

***SEA THE VALUE:***  
**Quantifying the value of marine life to divers**

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## **ABSTRACT**

Contemporary wildlife conservation is often promoted through market-mechanisms. The logic behind this approach is that wildlife must 'pay its way' if it is to be conserved. While this approach can be critiqued from a variety of perspectives, considerable investment has been made in finding ways to create markets for wildlife conservation. From a methods perspective, assessments of willingness to pay, using contingent valuation surveys, have become widely used to determine whether or not various values for wildlife can be translated into market values, and thus into economic arguments for their conservation. This study assesses respondent views of the role of divers in marine conservation and examines willingness to pay among certified U.S. scuba divers for particular wildlife encounters while diving.

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## **1.0 INTRODUCTION**

### 1.1 Introduction

Studying the economics of conservation is important because contemporary wildlife conservation is often promoted through market-mechanisms. The logic behind this approach is that wildlife must ‘pay its way’ if it is to be conserved. In environmental economics, both market and non-market values need be assessed. Non-market values for ecosystem services, such as non-consumptive use value, are difficult to quantify and rarely incorporated into environmental management decisions..

The purpose of this research was to estimate scuba divers’ non-consumptive use value for marine wildlife. We estimated divers’ non-consumptive use value based on their willingness to pay for wild encounters with sea turtles, sharks, and coral reefs while diving. Our objective was to evaluate U.S. divers invested in U.S. conservation.

### 1.2 Problem Statement

Non-market values for wildlife are not obvious and are often left out of economic discussions of conservation. Non-market valuation literature is limited. Methods for estimating non-market values are scrutinized, but non-market value is still important for developing sound environmental policy. We had two main research questions in our study:

- 1) What are scuba divers’ attitudes towards conservation?
- 2) Are divers willing to pay for an increased chance of a wild encounter with sea turtles, sharks, and corals?

While they are separate questions, they are linked. We wanted to know the divers’ attitudes toward conservation to help interpret how they value marine resources. A

NOAA report on CV recommended using environmental attitudes to understand valuation responses (Arrow et al. 1993). We were interested in the WTP values to estimate a complete conservation value of the species.

### 1.3 Rationale

Environmental valuation is based on the preferences and choices of individuals (Simpson, 1998). In contemporary conservation, environmental values are assessed in a market system. The basis of this approach is that market solutions will be able to correct the policy failures that stem from human industrialization of nature (McAfee, 1999). Traditional market environmentalism has two main flaws: the markets do not internalize the costs of natural resource use and they do not capture the beneficial values of natural ecosystems (Freese, 1998). Environmental economists correct this by adding values of natural capital to the economic framework (Adams, 2001). The belief of market environmentalists that efficient markets will lead to sustainable use of resources does not fully capture the economic value of natural resources. A new development discourse coined by McAfee as “green developmentalism” does account for the value of nature. Green developmentalism is based on policies that account for environmental costs and benefits and structures to manage natural capital (McAfee, 1999).

To establish structures for the management of natural capital it is necessary to quantify the flow of services from natural capital stocks. Placing a value on ecosystem services is difficult, but necessary since natural capital cannot be separated from human welfare (Costanza et al., 1997). In other words, we value the ecosystem in every decision we make. The total economic value of ecosystem services include: use values and non-

use values. The use values are further defined as direct use value, indirect use value, or option value (Freese, 1998). Direct use can be either consumptive or non-consumptive.

Non-consumptive use values capture the active enjoyment of nature to humans (Campbell and Smith, 2006). Estimating non-consumptive use values is challenging because they are not captured in a traditional market system. The contingent valuation method (CVM) is the most commonly used method for directly estimating non-market values. Contingent valuation can be used to determine whether or not non-consumptive use values for wildlife can be translated into market values.

This method has been used for decades, but controversy still exists over whether CV results accurately reflect an individual's willingness to pay. A limitation of the method is that the results are not reliable, meaning that they are not reproducible (Hanemann, 1994). People also have a tendency to want to be altruistic and inflate their stated value. This is called the "warm glow" effect; people say yes because they feel good about giving to a social good (Mitchell, 2002). Income and WTP are often positively correlated, since environmental goods are viewed as luxury goods, this can result in the "income effect", where a low-income respondent may say no, even if they value the good, since it is not a necessity in their life. Familiarity with the good can also skew results (Carson et al., 2001). Most individuals are not practiced at valuing non-market goods, so their answers may not reflect their true WTP.

