Conservation Compliance and Public Awareness:
Assessing Dolphin and Sea Turtle Interactions in Coastal Alabama

by

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Abstract

The Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA) serve as critical legislation for safeguarding marine species in the United States, particularly in the Gulf of Mexico region. Despite legal protections, charismatic and ecologically important species like dolphins and sea turtles remain vulnerable to human activities along the Gulf Coast. Anthropogenic threats include habituation to human presence, habitat degradation, harassment, bycatch, and challenges in enforcing legal protections. Understanding public awareness of wildlife and compliance with conservation laws is crucial for mitigating such threats. This study addresses this gap by examining the extent of public demographics, knowledge, and behaviors regarding dolphins and sea turtles in Mobile Bay, Alabama. Analysis of survey data using generalized linear models highlights the relationship between various factors, such as gender, state residency, and ecological knowledge, on public willingness to adopt pro-conservation behaviors, specifically receptiveness to stop feeding dolphins and using sea turtle-friendly fishing gear. These findings emphasize the importance of tailored strategies and educational outreach efforts by state and federal fish and wildlife agencies, such as targeted educational campaigns and community engagement initiatives, to enhance public awareness and promote behavioral changes that align with wildlife protection laws. By addressing gaps in understanding and promoting responsible behaviors among coastal tourists, conservation efforts can effectively mitigate anthropogenic threats to dolphin and sea turtle populations in the Gulf of Mexico and beyond.

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List of Abbreviations

ADCNR	Alabama Department of Conservation and Natural Resources
ESA	Endangered Species Act
FWS	U.S. Fish and Wildlife Service
GLM	Generalized Linear Model
GoM	Gulf of Mexico
MMPA	Marine Mammal Protection Act
MRD	Marine Resources Division
NOAA	National Oceanic and Atmospheric Administration's
VIF	Variance Inflation Factor

What Predicts Willingness to Comply with the Marine Mammal Protection Act? Using Bottlenose Dolphin Feeding as a Case Study

1. Introduction

Enacted in 1972, the Marine Mammal Protection Act (MMPA) is a United States federal law establishing powerful protections for marine mammals and their habitats. The MMPA created a framework for preserving and restoring marine mammal species and stocks to their optimum, sustainable populations [1]. Key provisions of the MMPA include the prohibition of marine mammal take [2], vital habitat protection, marine mammal health and population monitoring, and engagement in international marine mammal conservation efforts [1]. Three U.S. federal agencies are responsible for upholding these MMPA protections. The U.S. Fish and Wildlife Service within the U.S. Department of the Interior is responsible for protecting manatees, dugongs, sea otters, walruses, and polar bears, while the National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service within the U.S. Department of Commerce is responsible for the protection of dolphins, porpoises, whales, seals, and sea lions. The act also developed the Marine Mammal Commission, an independent agency responsible for providing science-based supervision on domestic and international policies and programs related to marine mammal conservation. Through deliberate collaboration, these agencies share authority over the MMPA and work to prevent further reductions of marine

[1] The optimal sustainable population is defined by the MMPA as a population size that falls within a range from the population level of a given species or stock, which is the largest supportable within the ecosystem, to the population level that results in maximum net productivity.

[2] Take, as defined by the MMPA, means to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

mammal species and stocks [3] in U.S. waters [1]. One species of consistent public interest for conservation is the common bottlenose dolphin [2].

Common bottlenose dolphins (*Tursiops truncatus*; hereafter dolphins) are among the most widely recognized and charismatic flagship species for marine mammals and ocean conservation, often reflecting the health of coastal ecosystems and other species, with an unparalleled emotional connection to people among wildlife species [3], [4]. However, dolphins continually face intense and diverse threats to their survival, especially through increased human-wildlife interactions as coastal populations and visitation continue to grow. Tourists and residents alike may inadvertently or deliberately pose threats to dolphins and their habitats. Primary threats include habitat degradation, pollution, vessel strikes, harassment, and supplemental feeding activities, which are the focus of this research [5], [6], [7], [8].

Bottlenose dolphins are carnivorous, opportunistic feeders, primarily consuming several species of fish (mullet, mackerel, etc.), squid, and crustaceans, with preferences depending on the specific region and prey availability [9]. Feeding wild dolphins has received little attention in the peer-reviewed literature compared to more drastic forms of wildlife harassment or take (e.g., harming dolphins or accidental capture in fishing gear). That said, dolphin feeding has been documented to disrupt their natural behaviors, with habitually fed dolphins developing aggressive begging and congregation around human food sources, such as fishing sites, boat docks, ramps, and approaching the vessels themselves (see Figure 1), all of which can have detrimental impacts on their health while also posing safety and ethical concerns [6], [10], [11]. Humans also face potential harm, such as injuries from wild animals that have been provided with food or are persistently disturbed [12].

[3] A stock is defined by the MMPA as a group of marine mammals of the same species or smaller taxa in a common spatial arrangement that interbreed when mature.

Fig. 1. Dolphins swimming near fishing poles during an offshore Alabama charter fishing trip. Photo taken by the author.

Enforcing a law like the MMPA is challenging because interactions with dolphins occur with many people over many miles of coastline, and agencies are often limited in capacity to enforce the law. The enforcement of the MMPA is done through the efforts of U.S. federal and state fish and wildlife agencies, with NOAA as the primary point of contact. These agencies, alongside various law enforcement bodies (e.g., coastal municipal and county police departments), ensure that individuals, organizations, and entities comply with MMPA regulations in U.S. waters. However, compliance with conservation laws and policies depends on a variety of factors, including the type of user group, policy awareness, economic interests, social norms, enforcement challenges, and capacity [13], [14], [15].

Even amongst the industries that are supposed to be the most well-versed in dolphin interactions, namely dolphin-based tourism, habitual non-compliance with marine mammal viewing regulations regularly occurs. This may be due to a lack of awareness of wildlife regulations or of the negative impacts noncompliance has on the dolphins themselves, or both [16], [17], [18]. Commercial fisheries also vary in their compliance with the MMPA when it comes to interacting with marine mammals, with the primary reasons for non-compliance being listed as the lack of MMPA law enforcement and weak penalties for violations [1], [19], [20]. While there have been studies conducted on compliance amongst tour operators and commercial fisheries stakeholders, there has been limited research on the largest, yet most understudied, stakeholder group for MMPA implementation, the general public recreating on coasts.

Our research asks several questions, assessing how awareness and understanding of dolphin-related laws and policies like the MMPA vary among coastal tourists and how demographics and willingness to end feeding are related. Our research is participatory, in the sense that we elicited questions and research priorities from coastal decision-makers from state and federal conservation agencies with MMPA jurisdiction to ensure that our research could be used in decision-making. Findings can inform future public engagement programs to increase voluntary, individual compliance with the MMPA amongst the largest stakeholder group interacting with dolphins: the public. Our findings may have insights for a wider variety of conservation laws beyond the MMPA, with information on voluntary compliance for the benefit of wildlife that could inform a wide range of conservation agency programs.

2. Materials and Methods

2.1 Study Site

In some coastal towns in the Gulf of Mexico [4], the region where our research takes place, feeding dolphins is a common yet harmful practice among the public, most notably in Panama City Beach, Florida, just 120 miles from our study site in Alabama [6], [21], [22], [23]. Our study site is defined as Mobile Bay, Alabama, which is bordered by Mississippi to the west and Florida to the east (see Figure 2). It is a popular destination for tourism and outdoor recreational activities, with its coastal communities offering beaches, seafood, and cultural attractions [24]. Among the top 5 most visited counties in Alabama are Mobile and Baldwin, both of which are situated directly along Mobile Bay [25]. In 2021, the 53 miles of coastline in Alabama attracted over 8 million tourists [26]. This region was selected because it is the only coastal area located in Alabama that receives high levels of visitation and has a wide array of marine-based tourism that is popular among residents and tourists alike. However, there is limited information on tourists' knowledge and perceptions about wildlife laws and charismatic species that occur here, including dolphins.

According to the most recent NOAA Marine Mammal Stock Assessment in 1993, there are an estimated 122 residential dolphins in Mobile Bay, Alabama, with an updated assessment forthcoming. This site has a high potential for interactions between coastal recreationalists and dolphins due to the large number of resident dolphins [27]. Research by Dames [28] suggests that the presence of high anthropogenic activity in Mobile Bay may affect dolphin-feeding behavior, particularly regarding angler bycatch, making this area particularly susceptible to harmful dolphin-feeding activities. These negative human-dolphin feeding interactions are

[4] The coastal states that have a shoreline on the Gulf of Mexico are Texas, Louisiana, Mississippi, Alabama, and Florida, and these are known as the Gulf States.

hypothesized to be a result of regional norms and a lack of knowledge or understanding of wildlife laws and regulations [8], [29], [30].

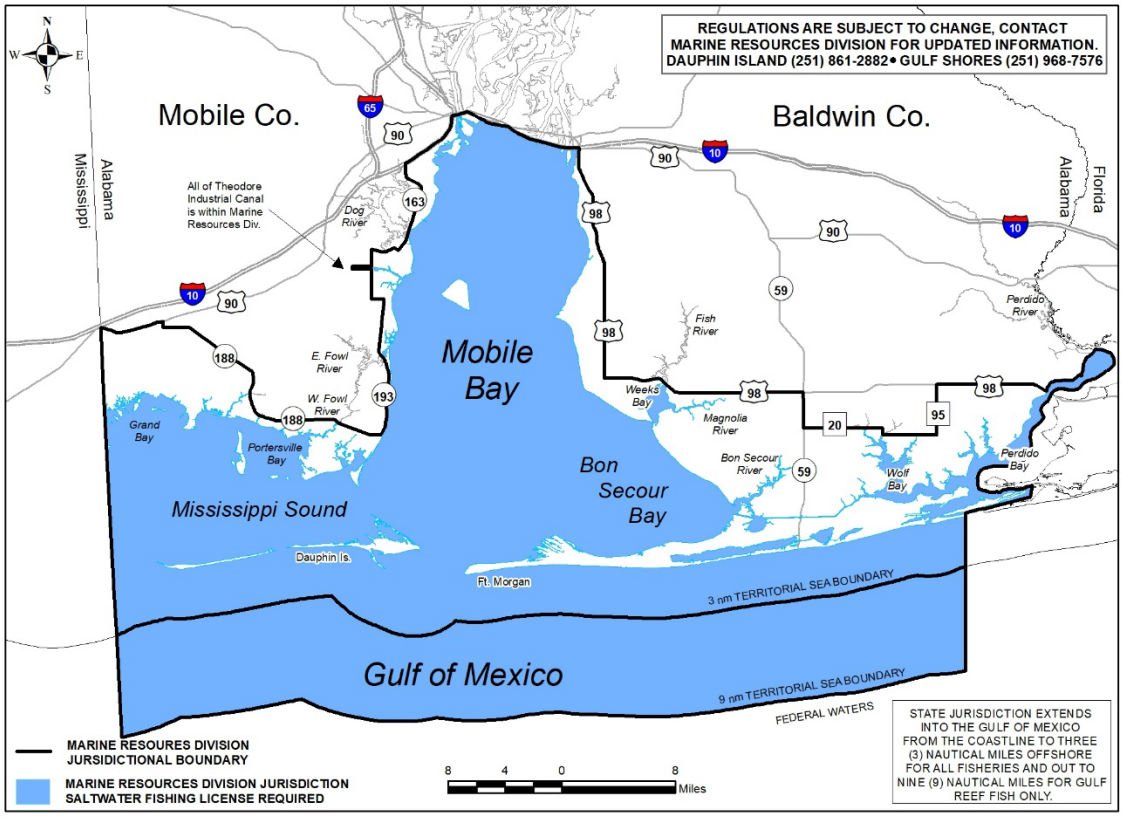

Fig. 2. Map of Mobile Bay, Alabama, provided by the Alabama Department of Conservation and Natural Resources Marine Resources Division.

2.2 Survey Instrument and Data Collection

The survey aimed to obtain general demographic information about coastal users and assess their knowledge about dolphins, associated laws and policies, interaction type and frequency, and willingness to change behavior. The survey was administered using Qualtrics software, consisted of 46 questions, and used a variety of question types, including text entry, matrix tables, and multiple choice using 5-point Likert-type scales. The survey was developed

collaboratively between the Alabama Department of Conservation and Natural Resources Marine Resources Division (ADCNR/MRD), the National Oceanic and Atmospheric Administration, and social scientists at the Auburn University College of Forestry, Wildlife, and Environment. The survey questions and procedure followed the guidelines and requirements set by the Auburn University Institutional Review Board and were approved by this body (22-502 EX 2211).

