

ANGLER AND VOTER PERCEPTIONS OF GREY SEALS ON NANTUCKET

Honors Thesis

**Presented in Partial Fulfillment of the Requirements for the Degree of
Bachelor of Science**

**In the College of Arts and Sciences
at Salem State University**

By

Brandi Brook

Dr. Jennifer Jackman

Faculty Adviser

Department of Political Science

Commonwealth Honors Program

Salem State University

2016

Abstract

Grey seals came close to extinction prior to enactment of the 1972 Marine Mammal Protection Act (MMPA). Since the MMPA, seal populations have greatly recovered, especially around Cape Cod and Islands, which has caused controversy between fishing interests and the seals. This article offers insight into the beliefs of Nantucket voters and anglers about seals and their attitudes towards the MMPA. Surveys were mailed to Nantucket voters and administered to anglers on-site. While previous research suggested that anglers would be more anthropocentric and voters more ecocentric, differences were not statistically significant because of the high number of voters who were anglers. However, when voters were subdivided into “non-angler voter” and “angler voter,” and anglers into “non-resident angler” and resident angler,” “non-angler voters” and “non-resident anglers” were found to be more ecocentric while their counterparts were more anthropocentric. Overall acceptance of seals and support for the ecosystem and MMPA was high.

Keywords: voter, angler, MMPA, ecocentric, anthropocentric, seals

Table of Contents

I.	Introduction	1
II.	Literature Review	1-9
III.	Methodology	9-14
IV.	Response Rates	15
V.	Results	16-27
VI.	Discussion/Conclusion	27-29
VII.	Appendix	30-32
VIII.	References	33-34
IX.	Acknowledgments	35

List of Tables

- Table 1 Ecocentric Variables 11
- Table 2 Anthropocentric Variables 12
- Table 3 Marine Mammal Protection Act Variables 12
- Table 4 Voters and Anglers Ecocentric Scale 17
- Table 5 Voters and Anglers Anthropocentric Scale 18
- Table 6 Non-angler Voters and Angler Voters Ecocentric Scale 19
- Table 7 Non-angler Voters and Angler Voters Anthropocentric Scale 20
- Table 8 Non-resident Anglers and Resident Anglers Ecocentric Scale 21
- Table 9 Non-resident Anglers and Resident Anglers Anthropocentric Scale 22
- Table 10 Voters and Anglers MMPA Scale 24
- Table 11 Non-angler Voters and Anglers Voters MMPA Scale 25
- Table 12 Non-resident Anglers and Resident Anglers MMPA scale 26
- Table 13 Ecocentric Beliefs All Groups 30
- Table 14 Anthropocentric Beliefs All Groups 31
- Table 15 Marine Mammal Protection Act Beliefs All Groups 32

Introduction

The grey seal population of the North Atlantic has made a miraculous recovery in the last thirty years. Grey seals came close to extinction in Massachusetts coastal waters in the 1960s. The Marine Mammal Protection Act (MMPA) was enacted in 1972 and is credited with the healthy recovery of the population. The act made it illegal to harm or harass marine mammals in any way, putting an end to the seal bounty. The estimated population of grey seals on Cape Cod and Islands rose from 5,611 in 1999 to just under 16,000 in 2011 (Fraser, 2013). Although this increase is seen by environmentalists and scientists as a major conservation achievement, commercial fishermen and anglers in the area find the growing number of seals to be problematic. The political controversy revolving around the seals continues to grow, with some stakeholders resorting to lethal violence against seals (Fraser, 2011).

Literature Review

Beliefs of Commercial Fishermen and Anglers

Throughout history there have been reported conflicts between the fishing industry and seals. Fishermen have claimed that seals have contributed to a decrease in fish stocks and increase and damaged catch and fishing equipment. However, most studies have been conducted outside the United States, focused on the attitudes of the commercial fishermen (with the exception of one study on California angler attitudes toward sea lions) and relied on small sample sizes. Although some organizations representing anglers and fishermen are among the most vocal stakeholders in the seal

management controversy in the U.S., it is not known whether their views and prior research are representative.

Seals as Competition

Past research has suggested that people involved in fishing, whether commercial or recreational, find seals to be problematic because they believe seals threaten their livelihood and/or recreational activity. A 1998 study of attitudes towards ringed seals in the U.K. concluded that 83% of the surveyed commercial fishermen in the area believed that seals had an influence on their activity. When respondents were asked whether or seals were considered competition 61.5% agree and cited a 6% average loss of yearly profit due to seals (Glain, Kotomatas, and Adamanttopoulou, 2001). A survey conducted in Lake Pihlajavesi, Finland suggested fishermen believe the population is much higher than scientific research indicates. The Finland study concludes that fishermen believe the seals are affecting their annual income because the seals are damaging their fish stocks (Tonder and Jurvelius, 2004). A survey of members of the Clyde Fishermen's Association in Scotland showed that 81% of fishermen reported that seals would frequently take fish from their nets and 91% reported damage to their stocks as result for seal interaction (Moore, 2002). Another study of commercial fishermen in Scotland found seals to be the greatest factor influencing their stocks and catches and out of the 45 fisheries who responded, a total of 36,689 angler days was reported as lost as a result of the seals (Butler, Middlemas, Graham, Harris, 2011).

The only research on fishery attitudes towards seals in the Northwest Atlantic, are several, mostly qualitative masters theses. Gruber (2010) found that commercial

fishermen believed that seal predation on commercial fish stocks and forage stocks to be two of the main impacts of the grey seal. Respondents also suggested that seals disturb fish schooling and spawning behavior and are therefore “scaring away the fish” before they can be caught. Respondents in this study view seals as a competition because they feed on the fish, but also complain of financial loss because of loss of time, effort, and depredation (Gruber, 2010). Pereira (2014) suggests that fishermen cite frequent disturbances to their catch. Many respondents indicated that they have witnessed seals removing fish directly from around their nets, scaring the fish away from their nets and/or taking fish directly from their lines (Pereira, 2014).