On the other hand, CV is a very flexible tool. It can be used to quantify values for almost any good (Lipton et al., 2005). It is one of the only methods that can measure the total economic value of a good. The results of CV studies are easy to analyze and commonly presented as mean, median, or aggregate values. CV is the most widely used

method for measuring the value of non-market goods. Its widespread use has led to the development of better methodology so that questions yield more valid and reliable results.

## **2.0 METHODS**

### **2.1 Survey Development**

Survey development began in May 2007. The survey design was a collaborative effort between Duke University and Oceana, an environmental non-governmental organization. We used the contingent valuation method (CVM) to address our main objective of quantifying divers' willingness to pay to actively enjoy seeing sea turtles, sharks, and coral reefs while diving. We chose a web-based survey to reach a large number of people in a short period of time. After finalizing the logistics of our survey, we received approval to proceed from The Institutional Review Board for the Protection of Human Subjects in Non-Medical Research at Duke University.

#### **2.1.1 Focus Group**

We held a focus group, composed of certified divers from Oceana's Washington, D.C. office, on June 18, 2007. Seven divers attended the focus group to share their thoughts on marine resource conservation from a diver's perspective and to help us design clearly worded questions. The group met in the Oceana conference room for one hour.

Focus group members represented a range of ages from 21 to over fifty-years old. The group was very experienced; the majority of participants had been on over 100 dives. California, Florida, and Texas were some of the participants favorite dive spots in the

U.S. When selecting dive locations the group identified coordination with other travel, cost, and the characteristics of the dive site as the most important traits.

The marine wildlife that focus group members most enjoyed seeing were sharks and corals. Whale sharks and “human-size” fish were species that some members had never seen, but really wanted to see. The group also emphasized that diverse, healthy coral reef ecosystems made the best dive sites. All divers were interested in seeing a variety of species on their dives.

After learning about their personal diving preferences, we asked the group how they perceive the role of divers and the dive community in conservation. Focus group members saw divers as an untapped resource; they did not feel the community was as involved as it should be in the conservation movement. They believed that dive masters and guides need to be encouraged to emphasize the conservation aspects of respectful, ‘eco-friendly’ scuba diving.

During the focus group the participants answered the three WTP questions on the computer. We asked for follow-up comments in person. The focus group members advised us to make it clear in the WTP questions that the wildlife would be experienced naturally, without the use of food provocation. They felt that stating a base cost of the dive trip that their contribution would be in addition to would yield more accurate responses. They also thought that there should be open-ended follow-up questions for comments after each WTP question.

### 2.1.2 Question Design

To answer our main research questions, divers' attitudes towards conservation and willingness to pay for encounters with marine life, we relied on two common survey methods: the Likert-like scale and the contingent valuation method.

To assess the divers' environmental attitudes we used the Likert-like scale, in which divers rate their agreement with a statement on a five point scale from low to high.

To measure the divers' WTP we employed the contingent valuation method. Contingent valuation translates non-market values into a dollar amount by asking respondents to state their maximum willingness to pay for a good in the context of a hypothetical scenario. The survey included a WTP question for each of our three focal species: sea turtles, sharks, and coral reefs.

We focused on estimating values for sea turtles, sharks, and coral reefs because they are all threatened by direct human pressure. Oceana has major campaigns dealing with protecting all of these species: 'Save Sea Turtles', 'Safeguard Sharks', and 'Stop Destructive Bottom Trawling'. Sea turtles are protected species and their survival is threatened by interactions with fisheries, pollution, and habitat loss. Sea turtles have a consumptive use value for their eggs and meat which can be quantified in the market. Sharks suffer from interactions with commercial fisheries, too, as both a target and non-target species. Sharks' consumptive use value comes primarily from their fins and liver oil. Coral reefs have been destroyed by fisheries using bottom trawling and dredging gear. A consumptive use value for coral species comes from sponge and coral harvests for commercial and private use.

Sea turtles, sharks, and coral reefs all have non-consumptive use values, in addition to their consumptive use values. These values are much harder to quantify and traditional market economic analyses do not capture non-consumptive use value. Sea turtles, sharks, and corals have non-consumptive use values to divers based on their active enjoyment of diving with these species.