Surveys were voluntary and only distributed to participants who were 19 and older and who had visited the Alabama coast in 2023. The survey was offered in both a paper and online format to ensure participant accessibility and increase the response rate. The primary in-person methodology for collecting survey data was done opportunistically using an intercept approach with participants at locations frequented by coastal tourists. These locations included marinas, piers, beaches, and coastal businesses (e.g., restaurants, hotels, and shops) recommended by ADCNR/MRD. To prevent non-response bias and offer accommodation to tourists who were unable to complete the survey when intercepted, flyers with a QR code for the survey were posted in popular locations in the Mobile Bay region. The survey was also administered online and distributed through web-based forums focused on Mobile Bay recreation on social media platforms (i.e., Facebook). Respondents were given as much time as necessary to complete the survey, which took approximately 15 minutes. Upon completion of the survey, participants were offered the option to include their email address to be entered to win a $50 gift card. The survey was available between March and September 2023. Surveys that were submitted but that did not meet the survey qualifications (i.e., answering no to “Have you traveled to the Alabama coast in 2023?” and participants aged under 18) were not included in this study.

2.3 Analysis

The analysis of our data was performed in R, using both descriptive statistics and a binomial Generalized Linear Model (GLM) [31]. Specifically, we created a model to quantify and analyze 17 explanatory variables that we hypothesized might be predictive of a person's willingness to stop feeding dolphins. Questions can be referenced in Appendix A.

Table 1. Description of explanatory variables.

Variable name	*Type*	*Answer options*
Age	Discrete	The age of the participants in the study
Race	Categorical	White, Native American, Black, Asian
Gender	Categorical	Male, Female, Other
State residency	Categorical	From Alabama, From elsewhere
Highest level of education	Categorical	Higher education (Graduate or Professional School, College Grad/BA or BS, Some College/AA or AS), Lower education (Technical/Vocational School, HS graduate/GED, Did not graduate HS/no GED)
Angler	Categorical	Participates in fishing activities, Does not participate in fishing activities
Motivation for visit to the Alabama coast	Categorical	Viewing dolphins, Viewing sea turtles, Viewing other wildlife (i.e. birds, etc.), Fishing from the beach, Fishing from the jetty, Fishing

		from a boat, Boating (motor), Boating (sailing)
Knowledge of dolphin policy	Continuous	Calculated score based on correct answers to dolphin policy questions
Knowledge of dolphin ecology	Continuous	Calculated score based on correct answers to dolphin ecology questions

These 17 explanatory variables encompass various demographic, behavioral, and attitudinal factors that may influence participants' dolphin-feeding attitudes and behaviors (Table 1). These include age, race, gender, residency in Alabama, highest education level, engagement in recreational angling, motivation to visit the beach, interest in wildlife viewing (including dolphins and sea turtles), preferences for boat activities, knowledge of dolphin conservation laws and policies, and knowledge of dolphin ecology and behaviors. The knowledge variables, specifically dolphin policy knowledge and dolphin ecology knowledge, were determined by calculating the proportion of correctly answered questions by respondents, serving as a measure of their proficiency in each category. The selection of these predictors was informed by previous research and theoretical considerations, aiming to capture a comprehensive array of factors relevant to human-dolphin interactions and conservation behaviors.

We calculated the variance inflation factor to assess the amount of multicollinearity among the independent variables in our model, all of which were < 2, suggesting minimal multicollinearity. We interpreted the relationship of these explanatory variables with the participants' willingness based on the transformed coefficient parameter estimate (β) to calculate the odds ratio, which is used to measure and quantify the strength and direction of the relationship between the independent variables and participant willingness to stop feeding

dolphins bycatch. Confidence limits for each variable were calculated using the 'confint' function from the package 'stats' in R. All analyses were carried out in the statistical software R [31].

3. Results

Through both online and in-person distribution, the number of completed surveys was 1,161. The sample size was believed to be sufficient, exceeding the minimum recommendations for regression analysis by Green [32] and VanVoorhis and Morgan [33].

3.1 Demographics: Who are the tourists on the Alabama coast?

Part of our survey's intention was to characterize who visits the coast of Alabama. Few studies have investigated the coastal tourist demographics in the state of Alabama, with previous research focusing solely on participant gender, race, age, and visitor spending [34]. Our results provide near- and real-time data on current coastal tourist demographics, particularly new information on visitor residency. Table 2 displays respondent demographics, including gender, ethnicity, age ranges, education levels, state residency (also see Figure 3), and visitor type. We further characterized tourists based on their motivation for visiting the coast, with viewing dolphins being the top activity selected among participants (see Figure 4).

The majority of survey respondents were middle-aged, with a mean age of 34, and male (56%). The largest ethnic groups were comprised of white (74%), Hispanic/Latino (54%), and indigenous (15%). Most respondents had higher education, earning either an associate's degree (25%) or a bachelor's degree (28%). For residency, most participants (64%) were from the state

where our survey took place, Alabama. We further characterized visitors based on their visitation frequency; the largest group was seasonal residents [5] (30%).

Table 2. Descriptive statistics of respondent demographics.

Demographic variables	*Percent*	*Count*
Gender		
Male	56%	621
Female	40%	444
Other	1%	9
I prefer not to answer	3%	31
Total		**1105**
Race		
White	73%	856
Native American	15%	169
Black	6%	72
Asian	3%	30
Other	1%	13
I prefer not to answer	2%	19
Total		**1159**
Do you identify with Latino, Hispanic, or Spanish origin?		
Yes	54%	600
No	39%	431

[5] A seasonal resident is an individual who only lives in the state and/or property for a specific time period throughout the year.

I prefer not to answer	7%	75
Total		**1106**

Age Ranges

19-24	9%	97
25-34	54%	620
35-44	25%	282
45-54	7%	85
55-64	3%	37
65+	2%	27
Total		**1148**

Highest Level of Education

Did not graduate HS/no GED	3%	32
HS graduate/GED	15%	173
Technical/Vocational School	20%	229
Some College/AA or AS (2-year degree)	25%	295
College Grad/BA or BS (4-year degree)	28%	326
Graduate or Professional School	9%	103
Total		**1158**

Alabama Residency

From Alabama	64%	744
From elsewhere	36%	411
Total		**1155**

Visitor Type

Resident	25%	287
Seasonal Resident	30%	343
Short Term Visitor (1-3/year)	27%	303
Short-Term Visitor (4-6/year)	12%	143
Short-Term Visitor (6 or more times)	6%	71
Total		**1147**

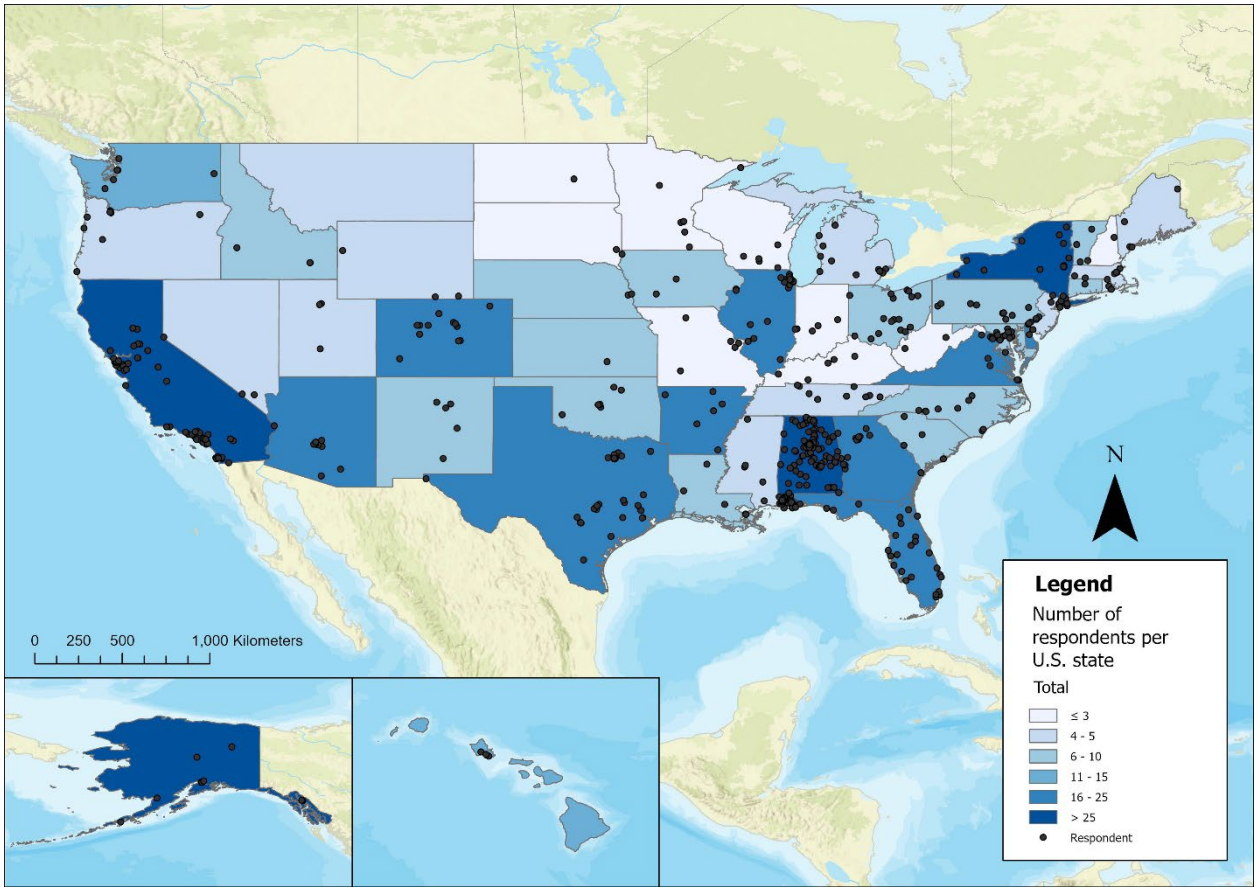

Fig. 3. This map illustrates two layers of data: the number of respondents per state (selected from a drop-down list) and respondent-provided zip code locations. Discrepancies in counts may occur due to respondents providing zip codes from different states or incomplete reporting.

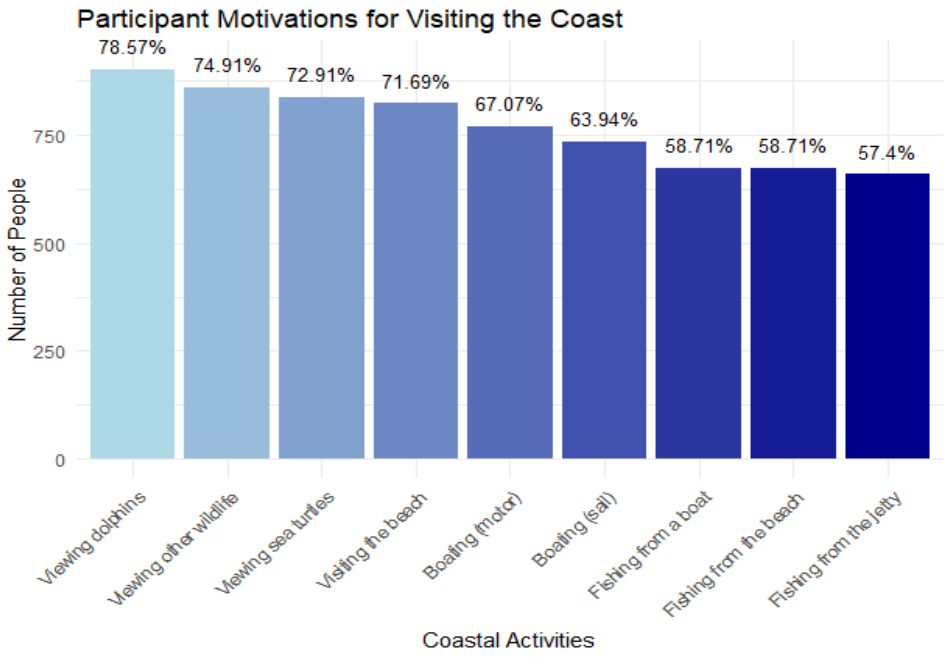

Fig. 4. Barplot of participant motivations for visiting the Alabama coast.

3.2 Attitudes and Knowledge of the Marine Mammal Protection Act

This section examines respondents' attitudes toward and level of knowledge regarding the MMPA and its applications to dolphins. An analysis of respondents' attitudes toward marine mammal conservation laws and policies revealed that the majority (75%) viewed these legal protections as important (see Figure 5). The MMPA knowledge test section of the survey contained eight questions, seven of which were true or false, and the last was multiple choice, with questions and percentages of correct answers displayed in Table 3 (All questions are present in Appendix A). Questions were derived directly from the MMPA and NOAA marine life viewing guidelines, focusing on guidelines specific to cetaceans [35]. Participant scores for this section indicated how knowledgeable participants were about key aspects of the MMPA and its applications to dolphins. This table provides insights into the extent of coastal tourists' awareness of aspects of the MMPA, which is vital for assessing their preparedness to adhere to and support

conservation regulations while recreating. The knowledge score for this section had a minimum possible score of 0% and a maximum score of 100%, with the mean score of respondents at 54%. Of the MMPA knowledge questions, the majority of participants understood that chasing dolphins with a vessel could both disturb the animals (71%) and be considered harassment (70%). Compared to chasing, fewer participants knew that it was illegal to feed wild dolphins (62%). The areas of the MMPA where participants struggled most were surrounding the legality of changing the behavior of wild animals, which is illegal under the definition of level B harassment[6]. In addition, the majority (54%) of participants could not identify the correct number to call if they encountered sick, injured, stranded, or dead marine mammals.

