5$, 7%).

Hunting Motivations

Hunters considered getting outdoors to enjoy the natural environment the most important motivation to hunt alligators ($\bar{x} = 4.23$, $SD = 0.94$), followed by using their hunting skills ($\bar{x} = 3.96$, $SD = 0.94$), and getting rid of problem alligators ($\bar{x} = 8.54$, $SD = 1.30$). They considered the possibility of killing a trophy alligator the least important

motivation to hunt alligators ($\bar{x} = 2.66$, $SD = 1.33$), followed by partaking in a family tradition ($\bar{x} = 2.80$, $SD = 1.54$), and putting meat in the freezer ($\bar{x} = 2.98$, $SD = 1.26$) (Table 9).

Table 9. Hunter Motivations for Spring Alligator Hunting in Texas.

Index and items	Mean (\bar{x})	Standard Deviation (SD)	Alpha if item deleted	Cronbach's Alpha (α)
<i>Motivations*</i>				0.990
Putting "meat in the freezer"	2.98	1.26	0.989	
Being with hunting companions	3.45	1.22	0.989	
Getting rid of a specific problem alligator (i.e., nuisance alligator)	3.54	1.30	0.989	
Possibility of killing a trophy alligator	2.66	1.33	0.989	
Getting away from everyday problems	3.19	1.44	0.989	
Seeing alligators or signs of alligators	3.23	1.39	0.989	
Getting outdoors to enjoy the natural environment	4.23	0.94	0.988	
Using my hunting skills	3.96	0.94	0.988	
Partaking in a family tradition	2.80	1.54	0.989	
The adrenaline and thrill of catching and dispatching an apex predator	3.21	1.55	0.989	

* Scale ranged from 1 (*not important at all*) to 5 (*extremely important*).

Management Preferences

The majority of hunters ($n = 62$, 91%) stated that alligator management is very or extremely important, followed by moderate importance ($n = 4$, 6%), and slightly important ($n = 2$, 3%). Most hunters ($n = 61$, 94%) stated they were somewhat to not at all concerned with overhunting potential, followed by very concerned ($n = 4$, 6%).

Table 10. Hunter Management Preferences.

Index and items	Mean (\bar{x})	Standard Deviation (SD)	Cronbach's Alpha (α)
<i>Management Preference*</i>			0.698
Removing the spring alligator hunting season in non-core counties	1.56	0.86	
Implementing a statewide fall alligator hunting season	2.95	1.41	
Removing the spring alligator hunting season in non-core counties AND implementing a statewide fall alligator hunting season	2.29	1.21	

* Scale ranged from 1 (*totally unacceptable*) to 5 (*perfectly acceptable*).

Most hunters stated that the removal of the spring season would be unacceptable ($\bar{x} = 1.56$, SD = 0.86) (Table 10). Hunters also generally disliked the removal of the spring season AND the implementation of a statewide fall season ($\bar{x} = 2.29$, SD = 1.21). The most acceptable option among hunters, yet still considered unacceptable, was just the implementation of a statewide fall season (keeping the spring season as is) ($\bar{x} = 2.95$, SD = 1.41) (Table 10).

Hunter Beliefs

Nuisance Beliefs. Hunters were most likely to agree that hunting alligators is warranted when alligators pose a threat to humans ($\bar{x} = 5.85$, SD = 1.52), followed by posing a threat to livestock ($\bar{x} = 5.75$, SD = 1.44), then hunting dogs ($\bar{x} = 5.51$, SD = 1.46), and pets ($\bar{x} = 5.21$, SD = 1.54) (Table 11). Hunters were least likely to agree that hunting of alligators is warranted because humans and alligators cannot share the same landscape ($\bar{x} = 2.43$, SD = 1.50), followed by maintaining minimum viable populations ($\bar{x} = 2.84$, SD = 1.56) (Table 11).

Table 11. Hunter Responses to: Hunting of alligators is warranted when...