### 2.1.3 Pre-test

The final survey was twenty-five questions long. The questions fell into four main types: demographics, diving experience, attitudes towards conservation, and willingness to pay. We conducted a pre-test of the survey online to check question content and to work out any technical glitches with the ViewsFlash 3 by Cogix online-survey software. Our friends and family members with diving certification were recruited to take part in the pre-test. Eleven people participated in the pre-test by our July 10, 2007 cutoff.

### 2.1.4 Sampling Frame

Certified scuba divers comprised the sampling frame for this survey. The sample was non-random and non-representative of the general U.S. population, but was fairly representative of the diver population. We chose to target divers as our unit of analysis because divers share a unique perspective on the marine environment which yields a non-consumptive use for marine resources. Divers presumably pay to go diving (market value) because they actively enjoy seeing marine species and habitats and value them for this non-consumptive service (non-market value).

## 2.2 Survey Implementation

We implemented the survey online because it could be housed on Oceana's website and be accessible to many divers in a short period of time. We left the poll open for nine weeks, from July 23 to September 30, 2007.

We publicized the link via e-mail. We emailed the link to the survey ([www.oceana.org/diversurvey](http://www.oceana.org/diversurvey)) to several diver listservs: scubaboard, singledivers, divenewswire, techdiver-SE, atlanticdiver, dc-scuba, floridawreck-tech, e-divers, paquarrydivers. Contacts at three universities helped distribute the link by sending an e-announcement to their respective university's listserv (Nova Southeastern University, University of Miami, and Duke University). Oceana's Dive Wavemakers, the e-activist group, were alerted about the survey and Oceana published a press release on their website to further advertise the survey.

The link was forwarded on to more listservs and private addresses. Forwarding coupled with the fact that divers' are likely to be members of multiple listservs meant that we could not estimate how many individuals were contacted to take the survey. Thus, we could not calculate a response rate.

## 2.3 Sources of Error

Web-based surveys can bias a sample since they lack universal access and random sampling. Our sample frame was certified scuba divers, and since diving is an expensive activity, we were already working with a privileged group. Under the assumption that our non-random sample of divers would have a higher education-level and income, and, therefore, more computer access than the general public, we concluded that a web-based survey would be able to capture a representative sample of divers.

Web-based surveys bias participation, in that respondents are self-selecting. Divers had to choose to take our survey and divers who are interested in conservation are more likely to put forth this effort. It is possible that the results overstate a positive attitude toward conservation in the dive community. But given the high initial investment costs of the sport, an initial value for and interest in the marine environment has already been stated by divers.

#### 2.4 Methods of analysis

A log distribution censored regression model was fitted to explain the variation in WTP. A completely censored regression model is a maximum likelihood (ML) estimation procedure that has been shown to avoid the biases associated with the ordinary least squares (OLS) regression. The OLS model assumes interval midpoints as the approximate expected WTP value; however, the expected value is not necessarily equal to the midpoint. ML estimation uses an “interval regression” method, rather than a “midpoint method”, making it better suited for payment card data (Cameron and Huppert, 1989).

The independent variables included in the model were: state, number of years since certification, number of dives completed in lifetime, gender, age, education, and income. A log-normal distribution was assumed for the interval data variables: WTP, years certified, age, and income.

### 3.0 RESULTS AND DISCUSSION

#### 3.1 Response

In the nine weeks the survey was open, 804 people accessed the survey link. Five-hundred and sixty-three divers completed the survey, for a 70% completion rate. Our analysis is focused on the 504 divers from the United States, as Oceana was most interested in U.S. divers' invested in U.S. conservation.

#### 3.2 Demographics

Respondents were from thirty-eight states and Washington, DC. Divers were not evenly distributed throughout the states; Florida (30%) and California (11%) had the highest percentages of respondents (Figure 1). Florida's dominance was most likely due to circulating the link through Nova Southeastern University and the University of Miami email lists.