Damage to Gear

In addition to concerns about the loss of catch and/or damage to catch as a result of seals, fishermen also have reported seal damage to costly fishing gear. The U.K. study suggests that about a quarter of the responding fishermen cited seals as damaging their fishing gear and over 40% of fishermen stated they needed to change some of their fishing methods (Glain, Kotomatas, and Adamanttopoulou, 2001). They also reported catching an average of 3.2 seals per year in their nets. The Finland study suggests that seals were not much of a problem in regards to fishing gear, unless the nets were close to their lair. Research stated that the seals tend to follow the schools of fish and if a net is positioned near a seal, the seal will likely cause it damage (Tonder and Jurvelius, 2004). In Moray Firth, Scotland, the fishermen did report extreme damage to fishing nets that were left unattended for some time (Butler, Middlemas, Graham, Harris, 2011). The survey administered to the Clyde Fishermen’s Association in Scotland

reported that 91% of their surveys fishermen have reported catching a seal in their towed gear and overall 32% of survey participants stated that seals have damaged their fishing gear at some point (Moore, 2002).

According to Gruber (2010), damage to gear was not reported as being as much as a financial constraint on the fishermen compared to loss of catch. However, gear repair/replacement and need for extra fuel totaled at 35.4% of fishermen's costs. Gear that has been reported as damage included weir nets which are estimated to cost about \$15,000 (Gruber, 2010).

Views on Public Policy and Management

The economic losses, along with the frustrations the fishermen face, have led many in the fisheries to conclude that management is the only solution to the "seal problem." In England, Glain, Kotomatas, and Adamanttopoulou (2001) reported that 63.5% believe some sort of management tactic needs to be enacted in order to keep seals from becoming involved in their fishing activities and over 50% of fishermen in Greece suggested a limited cull or simply killing of rogue seals (Glain, Kotomatas, and Adamanttopoulou, 2001). The Moray Firth, Scotland concluded that most of the respondents agree a better management plan needed to be put in place and culling was the most frequently suggested plan of management (Butler, Middlemas, Graham, Harris, 2011).

On Cape Cod, Gruber (2010) suggests that fishermen believe the government's information on the current seals population is outdated and believe it is very important

to collect new data on the populations of grey seals. Gruber (2010) also found that 100% of his 40 respondents believed that seals should be managed (Gruber, 2010). Pereira (2014) also suggests a need for new counts and management procedures. Her research points to an over-whelming concern about the mismanagement of fisheries in relation to their protection of seals. Many of her participants feel as though their voices have not been properly heard and share very negative perceptions of the current management plan and conservation efforts towards marine mammals, like the grey seal (Pereira, 2014).

Public Beliefs about Seals

There are virtually no studies of public attitudes towards seals in the United States, with the exception of Yale University researcher Stephen Kellert's 1998 study, *American Perceptions of Marine Mammals and Their Management*. The Marine Mammal study was a national sample of American adults (n=1000) that included many questions relating to the public's attitudes and beliefs towards marine mammals and marine mammal protection. There were also some limited questions focusing specifically on seals (Kellert, 1999).

Commercial exploitation of Marine Mammals

Kellert (1999) found that the majority of respondents oppose lethal management of seals. Seventy Seven percent of respondents disagree that fishermen should kill seals if they "steal" fish or damage their equipment, with 55% indicating that they "strongly disagree." Seventy five percent of respondents felt that abundant numbers of seals should not be reduced, regardless of if they eat valuable fish (Kellert,

1999). Seventy four percent of the public morally objected to the killing of marine mammals because of their capacity to experience suffering and acknowledged intelligence. It also suggested that the public opposes hunting an endangered species or hunting a species that has recovered from previously being endangered (Kellert, 1999). Over 70% respondents also stated that they objected to the capture and display of marine mammals (in zoos, aquariums, etc.) unless they serve a larger scientific and/or education purpose and the animals are well cared for (Kellert, 1999).

Most of the respondents favored the protection of marine mammals at the expense of the interests of the commercial fishing industry. Fifty one percent of respondents believed that fishermen should be required to use costly equipment in order to protect the seals. Views in support of marine mammals were held by the majority of respondents across demographic groups, with somewhat lower support, among people who identified as affiliated with the fishing industry, along with the elderly and those less educated (Kellert, 1999).

Public Policy and Management

Support for the Marine Mammal Protection Act was strong in the Kellert study. About 80% of respondents believe marine mammals should be protected from going extinct. Just under 80% believe that areas of the ocean that that are important feeding and/or breeding grounds for marine mammals also need protection and that harm/suffering to marine mammals should be minimized (Kellert, 1999). There is also

strong support (about 70%) to return and/or maintain marine mammals about abundant levels (Kellert, 1999).

There is a dire need for more research on public attitudes towards seals. Although Stephen Kellert's research is extremely useful when addressing public attitudes towards marine mammals, it is dated and seals are only a small part of the study's focus. More recent research on attitudes towards marine mammals, specifically the grey seal, would be very useful to the scientific community and to assist with public policy creation.

Theoretical framework

Cognitive Hierarchy

The cognitive hierarchy is used in Human Dimensions of wildlife research and focuses on the importance of understanding beliefs and attitudes. The cognitive hierarchy is a structure of cognitions that predict behavior. The hierarchy consists of values, beliefs, attitudes, norms, behavior intentions, and behaviors, including voting (Fulton and Manfredi, 1996). Values can be defined as qualities of life that we find to be imperative or methods of conduct. People tend to hold a small sum of "core" values and values typically are shared by members of the same culture (Vaske and Manfredi, 2012). Beliefs are whether a person expects something to be true and they influence people's attitudes. Attitudes are favorable/unfavorable evaluations, whether they be of a person, action, or an object. Attitudes typically cause direct behavior. Norms can be described as what people are doing or what they should/ought to do. A person's "social

norms” are generally their standards of living learned for their own experience and/or expectations (Vaske and Manfredi, 2012).