Index and items	Mean (\bar{x})	Standard Deviation (SD)	Alpha if item deleted	Cronbach's Alpha (α)
<i>Nuisance Beliefs*</i>				0.932
Pose a threat to livestock	5.75	1.44	0.916	
Pose a threat to hunting dogs	5.51	1.46	0.917	
Pose a threat to humans	5.85	1.52	0.920	
Are showing up in place they have never been seen before	3.74	1.73	0.933	
Cause property damage	4.48	1.8	0.922	
Pose a threat to pets	5.21	1.54	0.914	
Compete with hunters for prey	3.35	1.66	0.927	
When humans express they are feeling afraid	3.1	1.74	0.932	
Alligators and humans cannot share the same landscape	2.43	1.50	0.925	
Alligator populations should only be maintained to viable populations	2.84	1.56	0.924	

* Scale ranged from 1 (*strongly disagree*) to 7 (*strongly agree*).

Three additional nuisance belief questions were proposed to determine the point at which hunters consider an alligator a nuisance in regard to humans, livestock, and pets and/or hunting dogs. Overall, alligators become a nuisance when it attacks and/or kills humans (n = 59, 33%), then livestock (n = 64, 52%), and hunting dogs and/or pets (n = 62, 45%) (Table 12). Attacking and/or killing livestock was the overall highest rated scenario that would classify an alligator as a nuisance (n = 64, 52%). The scenario where hunters were least likely to consider an alligator a nuisance was when an alligator appears in a location they have never been seen before in regard to humans (n = 7, 4%), livestock (n = 4, 3%), and hunting dogs and/or pets (n = 5, 4%). A quarter of hunters were considered alligators a nuisance after they have been fed by humans (n = 44, 25%),

making it the second most selected response for alligators becoming a nuisance in regard to humans (Table 12). Few hunters did not consider alligators a nuisance in any sense in regard to humans (n = 4, 2%), livestock (n = 3, 3%), and hunting dogs and/or pets (n = 8, 6%).

Table 12. Hunter Nuisance Beliefs.

At what point do you consider alligators a nuisance in regard to...						
	Humans		Livestock		Hunting Dogs or Pets	
	Count	%	Count	%	Count	%
They appear in a location they have never been seen before	7	4%	4	3%	5	4%
They are “too close for comfort”	22	13%	19	15%	21	15%
They have approached (humans/livestock/hunting dogs or pets) in the past	41	23%	34	27%	41	30%
They have attacked/killed (humans/livestock/hunting dogs or pets)	59	33%	64	52%	62	45%
They have been fed by humans.	44	25%	----	----	----	----
I do not consider alligators a nuisance in this sense.	4	2%	3	3%	8	6%

Termination Beliefs. When asked to rank the top benefits of moving the spring season to the fall, most hunters stated that they did not support moving the season to the fall (n = 39, 66%). Some hunters considered allowing alligators to breed freely without human interference (n = 7, 12%) and lessening confusion across seasons (n = 7, 12%) as the most important benefits to moving the season, followed by a more sustainable impact on alligator populations (n = 6, 10%) (Table 13).

Table 13. Hunter Ranked Benefits to Moving the Spring Hunting Season to the Fall.

Most Important Benefits...	Count (n = 59)	Percentage
It would allow for alligators to breed freely without human interference.	7	12%
Having all alligator hunting in the fall would lead to less confusion about regulations across seasons.	7	12%
A statewide fall alligator hunting season would have a more sustainable impact on alligator populations.	6	10%
I do not support moving the season to the fall.	39	66%

When asked to rank the top drawbacks of moving the spring season to the fall, hunters ranked choosing between fall hunting seasons as there were already many different hunting seasons taking place in the fall (n = 16, 29%) as the most important drawback, followed by the difficulty of hunting alligators in the fall due to cold weather and less alligator activity (n = 13, 24%). The third most important drawback to hunters was that moving the season would not matter due to the low impact the spring season has on the alligator population (n = 12, 22%). A few hunters did not consider any of these options as drawbacks, as they supported the move of the season (n = 4, 7%) (Table 14).

Table 14. Hunter Ranked Drawbacks to Moving the Spring Hunting Season to the Fall.