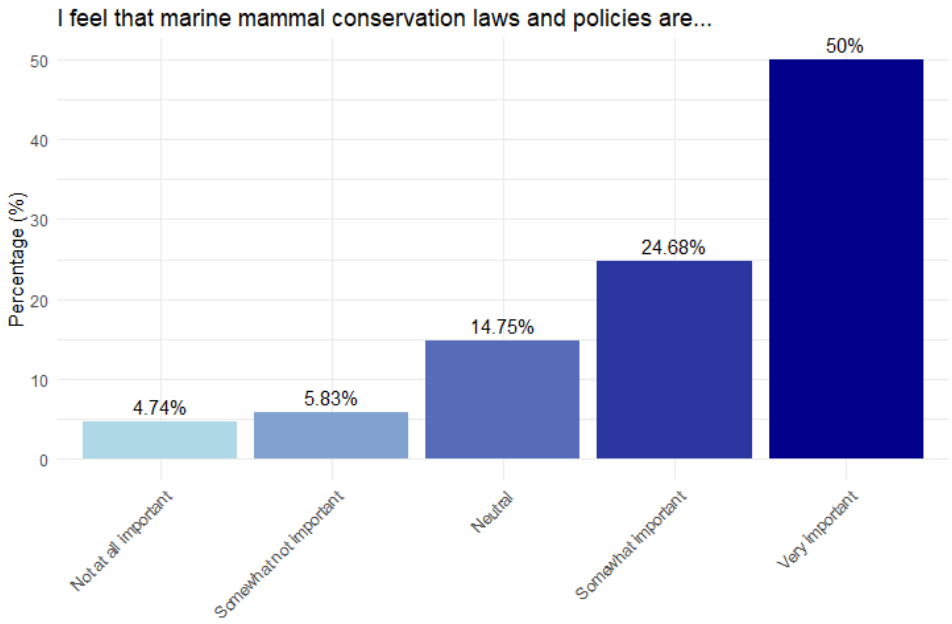

Fig. 5. Barplot of participant perceptions towards marine mammal conservation laws and policies.

[6] Level B harassment refers to acts that have the potential to disturb (but not injure) a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering.

Table 3. Participant knowledge of the Marine Mammal Protection Act.

Question and answer	*Percent correct*	*Percent incorrect*
If I chase a dolphin with my boat, this may disturb them. (Correct answer: True)	71%	29%
If I chase a dolphin with my boat, it may constitute harassment. (Correct answer: True)	70%	30%
If I approach a dolphin with my boat and their behavior changes, such as stopping feeding, this is harassment. (Correct answer: True)	64%	36%
It is against the law to feed wild dolphins. (Correct answer: True)	62%	38%
If we encourage dolphins to wake ride, by riding our boat directly at a group of dolphins, this may cause dolphins to start jumping. (Correct answer: True)	57%	43%
If my actions cause a dolphin to change their behavior, this is against the law. (Correct answer: True)	54%	46%
If I approach a dolphin with my boat and they start jumping, this is harassment. (Correct answer: True)	50%	50%
In the event that I encounter an injured dolphin, I call: (Correct answer: Marine Mammal Stranding Hotline)	46%	54%

3.3 Attitudes and Knowledge of Dolphin Ecology

This section investigates respondents' attitudes toward the presence of dolphins in the ecosystem, alongside an assessment of their knowledge regarding dolphin behaviors and threats. Attitudes toward the presence of dolphins in the ecosystem were overwhelmingly positive, with most (75%) respondents expressing favorable views (see Figure 6). The dolphin ecology knowledge test contained nine questions, eight of which asked respondents to “select all that apply” from a list of possible dolphin stress behaviors to determine what the public knows about activities that may cause dolphin distress (All questions are present in Appendix A). The last question was a true or false question about dolphin threats. These questions were designed in collaboration with federal and state-level scientists with specialized knowledge of dolphins and what activities the MMPA prohibits. The knowledge score for this section had a minimum possible score of 0% and a maximum score of 100%, with a mean score of 50%. Participant scores for this section of the survey indicated how knowledgeable participants were about important dolphin behaviors related to harassment and human-wildlife interactions, which can be seen in Table 4. Overall, participants understood less about dolphin ecology in comparison to dolphin policy. Among the behaviors that indicate stress in dolphins, the activity that most respondents correctly identified was an ‘abrupt change in speed’ (59%). Conversely, the activity with the least correct identification was ‘female sheltering calves’ (37%). However, the majority of participants correctly understood that fishing gear interactions are a major threat to dolphin conservation (69%).

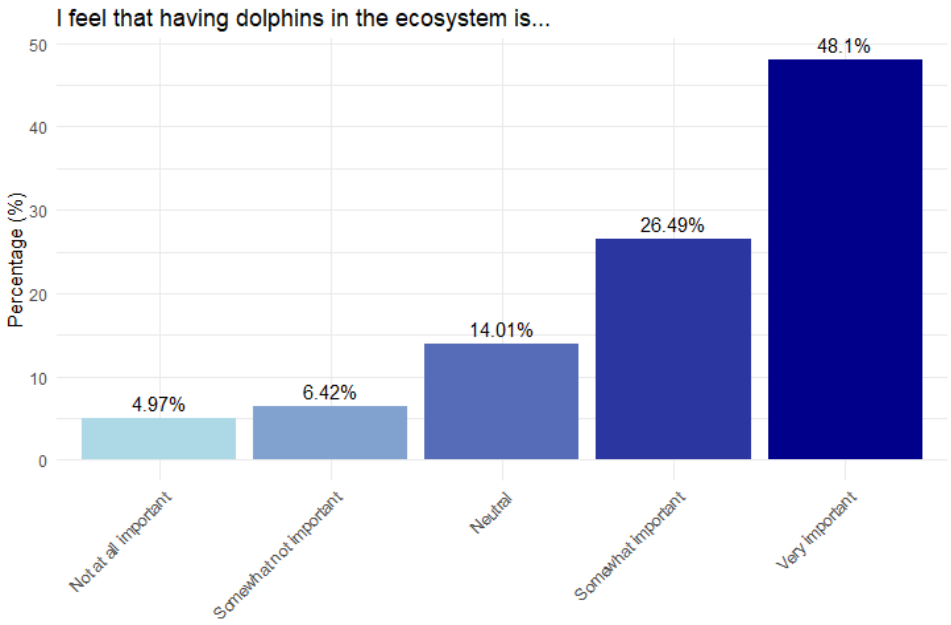

Fig. 6. Barplot of participant perceptions towards having dolphins in the Mobile Bay ecosystem.

Table 4. Participant knowledge of dolphin ecology.

Question and answer	*Percent correct*	*Percent incorrect*
Please select all behaviors that indicate that a dolphin is stressed: (All are true.)		
Abrupt change in speed	59%	41%
Increased respiration rates	53%	47%
Tail slapping	52%	48%
Continually moving away from a source of disturbance	51%	49%
An abrupt change in direction	50%	50%

"Chuffing" or forceful exhalations	50%	50%
Side breaching	46%	54%
Females sheltering calves	37%	63%
One of the most important threats faced by dolphins is interactions with fishing gear. (Correct answer: True)	69%	31%

3.4 Dolphin Interactions

This section examines the frequency and type of interactions the public has with dolphins in coastal Alabama, alongside their attitudes towards such interactions. A significant majority of participants (71%) indicated they enjoy encountering dolphins in their natural habitat (see Figure 7). Summarized in Table 5, we asked participants questions about how often they encounter dolphins, how frequently they feed dolphins bycatch from recreational fishing, and instances of dolphins consuming unwanted fish, such as discarded, undersized, or out-of-season fish. The majority of participants (42%) reported encountering dolphins sometimes (4-12 times per year) while out on the water. In terms of feeding dolphins bycatch, most respondents reported engaging in the activity to some degree (59%), with a smaller but substantial proportion claiming to have never fed dolphins bycatch (41%). For observations of dolphins consuming thrown-back, undersized, or out-of-season fish, the majority reported rare occurrences (37%). These findings illustrate the diverse range of activities and frequency of human-dolphin interactions among the public in Mobile Bay, Alabama. Of the desired behaviors amongst managers (e.g., rarely or never engaging in the feeding of bycatch), 71% of respondents responded in this way, suggesting that while there is engagement and education work to be done, a majority of people are aware of how to interact with wildlife on the water.

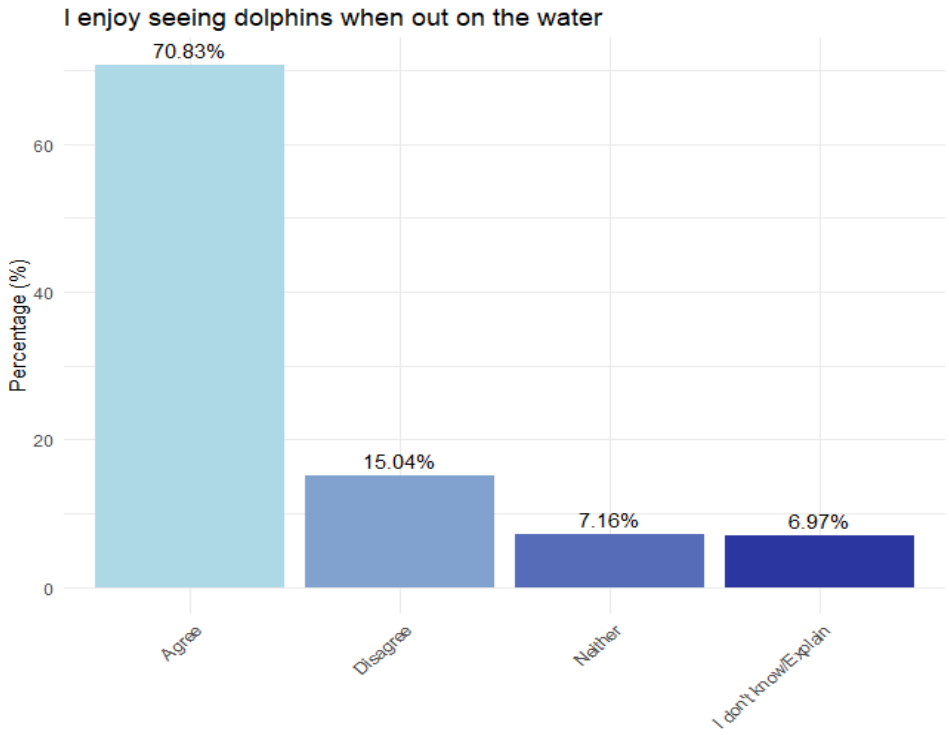

Fig. 7. Participant attitudes towards dolphins in general.

Table 5. Participant dolphin interactions and frequency.

Question	*Percent*	*Count*
How frequently do you encounter dolphins when you're on the water?		
Rarely (1-3 times per year)	35%	397
Sometimes (4-12 times per year)	42%	465
Frequently (12 or more times per year)	21%	240
Other	2%	19
Total		**1121**

How frequently do you feed dolphins bycatch?

Never	41%	462
Rarely (1-3 times per year)	30%	335
Sometimes (4-12 times per year)	22%	243
Frequently (12 or more times per year)	7%	74
Total		**1114**

How frequently are dolphins eating thrown back, undersized, or out-of-season fish?

Never	28%	307
Rarely (1-3 times per year)	37%	411
Sometimes (4-12 times per year)	26%	293
Frequently (12 or more times per year)	9%	101
Total		**1112**

3.5 Willingness to Change Behavior

We sought to predict public willingness to cease dolphin feeding activities using a generalized linear model, a form of regression analysis, based on participant demographics (see Table 6). The model revealed that the demographic variables of age, race, gender, or education level were not significant predictors of participant willingness to stop feeding dolphins bycatch (all $p > 0.13$). However, we found that Alabama residents were 1.7 (1.1 - 2.5; 95% C.L.) times as likely to be willing to stop feeding dolphins bycatch compared to non-Alabama residents ($p = 0.014$). Participants who were anglers were 1.6 (1.1 - 2.3; 95% C.L.) times as likely to stop dolphin feeding behavior compared to non-anglers ($p = 0.031$).