Wildlife Values Orientation

The wildlife values orientation (WVO) framework was developed in order to describe how a value “attains meaning for an individual (Vaske and Manfredi, 2012).” The WVO describes the pattern/direction of intensity of basic beliefs as they relate to wildlife. However, Manfredi (2012) later suggested that values can be adapted by either the cultural ideology of domination (utilitarian views of wildlife) or egalitarianism (equality with wildlife). Either of these ideologies can be measured through a series of statements proposing ideal relations between humans and animals (Vaske and Manfredi, 2012).

Normative Beliefs and Wildlife Management

Normative beliefs are also known as judgements; people utilize their normative beliefs when they decide what they should do in a specific situation. Normative beliefs are influenced by one’s values. They are also extremely situational and therefore the specifics of each situation must be addressed in order to understand a relation between normative beliefs and wildlife management (Zinn et al. 1998). There are two major philosophical views of human-environment interaction. The first is ecocentrism which states “concern for nonhuman objects and ecosystems even if conservation of them involves human sacrifice (Bjerke and Kaltenborn, 1999).” The second is anthropocentrism which “which holds human needs above other values, and which

implies a support for protection of the environment if it sacrifices human needs (Bjerke and Kaltenborn, 1999).” There typically is a positive correlation between ecocentrism and positive attitudes towards animals and anthropocentrism and negative attitudes towards animals (Bjerke and Kaltenborn, 1999). Thus, people’s values and beliefs tend to influence their attitudes and eventually their behavior.

This present study examines differences between angler and voter beliefs about seals by evaluating survey results through the framework of the cognitive hierarchy and ecocentric/anthropocentric behavioral characteristics. This study also examines differences in attitudes towards Marine Mammal Protection Act in order to assess whether they are consistent with respondents’ attitudes towards seals.

Methodology

Survey Site

The largest breeding colony of grey seals in the U.S. is on Muskeget Island, which is a small, non-residential island just off the coast of Nantucket. Currently 7,500 people resident year-round on Nantucket Island (Fraser, 2013). Nantucket is also well-known for its extensive fishing history which remains to this day. Media frequently highlights the political tensions between the fishing industry, anglers and the grey seals in Nantucket. Anglers led by the Seal Abatement Coalition are large political voices amidst the controversy. Nantucket was therefore deemed to be an appropriate selection for a survey site because it lies at the heart of the angler-seal conflict (Fraser, 2013).

Data Collection

Our research team, which was led by Professors Jennifer Jackman, Michelle Sweeney and K.C. Bloom, sought to compare stakeholder's views of seals by administering the same survey to samples of voters, anglers and tourists. Voter perceptions of the seals conflict on Nantucket were measured through a mail survey study. Mail surveys are common when measuring attitudes towards wildlife and tend to have a higher response rate compared to other measures (Dillman 2009). In order to collect data for the registered voters on the island, we selected a random sample of 1173 voters. The survey utilized Dillman's 5-contact survey methodology, which includes the first contact by a pre-notice letter which is followed by a survey packet about five days later. A week after that a reminder postcard is mailed out, followed by a replacement survey (10 days later) and then a final reminder (Dillman, 2009).

In order to collect angler data, part of the research team travelled to Nantucket to administer surveys in the field. The angler survey was virtually the same survey as the one used for the voters, with the exception of the first question about residence because some anglers did not live on the island. We administered surveys to people who considered themselves to be an "angler" and made sure we went to survey sites where this demographic would be prominent. We made chose a variety of survey administration sites to reach a representative of anglers on Nantucket, including the Nantucket Angler Club, Straight Wharf (where the charter boats docked), tackle shops, and various popular beaches. Surveys were only administered to people who identified themselves as anglers and were over the age of 18. Both voter and angler surveys received IRB approval. Both guaranteed anonymity to survey respondents. Surveys also

were administered to tourists on-site, but these data are beyond the scope of the present analysis.

Variables

Adopting the cognitive hierarchy framework, we analyzed a subset of survey variables related to respondent beliefs about seals, sharks, fisheries and the Marine Mammal Protection Act. Beliefs were grouped into two categories; ecocentric (Table 1) and anthropocentric (Table 2). The 7 ecocentric variables and 5 anthropocentric variables were each measured on a 7-point scale, with 7 being “strongly agree”, 4 neutral, and 1 “strongly disagree.”

Table 1 Ecocentric Variables

<i>Variable Name</i>	<i>Survey Question</i>
WONDER	Seals symbolize the beauty and wonder of Nantucket.
RIGHT	Seals have a right to exist.
ECOSYSTEM	Seals are important to the ecosystem.
OVERFISH	Overfishing is the main cause of declining fish stocks.
HELPECON	Seals contribute to the economy because they draw tourists.
ENTANGLE	Fishing poses a threat to seals that become entangled in gear or die as by-catch.
SHARKSECO	Sharks are important to the ecosystem.

Table 2 Anthropocentric Variables

<i>Variable Name</i>	<i>Survey Question</i>
NUISANCE	Seals are nuisance animals.
FISHSTOCK	Seals are the main cause of declining fish stocks.
DRAWSHARKS	Seals pose a threat to people because they draw in sharks.
HURTECON	Seals hurt the economy because they compete with fishermen.
DISEASE	Seals spread disease to fish.