Most Important Drawbacks....	Count (n = 55)	Percentage
There are already many different hunting seasons in the fall, and a change would force hunters to choose.	16	29%
Moving the season would not achieve its intended aim because the spring season has a minimal impact on the alligator population.	12	22%
To keep alligator populations in check, we need more alligator hunting not less.	6	11%
The alligators are less active in the fall due to colder weather and, therefore, hunting would be more difficult at that time of year.	13	24%
It would not be fair because core counties have more alligators and would have a better chance at taking an alligator during the fall season.	0	0%
There are other factors that play a bigger role in alligator population dynamics than hunting them in the spring.	4	7%
There are no drawbacks. I support this move.	4	7%

Spring Season Beliefs. Over a quarter of hunters believed the season was created to regulate alligator population sizes (n = 61, 28%) and to create recreational hunting opportunities (n = 54, 25%) (Table 15). Fewer hunters chose targeted removal (n = 27, 13%), protecting domestic animals (n = 18, 8%), and preventing encroachment on human lands (n = 14, 7%) as the reason for the season's existence. A small percentage of hunters believed the season is intended to sustain the meat and hide market (n = 11, 5%), with even fewer believing its purpose is to increase alligators' fear of humans (n = 4, 2%). Few hunters believed the reason the spring season existed was created to help offset the abundance of nuisance alligator calls taken by wildlife agencies (n = 25, 12%) (Table 15).

Table 15. Hunter Spring Season Existence Beliefs.

For what reason(s) do you think the spring season exists (in non-core counties) in Texas?		
	Count	Percentage
Increase alligators' fear of humans.	4	2%
Prevent alligators from moving into human populated areas.	14	7%
Protect domestic animals from alligator predation.	18	8%
Regulate alligator population sizes.	61	28%
Targeted removal of problem alligators.	27	13%
Help offset the abundance of nuisance alligator calls taken by wildlife agencies.	25	12%
Recreational hunting opportunities.	54	25%
Obtaining alligator hides and meat for commercial use.	11	5%

Hunting Activity

Most hunters stated that they were moderately likely to hunt alligators in Texas in the future ($\bar{x} = 3.53$, $SD = 1.51$) upon the removal of the spring season (Table 16).

Hunters were also generally likely to apply for a Texas alligator hunting license next year ($\bar{x} = 3.90$, $SD = 1.26$). The least likely hunting activity for future hunters was to hunt alligators in another state ($\bar{x} = 2.15$, $SD = 1.31$) (Table 16).

Table 16. Hunter Indicated Future Hunting Activity.

Items and index	Mean (\bar{x})	Standard Deviation (SD)	Cronbach's Alpha (α)
<i>Activity*</i>			0.416
I will hunt alligators in Texas in the future.	3.53	1.51	
I will apply for a Texas alligator hunting license next year.	3.90	1.26	
I will hunt alligators in another state.	2.15	1.31	

*Scale ranged from 1 (*extremely unlikely*) to 5 (*extremely likely*)

Likelihood to Oppose Termination

Hunter attributes do influence the likelihood to oppose termination, supporting H1. Specifically, self-proclaimed knowledge about alligators ($\beta = -0.73$, $p < 0.05$) and where alligator hunters typically go hunting ($\beta = -0.44$, $p < 0.05$) (Table 17) influenced opposition to termination. Hunters who claimed to have higher knowledge of alligators were less likely to oppose termination, refuting H1b. Hunters with micro-level access to hunting lands were more likely to oppose termination than hunters with macro-level access, supporting H1c. Our findings refute H1a, as alligator hunting experience did not have an effect on likelihood to oppose termination. Hunter motivations also influenced termination opposition likelihood, supporting H2. Hunters who hunt alligators to use their hunting skills as a motivation were less likely to oppose termination ($\beta = -0.56$, $p < 0.05$) (Table 17), refuting H2a. H2b-c were also refuted as enjoyment of nature and companionship with other hunters as motivations did not influence termination opposition likelihood.

Our model also revealed that hunter beliefs influenced likelihood to oppose termination, supporting H3. Specifically, hunters who believe that alligators and humans cannot share space ($\beta = 0.38$, $p < 0.05$) were more likely to oppose the spring season termination, supporting H3a. H3b, however, was refuted, as hunters who believed the season was created for nuisance control were not significantly more likely to oppose termination. Hunters with a high importance of hunting for alligator management ($\beta = 0.80$, $p < 0.05$) (Table 17) were more likely to oppose termination, supporting H4.

Hunters were also less likely to oppose termination depending on their future hunting activity, refuting H5. Specifically, hunters who planned on hunting alligator in

Texas in the future had a lower likelihood to oppose termination ($\beta = -0.47, p < 0.05$) (Table 17).

Table 17. Binary Logistic Regression Models; Likelihood to oppose termination as dependent variable.