We also found significant relationships between different motivations for coastal tourism and participants' willingness to stop feeding. Participants who were motivated to visit the beach ($p < 0.001$) and view dolphins ($p = 0.025$) on their visit to the coast were 3.0 (1.8 - 4.7; 95% C.L.) and 1.7 (1.1 - 2.2; 95% C.L.) times as likely to be willing to stop feeding dolphin bycatch, respectively, compared to those not motivated by those activities. Those who were motivated to fish from the shore ($p = 0.034$) were 36.9% (2.6% - 59.1%) less likely, and those motivated to go motor boating ($p = 0.022$) were 41.2% (6.4% - 63%) less likely to be willing to stop feeding dolphins bycatch, suggesting that anglers are a key group in need of public engagement on the MMPA.

There was a significant relationship between both knowledge categories (dolphin policy and dolphin ecology) and willingness to stop feeding dolphins. For each 10% increase in participant knowledge of dolphin policy, we found a 13% (5% - 21%) increase in participant likelihood to be willing to stop feeding ($p < 0.001$). For each 10% increase in participant knowledge of dolphin ecology, we found a 18% (9% - 27%) increase in participant likelihood to be willing to stop feeding ($p < 0.001$).

Table 6. Logistic regression estimates for the model factors explaining coastal users' willingness to stop feeding dolphins bycatch in Alabama.

	Estimate	*Std. error*	*z value*	*P-value*
Intercept	-2.05580	0.49193	-4.179	2.93e-05 ***
Age	0.01172	0.01082	1.083	0.27887
Native American	0.30951	0.27924	1.108	0.26768
Asian	-0.80688	0.54278	-1.487	0.13713

Black	-0.18298	0.37359	-0.490	0.62427
Female	0.07584	0.19197	0.395	0.69281
“Other” gender	-0.48675	0.88627	-0.549	0.58286
Alabama resident	0.50858	0.20700	2.457	0.01402 *
Higher education	0.06083	0.19880	0.306	0.75963
Angler	0.44102	0.20402	2.162	0.03065 *
Motivated to visit the beach	1.07361	0.23998	4.474	7.69e-06 ***
Motivated to view turtles	0.11137	0.23938	0.465	0.64174
Motivated to view dolphins	0.55243	0.24638	2.242	0.02495 *
Motivated to view other wildlife (birds, etc.)	-0.15157	0.23899	-0.634	0.52593
Motivated to fish on the beach	-0.45980	0.21708	-2.118	0.03417 *
Motivated to fish on the jetty	-0.33044	0.22771	-1.451	0.14674
Motivated to fish on a boat	0.01537	0.22682	0.068	0.94597
Motivated to go boating (motor)	-0.53050	0.23216	-2.285	0.02231 *
Motivated to go boating (sail)	0.27899	0.23064	1.210	0.22641

Knowledge of dolphin policy	1.23487	0.35369	3.491	0.00048 ***
Knowledge of dolphin ecology	1.64862	0.37658	4.378	1.20e-05 ***

Note: Significance notes as *p<0.05, **p<0.01, ***p<0.001. Odds ratios can be calculated by exponentiating the beta.

4. Discussion

The existing literature has suggested that demographic variables are likely to influence interest in wildlife and pro-conservation behaviors [36], [37], [38], [39], [40]. Despite this, we did not find a significant relationship between age, race, gender, or education level and willingness to comply with dolphin feeding regulations; rather, we found a significant relationship between state residency and willingness to change behavior. Previous research has shown that geographic location plays a large role in wildlife knowledge and attitudes, including that western states in the U.S. tend to have greater wildlife appreciation and knowledge, while southern U.S. states have the least interest in and concern for wildlife [2], [37]. However, our research found a significant relationship between Alabama residency, the state in which our survey took place, and the willingness to stop feeding dolphins bycatch. This may suggest that people who live within the state where they do nature-based recreation are more willing to engage in pro-conservation behaviors for charismatic flagship species like dolphins. Examples from similar coastal regions demonstrate that state residents view environmental problems and policies as urgent matters, such as conservation issues [41]. This is important for areas like Mobile Bay, Alabama, and other coastal tourism destinations that receive high non-resident

visitation and are at increased risk for environmental degradation. Managers may have a greater impact if they target out-of-state visitors in their educational programs on human-wildlife interactions.

Another important factor that may affect how people value nature and their resulting overall environmental awareness is participation in animal-based activities, such as hunting, fishing, or birdwatching, which tend to have more naturalistic views [37]. Our results confirm this notion, as anglers in general were more likely to stop dolphin-feeding behaviors compared to non-anglers. However, there are discrepancies in their willingness to change based on how participants chose to fish. The observation that anglers who fished from the shore were less willing to stop dolphin feeding behaviors compared to those fishing from the jetty or on a boat may indicate outside factors that influence angler type, such as their socioeconomic background, can impact their conservation perceptions, willingness to change, and resulting behaviors.

We showed that people with more knowledge about dolphin-related policies and dolphin ecology are potentially more likely to be willing to voluntarily stop illegal and harmful behaviors for dolphin conservation. Research by Barney [4] found similar results focused just on participant knowledge of dolphins, wherein those more knowledgeable about dolphins were less likely to engage in dolphin harassment behaviors. In our research, knowledge of dolphin ecology had the largest odds ratio for participant willingness to stop feeding dolphins bycatch. Our study provides evidence that public knowledge about dolphin ecology may be more likely to reduce negative behaviors like feeding dolphins in comparison to knowledge of dolphin laws and policies. This means a person does not necessarily need to have a comprehensive understanding of dolphin-related laws. Rather, a person's interest in and knowledge of dolphin ecology could have a greater influence on behavior change by reducing harmful behaviors and promoting

overall dolphin conservation. This underscores the importance of wildlife education efforts done by state and federal fish and wildlife agencies, along with other educational groups like non-governmental organizations and environmental extension groups.

Our findings suggest a strong appreciation for marine mammal conservation efforts among tourists visiting the Mobile Bay area. The overwhelming positive attitudes toward both the legal protections and the presence of dolphins in the ecosystem indicate a general sentiment of support for preserving and protecting these charismatic marine mammals. Furthermore, the majority of participants enjoyed dolphin encounters, emphasizing an emotional connection and affinity for these animals and highlighting their importance as key attractions for ecotourism in the region and the need for continued conservation efforts to ensure their well-being and preservation. Previous research has investigated whether or not the public is aware of the MMPA as a policy in general [42]. Our research builds on this understanding by highlighting the public's lack of knowledge about the specific legal protections and policies regarding marine mammals set by the MMPA and likely other key wildlife legislation. It is evident that the public does not have a clear understanding of what activities and interactions with dolphins are illegal, with participant MMPA knowledge averaging 54% correct answers on what types of behavior are allowed around marine mammals. This deficiency emphasizes a critical need for targeted outreach initiatives to enhance public literacy of policy initiatives like the MMPA, especially when human-dolphin interactions are frequent in coastal tourism areas. While the existing literature debates the efficacy of educational campaigns to support public understanding and compliance with conservation laws, studies have shown that education may increase the public's tolerance of wildlife populations [43], [44], [45]. This is particularly important in the context of human-wildlife conflict between carnivorous megafaunal species, like dolphins, and anglers,

who are among the most valuable partners for fisheries and marine conservation management strategies [46].

5. Conclusion

This research contributes to a better understanding of the general public in coastal Alabama, specifically the Mobile Bay region, by characterizing their demographics, knowledge, and willingness to change behaviors to comply with the MMPA, particularly for dolphins. Dolphins face a range of anthropogenic threats, including injury or mortality resulting from the adoption of unnatural behaviors like begging, reliance on human-provided resources, harassment, and human encroachment into vital habitats. It is critical for the public to be aware of the potential impacts of their activities on dolphins and to follow guidelines and regulations designed to protect these animals and their habitats. The significance of the MMPA in the context of this research lies in its pivotal role as a legal framework to safeguard marine mammal populations, regulate human-dolphin interactions, and ensure the conservation of these species in the face of increasing threats. These aspects of conservation laws, like the MMPA, thereby influence public behaviors, policies, and conservation efforts. Efforts to improve policy literacy, strengthen enforcement, enhance wildlife knowledge, and engage with stakeholders can help address these issues and enhance compliance with the Marine Mammal Protection Act.

Adapting Angling: Assessing the Willingness of Recreational Anglers to Modify Hook and Bait Choices for Sea Turtle Conservation

1. Introduction

Saltwater angling is one of the most prominent and culturally important coastal recreation activities in the United States, particularly in the Gulf of Mexico (hereafter "the Gulf" or GoM) [47]. The Gulf's diverse marine life and robust fishery attract tourists and fishing enthusiasts nationwide and from around the world [48]. Economically, saltwater fishing is a significant driver, encompassing charter services, fishing equipment and license sales, and various tourism-related businesses, which ultimately create jobs and stimulate economic growth in states surrounding the Gulf [49], [50]. Saltwater fishing is also a culturally significant form of outdoor recreation. Access to recreational fishing improves the overall quality of life for Gulf Coast inhabitants and visitors alike, linking communities to their marine heritage and fostering a connection with local ecosystems [51], [52]. Anglers also serve a vital role in conservation efforts, contributing valuable data to scientific research, which in turn informs regulations and greater fishery management [53], [54], [55]. Ultimately, the sustainable management of recreational fishing and marine resources is crucial for preserving the Gulf's economic, cultural, and ecological vitality. However, many marine species face global conservation threats due to bycatch and negative interactions with fishing gear, especially charismatic and ecologically important species like sea turtles.

Five of the seven sea turtle species in existence worldwide are found in the same Gulf of Mexico waters that are popular amongst recreational anglers: loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*),

and Kemp's ridley (*Lepidochelys kempii*) (hereafter referred to as "sea turtles") [56]. All sea turtle species found in U.S. waters are federally listed and protected by the most important wildlife conservation law in the United States, the Endangered Species Act of 1973 (ESA). The ESA safeguards sea turtles and their populations from anthropogenic activities by listing them as endangered or threatened, making any form of what the law refers to as "take" [7] illegal. Once a species is listed, federal agencies must regulate fisheries to reduce turtle-related impacts, enforce the prohibition of injury and harassment, preserve vital habitats, and enforce recovery plans [57]. Sea turtles present unique conservation challenges since they spend important parts of their lives both at sea and on land, resulting in two federal agencies having jurisdiction over their conservation: The National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service and the U.S. Fish and Wildlife Service (FWS). The NOAA oversees sea turtles in the marine environment, while the FWS manages their nesting beaches and other terrestrial environments [58]. However, even with such federal protections, sea turtles that reside in or near human-populated coastal ecosystems may be more vulnerable to anthropogenic threats, including recreational fishing [2].

[7] Take, as defined under the ESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."

Fig. 8. Sign educating visitors about sea turtle laws and protections on a fishing pier in Fort Morgan, Alabama. Photo taken by the author.

Recreational saltwater fishing can present challenges to the conservation of sea turtles (See Figure 8). Nearshore recreational hook-and-line captures are identified as a threat in the recovery plans for all GoM species, except the leatherback (whose major threats are cited as pelagic longline commercial fisheries) [59], [60], [61], [62], [63], [64]. Recent reports have shown a rise in bycatch, or the unintentional capture of sea turtles, especially by hook-and-line fishermen fishing from fishing piers while using lines, hooks, and nets [65], [66]. Bycatch often results in injuries or fatalities if sea turtles become entangled in gear, which can lead to physical trauma, increased risks of drowning, starvation, infections from gear cutting into their flesh, and an increased likelihood of vessel strikes as they struggle to navigate waters freely [67], [68],

[69], [70]. Further, the ingestion of fishing equipment can cause damage throughout the sea turtle's esophagus and gastrointestinal tract, making it more difficult for the animal to feed, all of which can be fatal [71], [72], [73]. The frequency of sea turtle bycatch may depend on several variables, including the style of the hook, the bait's accessibility, the depth, and the gear setting or retrieval circumstances (e.g., the way the angler reels in an accidentally captured turtle) [62], [74]. Thus, if anglers adjust their gear and methods, they may save protected wildlife.

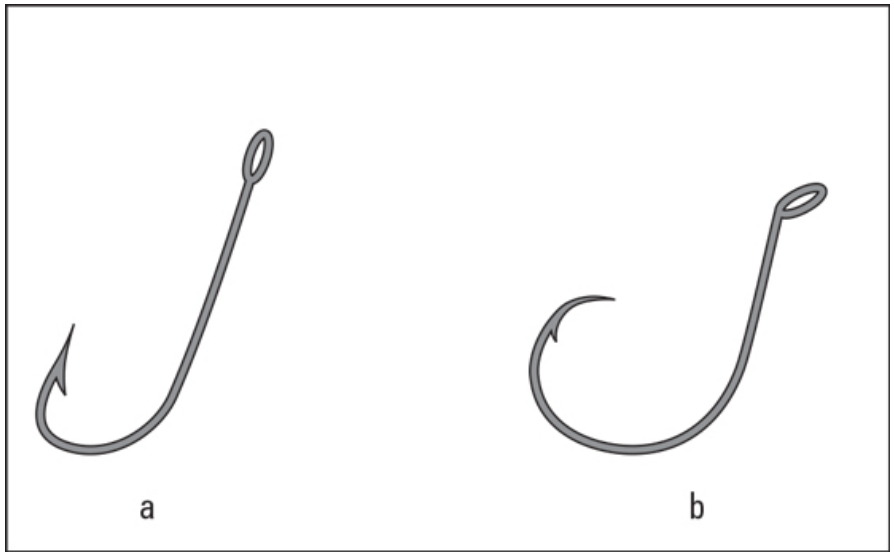

Fig. 9. Comparison of Fishing Hook Designs: (a) J-hook and (b) Circle Hook [75].