To measure support for the Marine Mammal Protection Act, the survey replicated items from Kellert (1999) on the Act's goals (Table 3). Respondents were asked to rank their agreement for these goals along a 7-point scale ranging from "strongly agree" (7) to "strongly disagree" (1).

Table 3 Marine Mammal Protection Act Variables

<i>Variable Name</i>	<i>Survey Question</i>
MMPAPREVENT	Prevent marine mammals from going extinct
MMPARESTORE	Maintaining or restoring marine mammal protection levels*
MMPACONFLICT	Minimizing conflicts between marine mammals and commercial fishing
MMPAHARM	Minimizing harm and suffering of marine mammals
MMPAPROTECT	Protecting areas of the ocean important for marine mammal feeding and breeding

*The survey revised the original item, which read "Maintain/return marine mammal populations to abundant levels"

Categorical variables measured demographic characteristics, including sex, age and education. We also used the variable on participation in saltwater fishing to group voters as non-angler voters and angler voters. Non-angler voters were defined as voters who had participated in saltwater fishing only a few times (7 or under); angler voters were defined as those who participated in saltwater fishing “many times” (over 7). To differentiate between the anglers who resided on Nantucket and those who were visiting, we utilized the residence variable; if the respondent identified that they did live on Nantucket, they were considered a resident angler. If they identified that they did not live on the island, they were considered a non-resident angler.

Data Analysis

Scales were created for ecocentric, anthropocentric and the Marine Mammal Protection Act. The ecocentric scale was calculated from the mean of the seen variables: WONDER, RIGHT, ECOSTSTEM, OVERFISH, HELPECON, ENTANGLE, and SHARKSECO. The anthropocentric scale was generated from the means of NUISANCE, FISHSTOCK, DRAWSSHARKS, HURTSECON, and DISEASE. The Marine Mammal Protection Act scale was calculated from the means of MMPAPREVENT, MMPARESTORE, MMPACONFLICT, MMPAHARM, and, MMPAPROTECT. All data was inputted into SPSS, a commonly used statistical analysis software. Independent T-tests were used to compare the response means for full samples of voters and anglers and subsamples of non-angler voters/angler voters and non-resident anglers/resident anglers on the three scales and related scale items. Bi-variate regression was employed to examine the influence of ecocentric and anthropocentric beliefs on attitudes toward the Marine Mammal

Protection Act. Crosstabs were used to provide descriptive findings for specific scale items.

Hypotheses

The following hypotheses were tested in this analysis:

H₁ Voters will be more ecocentric than anglers; anglers will be more anthropocentric than voters.

H₂ Non-angler voters will be more ecocentric than angler voters; angler voters will be more anthropocentric than non-angler voters.

H₃ Non-resident anglers will be more ecocentric than resident anglers; resident anglers will be more anthropocentric than non-resident anglers.

H₄ Voters will be more likely to favor the Marine Mammal Protection Act than anglers.

H₅ Non-angler voters will be more likely to favor the Marine Mammal Protection Act than angler voters.

H₆ Non-resident anglers will be more likely to favor the Marine Mammal Protection Act than resident anglers.

H₇ Ecocentric and anthropocentric beliefs will influence attitudes toward the MMPA, with ecocentric views positively related to MMPA support and anthropocentric views inversely related.

Response Rates

Voter Survey

A total of 350 Nantucket voters completed the mail survey for a response rate of 36%.¹

There was a total of 114 undeliverable surveys because of bad addresses, deaths or people who moved. The male and female breakdown of respondents reflected the demographics of the voter population, 49% male and 51% female. Because of the cultural history of Nantucket Island, the majority of registered voters also participated in saltwater fishing; 58% participated in saltwater fishing frequently (more than 7 times), which we labeled “angler voter.”

Angler Survey

Surveys were administered on-site to 123 anglers at multiple location on Nantucket, including beaches, angler club, and docks where the boats port. Of respondents, 84% were male 6% female. Forty eight percent of anglers were residents of Nantucket while 51% were non-residents.

Scales

Cronbach’s alpha was used to test the reliability of the scale items. All three scales demonstrated internal reliability: ecocentric (Cronbach’s alpha=.773), anthropocentric (Cronbach’s alpha=.812), and Marine Mammal Protection Act (Cronbach’s alpha=.821).

¹ Because the response rate was less than 50%, non-response bias checks were conducted, which found that respondents were older than non-respondents and the voter population. In future analyses, data will be weighted by age. Data for the present analysis are unweighted.

Results

H₁ Voters will be more ecocentric than anglers; anglers will be more anthropocentric than voters.

The ecocentric scale revealed no significant difference between voters (M=4.68) and anglers (M=4.64), $t(447)=-.387$, $p=.699$ (Table 4). However, differences between voters and anglers were found on several scale items. Voters (M=5.13) were more likely than anglers (M=4.69) to attribute declines in fish stocks to overfishing ($p=0.25$). Voters (M=2.96) were less likely than anglers (M=3.66) to agree that seals contribute to the economy ($p=.000$). Both voters (79%) and anglers (76%) agreed that “seals have a right to exist.” Both groups agreed “sharks are important to the ecosystem” (voters 83%, anglers 84%), while there was less agreement (voters 68%, anglers 58%) towards “seals are important to the ecosystem.” The statement which evidenced the least amount of support with both categories was “seals contribute to the economy because they draw tourists” with only 12% of voters agreeing with that statement and 37% of anglers. (See Appendix A for cross-tabulations.)