	Beta (β)	SE	Probability (p)	R ²	Odds Ratio
<i>Hunter Attributes</i>					
Who owns the land where you typically go hunting	-0.44	0.19	0.013	0.082	0.64
How would you rate your level of knowledge about alligators	-0.73	0.39	0.047	0.052	0.48
<i>Hunting Motivations</i>					
Using My Hunting Skills	-0.56	0.33	0.048	0.052	0.57
<i>Hunter Beliefs</i>					
Alligators and humans cannot share the same landscape	0.38	0.21	0.047	0.052	1.47
<i>Management Preferences</i>					
How important is hunting to the management of alligators	0.80	0.40	0.033	0.060	2.22
<i>Hunting Activity</i>					
I will hunt alligators in Texas in the future	-0.47	0.22	0.019	0.072	0.63

Discussion

This study provides an example of how management severity can affect acceptability among key demographics. Hunters can be considered the main audience of hunting policy conflicts. Our study highlighted that through a gradient of management intensity, hunters are opposed to policies that limit their activities. Instead, hunters prefer more freedom and less regulations (Serenari et al., 2019; Song et al., 2019). However, hunters who had intentions to continue hunting past the 2020 spring season were less likely to oppose termination, following a trade-off that some hunting is better than no

hunting (Moro et al., 2013). Access is also an important factor when hunters consider termination of hunting policies. Hunters who have easier access to hunting lands were more likely to oppose termination likely in part due to the ease at which hunting takes place on familiar properties, as well as personal ties to the property (Burke et al., 2019). Additionally, the majority of hunters were opposed to moving the spring season, listing the multitude of current fall hunting seasons as the main drawback. The spring season provides hunters with a recreational hunting opportunity in what most consider the “off-season”. Our study suggests that potential oppositionist hunters are hunters that plan to hunt alligators in the future as well as self-proclaimed knowledgeable hunters. Practically speaking, these results will allow TPWD to better understand public and hunter opposition as well as concerns voiced by a key group of constituents (Miller & Graefe, 2001). Yet, some hunters in our study were conflicted in that they wanted to sustain populations for future generations, while also exhibiting freedom to hunt all year. Moreover, these hunters recognize the potential impact the spring season has on alligator breeding success. These findings signal the potential for policy conflict as well as a principle policy paradox in that conflicting cognitions about current policy and ecological attitudes among hunters can cause difficulty for carnivore management plans to integrate with hunters (Marshall et al., 2016; Stanley Jr., 1995).

With hunter beliefs about alligators grounded in a nuisance background, hunting policy termination seems inconceivable. Instrument choice is key in bridging the gap between oppositionists and conservationists (Serenari, 2021). Finding a way to appeal to oppositionist lead coalitions will provide a smoother transition for policy termination. However, due to hunter management preferences, discourse can be highly politicized

(Serenari & Lute, 2020). Researchers suggest that decision makers need to rethink their carnivore designations because words matter, dictate conservation outcomes, and underscore carnivore policy conflict (Serenari, 2021). Therefore, alligator decision makers will want to consider how a nuisance designation potentially hinders doing what is best for alligators.

Effective management practices rely on understanding the dynamics between the hunter and the hunted. Texas alligator hunters stated that they participate in the spring season to get outdoors and enjoy the environment. Seasonality of hunting appears to be trivial. Researchers have also noted that seasonality tends matter when alligator population success is contingent on it due to the location of their breeding season (Eversole et al., 2015; Fujisaki et al., 2016). Therefore, TPWD and agencies facing similar scenarios may benefit from considering more sustainable hunting seasonality.

Misaligned hunter beliefs about policy creation, intention, and purpose can cause difficulties for agencies when policy revision or termination is needed. Previous studies have linked existing hunter beliefs to hunter desire to control populations, especially when large carnivores are considered a nuisance (Schroeder et al., 2018). When risk perceptions are high and coexistence incentives are low, hunters don't see the same satisfaction in population conservation as wildlife agencies (Langley, 2010). In our case, hunters that were unwilling to share space with alligators were more likely to oppose the termination of the spring season.

In terms of large carnivores, understanding the aspects of hunters that contribute to lack of progress on the wildlife conservation front will allow future managers to plan for and combat potential anti-termination stances and political uproar. This can be

particularly useful in the United States where the delisting of a major carnivore (gray wolf) from the Endangered Species Act will undoubtedly bring up political strife in terms of management and hunting policies, as seen with previous predator reintroduction (Serfass et al., 2014). Studies have already found that hunters oppose conservation-reliance for large carnivores in conjunction with coexistence (Serenari, 2021). For wildlife governance to be effective, humans must be a main component in the discussion (M. Peterson et al., 2020).