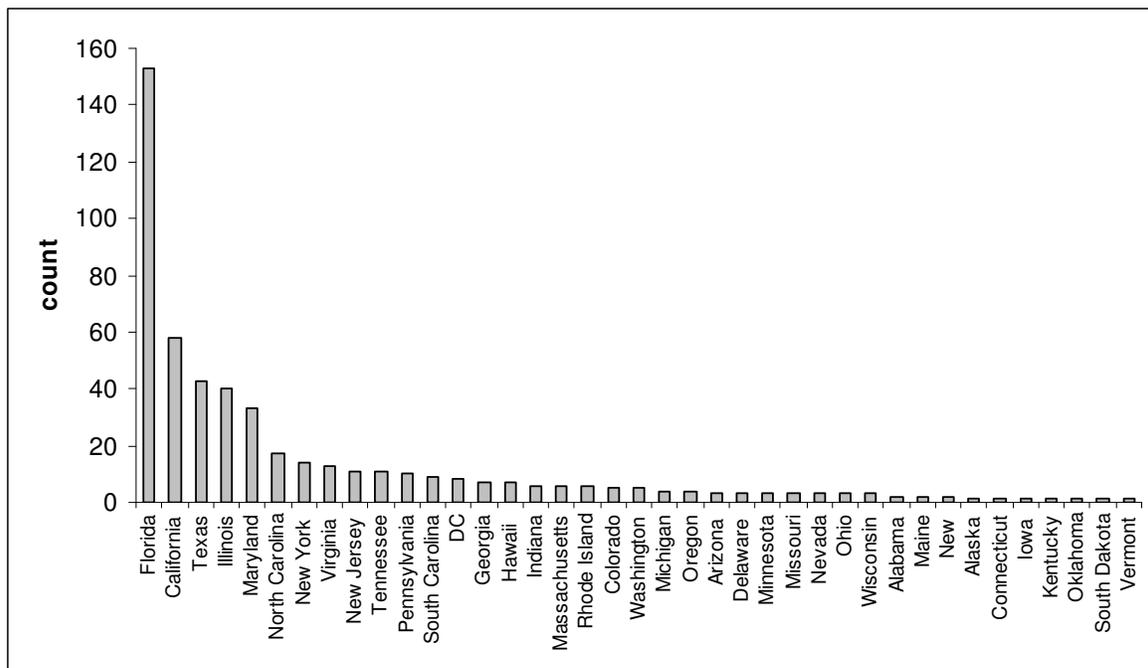
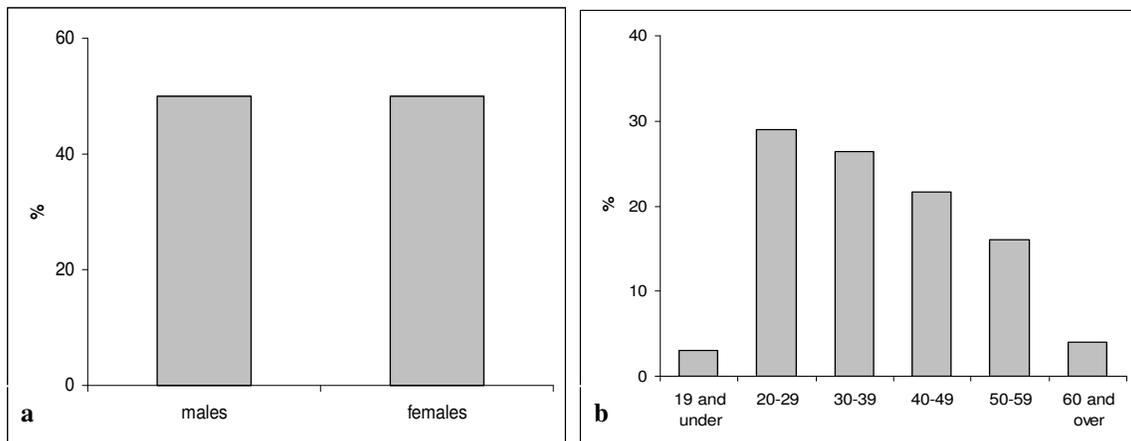


Figure 1. Frequency distribution of US respondents by state (n=504).

The Diving Equipment and Marketing Association's (DEMA) profile of active divers in the U.S. also found Florida to have the highest percentage of divers (DEMA, 2006). Florida attracts divers because of its location and abundance of dive sites and divers. Interestingly, two non-coastal states, Illinois and Tennessee, ranked in the top ten states.