Table 4 Voters and Anglers Ecocentric Scale

	Voter (M)	Angler (M)	t	p-value
Scale				
Ecocentric	4.68	4.64	.387	.699
Seals symbolize the beauty and wonder of Nantucket.	3.58	3.59	-.040	.968
Seals have a right to exist.	5.85	5.62	1.425	.155
Seals are important to the ecosystem.	5.26	5.05	1.254	.211
Overfishing is the main cause of declining fish stocks.	5.13	4.69	2.262	.025
Seals contribute to the economy because they draw tourists.	2.96	3.66	-3.610	.000
Fishing poses a threat to seals that become entangled in gear or die as by-catch	4.24	3.92	1.574	.117
Sharks are important to the ecosystem.	5.78	5.95	-1.164	.117

The anthropocentric scale also shows no difference between voters (M=4.03) and anglers (M=4.23), $t(446)=-1.556$, $p=.120$ (Table 5). The only scale item that has a mean of statistical significance between voters (M=3.43) and anglers (M=3.89) is “seals spread disease to fish”, $p=.007$. Differences between voters (M=4.18) and anglers (M=4.58) in response to the statement “seals are the cause of declining fish stocks” is approaching significance ($p=.059$). Notably there is less agreement that seals are responsible for fish stock decline than that blame should be placed on overfishing. With two exceptions, the majority of both voters and anglers agree with each of the anthropocentric scale items. Both voters (7%) and anglers (22%) reject the claims that “seals spread to disease to fish

and “seals hurt the economy because they compete with fishermen” (36% voters, 45% anglers).

Table 5 Voters and Anglers Anthropocentric Scale

	Voter (M)	Angler (M)	t	p-value
Scale				
Anthropocentric	4.03	4.27	- 1.556	.120
Seals are Nuisance animals	4.06	4.41	-1.539	.125
Seals are the main cause of declining fish stocks	4.18	4.58	-1.889	.059
Seals pose a threat to people because they draw in sharks	4.66	4.28	1.860	.064
Seals hurt the economy because they compete with fishermen	3.80	4.17	-1.823	.069
Seals spread disease to fish	3.43	3.89	-2.712	.007

H₂ Non-angler voters will be more ecocentric than angler voters; angler voters will be more anthropocentric than non-angler voters.

A comparison of non-angler voters (M=5.03) and angler voters (M=4.43) on the ecocentric scale revealed significant differences, $t(327)=5.287$, $p=.000$ (Table 6), with non-angler voters displaying more ecocentric beliefs. With the exceptions of “overfishing is the main cause of declining fish stocks” and “sharks are important to the ecosystem,” differences on all scale items were statistically significant. The largest areas of disagreement are “seals symbolize the beauty and wonder of Nantucket” (46% non-angler voters, 23% angler voters), “seals are important to the ecosystem” (78% non-angler voters, 60% angler voters), “seals contribute to the economy because they draw

tourists” (20% non-angler voters, 7% angler voters), and “fishing poses a threat to seals that become entangled in gear or die as by-catch” (55% non-angler voters, 29% angler voters). Both non-angler voters (82%) and angler voters (77%) showed overwhelming support for “seals have a right to exist” and “sharks are important to the ecosystem” (non-angler voters 78%, angler voters 88%).

Table 6 Non-angler Voters and Angler Voters Ecocentric Scale

	Non-angler voter (M)	Angler voter (M)	t	p-value
Scale				
Ecocentric	5.03	4.43	5.287	.000
Seals symbolize the beauty and wonder of Nantucket.	4.27	3.07	5.750	.000
Seals have a right to exist.	6.12	5.66	2.935	.004
Seals are important to the ecosystem.	5.71	4.92	4.953	.000
Overfishing is the main cause of declining fish stocks.	5.30	5.01	1.625	.105
Seals contribute to the economy because they draw tourists.	3.41	2.62	4.560	.000
Fishing poses a threat to seals that become entangled in gear or die as by-catch	4.80	3.82	5.657	.000
Sharks are important to the ecosystem.	5.61	5.90	-1.914	.057

Non-angler voters (M=3.47) and angler voters (M=4.43) also differ on the anthropocentric scale, $t(327)=-6.511$, $p=.000$ (Table 7), with angler voters more anthropocentric than non-angler voters. Based on the means of the scale items, every statement demonstrated a statistical difference between non-angler voters and angler voters. The majority of angler voters showed strong supports towards the

anthropocentric scale items; “seals are nuisance animals” (22% non-angler voters, 59% angler voters), “seals are the main cause of the declining fish stocks” (29% non-angler voters, 51% angler voters), “seals pose a threat to people because they draw in sharks” (46% non-angler voters, 61% angler voters), and “seals hurt the economy because they compete with fishermen” (19% non-angler voters, 48% angler voters).

Table 7 Non-angler Voters and Angler Voters Anthropocentric Scale

	Non-angler voter(M)	Angler Voter (M)	t	p-value
Scale				
Anthropocentric	3.48	4.43	-6.511	.000
Seals are Nuisance animals	3.10	4.76	-7.978	.000
Seals are the main cause of declining fish stocks	3.64	4.57	-4.425	.000
Seals pose a threat to people because they draw in sharks	4.26	4.96	-3.481	.001
Seals hurt the economy because they compete with fishermen	3.16	4.28	-5.709	.000
Seals spread disease to fish	3.20	3.59	-2.421	.016

H₃ Non-resident anglers will be more ecocentric than resident anglers; resident anglers will be more anthropocentric than non-resident anglers.

The ecocentric scale shows significant differences between the beliefs of non-resident anglers (M=4.90) and resident anglers (M=4.43), $t(113)=2.352$, $p=0.20$ (Table 8). Non-residential anglers demonstrate more ecocentric beliefs when compared to resident anglers. Individual scale items illustrate that the difference is statistically significant for “seals symbolize the beauty and wonder of Nantucket” (non-residential anglers M=

4.22, resident anglers M=3.00, P=.001) and “seals contribute to the economy because they draw tourists” (non-residential anglers M=4.07, resident anglers M=3.32, p=.028). The difference is approaching significance regarding if sharks are important to the ecosystem (p=.057) and seals are important to the ecosystem (p=.054). “Seals symbolize the beauty and wonder of Nantucket” (non-resident anglers 43%, resident anglers 23%) and “seals have a right to exist” (non-resident anglers 86%, resident anglers 68%) have the largest marginal differences. The lowest percentage of agreement for non-resident anglers (40%) is for whether fishing poses a threat to seals and the lowest percentage of agreement for resident anglers (28%) is for “seals contribute to the economy because they draw in tourists.”