We argue that hunters should be involved in carnivore management decision-making and outcomes worldwide, implying the need to better understand factors influencing their potential management decisions. The termination of the spring alligator hunting season could pave the way for agencies across the United States and across the world to reevaluate their current large carnivore management plans (Darimont et al., 2020). Future research should aim to further understand ideological underpinnings of large carnivore policy, including hunting season bans. As trophy and large carnivore hunting increases worldwide (Croes et al., 2011), bringing hunters to the table for management decisions can help combat illegal take and harvest (Gangaas et al., 2013).

Conclusions

This study provided important foundational information on spring alligator hunter attributes, motivations, management preferences, beliefs, and hunting activity. A comprehensive understanding of these hunters is important for future management actions as politically charged groups and anti-termination coalitions can essentially halt any conservation advancement. As much of the human-wildlife conflict literature has ignored the power an anti-termination coalition can have on the political process of

carnivore conservation, we argue that understanding the drivers and motivation of said coalition will help decision-makers be better prepared. In addition to termination, agencies should also consider an alteration to the policies in question that would benefit both large carnivores and hunters alike.

APPENDIX SECTION

Appendix A. Qualitative Interview Prompt

1. Please list three benefits to having alligators in Texas
2. Please list three drawbacks to having alligators in Texas
3. What encounters have you had with alligators on your property in the past?
 - a. Probe: Please explain your view on the current alligator population in Texas.
 - b. Probe: What influences your decision to participate in the spring alligator hunting season?
 - c. Probe: How does culture play a role in alligator hunting in your community/family?
 - d. Probe: Please list where you typically go alligator hunting (i.e., private property, public, etc.).
4. What are the three major reasons for conflict with alligators in your area?
 - a. Probe: How might these conflicts be resolved in your opinion?
5. Please give your 3 main motivations for spring alligator hunting.
6. How well does the current alligator hunting season control the conflict/populations?
 - a. Probe: What criteria influence how you might react to the removal of the spring alligator hunting season?
 - b. Probe: What criteria influence how you might react to the implementation of a statewide fall alligator hunting season?
 - c. Probe: Why might you react this way? Please explain your reasoning.

7. Are you in favor of canceling the spring alligator season and moving to a statewide fall season?
 - a. Probe: Justify why or why not.
8. In your opinion, what are the implications for removing the spring hunting season?

Appendix B. Quantitative Survey Questions



Introduction/Consent

Hello!

You are invited to participate in a research project conducted by Dr. Chris Serenari's lab at Texas State University in collaboration with Texas Parks and Wildlife Department (TPWD). This study seeks to elicit and compare the social drivers prompting the hunting of alligators during the spring season in Texas. The information gathered will be used to help TPWD understand the policy implications of spring hunting in non-core counties. You are being asked to participate because of your involvement in alligator hunting during the spring season through a TPWD-approved hunting license.

Procedures: Participation in this research involves taking a survey that asks about your hunting history and the reasons why you choose to hunt alligators in Texas. The survey will take approximately 20 minutes to complete. In the event that some of the survey questions make you uncomfortable or upset, you are always free to decline to answer or to stop your participation at any time.

Risk and Discomforts: This study involves no foreseeable risks beyond those associated with daily activities that are associated with participation in this study.

Voluntary Participation: You do not have to be in this study if you do not want to. You may also refuse to answer any questions you do not want to answer. If you volunteer to be in this study, you may withdraw from it at any time without consequences of any kind or loss of benefits to which you are otherwise entitled.

Benefits: There will be no direct benefit or compensation to you from participating in this study. Indirect benefits include the opportunity to inform policies concerning alligator management.

Statement of Confidentiality: Reasonable efforts will be made to keep the personal information in your research record private and confidential. Any identifiable information obtained in connection with this study will remain confidential and will be disclosed only with your permission or as required by law. The members of the research team and the Texas State University Office of Research Compliance (ORC) may access the data. The ORC monitors research studies to protect the rights and welfare of research participants. Your name will not be used in any written reports or publications which result from this research. Data will be kept for three years (per federal regulations) after the study is completed and then destroyed.