Males and female respondents were nearly equal. Males composed 50.1% and females 49.9% of the sample population (n=499) (Figure 2a). The median age group was 30-39 (n=500). The under 20-bracket was the least represented (Figure 2b). The majority of respondents had completed schooling up to the undergraduate level or higher (86.9%, n=496) (Figure 2c). Completed undergraduate degree was the median education level. The median household income bracket was US\$60,000-79,000 (n=496) (Figure 2d).



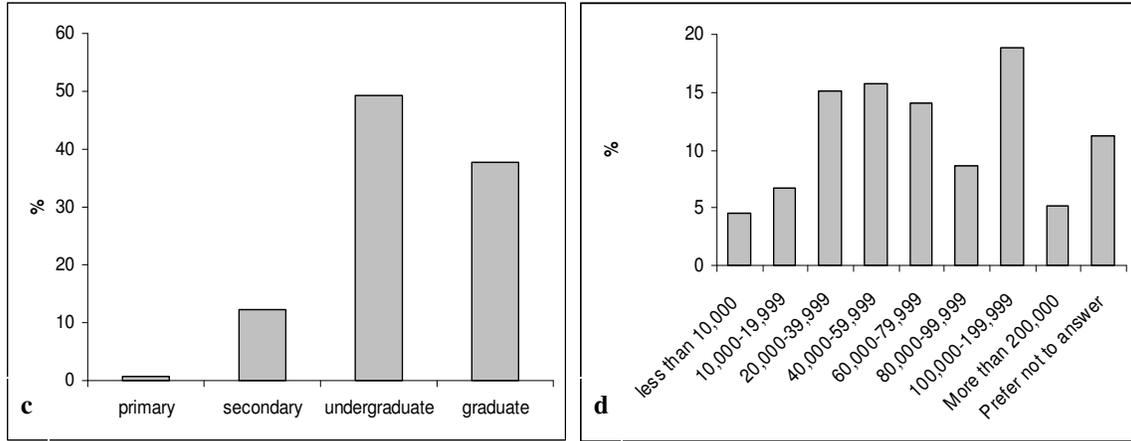


Figure 2. a. Gender distribution of US respondents (n=499). b. Age distribution for US respondents (n=500). c. Distribution of highest level of education completed by US respondents (n=496). d. Distribution of household income for US respondents (n=489).

### 3.3 Experience

Respondents were generally very experienced scuba divers. Forty-percent had been certified for more than ten years (n=503) and over half had been on more than 100 dives (n=504). The frequency of diving in a typical year was fairly evenly distributed. Approximately thirty-percent dove less than 5 times a year or 5-20 times a year (n=502). The remaining 40% were split between 21-50 dives a year and over 50 times a year. Fifty-six percent of respondents said they dive in the U.S. more than 50% of the time (n=501). Nearly two-thirds of respondents reported researching their trips for six hours or less (n=500).

### 3.4 Attitudes

To gauge their attitudes toward conservation, divers were asked three Likert-like scale questions and two ranking questions. Respondents tended to agree that divers play an active role in conservation (Table 1). Respondents' views were more ambiguous about whether dive tourism is good for the ocean's health (Table 1). When asked

whether the U.S. government sufficiently protects its dive sites, most divers disagreed (Table 1).

Table 1. Response percentages to three Likert-like scale environmental attitudes questions.

|                   | Divers are active<br>conservationists<br>(%) | Dive tourism is<br>good for ocean<br>health (%) | U.S. government<br>protects dive sites<br>sufficiently (%) |
|-------------------|--|---|--|
| strongly agree    | 45.8   | 18.6  | 2.4  |
| agree             | 36.3   | 36.0  | 11.5   |
| neutral           | 8.4  | 27.8  | 26.4   |
| disagree          | 4.0  | 12.8  | 45.7   |
| strongly disagree | 5.6  | 4.8   | 14.1   |
| n                 | 502  | 500   | 497  |

Survey respondents were asked to rank their desire to see seven types of marine life, with 1 being the organism they wanted to see the most while diving and 7 being the organism they wanted to see the least. Sharks received the most number one votes (143), followed closely by marine mammals and coral and other invertebrates (139 each) (Table 3). Sea turtles were fourth for number one votes (121), but received the most second and third place votes. Marine plants were the least desired type of marine life, with 242 seventh place votes (n=504).