Table 8 Non-resident Anglers and Resident Anglers Ecocentric Scale

	Non-resident angler (M)	Res-angler (M)	t	p-value
Scale				
Ecocentric	4.90	4.43	2.352	.020
Seals symbolize the beauty and wonder of Nantucket.	4.22	3.00	3.358	.001
Seals have a right to exist.	5.90	5.40	1.641	.103
Seals are important to the ecosystem.	5.34	4.77	1.947	.054
Overfishing is the main cause of declining fish stocks.	4.93	4.51	1.229	.222
Seals contribute to the economy because they draw tourists.	4.07	3.32	2.222	.028
Fishing poses a threat to seals that become entangled in gear or die as by-catch	3.98	3.86	.343	.732
Sharks are important to the ecosystem.	5.61	5.90	-1.914	.057

The difference is also significant between non-resident anglers (M=3.75) and resident anglers (M=4.75) on the anthropocentric scale, $t(113)=-3.946$, $p=.000$ (Table 9), with resident anglers more anthropocentric. “Seals are nuisance animals” (non-resident anglers 33%, resident anglers 69%) and “seals hurt the economy because they compete with fishermen” (non-resident anglers 31%, resident anglers 58%) are the largest statistical differences between the two groups. The rest of the scale items, “seals spread disease to fish” (non-resident anglers M=3.56, resident anglers 4.17, $p=.063$), “seals pose a threat to people because they draw in sharks” (non-resident anglers M=3.93, resident anglers 4.62, $p=.063$) and “seals are the main cause of declining fish stocks” (which is approaching significance, non-resident anglers M=4.21, resident anglers 4.93, $p=.052$), are not significant.

Table 9 Non-resident Anglers and Resident Anglers Anthropocentric Scale

	Non-resident angler (M)	Resident angler (M)	t	p-value
Scale				
Anthropocentric	3.74	4.75	-3.946	.000
Seals are Nuisance animals	3.44	5.31	-5.142	.000
Seals are the main cause of declining fish stocks	4.21	4.93	-1.964	.052
Seals pose a threat to people because they draw in sharks	3.93	4.62	-1.879	.063
Seals hurt the economy because they compete with fishermen	3.58	4.72	-3.241	.002
Seals spread disease to fish	3.56	4.17	-1.877	.063

H₄ Voters will be more likely to favor the Marine Mammal Protection Act than anglers.

The MMPA scale found that voters (M=6.25) are more supportive of the MMPA than anglers (M=5.97), $t(161.718)=2.284$, $p=.024$ (Table 10). However, both groups overwhelmingly support the law. “Protecting areas of the ocean important for marine mammal feeding and breeding” is the only statistically significant difference between voters (M=6.15) and anglers (M=5.75), ($p=.46$), most likely because protecting areas of the ocean directly conflicts with fishery interests compared to the other goals of the act which are much more abstract. While “prevent marine mammals from going extinct” is very close to being significant ($p=.053$). Both voters and anglers demonstrated high levels of support for each scale item (prevent marine mammals from going extinct voters 95%, anglers 88%, maintaining or restoring marine mammal protection levels voters 84%, anglers 79%, minimizing conflicts between marine mammals and commercial fishing voters 88%, anglers 83%, minimizing harm and suffering of marine mammals voters 89%, anglers 82% and protecting areas of the ocean important for marine mammal feeding and breeding voters 86%, anglers 77%).

Table 10 Voters and Anglers MMPA Scale

	Voter (M)	Angler (M)	t	p-value
Scale				
Marine Mammal Protection Act	6.25	5.97	2.284	.024
Prevent marine mammals from going extinct	6.56	6.31	1.952	.053
Maintaining or restoring marine mammal protection levels	6.08	5.81	1.708	.088
Minimizing conflicts between marine mammals and commercial fishing	6.18	5.91	1.634	.104
Minimizing harm and suffering of marine mammals	6.26	6.06	1.414	.158
Protecting areas of the ocean important for marine mammal feeding and breeding	6.15	5.75	2.015	.046

H₅ Non-angler voters will be more likely to favor the Marine Mammal Protection Act than angler voters.

Non-angler voters (M=6.47) were more supportive of the MMPA than angler voters (M=6.09), $t(322.946) = 3.649$, $p = .000$ (Table 11). The difference was significant for the scale items “maintaining or restoring marine mammal protection levels” (non-angler voters M=6.34, angler voters M=5.90, $p = .003$), “minimizing harm and suffering of marine mammals” (non-angler voters M=6.55, angler voters M=6.05, $p = .000$) and “protecting areas of the ocean important for marine mammal feeding and breeding” (non-angler voters M=6.55, angler voters M=5.87, $p = .000$). About 90% Non-angler voters supported each statement on the MMPA scale compared to about 80% of angler voters. However, the support was still overwhelming in both groups. The highest level of support for non-angler voters (97%) and angler voters (94%) is for “prevent marine mammals from going extinct. The lowest level of support for non-angler voters (90%) is

for “maintaining or restoring marine mammal protection levels” and the lowest for angler voters (80%) is for “protecting areas of the ocean important for marine mammal feeding and breeding.”