The use of large circular hooks, as opposed to the more traditional "J" hooks that are narrower with prominent barbs (See Figure 9), can reduce the risk of serious injury to sea turtles and other marine life by reducing instances of deep hooking [76], [77], [78], [79], [80], [81]. Deep hooking occurs when the hook is swallowed into the esophagus or deeper, as opposed to being hooked in the mouth or superficially on the body, referred to as foul hooking [8] [82], [83]. Additionally, certain baits may be more attractive to sea turtles based on their diet (see Table 7), increasing the risk of negative interactions [84], [85], [86], [87], [88], [89]. The way that sea

[8] A foul hooked fish or animal has been caught by a hook anywhere on its body except in its mouth.

turtles select bait to pursue is influenced by several variables, including visual (size, shape, color), physical (texture), chemical (aroma, flavor), or other sensory factors [81], [90], [91], [92]. Whole finfish baits, such as mackerel and mullet, contrary to squid bait, have been demonstrated to effectively reduce sea turtle bycatch in some commercial saltwater fishing industries [76], [80], [93], [94], [95], [96], [97], [98]. Furthermore, live finfish are only known to be a part of the Kemp's ridley adult diet (particularly in the Gulf), so the use of finfish as a bycatch mitigation method has significant potential to improve unintentional capture among most turtle species [87]. However, the success of hook and bait-based mitigation techniques is contingent upon fishery-dependent factors, including bait and gear type, turtle species and life stage, seasons, and specific oceans, requiring careful evaluation for each individual fishery [62], [99], [100].

Table 7. Diets of adult sea turtles found in Gulf of Mexico waters.

Species	*Publications*	*Classification*	*Adult Diet*
Loggerhead (*Caretta caretta*)	Mariani et al., 2023 Plotkin et al., 1993	Carnivore	Crabs, mollusks, horseshoe crabs
Green (*Chelonia mydas*)	Stringell et al., 2016	Herbivore	Algae, seagrasses, seaweed
Leatherback (*Dermochelys coriacea*)	Dodge et al., 2011	Gelatinivore	Soft-bodied invertebrates
Hawksbill (*Eretmochelys imbricata*)	Stringell et al., 2016	Spongivore	Sponges
Kemp's ridley (*Lepidochelys kempii*)	Ramirez et al., 2020 Seney 2016	Carnivore	Crabs, fish

While significant research has been conducted to develop and evaluate sea-turtle-safe fishing practices in the commercial fishing industry, few studies have investigated one of the largest and most widespread stakeholder groups in sea turtle conservation, recreational anglers. Our research aims to assess the willingness of recreational anglers to adopt sea turtle-friendly tackle [9] modifications, such as changing bait and hook styles, which can dramatically influence the risk recreational fishing activities pose to sea turtles and other taxa [23]. Using social science surveys, we gauge the willingness of anglers to make modifications, and the relationships between that willingness and various factors, which can inform fish and wildlife managers on potential barriers and incentives. Thus, this information may facilitate the development of targeted and effective educational campaigns and outreach programs. Social science research of this kind not only enables the promotion of environmentally responsible fishing practices but also fosters a collaborative approach wherein anglers become active participants in the preservation of marine ecosystems [101], [102], [103], [104]. Moreover, a willingness to adopt wildlife-friendly behaviors while engaging in outdoor recreation can be applied in settings beyond the GoM, and with other protected species.

2. Materials and Methods

2.1 Study Site

Our study site is defined as the Mobile Bay ecosystem (see Figure 10), an expansive estuary situated in coastal Alabama that ranks as the 6th largest estuary in the continental United States [105]. Renowned for its ecological significance, Mobile Bay serves as a critical habitat for a diverse array of marine fish and wildlife [105]. This biodiversity, coupled with varied habitats,

[9] Tackle refers to the fishing equipment that is used to catch fish. This includes a wide variety of items, such as rods, reels, lines, lures, baits, and hooks.

attracts thousands of visitors annually, especially those interested in marine recreational activities like boating and fishing [24].

Mobile Bay has earned its reputation as a recreational fishing hub, recognized as the "Red Snapper Capital of the World," a title earned through its remarkable contribution to the Gulf's recreational catch. This achievement is attributed, in part, to the state's innovative Artificial Reef Program, initiated in the 1950s, which strategically places various materials such as car bodies, ships, and planes to create artificial reefs in the Gulf of Mexico [106], [107]. These reefs have significantly enhanced species diversity, particularly benefiting valuable reef and sport fish sought after by anglers. The region is further distinguished by its jubilees, a globally rare phenomenon where fish and crustaceans migrate to the bay's shallow shoreline and beach every year as a result of seasonal oxygen depletion [108], [109]. Although jubilee events can occur elsewhere in the world, Mobile Bay is one of the only bodies of water on Earth where this phenomenon is regularly observed, typically throughout the summer months, with a notably high degree of predictability [110]. This aspect adds to the allure of Mobile Bay, making it a unique and special destination for both recreational fishing and maritime culture.

The recreational fishing industry is integral to Alabama, supporting local livelihoods, preserving cultural heritage, and contributing to the overall well-being of coastal communities. Concurrently, five of the seven sea turtle species worldwide use Alabama waters, and three of which use the beaches directly for nesting (loggerhead, green, and Kemp's ridley) [111]. This dynamic combination of ecological richness and recreational appeal positions Mobile Bay as an ideal setting for our study, exploring anglers' willingness to adopt conservation measures benefiting sea turtles in the greater Gulf of Mexico.

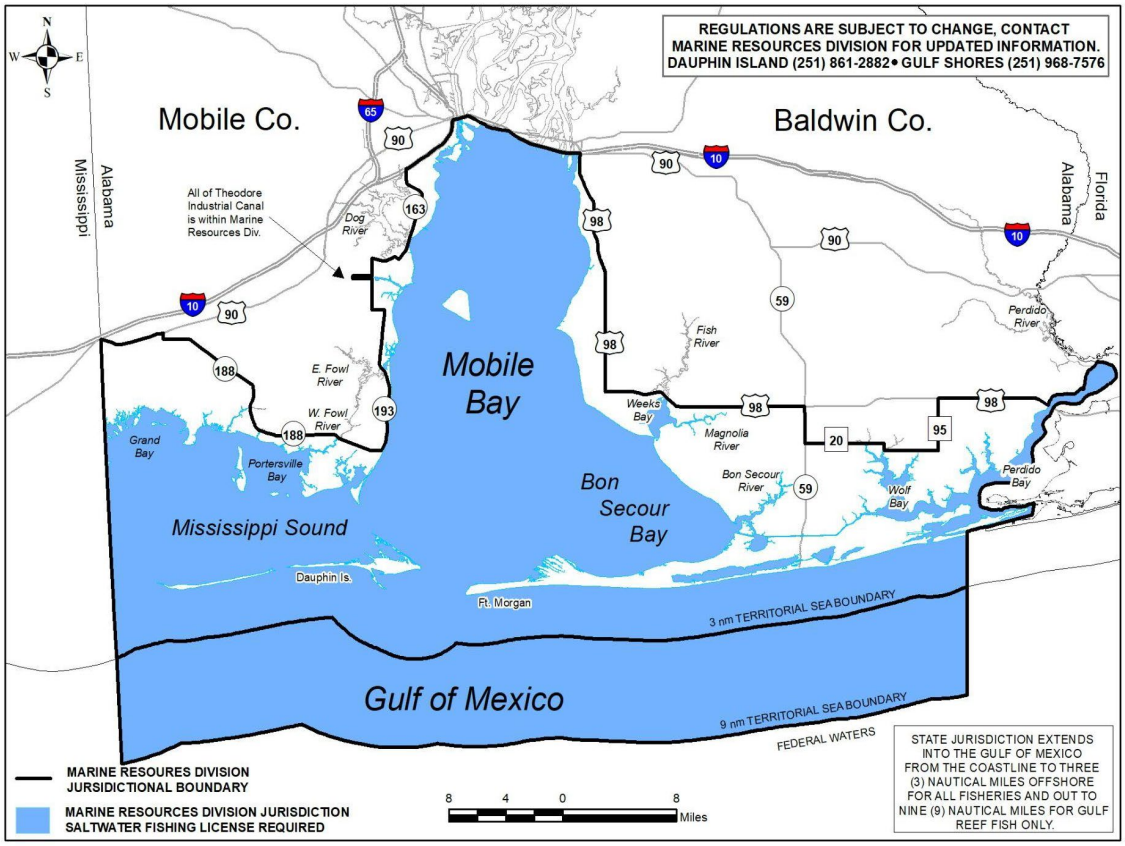

Fig. 10. Map of Mobile Bay, Alabama, provided by the Alabama Department of Conservation and Natural Resources Marine Resources Division.

2.2 Survey Instrument and Data Collection

We designed a social science survey aimed at understanding angler knowledge, views, and attitudes toward sea turtle species that reside in and use Alabama waters. The survey, which included 46 questions of various types, such as text entry, matrix tables, and multiple-choice using 5-point Likert-type scales, was aimed at gathering detailed demographic data on coastal users. This project was a collaborative effort between the Alabama Department of Conservation and Natural Resources Marine Resources Division (ADCNR/MRD), the National Oceanic and Atmospheric Administration (NOAA), and social scientists at the Auburn University College of

Forestry, Wildlife, and Environment. The survey adhered to guidelines and requirements outlined by the Auburn University Institutional Review Board, receiving approval under the reference 22-502 EX 2211.

The surveys were voluntary, and only those who had visited the Alabama coast in 2023 and were at least 19 years old were eligible to participate. The survey was made available online and on paper to promote accessibility and increase response rates. The primary method for gathering data in person was an intercept approach at different locations that coastal visitors frequent, such as marinas, piers, and beaches, and recommended coastal businesses like restaurants, lodging facilities, and retail establishments, as advised by the ADCNR/MRD. To address non-response bias and provide accommodations for visitors who were unable to participate in person, flyers including a QR code for the survey were posted in well-known areas throughout Mobile Bay. The online survey was made available by Qualtrics software and was distributed on web-based forums devoted to fishing activities in Mobile Bay on social media sites such as Facebook. The survey took around fifteen minutes to complete, although respondents had unlimited time to complete the survey. Responses to the survey were received from March through September of 2023. Surveys that did not match the qualifying requirements (such as visiting the Alabama coast in 2023) were not included in this research.

2.3 Analysis

We developed two binomial Generalized Linear Models (GLM) to measure and examine 17 explanatory factors that we hypothesized may be related to two response variables: an individual's willingness to change hook styles and willingness to change bait choices. The explanatory variables were composed of the participants' demographics (age, race, gender, state

residency, and highest level of education), motivation for visiting the coast, and knowledge of sea turtle policy and ecology (Table 8). The knowledge variables were calculated by taking the proportion of questions correctly answered by participants, indicating their knowledge level in each subject area. Questions can be referenced in Appendix A.

Table 8. Description of explanatory variables.

Variable name	*Type*	*Answer options*
Age	Discrete	The age of the participants in the study
Race	Categorical	White, Native American, Black, Asian
Gender	Categorical	Male, Female, Other
State residency	Categorical	From Alabama, From elsewhere
Highest level of education	Categorical	Higher education (Graduate or Professional School, College Grad/BA or BS, Some College/AA or AS), Lower education (Technical/Vocational School, HS graduate/GED, Did not graduate HS/no GED)
Angler	Categorical	Participates in fishing activities, Does not participate in fishing activities
Motivation for visit to the Alabama coast	Categorical	Viewing dolphins, Viewing sea turtles, Viewing other wildlife (i.e. birds, etc.), Fishing from the beach, Fishing from the jetty, Fishing from a boat, Boating (motor),

		Boating (sailing)
Knowledge of sea turtle policy	Continuous	Calculated score based on correct answers to sea turtle policy questions
Knowledge of sea turtle ecology	Continuous	Calculated score based on correct answers to sea turtle ecology questions

To evaluate the degree of multicollinearity among the independent variables in our models, we computed the variance inflation factor (VIF) for each variable; all variables had VIF scores < 2, suggesting minimal multicollinearity. We used the odds ratio, which measures and quantifies the strength and direction of the relationship between the independent variables and the response variable (either changing hook style or bait choice) and is based on the transformed coefficient parameter estimate (β), to assess the association of these explanatory variables on with the participants' willingness. The 'confint' function from the R package ‘stats’ was used to generate confidence bounds for each variable. All analyses were carried out in the statistical software R [31].