Contacts for questions: If you have any questions or concerns feel free to contact Dr. Serenari at c_s754@txstate.edu or 210-816-3709.

This project (#7620) was approved by the Texas State IRB on 5/11/20. Pertinent questions or concerns about the research, research participants' rights, and/or research-related injuries to participants should be directed to the IRB chair, Dr. Denise Gobert 512-716-2652 – (dgobert@txstate.edu) or to Monica Gonzales, IRB Regulatory Manager 512-245-2334 – (meg201@txstate.edu).

If you would prefer not to participate, please do not fill out a survey.

If you consent to participate, please click "Let's do it" and we'll get started

Let's do it

No thanks

Hunter Assessment

Hunter Assessment: This section will be designed to understand your hunting background in regards to alligator hunting in Texas.

How long have you hunted alligators in Texas?

Never/First-timer

1-2 years

3-5 years

6-8 years

9-11 years

12+ years

How would you best describe yourself as a hunter?

Contracted hunter through TPWD

Sport/recreational hunter

Other (specify):

Who owns the land where you typically go alligator hunting?

Self
Family
Friend
Corporation
Leased Property

Other (specify):

What personal experiences have you had with alligators on your property or elsewhere? (select all that apply)

I just watched them.
They stalked children I accompanied.
They stalked/threatened my pet(s).
They disturbed me while I was fishing recreationally.
They threatened my livestock.
They threatened my hunting dogs.

Other (specify):

I have not had personal experiences with alligators.

Knowledge about Alligators: The following section is designed to understand your level of knowledge about alligators in Texas.

How would you rate your level of knowledge about alligators?

Extremely knowledgeable	Very knowledgeable	Moderately knowledgeable	Slightly knowledgeable	Not knowledgeable at all
----------------------------	-----------------------	-----------------------------	---------------------------	--------------------------------

How would you describe the current alligator population in Texas?

- Far too few
- A little too few
- About right
- A little too many
- Far too many
- Unsure

Alligator Attitudes

Attitudes and Beliefs about Alligators: The following section is designed to understand your views about the presence of alligators in Texas.

Please indicate how much you agree or disagree with the following statements about Texas alligators:

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree
I enjoy the presence of alligators in the wild.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alligators provide an educational opportunity for me or my family.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alligators are culturally important.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The presence of an alligator is a sign of a healthy environment.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would like to see more alligators in the wild.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Alligators should be preserved for future generations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alligators and humans cannot share the same landscape.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Managers should focus on reducing humans' negative impacts on alligator populations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alligator populations should only be maintained to minimal viable populations.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alligators help other species thrive.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Which of the following areas are appropriate areas where alligators can inhabit? (check all that apply)

- Rural area
 - Urban areas
 - Private lands with domestic animals
 - Private lands without domestic animals
 - Public lands without human activity
 - Public lands with human activity
-

Nuisance Alligators: This section is designed to understand your views about the notion of nuisance alligators in Texas.

When it comes to **humans**, at what point do you consider alligators a nuisance? (check all that apply)

- They appear in a location they have never been seen before.
- They are "too close for comfort" to humans.

They have approached humans in the past.
They have been fed by humans.
They have attacked/killed a human.
I do not consider alligators a nuisance in this sense.

When it comes to **livestock**, at what point do you consider alligators a nuisance? (check all that apply)

They appear in a location they have never been seen before.
They are "too close for comfort" to livestock.
They have approached livestock in the past.
They have attacked/killed livestock.
I do not consider alligators a nuisance in this sense.

When it comes to **pets** and/or **hunting dogs**, at what point do you consider alligators a nuisance? (check all that apply)

They appear in a location they have never been seen.
They are "too close for comfort" to pets/hunting dogs.
They have approached pets/hunting dogs in the past.
They have attacked/killed pets/hunting dogs.
I do not consider alligators a nuisance in this sense.

Alligator Management: The following section will help us understand your views about general alligator management in Texas.

Please choose your **TOP 3** most important threats to alligators by **dragging and dropping one answer into each box to the right.**

Items	Top Threat
Urbanization	
Hunting	
Intensification of agriculture	
Human population growth	
Energy development	2nd Most Important Threat
Increased interactions with humans	
Media representation	
Public misunderstandings about alligator behavior	
Lack of transparency in alligator decision-making	Third Most Important Threat
Other (specify):	
<input type="text"/>	

Hunting Alligators: This section will help us understand your views about hunting alligators in Texas.