Table 11 Non-angler Voters and Anglers Voters MMPA Scale

	Non-angler voter (M)	Angler voter (M)	t	p-value
Scale				
Marine Mammal Protection Act	6.47	6.09	3.649	.000
Prevent marine mammals from going extinct	6.63	6.52	1.000	.324
Maintaining or restoring marine mammal protection levels	6.34	5.90	2.947	.003
Minimizing conflicts between marine mammals and commercial fishing	6.27	6.12	1.103	.271
Minimizing harm and suffering of marine mammals	6.55	6.05	3.982	.000
Protecting areas of the ocean important for marine mammal feeding and breeding	6.55	5.87	4.954	.000

H₆ Non-resident anglers will be more likely to favor the Marine Mammal Protection Act than resident anglers.

There is no significant difference in the levels of support for the MMPA between non-resident anglers (M=5.93) and resident anglers (M=5.97), $t(106)=-1.67$, $p=.868$ (Table 12). However, the percentage of support is still incredibly high for both groups (averaging around 75%). None of the scale items were revealed to be statistically significant. Non-resident anglers (90%) and resident anglers (84%) wish to “prevent marine mammals from going extinct” higher than any other variable and they both have

the support “protecting areas of the ocean important for marine mammal feeding and breeding” (non-resident anglers 71%, resident anglers 81%) the least.

Table 12 Non-resident Anglers and Resident Anglers MMPA scale

	Non-resident angler (M)	Resident Angler (M)	t	p-value
Scale				
Marine Mammal Protection Act	5.93	5.97	-1.67	.868
Prevent marine mammals from going extinct	6.35	6.25	.399	.691
Maintaining or restoring marine mammal protection levels	5.92	5.66	.884	.379
Minimizing conflicts between marine mammals and commercial fishing	5.92	5.86	.214	.831
Minimizing harm and suffering of marine mammals	5.98	6.11	-4.90	.625
Protecting areas of the ocean important for marine mammal feeding and breeding	5.48	5.96	-1.314	.192

H₇ Ecocentric and anthropocentric beliefs will influence attitudes toward the MMPA, with ecocentric views positively related to MMPA support and anthropocentric views inversely related.

Support for the MMPA act and its goals are affected by both ecocentric and anthropocentric beliefs. Bivariate regression found that ecocentric beliefs did correlate with high levels of support towards the MMPA. The relationship was statistically significant, $F(1, 430) = 126.583$, $p < .001$. The adjusted R squared value was .227, which indicates that 23% of variation in MMPA support was explained by ecocentric beliefs.

The relationship between anthropocentric beliefs and MMPA support was also significant, but it was an inverse relationship. Higher scores on the anthropocentric scale

predicted lower MMPA support, $F(1, 430) = 51.751, p < .001$. Anthropocentric beliefs explained 11% of variation in MMPA support, with an adjusted R squared of .105.

Discussion

Despite the political controversy between seals and fishing interests, the survey results illustrate substantial agreement among voters and anglers for the beliefs that seals right to exist, importance of seals to ecosystem and overfishing as the major reason for declining fish stocks. Support for the importance of sharks to the ecosystem was even higher at 80%. Like Kellert (1999), this study showed overwhelming support for the MMPA with over three-quarters of voters, anglers and subgroups supported MMPA goals.

At the same time, plurality of voters and majority of anglers expressed concern for seal-fishery conflicts. In particular, many respondents in both groups attributed declines in fish stocks to seals, believed that seals present a threat because they draw sharks and saw seals as competition to fishermen. These beliefs among anglers are consistent with Glain, Kotomatas, and Adamantopoulou (1999), Tonder and Jurvelius (2004), Moore (2002), Gruber (2010), and Pereira (2014) which found that seals were a competition to fishermen and fishermen cite financial losses because seals damage their stocks, take fish from their nets, scare fish away, and prey on fish that fishermen wish to catch. Our research did show that a significant percentage of anglers blamed seals for the declining fish stocks and this was also consistent with Butler, Middlemas, Graham, Harris (2011).

However, it is important to note that even higher numbers of voters and anglers hold fishermen responsible for fish stock decline.

Because the majority of voters also were anglers, the expected differences between voters and anglers on ecocentric and anthropocentric scales were not found. However, segmenting voters in to non-angler voters and angler voters revealed significant differences with a plurality of non-angler voters aligning more with the ecocentric scale, with the exception of the variable blaming overfishing for the declining fish stocks and sharks being important to the ecosystem, which were not statistically different because they were strongly supported by both groups. Similarly, anglers are not monolithic. Differences were found between non-resident anglers and resident anglers, with the majority of non-resident angler's beliefs being more ecocentric and the majority of resident anglers siding more with anthropocentric. Non-resident anglers are most likely more ecocentric because they are less influenced by anti-seal political forces on Nantucket like the Seal Abatement Coalition (SAC).

The study faced some limitations because of small sample sizes of both voters and anglers. The low response rate among voters may be attributed to competition from election mailings during the data collection period. Anglers also proved difficult to locate for on-site survey administration, although their high representation in the voter sample made up for this shortcoming. In addition, although the voter survey was equally representative of both sexes (49% male, 51% female), the angler surveys were very heavily male dominated (84%), which may have resulted in more anthropocentric views.

Additional research is needed in the future in order to understand and confirm the patterns found in this study.

Conclusion

Policy makers and managers need to recognize that despite the conflicts between seals and the fishing industry, support for seals, the marine ecosystem and the MMPA is at almost consensus level among voters and anglers. Among all groups, the MMPA and its goals are supported by about three-quarters of respondents. The on-going controversy surrounding groups of resident anglers on Nantucket often masks the high levels of acceptance of seals on the island.