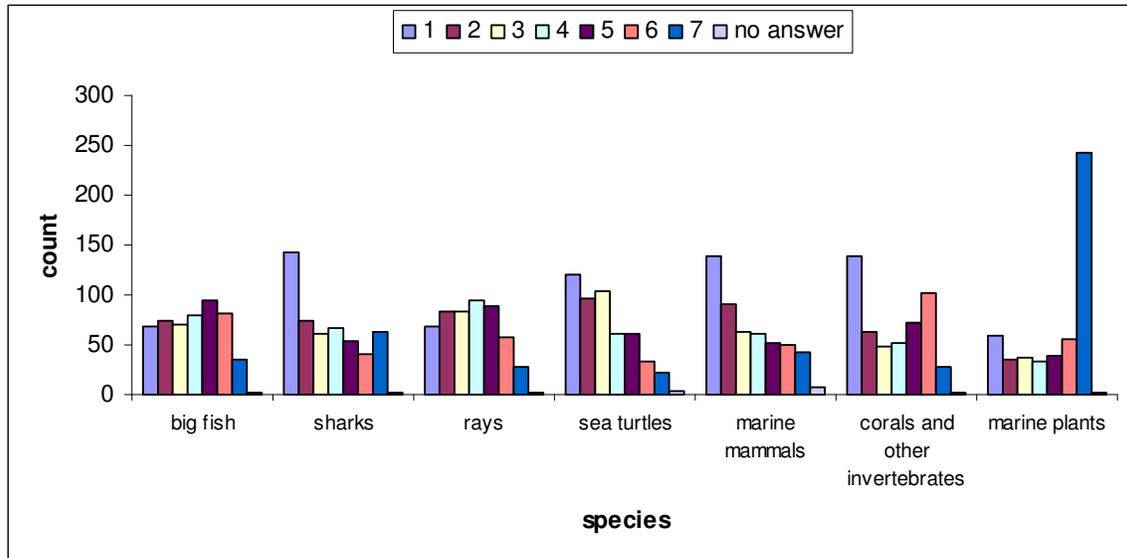


Figure 3. Ranking tallies for which types of marine life US respondents most wanted to see while diving (n=504).

A second ranking question asked which threat to ocean health respondents saw as the most damaging. The most damaging threat was given a one and the least damaging a five. Pollution was the most severe threat, with 232 number one votes (Figure 4). Unsustainable fishing ranked second most often (131) and loss of habitat was perceived as the third most damaging threat to the health of the ocean (118). Loss of biodiversity received the most fourth place votes (135). Climate change was ranked fifth most damaging (153) (n=504).

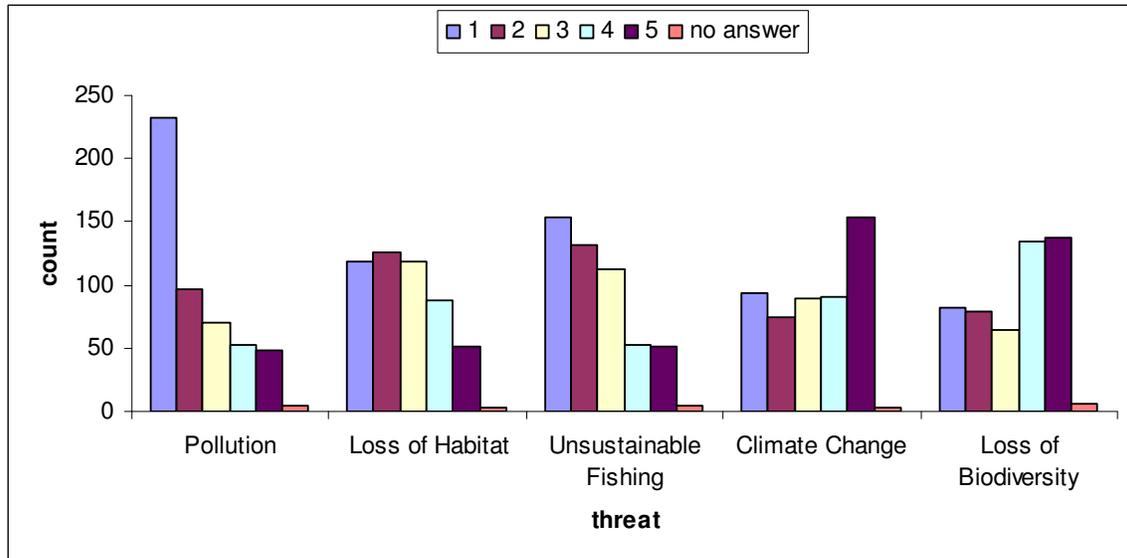


Figure 4. Ranking tallies for which environmental threats US respondents view as most damaging to ocean health (n=504).