3. Results

We obtained 567 recreational angler responses from both online and in-person data collection. We considered the sample size to be adequate, as it was greater than the recommendations from Green [32] and VanVoorhis and Morgan [33] on the minimum sample size for regression analysis.

3.1 Demographics

One of the objectives of this survey was to characterize current Alabama recreational anglers by their demographics, including gender, race, ethnicity, age, education level, state residency, and what type of visitor they are, which is summarized in Table 9 below. Respondents were mostly white (66%), female (61%), and middle-aged, with a mean age of 35 years old. In terms of ethnicity, 54% of participants identified with Latino, Hispanic, or Spanish origin. Education levels varied, with 29% holding a bachelor's degree. Residency patterns indicated that 35% of participants were from Alabama (see Figure 11). Among visitor types, the two largest groups were residents (29%) and seasonal residents [10] (29%).

Table 9. Descriptive statistics of Mobile Bay recreational angler demographics.

Demographic variables	*Percent*	*Count*
Gender		
Female	61%	348
Male	28%	159
Other	1%	4
I prefer not to answer	10%	56
Total		**567**
Race		
White	66%	374
Native American	18%	99
Black	8%	47

[10] A seasonal resident is an individual who only lives in the state and/or property for a specific time period throughout the year.

Asian	4%	23
Other/I prefer not to answer	4%	24
Total		**567**

Do you identify with Latino, Hispanic, or Spanish origin?

Yes	54%	282
No	39%	198
I prefer not to answer	7%	87
Total		**567**

Age Ranges

19-24	7%	40
25-34	50%	284
35-44	25%	139
45-54	11%	62
55-64	3%	18
65+	4%	20
Total		**563**

Highest Level of Education

Did not graduate HS/no GED	2%	12
HS graduate/GED	16%	91
Technical/Vocational School	22%	124
Some College/AA or AS (2-year degree)	23%	133
College Grad/BA or BS (4-year degree)	29%	163
Graduate or Professional School	8%	44

Total		**567**
Alabama Residency		
From Alabama	35%	198
From elsewhere	65%	369
Total		**567**
Visitor Type		
Resident	29%	164
Seasonal Resident	29%	162
Short-Term Visitor (1-3/year)	22%	126
Short-Term Visitor (4-6/year)	15%	83
Short-Term Visitor (6 or more times)	5%	28
Total		**563**

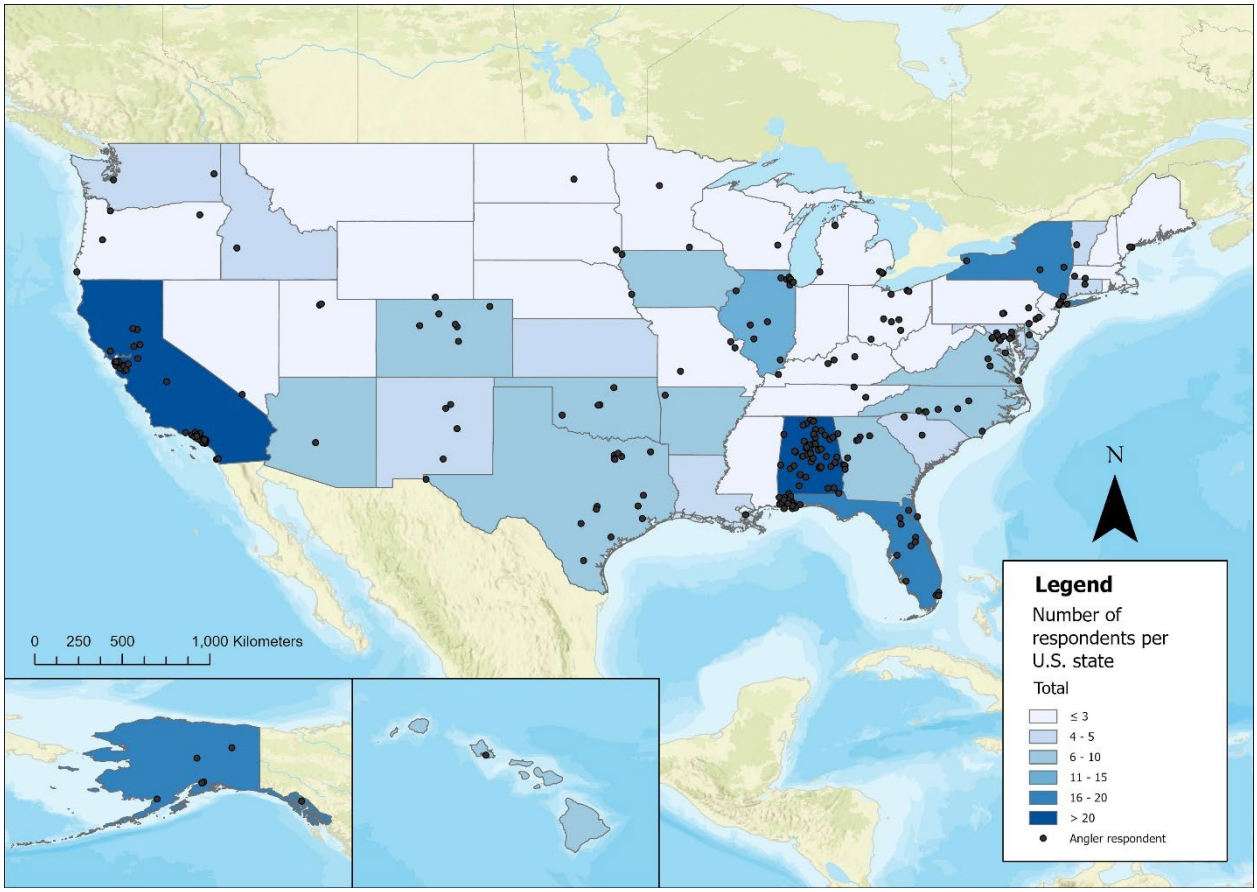

Fig. 11. This map illustrates two layers of data: the number of respondents per state (selected from a drop-down list) and respondent-provided zip code locations. Discrepancies in counts may occur due to respondents providing zip codes from different states or incomplete reporting.

3.2 Fishing Techniques

Participants in the study were surveyed to gain insights into their fishing techniques, specifically focusing on the primary fish species they target, the gear they use, and their bait preferences. The results are outlined in Table 10. These findings show the preference for different fish species in Alabama, with mackerel being the most frequently selected species (49%). Among the various fishing methods, hook and line was the predominant choice (56%). Additionally, the data on bait preferences underscores the popularity of live bait among the

surveyed anglers (59%), which may be dependent on the availability of high-quality bait at reasonable prices [112].

Table 10. Descriptive statistics of fishing techniques and bait used among Mobile Bay recreational anglers.

Question	*Percent*	*Count*
Please select the main species of fish that you're trying to catch (select all that apply).		
Mackerels	49%	276
Reef fish	44%	248
Shrimp	36%	203
Mullet	35%	197
Blue crab	28%	157
Total		**567**
What gear do you use (select all that apply)?		
Hook and line	56%	320
Casting net	32%	182
Trawls	29%	163
Speargun	28%	161
Gillnet	26%	145
Trap pots	16%	90
Skimmers	14%	80
Total		**567**

What bait do you use (select all that apply)?

Live bait	59%	336
Top water lures	45%	256
Cut bait	43%	241
Frozen bait	39%	223
Total		**563**

3.3 Endangered Species Act Knowledge

We sought to understand how familiar recreational anglers are with the ESA, and what activities are encouraged or prevented by the law. Table 11 presents the findings of the ESA knowledge assessment. Notably, 79% of anglers correctly recognized that sea turtles are protected under the ESA, reflecting a relatively high awareness level. Comparably, 62% of anglers understood that it is prohibited to touch any living sea turtle, while 38% held misconceptions about touching a protected turtle. According to NOAA, fishermen should report an injured turtle to the NOAA Sea Turtle Stranding Hotline [113]. Regarding the appropriate action when encountering an injured sea turtle, only 51% of anglers correctly identified the NOAA Sea Turtle Stranding Hotline.

Table 11. Recreational angler knowledge of the Endangered Species Act.

Question and answer	*Percent correct*	*Percent incorrect*
Sea turtles are protected under the Endangered Species Act. (True)	79%	21%

It is illegal to touch any living sea turtle in Alabama. (True)	62%	38%
In the event that I encounter an injured sea turtle, I call: (NOAA Sea Turtle Stranding Hotline)	51%	49%

Note: Proportion of correct and incorrect answers by participants for the sea turtle policy knowledge test section. Answers are represented as percentages by question.

3.4 Sea Turtle Ecology Knowledge

Recreational angler's ecological knowledge of sea turtles is shown in Table 12. These statistics show participants' awareness of critical challenges, notably recognizing the threat of accidental capture by hook-and-line, and understanding that sea turtles breathe air. Our data indicates that 65% of respondents accurately recognized that one of the main threats to sea turtles is accidental capture by recreational hook-and-line fishermen, while 35% did not. Furthermore, 75% of participants correctly understood general sea turtles' capacity to breathe air and stay submerged for long periods of time, whereas 25% gave an inaccurate response.

Table 12. Recreational angler knowledge of sea turtle ecology.

Question and answer	*Percent correct*	*Percent incorrect*
Accidental capture of sea turtles by hook-and-line recreational fishermen is one of the main threats that sea turtles face. (True)	65%	35%
Sea turtles breathe air; however, they can remain	75%	25%

submerged underwater for hours. (True)

Note: Proportion of correct and incorrect answers by participants for the sea turtle ecology knowledge test section. Answers are represented as percentages by question.

3.5 Willingness to Change Hooks

Table 13 presents the GLM results for angler willingness to change hook styles. Our model revealed that traditional demographic variables, including age, race, and education, were not significant predictors of an angler's willingness to change hook style (all $p > 0.07$), but participant gender was. We found that anglers who were female were 3.6 (1.8 - 7.9; 95% C.L.) times as likely to be willing to change hook styles compared to male participants ($p = 0.001$). There was also a significant relationship between state residency and willingness to change, with Alabama residents being 2.7 (1.4 - 5.6; 95% C.L.) times as likely to be willing to change hook styles in contrast to non-residents ($p = 0.005$). We also found that anglers who were motivated to visit the coast to go to the beach were 2.8 (1.4 - 5.7; 95% C.L.) times as likely to be willing to change their hook styles compared to those who were not motivated to visit the beach ($p = 0.003$). Additionally, we found a significant relationship between two methods of fishing and participant willingness to change hook styles: beach fishing and fishing on a boat. Anglers who were motivated to fish from the shore ($p = 0.028$) and while on a boat ($p = 0.009$) were 0.5 (0.2 - 0.9; 95% C.L.) and 2.6 (1.3 - 5.4; 95% C.L.) times as likely, respectively, to be willing to change their hook styles compared to those not motivated by those methods of fishing. Lastly, we considered how an angler's knowledge of sea turtle policy and sea turtle ecology may influence their willingness to change hook types for sea turtle conservation. While we did not find that an angler's knowledge of sea turtle policy was a significant predictor of an angler's willingness to

change ($p = 0.76$), their knowledge of sea turtle ecology was. We found that for a 50% increase in an angler's knowledge of sea turtle ecology, the angler was 3.5 (1.8 - 6.7; 95% C.L.) times as likely to be willing to change hook types in support of sea turtle conservation ($p < 0.001$).

Table 13. Logistic regression estimates for models of factors explaining recreational anglers' willingness to change hook styles.

	Estimate	*Std. error*	*z value*	*P-value*
Intercept	-1.474633	0.838806	-1.758	0.078745
Age	-0.004375	0.014195	-0.308	0.757933
Native American	0.211841	0.392345	0.540	0.589242
Asian	1.708875	0.942756	1.813	0.069888
Black	-0.271526	0.538404	-0.504	0.614039
Female	1.281464	0.383325	3.343	0.000829 ***
“Other” gender	-1.235064	1.074416	-1.150	0.250341
Alabama resident	1.007338	0.355931	2.830	0.004653 **
Higher education	0.555443	0.324249	1.713	0.086711
Motivated to visit the beach	1.039565	0.355447	2.925	0.003448 **
Motivated to view turtles	0.158828	0.338484	0.469	0.638902
Motivated to view dolphins	0.403730	0.362653	1.113	0.265594
Motivated to view other wildlife (birds, etc.)	-0.451073	0.354565	-1.272	0.203306

Motivated to fish on the beach	-0.759044	0.346000	-2.194	0.028252 *
Motivated to fish on the jetty	-0.294930	0.344454	-0.856	0.391874
Motivated to fish on a boat	0.954811	0.363884	2.624	0.008692 **
Motivated to go boating (motor)	-0.398890	0.369497	-1.080	0.280343
Motivated to go boating (sail)	0.163764	0.343577	0.477	0.633615
Knowledge of sea turtle policy	-0.260222	0.858341	-0.303	0.761762
Knowledge of sea turtle ecology	2.486766	0.652510	3.811	0.000138 ***

Note: Significance notes as *p<0.05, **p<0.01, ***p<0.001. Odds ratios can be calculated by exponentiating the beta.