How important is hunting to the management of alligators in Texas?

Not at all important Slightly important Moderately important Very important Extremely important

Please tell us to what extent you agree or disagree with the following statements:

Hunting of alligators in Texas is warranted when alligators...

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree
Pose a threat to livestock	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pose a threat to hunting dogs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pose a threat to humans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are showing up in places they have never been seen before	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cause property damage	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pose a threat to pets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Compete with hunters for prey	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When humans express they are feeling afraid	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (specify) <input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

For what reason(s) do you think the spring season exists (in non-core counties) in Texas?
(select all that apply)

- Increase alligators' fear of humans
- Prevent alligators from moving into human populated areas
- Protect domestic animals from alligator predation
- Regulate alligator population sizes
- Targeted removal of problem alligators

Help offset the abundance of nuisance alligator calls taken by wildlife agencies
 Recreational hunting opportunities
 Obtaining alligator hides and meat for commercial use

Please tell us to what extent you dis/agree with the following statements:

Hunting alligators in the spring season could affect the population by...

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree
Increased infanticide	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Disrupted social structure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Reduced juvenile survival	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Reduced juvenile recruitment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Reduced gene transfer among populations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Reduced human interactions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Increased livestock predation events	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
Other (specify) <input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

How concerned are you with the potential of overhunting alligators in Texas?

Not at all concerned

Somewhat concerned

Very concerned
Extremely concerned

Decision Making: This section is designed to understand your views about decision-making regarding alligators in Texas.

To what extent should alligator biology and ecology factor in to decisions to hunt alligators in Texas?

None at all
A little
A moderate amount
A lot
A great deal

To what degree should alligator conservation practices ideally rely on evidence-based planning, decision-making, and justification for alligator hunting?

Always
Most of the time
Occasionally
Never
I do not know

What alligator-specific qualities should factor into their management? (Select all that apply.)

Age
Health

Movement
 The place/space they occupy
 Predatory behavior
 Impact on ecosystem structure and functioning
 Sex (male or female)
 Distribution of food and water
 How long they occupy a place/space
 Visibility to people

Other (specify):

Alligator Management (Spring Season): This section is designed to understand your views on spring alligator management and policy in Texas.

In your opinion, please drag and drop to rank the **benefits** of moving the spring alligator hunting season to a statewide fall hunting season.

#1 is the most important benefit and **#4 is the least important** benefit.

If you do not support the move, please rank the last item #1, but still rank the other options as well.

Items	Most Important Benefit
It would allow for alligators to breed freely without human interference.	
Having all alligator hunting in the fall would lead to less confusion about regulations across seasons.	

A statewide fall alligator hunting season would have a more sustainable impact on alligator populations.

I do not support moving the season to the fall.

2nd
3rd
Least Important Benefit

In your opinion, please drag and drop to rank the **drawbacks** to moving the spring alligator hunting season to a statewide fall hunting season

#1 is the most important drawback and **#7 is the least important** drawback.

If there are no drawbacks, please rank the last item #1, but still rank the other options as

well.

Items

There are already many different hunting seasons in the fall, and a change would force hunters to choose.

Moving the season would not achieve its intended aim because the spring season has a minimal impact on the alligator population.

To keep alligator populations in check, we need more alligator hunting not less.

The alligators are less active in the fall due to colder weather and, therefore, hunting would be more difficult at that time of year.

It would not be fair because core counties have more alligators and would have a better chance at taking an alligator during the fall season.

There are other factors that play a bigger role in alligator population dynamics than hunting them in the spring.

There are no drawbacks. I support this move.

Most Important Drawback

2nd

3rd

4th

5th
6th
Least Important Drawback

Please evaluate the acceptability of the following management actions regarding alligators:

	Totally unacceptable	Slightly unacceptable	Neutral	Slightly acceptable	Perfectly acceptable
Removing the spring alligator hunting season in the non-core countie.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Implementing a statewide fall alligator hunting season	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Removing the spring alligator hunting season in the non-core counties AND implementing a statewide fall alligator hunting season	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please indicate the likelihood of your participation in alligator hunting if the Texas spring seasons is terminated.