### 3.5 Willingness to Pay

#### 3.5.1 Sea Turtles

Box 1. Sea turtle willingness to pay question text.

Assuming that your dive expenses total \$100, what is the maximum amount in addition to your current dive costs that you would be willing to pay to increase your likelihood of seeing a sea turtle in the wild?

The response rate to the willingness to pay (WTP) to dive with sea turtles question was high (97.8%, n=493). Most divers were willing to pay for an increased likelihood of swimming with a sea turtle in the wild, 76% were willing to pay an additional amount and 24% said they would not pay more. The mean WTP was US\$29.63 (Table 2). Aggregated across the conservative estimate of 1.2 million divers<sup>1</sup> in the U.S. the value of seeing a sea turtle is US\$35.5 million per dive.

<sup>1</sup> Diver population estimated taken from Davison, B. 2007. How many divers are there?—and why you should care. *Undercurrent* (5). The estimated range of divers in the U.S. is 1-3 million.

Table 2. Descriptive statistics for sea turtle willingness to pay question.

|                    |       |
|--------------------|-------|
| n                  | 493   |
| mean               | 29.63 |
| standard error     | 2.98  |
| median             | 10    |
| mode               | 0     |
| standard deviation | 66.27 |
| sum                | 14610 |
| minimum            | 0     |
| maximum            | 500   |

Of the 378 respondents who were willing to pay an additional amount, about three-quarters had seen sea turtles in the wild before. Another 9.3% wanted to support sea turtle conservation because they had never seen a turtle while diving. The most common reason given by divers that were not willing to pay an additional amount was that they had already seen sea turtles while diving (41.5%).

We ran a censored regression to see if results from other questions would help explain the variation in willingness to pay. The number of dives a respondent had completed in their life and gender were the two variables that significantly explained the variation in the sea turtle WTP (Table 3).

Table 3. Censored regression output for the sea turtle WTP question using the model:  $wtp = \beta_0 + \beta_1state + \beta_2years\ since\ certification + \beta_3dives\ completed + \beta_4gender + \beta_5age + \beta_6education + \beta_7income + e$ .

|                 | coefficient | z-value  |
|-----------------|-------------|----------|
| intercept       | 1.1545      | 10.5147  |
| state           | -0.04789    | -0.6559  |
| years certified | -0.00339    | -0.0583  |
| life dives      | -0.15366    | -3.0088* |
| gender          | -0.10141    | -2.761*  |
| age             | -0.0104     | -0.2004  |
| education       | 0.03254     | 0.6625   |
| income          | 0.08643     | 2.2609   |

\* indicates  $p < 0.05$

Divers who had completed fewer dives in their lifetime were willing to pay more than experienced divers (Figure 5). Females were willing to pay more to see sea turtles than males. Females' mean WTP was US\$42.82 and males' was US\$35.56.