3.6 Willingness to Change Bait

Table 14 presents the GLM results for anglers' willingness to change the type of bait they use when fishing. We found that age, race, and education level were not significant predictors of anglers' willingness to change bait (all $p > 0.12$), while gender was, particularly females. In comparison to male anglers, female anglers were 2.2 (1.1 - 4.5; 95% C.L.) times as likely to be willing to change their bait choices ($p = 0.025$). We also found a significant relationship between

participant motivations to visit the coast and willingness to change bait. Anglers that were motivated to visit the beach were 2.9 (1.5 - 5.8; 95% C.L.) times as likely to alter bait choices compared to those not motivated by that activity (p = 0.0016). In addition, anglers who were motivated to view dolphins were 3.0 (1.5 - 6.1; 95% C.L.) times as likely to be willing to change their bait in contrast to those who were not motivated to view dolphins (p = 0.002). We did not find a significant relationship between participants' motivation to view sea turtles and their willingness to change bait (p = 0.61). However, anglers who were motivated to view other wildlife (such as birds) were 0.50 (0.25 – 0.99; 95% C.L.) times as likely to be willing to change their bait choices (p = 0.048). We also found a significant relationship between a participant's motivation to fish while on a boat and their willingness to change bait, with those motivated by that method of fishing being 2.1 (1.1 - 4.2; 95% C.L.) times as likely to be willing to change bait compared to those not motivated by the activity (p = 0.028). Lastly, we found that a participant's knowledge of sea turtle ecology was a significant predictor of their willingness to change bait. A 50% increase in a participant's knowledge of sea turtle ecology, resulted in participants being 2.0 (1.1 - 3.7; 95% C.L.) times as likely to be willing to change bait choices (p = 0.026).

Table 14. Logistic regression estimates for models of factors explaining recreational anglers' willingness to change bait choice for sea turtle conservation.

	Estimate	*Std. error*	*z value*	*P-value*
Intercept	-2.5249463	0.8337862	-3.028	0.00246 **
Age	0.0008853	0.0143285	0.062	0.95073
Native American	-0.5259544	0.9513295	-0.553	0.58036
Asian	-0.0413957	0.5974091	-0.069	0.94476

Black	0.0618775	0.3746867	0.165	0.86883
Female	0.7836685	0.3503363	2.237	0.02529 *
“Other” gender	-16.5414483	959.2232395	-0.017	0.98624
Alabama resident	0.4897073	0.3484418	1.405	0.15990
Higher education	0.4852081	0.3203260	1.515	0.12984
Motivated to visit the beach	1.0790686	0.3422946	3.152	0.00162 **
Motivated to view turtles	0.1697813	0.3358357	0.506	0.61317
Motivated to view dolphins	1.1103668	0.3505423	3.168	0.00154 **
Motivated to view other wildlife (birds, etc.)	-0.6914212	0.3495722	-1.978	0.04794 *
Motivated to fish on the beach	-0.4350868	0.3326049	-1.308	0.19083
Motivated to fish on the jetty	-0.1106408	0.3242171	-0.341	0.73291
Motivated to fish on a boat	0.7603335	0.3459822	2.198	0.02798 *
Motivated to go boating (motor)	-0.2687632	0.3633686	-0.740	0.45952
Motivated to go boating (sail)	-0.0900437	0.3417602	-0.263	0.79219
Knowledge of sea turtle	1.5322787	0.8373350	1.830	0.06726

policy				
Knowledge of sea turtle ecology	1.3740700	0.6172297	2.226	0.02600 *

Note: Significance notes as *p<0.05, **p<0.01, ***p<0.001. Odds ratios can be calculated by exponentiating the beta.

4. Discussion

The findings from the ESA knowledge assessment provide insights into the awareness and understanding of key legal and conservation aspects among recreational anglers in the Mobile Bay ecosystem. A substantial proportion of participants (79%) recognized that sea turtles are protected under the ESA but also revealed a notable knowledge gap, with only 62% of anglers understanding the illegality of touching sea turtles. Previous research on human-sea turtle encounters during ecotourism activities, alongside our findings, further suggests a need for targeted education efforts to enhance the public's awareness of specific legal restrictions, contributing to more informed and conservation-conscious behavior [114], [115], [116]. Additionally, only 51% of anglers correctly identified that contacting the NOAA Sea Turtle Stranding Hotline is the appropriate action to take when encountering a dead or injured sea turtle. A higher level of public knowledge regarding how to report distressed wildlife is essential for timely and effective responses to injured sea turtles, especially when wildlife face increased anthropogenic threats from human activity in coastal tourism destinations [117], [118].

Our data on angler knowledge of sea turtle ecology highlights a moderately high level of awareness among participants. Among our participants, 75% of anglers demonstrated knowledge about sea turtles' requirement to breathe air and their capacity to remain submerged. However,

the 25% who provided inaccurate responses showcase the existence of potential misconceptions. These findings emphasize the importance of addressing knowledge gaps concerning key aspects of sea turtle biology, particularly in understanding the risks sea turtles face as a result of their distinctive physiological capacities, which may make them more vulnerable compared to other marine species. Angler awareness of sea turtles' need for air helps fishermen be more cautious and take preventive measures, such as implementing time limits while gear is in the water, reducing the risk of sea turtle drowning. Additionally, 65% of respondents correctly identified accidental capture by recreational hook-and-line fishermen as one of the main threats to sea turtles. This recognition is crucial, as it indicates a majority of anglers are cognizant of their potential impact on sea turtle populations, given that fishing activities may result in unintentional negative interactions, such as hooking and entanglements, even when fishermen take precautions [119].

Collecting demographic data among anglers is vital for understanding the diverse characteristics of this coastal user group and providing insights into how these factors may be related to fishing behavior, gear preferences, and attitudes toward sea turtle conservation efforts. Notably, age, race, and highest education level did not emerge as significant predictors for the willingness to change hooks or bait, suggesting that these demographic factors may not strongly correlate with conservation attitudes or behaviors as past research has suggested [120], [121], [122], [123], [124]. Generally, existing research indicates that females exhibit greater concern for environmental issues and engage more frequently in conservation behaviors, such as showing a willingness to pay for environmentally friendly services or products [37], [38], [125]. Our findings align with this idea, as we observed that female anglers demonstrated a greater inclination to modify their hook and bait choices in support of sea turtle conservation compared

to their male counterparts. This disparity may stem from divergent perspectives on environmental conservation or a heightened level of concern for sea turtle welfare among females [126], [127], [128]. However, it is crucial to emphasize that there is still a lack of research on female anglers and whether their motivations differ from those of men, emphasizing the need for more research in this area [129]. Aside from gender, the other demographic variable we found to have a significant relationship with anglers' willingness to change hook styles was their state residency. We found that Alabama residents showed a greater inclination to adopt sea turtle-friendly modifications, possibly reflecting a sense of responsibility for protecting local marine ecosystems, which has been observed in previous research on seasonal recreation areas and sea turtles specifically as tourism drivers for local economies [130], [131].

Several studies have demonstrated that recreation motivation may influence a user's willingness to adopt conservation actions for natural resources and related wildlife, including among anglers [132], [133]. In our research, we found that individuals motivated to visit the beach demonstrated a higher willingness to change both hooks and bait. This may indicate the importance of considering various coastal activities, such as experiencing nature and other activities that go beyond fishing, is related to the respondent's concern for conservation. Thus individuals engaged in beach-related pursuits may possess a heightened awareness of environmental conservation concerns [134]. Furthermore, the different subgroups of anglers (e.g., shore anglers and boat anglers) and their differing levels of willingness to change tackle styles highlight the need for tailored conservation strategies based on distinct angler subgroups. For instance, engagement strategies with beach anglers may not be the same as strategies to engage boat anglers. Understanding such motivations can aid in enhancing voluntary

engagement and increase effectiveness in conservation efforts, particularly within the recreational angling community [135].

We observed a significant relationship between knowledge of sea turtle ecology and angler willingness to change both hook and bait types, which may suggest that enhancing anglers' understanding of the ecology of sea turtles may be a key strategy in promoting sustainable practices, as informed anglers may be more likely to adopt conservation measures. However, knowledge of sea turtle ecology had a larger effect on changing hooks than on changing bait. This may reflect that the use of circle hooks is more normalized and accepted in the fishing community, as non-stainless steel circle hooks are required to be used in Alabama when fishing for sharks and gulf reef species using natural bait [136]. Our findings suggest anglers may be more reserved about changing their bait choices, even for sea turtle conservation efforts.

Previous research has indicated that the public's decisions to support the protection of species are mostly influenced by their existing knowledge of wildlife species [137]. Charismatic and well-known species like sea turtles typically garner more conservation support compared to poorly-known species, especially those inhabiting less remote areas. [138]. While ecological knowledge of wildlife species appears to strongly shape individuals' support for conservation initiatives, it's notable that policy knowledge did not significantly correlate with anglers' willingness to adapt hook or bait styles. These results suggest that traditional methods of wildlife conservation communication by state and federal agencies, which often emphasize regulation or management-related information, may not always be effective in encouraging practical behavioral changes among certain groups, such as anglers [139]. Social marketing research on responsible sea turtle viewing among general tourists suggests that campaign factors to

encourage desired behavior change may include ease of implementing that behavior, enjoyment, uniqueness, popularity, and alignment of that behavior with personal identity, which can all be incorporated into targeted efforts in the angling community [140].

Our research enhances the understanding of the intersection between recreational fishing and sea turtle conservation, including the implementation of sustainable fishing practices, the modification of tackle to minimize negative interactions with wildlife, and the promotion of education and awareness initiatives tailored for fishermen and local communities. The implications of our study extend to the development of targeted campaigns, evaluating incentives for sea turtle-friendly tackle modifications, and fostering productive angler engagement efforts. Such endeavors are pivotal, as mitigation strategies must not only prove effective but also viable to garner full adoption among anglers [141]. Educational programs that equip anglers with best-practice knowledge for marine stewardship may then voluntarily modify their tackle and behavior, which has a significant potential for accomplishing official management goals and objectives [142]. Similar studies have shown how cooperation with fishermen may provide extensive monitoring of sea turtles, gathering information on the spatial distribution, bycatch, and fishing effort for enhanced conservation planning [143], [144].

However, certain limitations should be considered. The geographical focus of the study on the Mobile Bay ecosystem may limit the generalizability of the findings to other coastal regions and differing sociodemographics. Comparative studies across different regions will help identify variations in angler attitudes and behaviors toward sea turtle conservation, informing the development of region-specific conservation strategies. Additionally, assessing the long-term impact of changes in angler behavior on sea turtle populations is essential for a comprehensive understanding of the effectiveness of proposed conservation strategies. Future research may also

examine how fishing laws and policies could incorporate volunteer conservation measures to assess potential institutional support for sea turtle-friendly fishing practices.

5. Conclusion

Ultimately, understanding recreational angler knowledge, attitudes, and behaviors towards sea turtle-friendly tackle modifications is an integral, yet understudied, step in developing effective conservation initiatives that align with the interests of the angling community while ensuring the long-term health and conservation of sea turtle populations. In this study, we aimed to assess the willingness of recreational anglers to adopt sea turtle-friendly tackle modifications and understand the factors influencing their decisions to mitigate harm to sea turtles during recreational fishing activities. Our results provide valuable insights into the demographics, fishing characteristics, ecological and policy knowledge, and motivations of anglers in the Mobile Bay ecosystem. Understanding these sociodemographic aspects of recreational fisheries is essential for promoting sustainable fishing practices that align with angler practices and preferences, informing conservation strategies by fish and wildlife agencies, and tailoring educational efforts to address the specific needs of the angling community. Additionally, by identifying key factors influencing anglers' willingness to adopt sea turtle-friendly measures, our research provides actionable insights for the development of targeted conservation strategies. Our results emphasize the importance of targeted educational initiatives to enhance public understanding of sea turtle ecology, conservation policies, and appropriate responses to encounters with these endangered species, particularly during activities that may pose threats to sea turtles, including recreational fishing.

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Appendix 1: Survey Questions

Demographics.