	Extremely Unlikely	Somewhat Unlikely	Neither Likely nor Unlikely	Somewhat Likely	Extremely Likely
I will hunt alligators in Texas in the future.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will apply for a Texas alligator hunting license next year.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will hunt alligators in another state.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Hunter Motivations

Hunter Motivations: This section is designed to understand your motivations for participating in the spring alligator hunting season.

To what degree do the following factors influence your decision to participate in the spring alligator hunting season?

	Not at all important	Slightly important	Moderately important	Very important	Extre impoi
Putting "meat in the freezer"	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Being with hunting companions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting rid of a specific problem alligator (i.e., nuisance alligator)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Possibility of killing a trophy alligator	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting away from everyday problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Seeing alligators or signs of alligators	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Getting outdoors to enjoy the natural environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using my hunting skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Partaking in a family tradition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The adrenaline and thrill of catching and dispatching an apex predator	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other (specify): <input type="text"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Demographics

Demographics: The following section is designed to better understand the types of hunters that

participate in the spring alligator hunting season and is for comparative purposes only.

Please indicate your gender:

Male

Female

Please select the age range that applies to you:

18-25

26-35

36-45

46-55

55+

What best describes the area where you live?

Urban

Suburban (region just outside of urban area)

Exurban (region beyond suburban but not considered rural)

Rural

Please indicate your employment type:

Self-employed

Full-time

Part-time

Unemployed

Disabled, unable to work

Retired

With which category do you mostly identify?

White (Non-Hispanic)

White (Hispanic)

Black or African-American

Asian

American Indian or Native Alaskan

Native Hawaiian or Pacific Islander

Other (please specify):

Please indicate your highest level of completed education:

High school or GED

Vocational, technical, trade school or certificate program

Associate's Degree (2-year degree)

Bachelor's Degree (4-year degree)

Master's Degree or higher

What was your total household income in 2019, from all sources, before taxes?

Less than \$24,999

\$25,000-\$49,999

\$50,000-\$74,999

\$75,000-\$99,999

\$100,000+

Are you part of a wildlife conservation or hunting group/organization?

Yes

No

If yes, please list the name of the group or organization.

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Appendix C. IRB Approval Letter



The rising STAR of Texas

In future correspondence please refer to 7240

May 11, 2020

Elizabeth Pratt
Texas State University
601 University Drive.
San Marcos, TX 78666

Dear Elizabeth:

Your IRB application titled '*Analysis of the Drivers of Spring Alligator Hunting in Texas and Policy Implications*' was reviewed and approved by the Texas State University IRB. It has been determined that risks to subjects are: (1) minimized and reasonable; and that (2) research procedures are consistent with a sound research design and do not expose the subjects to unnecessary risk. Reviewers determined that: (1) benefits to subjects are considered along with the importance of the topic and that outcomes are reasonable; (2) selection of subjects is equitable; and (3) the purposes of the research and the research setting is amenable to subjects' welfare and producing desired outcomes; that indications of coercion or prejudice are absent, and that participation is clearly voluntary.

1. In addition, the IRB found that you need to orient participants as follows: (1) informed consent is confirmed by agreeing to participate in the survey; (2) informed consent is confirmed by verbally agreeing to participate in the telephone interview; (3) Provision is made for collecting, using and storing data in a manner that protects the safety and privacy of the subjects and the confidentiality of the data; (4) Appropriate safeguards are included to protect the rights and welfare of the subjects. (5) Compensation will not be provided to participants.

**This project is therefore approved at the Exempt Review Level
Only research activities that do not involve in person contact are approved due to COVID-19
for patient safety.**

2. Please note that the institution is not responsible for any actions regarding this protocol before approval. If you expand the project at a later date to use other instruments, please re-apply. Copies of your request for human subjects review, your application, and this approval, are maintained in the Office of Research Integrity and Compliance.

Report any changes to this approved protocol to this office. All unanticipated events and adverse events are to be reported to the IRB within 3 days.

Sincerely,

Monica Gonzales
IRB Regulatory Manager
Research Integrity and Compliance

CC: Dr. Christopher Serenari

OFFICE OF RESEARCH AND SPONSORED PROGRAMS
601 University Drive | JCK #489 | San Marcos, Texas 78666-4616
Phone: 512.245.2314 | fax: 512.245.3847 | WWW.TXSTATE.EDU

This letter is an electronic communication from Texas State University-San Marcos, a member of The Texas State University System.

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