APPENDIX A

Table 13 Ecocentric Beliefs All Groups

Question	Voter	Angler	Non-Angler Voter	Angler Voter	Resident angler	Non-Resident angler
Seals symbolize the beauty and wonder of Nantucket.	32.8%	32.5%	46.4%	22.7%	23.3%	43.1%
Seals have a right to exist.	79.1%	75.9%	82.5%	76.7%	68.3%	86.2%
Seals are important to the ecosystem.	67.9%	58.3%	78.1%	60.4%	46.6%	70.6%
Overfishing is the main cause of declining fish stocks.	69.7%	52.9%	70.9%	69.6%	47.4%	60.04%
Seals contribute to the economy because they draw tourists.	12.5%	35.6%	20.4%	6.6%	27.6%	44.8%
Fishing poses a threat to seals that become entangled in gear or die as by-catch.	40%	40.2%	54.6%	29.3%	40.8%	39.7%
Sharks are important to the ecosystem.	83.4%	84.1%	78.2%	87.8%	81.7%	87.9%

Table 14 Anthropocentric Beliefs All Groups

Question	Voter	Angler	Non-Angler voter	Angler voter	Resident angler	Non-Resident angler
Seals are nuisance animals.	42.9%	51.2%	21.7%	58.4%	68.8%	32.7%
Seals are the main cause of declining fish stocks.	41.4%	53.4%	28.7%	50.8%	62.1%	43.1%
Seals pose a threat to people because they draw in sharks.	54.2%	49.2%	45.8%	61.2%	60%	37.9%
Seals hurt the economy because they compete with fishermen.	36%	44.9%	19.1%	48.5%	58.3%	31.1%
Seals spread disease to fish.	7.5%	22%	2.1%	11.3%	30%	12.3%

¹The following percentages combine all agreement categories (response numbers 5-7).

Table 15 Marine Mammal Protection Act Beliefs All Groups

Question	Voter	Angler	Non-angler voter	Angler voter	Resident angler	Non-Resident angler
Prevent marine mammals from going extinct	94.8%	87.6%	96.6%	94%	84.5%	90.4%
Maintaining or restoring marine mammal protection levels	84.5%	78.6%	89.5%	81%	74.1%	82.7%
Minimizing conflicts between marine mammals and commercial fishing	88.2%	82.9%	91.6%	85.5%	82.4%	82.6%
Minimizing harm and suffering of marine mammals	89%	81.8%	95.1%	84.9%	80.4%	82.7%
Protecting areas of the ocean important for marine mammal feeding and breeding	85.9%	76.6%	93.1%	80.5%	80.7%	71.2%

¹The following percentages combine all agreement categories (response numbers 5-7).

References

- Bjerke, T & Kaltenborn, P. B. The Relationship of Ecocentric and Anthropocentric Motives to Attitudes Towards Large Carnivores. *Journal of Environmental Psychology* (1999) 19, 415-421.
- Butler, J. R., Middlemas, S. J., Graham, I. M., & Harris, R. N. (2011). Perceptions and costs of seal impacts on Atlantic salmon fisheries in the Moray Firth, Scotland: Implications for the adaptive co-management of seal-fishery conflict. *Marine Policy*, 35, 317-323.
- Dillman, D. (2009). *Internet, mail, and mixed-mode surveys: The tailored design method*. Hoboken, New Jersey: John Wiley & Sons, Inc.
- Fraser, D. (2011). Investigators seek more clues in Cape Cod seal killings. *Cape Cod Times*. June 17.
- Fraser, D. (2013). Cape fishermen battle seals for catch. *Cape Cod Times*. June 9.
- Fulton, C. D & Manfredi, J. M., et al. Wildlife Value Orientations: A conceptual and Measurement Approach. *Human Dimensions of Wildlife* (1996), 1(02), 24-47.
- Glain, D., Kotomatas, S., & Adamantopoulou, S. (2001). Fishermen and seal conservation: survey of attitudes towards monk seals in Greece and grey seals in Cornwall. *Mammalia*, 65(3), 309-318.
- Gruber, C. (2010). Social, economic, and spatial perceptions of gray seal (*Halichoerus grypus*) interactions with commercial fisheries in Cape Cod, MA. Unpublished master's project, The Nicholas School of the Environment, Duke University, Durham, North Carolina.
- Kellert, R. S. (1999). *American Perceptions of Marine Mammals and Their Management*. Yale University School of Forestry and Environmental Studies.
- Moore, G. P. (2002). Seals and fisheries in the Clyde Seal area (Scotland): traditional knowledge informs science. *Fisheries Research* 63 (2003) 51-61
- Periera, K. (2014). Conflicts in coastal coexistence: A qualitative investigation of pinniped and fisheries interactions in Cape Cod. Unpublished master's project, Center for Animals and Public Policy, Cummings School of Veterinary Medicine at Tufts University, No. Grafton, Massachusetts.
- Teel, T., & Manfredi, M. (2010). Understanding the diversity of public interests in wildlife conservation. *Conservation Biology*, 24, 128-139.
- Tonder, M., & Jurvelius, J. (2004). Attitudes towards fishery and conservation of the Saimaa ringed seal in Lake Pihlajavesi, Finland. *Environmental Conservation*, 31(02), 122-129.

Vaske, J. J., & Manfredo J. M. Social Psychological Considerations in Wildlife Management. *Human Dimensions of Wildlife Management*, 2012 (02), 43-47.

Zinn, C. H. et al. (1998). Using Normative Beliefs to Determine the Acceptability of Wildlife Management Actions. *Science & Natural Resources*, 11: 649-662.

Acknowledgments

I would like to thank Jennifer Jackman, K.C. Bloom, and Shelly Sweeney for allowing me to join their research team and take part in this incredible survey study. I would like to give an extra thanks to Jennifer Jackman for assistance throughout every part of this difficult project from teaching me how to use the data analysis software to reading drafts and helping me to analyze the data.