1. What year were you born?
2. Please indicate your race.
    a. American Indian or Alaskan Native Asian
    b. Asian
    c. Black or African American
    d. White
    e. Other (fill in)
    f. I prefer not to answer
3. Do you identify with Latino, Hispanic, or Spanish origin?
    a. Yes
    b. No
    c. I prefer not to answer
4. Please indicate your gender.
    a. Male
    b. Female
    c. Other
    d. I prefer not to answer
5. In which state do you currently reside?
6. What is your US Zip Code (5 digit zip code)?
7. What is your highest level of education?
    a. Did not graduate high school/no GED

b. High school graduate/GED

c. Technical/Vocational School

d. Some College/AA or AS (2 year degree)

e. College Graduate/BA or BS (4 year degree)

f. Graduate or Professional School

8. What type of visitor are you?

a. Resident (resides in community year round)

b. Seasonal resident (resides in community for part of the year)

c. Short term visitor who visits 1-3 times per year

d. Short term visitor who visits 4-6 times per year

e. Short term visitor who visits 6 or more times per year

What are your motivations for your visit to the coast?

9. Visiting the beach

a. Unsure (I don't know)

b. Not important

c. Somewhat important

d. Very important

10. Viewing sea turtles

a. Unsure (I don't know)

b. Not important

c. Somewhat important

d. Very important

11. Viewing dolphins

    a. Unsure (I don't know)

    b. Not important

    c. Somewhat important

    d. Very important

12. Viewing other wildlife (birds, etc)

    a. Unsure (I don't know)

    b. Not important

    c. Somewhat important

    d. Very important

13. Fishing from the beach

    a. Unsure (I don't know)

    b. Not important

    c. Somewhat important

    d. Very important

14. Fishing from the jetty

    a. Unsure (I don't know)

    b. Not important

    c. Somewhat important

    d. Very important

15. Fishing from a boat

    a. Unsure (I don't know)

    b. Not important

c. Somewhat important

d. Very important

16. Boating (motor)

a. Unsure (I don't know)

b. Not important

c. Somewhat important

d. Very important

17. Boating (sail)

a. Unsure (I don't know)

b. Not important

c. Somewhat important

d. Very important

Angler information.

18. Are you an angler/fisherman?

a. Yes

b. No

19. Please select the main species of fish that you're trying to catch (select all that apply).

a. Reef fish

b. Mackerels

c. Mullet

d. Shrimp

e. Blue crab

f. Other finfish (fill in)

20. What gear do you use (select all that apply)?

a. Casting net

b. Hook and line

c. Speargun

d. Gillnet

e. Trawls

f. Skimmers

g. Trap pots

h. Other (fill in)

i. What bait do you use (select all that apply)?

j. Live bait

k. Top water lures

l. Cut bait

m. Frozen bait

n. Other (fill in)

Wildlife laws and policies.

21. It is against the law to feed wild dolphins.

a. True

b. False

c. I don't know

22. If I chase a dolphin with my boat, it may constitute as harassment.

a. True

b. False

c. I don't know

23. If I chase a dolphin with my boat, this may disturb them.

a. True

b. False

c. I don't know

24. If I approach a dolphin with my boat, and their behavior changes (such as stop feeding) this is harassment.

a. True

b. False

c. I don't know

25. If I approach a dolphin with my boat, and they start jumping, this is harassment.

a. True

b. False

c. I don't know

26. If my actions cause a dolphin to change their behavior, this is against the law.

a. True

b. False

c. I don't know

27. If we encourage dolphins to wake ride (by riding our boat directly at a group of dolphins) this may cause dolphins to start jumping.

a. True

b. False

c. I don’t know

28. We enjoy encouraging dolphins to wake ride (by riding our boat directly at a group of dolphins) in order to (select all that apply).

a. Get photos

b. Bring joy to visitors

c. Get a closer look

d. It doesn't hurt the dolphins, so why not?

e. Dolphins have the option to swim away

f. Other (fill in):

29. Sea turtles are protected under the Endangered Species Act.

a. Agree

b. Disagree

c. Unsure

d. It depends on the situation (Explain)

30. It is against the law to disturb a sea turtle nest.

a. Agree

b. Disagree

c. Unsure

d. It depends on the situation (Explain)

31. It is against the law to disturb sea turtle hatchlings.

a. Agree

b. Disagree

c. Unsure

d. It depends on the situation (Explain)

32. It is illegal to touch any living sea turtle in Alabama.

a. Agree

b. Disagree

c. Unsure

d. It depends on the situation (Explain)

33. How far away from nesting sea turtles should you remain when viewing them from the beach?

a. 25 yards

b. 50 yards

c. 75 yards

d. 100 yards

34. How far away from sea turtle nests should you remain when viewing them from the beach?

a. 25 yards

b. 50 yards

c. 75 yards

d. 100 yards

<u>Wildlife behavior, biology, and ecology</u>

35. Please select all behaviors that indicate that a dolphin is stressed:

a. Abrupt change in direction

b. Abrupt change in speed

c. Increased respiration rates

d. Tail slapping

e. Side breaching

f. Females sheltering calves

g. “Chuffing” or forceful exhalations

h. Continually moving away from source of disturbance

i. All of the above

36. When do sea turtles lay their eggs in Alabama?

a. Winter (December through March)

b. Spring (March through June)

c. Summer (May through September)

d. Fall (October through December)

37. Sea turtles breathe air, however they can remain submerged under water for hours.

a. True

b. False

c. I don't know

38. Sea turtle hatchlings can be distracted by bright lights on the beach at night.

a. True

b. False

c. I don't know

Who to contact if you encounter an injured animal.

39. In the event that I encounter an injured dolphin, I call:

    a. The police

    b. The Coast Guard

    c. ADCNR

    d. The Marine Mammal Stranding Hotline

40. I am familiar with this phone number and know why I would call it: 1-877-WHALE-HELP (942-5343).

    a. Strongly agree

    b. Agree

    c. Disagree

    d. Strongly disagree

41. If I find a dead or injured sea turtle I should call:

    a. The police

    b. The Coast Guard

    c. ADCNR

    d. The Alabama Sea Turtle Stranding and Salvage Network Hotline

42. Would you be willing to report an injured dolphin?

    a. Yes

    b. Probably yes

    c. Unsure

    d. Probably no

    e. No

    f. Explain your answer here (optional).

Frequency of events.

43. How often are you out on the water?

    a. Daily

    b. Weekly

    c. Monthly

    d. A few times a year

    e. Almost never

    f. Never

44. How frequently do you encounter dolphins when you're on the water?

    a. Rarely (1-3 times per year)

    b. Sometimes (4-12 times per year)

    c. Frequently (12 or more times per year)

    d. Other (fill in)

Interactions with wildlife.

Please check the frequency that the following events occur:

45. Wake riding with a dolphin

    a. Never

    b. Rarely (1-3 times per year)

    c. Sometimes (around 4-12 times per year)

    d. Frequently (more than 12 times per year)

46. Catching ghost crabs on the beach at night

a. Never

b. Rarely (1-3 times per year)

c. Sometimes (around 4-12 times per year)

d. Frequently (more than 12 times per year)

47. Seeing a sea turtle nesting on the beach

a. Never

b. Rarely (1-3 times per year)

c. Sometimes (around 4-12 times per year)

d. Frequently (more than 12 times per year)

48. Accidental fishing gear interaction with dolphin

a. Never

b. Rarely (1-3 times per year)

c. Sometimes (around 4-12 times per year)

d. Frequently (more than 12 times per year)

49. Accidental fishing gear interaction with turtles

a. Never

b. Rarely (1-3 times per year)

c. Sometimes (around 4-12 times per year)

d. Frequently (more than 12 times per year)

50. Feeding dolphins bycatch

a. Never

b. Rarely (1-3 times per year)

c. Sometimes (around 4-12 times per year)

d. Frequently (more than 12 times per year)

51. Dolphins eating bait or fish off my gear

a. Never

b. Rarely (1-3 times per year)

c. Sometimes (around 4-12 times per year)

d. Frequently (more than 12 times per year)

52. Dolphins eating thrown back, undersized or out of season fish

a. Never

b. Rarely (1-3 times per year)

c. Sometimes (around 4-12 times per year)

d. Frequently (more than 12 times per year)

Threats to dolphins and sea turtles.

53. One of the most important threats faced by dolphins are interactions with fishing gear.

a. Agree

b. Disagree

c. I don't know

54. Accidental capture of sea turtles by hook and line recreational fishers is one of the main threats that sea turtles face.

a. Agree

b. Disagree

c. I don't know

55. Coastal lighting of buildings is a major threat to sea turtles.

a. Agree

b. Disagree

c. I don't know

56. Coastal lighting from a cell phone cameras while a sea turtle builds its nest is a major threat to sea turtles.

a. Agree

b. Disagree

c. I don't know

Willingness to change behavior.

57. Feeding dolphins bycatch

a. Very unwilling to change this behavior

b. Unwilling to change this behavior

c. Neutral or I do not know

d. Willing to change this behavior

e. Very willing to change this behavior

58. Using artificial lures that may be safer for sea turtles

a. Very unwilling to change this behavior

b. Unwilling to change this behavior

c. Neutral or I do not know

d. Willing to change this behavior

e. Very willing to change this behavior

59. Use of certain types of fishing hooks (“J” hook vs circle hook)

a. Very unwilling to change this behavior

b. Unwilling to change this behavior

c. Neutral or I do not know

d. Willing to change this behavior

e. Very willing to change this behavior

60. Turning off lights at night to protect turtles

a. Very unwilling to change this behavior

b. Unwilling to change this behavior

c. Neutral or I do not know

d. Willing to change this behavior

e. Very willing to change this behavior

61. Shining a cellphone light onto a nesting turtle

a. Very unwilling to change this behavior

b. Unwilling to change this behavior

c. Neutral or I do not know

d. Willing to change this behavior

e. Very willing to change this behavior

62. If you are choosing between taking a dolphin viewing tour, would you be interested in taking your trip with a certified dolphin friendly tour, where the tour provider has undergone a training to protect dolphins?

a. I'd be very interested in the certified tour

b. I'd be somewhat interested in a certified tour

c. I do not know I would need more information

d. I'd be uninterested in the certified tour

e. I'd be very uninterested in the certified tour

f. Write in reason

General attitude towards sea turtles and dolphins.

63. I enjoy seeing dolphins when out on the water.

a. Agree

b. Disagree

c. Neither

d. I don't know

64. I enjoy seeing sea turtles when out on the water.

a. Agree

b. Disagree

c. Neither

d. I don't know

65. I feel that having dolphins in the ecosystem is…

a. Very important

b. Somewhat important

c. Neither important nor unimportant: I'm neutral

d. Somewhat not important

e. Not at all important

66. I feel that marine mammal conservation laws and policies are…

a. Very important

b. Somewhat important

c. Neither important nor unimportant: I'm neutral

d. Somewhat not important

e. Not at all important

67. I feel that the future survival of sea turtle species is…

a. Very important

b. Somewhat important

c. Neither important nor unimportant: I'm neutral

d. Somewhat not important

e. Not at all important

68. I feel that the preservation of sea turtle nesting beaches is…

a. Very important

b. Somewhat important

c. Neither important nor unimportant: I'm neutral

d. Somewhat not important

e. Not at all important

69. I feel that sea turtle protection laws and policies are…

a. Very important

b. Somewhat important

c. Neither important nor unimportant: I'm neutral

d. Somewhat not important

e. Not at all important

Educational Materials & Outreach

We are asking for help planning new educational material on wildlife. Please indicate your willingness to read certain types of education materials.

70. Pamphlet
    a. Very unlikely to read
    b. Unlikely to read
    c. Neutral or I do not know
    d. Likely to read
    e. Very likely to read
71. Sign posted outside
    a. Very unlikely to read
    b. Unlikely to read
    c. Neutral or I do not know
    d. Likely to read
    e. Very likely to read
72. Magnet for my fridge
    a. Very unlikely to read
    b. Unlikely to read
    c. Neutral or I do not know
    d. Likely to read
    e. Very likely to read
73. Sticker
    a. Very unlikely to read

b. Unlikely to read

c. Neutral or I do not know

d. Likely to read

e. Very likely to read

74. Other (write in):

75. In your opinion, where would placement of educational signage on wildlife reach the biggest audience?

a. Orange Beach

b. Gulf Shores

c. Dauphin Island

d. Bayou La Batre

e. Fairhope

f. Write in any specific opinions or alternative locations:

76. How do you stay informed with the latest news?

a. Print News

b. Social media (write in main sources)

c. Friends and family

d. Television news (non-cable)

e. Television news (cable)

f. Radio

g. Online forums (e.g. reddit or fishing forums)

h. Other (fill in)

77. Where have you learned information about wildlife conservation (including the laws protecting dolphins and turtles)?

    a. Print News
    b. Social media (write in main sources)
    c. Friends and family
    d. Television news (non-cable)
    e. Television news (cable)
    f. Radio
    g. Online forums (e.g. reddit or fishing forums)
    h. School
    i. Other (fill in)