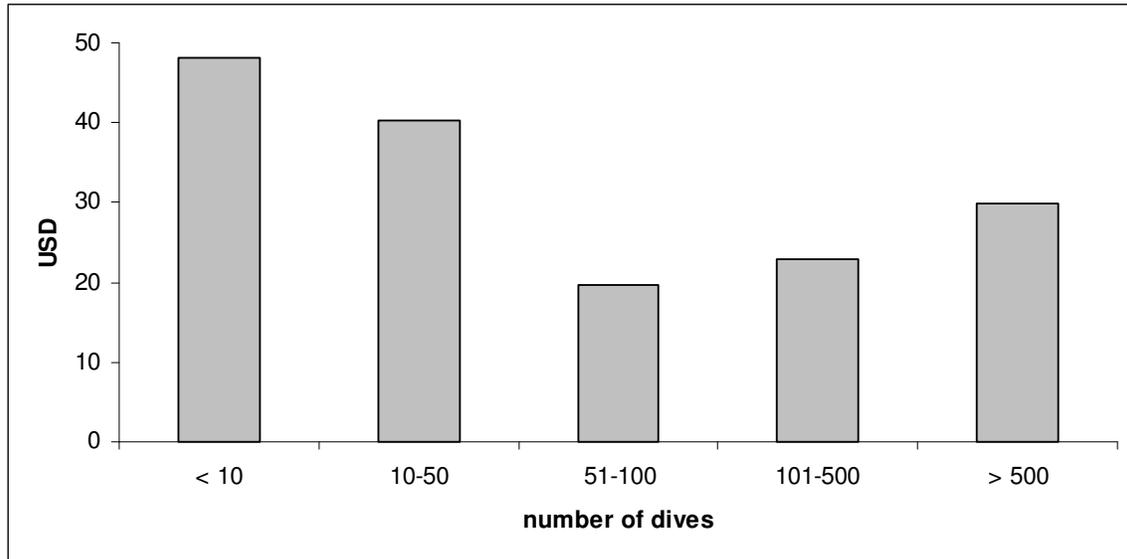


Figure 5. Divers' mean WTP to see sea turtles based on the number of lifetime dives completed (n=487).

### 3.5.2 Sharks

Box 2. Shark willingness to pay question text.

Assuming that your dive expenses total \$100, what is the maximum amount in addition to your current dive costs that you would be willing to pay to increase your likelihood of seeing a shark in the wild?

The response rate to the willingness to pay to dive with sharks question was 96.6% (n=487). Seventy-one percent of divers were willing to pay an additional amount to see sharks. One-hundred and forty-one divers (29%) said they would not pay more to see a shark. The mean WTP for sharks was US\$35.36 (Table 4). The aggregate mean was US\$42.4 million.

Table 4. Descriptive statistics for shark willingness to pay question.

|                    |       |
|--------------------|-------|
| n                  | 487   |
| mean               | 35.36 |
| standard error     | 3.40  |
| median             | 10    |
| mode               | 0     |
| standard deviation | 75.07 |
| sum                | 17220 |
| minimum            | 0     |
| maximum            | 500   |

Of the 346 respondents who were willing to pay an additional amount just over three-quarters had seen sharks in the wild before. Another 15.3% said they would pay more to see a shark in the wild because they had never seen a shark while diving. The most common reason given by divers that were not willing to pay an additional amount was that they had already seen sharks while diving, 41.8%, followed by there is no guarantee of seeing a certain species on a dive, 33.3%.

In the censored regression model no variables significantly explained the variation in willingness to pay to see sharks (Table 5).

Table 5. Censored regression output for shark WTP using the model:  $wtp = \beta_0 + \beta_1state + \beta_2years\ since\ certification + \beta_3dives\ completed + \beta_4gender + \beta_5age + \beta_6education + \beta_7income + e$ .

|                 | coefficient | z-value |
|-----------------|-------------|---------|
| intercept       | 1.19646     | 9.554   |
| state           | 0.02805     | 0.306   |
| years certified | -0.04198    | -0.648  |
| life dives      | -0.08451    | -1.49   |
| gender          | -0.0608     | -1.563  |
| age             | -0.00622    | -0.115  |
| education       | 0.02242     | 0.0536  |
| income          | 0.03293     | 0.837   |

### 3.5.3 Corals

Box 3. Coral reef willingness to pay question text.

What is the maximum amount that you would be willing to pay as an entrance fee to dive in a protected location, assuming that the money is going to a coral reef habitat protection fund, to see an intact, healthy coral reef ecosystem rather than an unhealthy coral reef ecosystem?

The response rate to the willingness to pay to protect coral reef ecosystems was 96.8% (n=488). Most divers were willing to pay for coral reef habitat protection, 95.6% were willing to donate to the fund, and just 4.3% said they would not be willing to donate money to support coral reef habitat protection. The mean WTP for coral reef ecosystems was US\$55.35 (Table 6). The aggregate mean was US\$66.2 million.

Table 6. Descriptive statistics for coral reef willingness to pay question.

|                    |       |
|--------------------|-------|
| n                  | 488   |
| mean               | 55.35 |
| standard error     | 4.07  |
| median             | 25    |
| mode               | 25    |
| standard deviation | 89.73 |
| sum                | 26960 |
| minimum            | 0     |
| maximum            | 500   |

Of the 467 respondents who were willing to pay, almost three-quarters viewed coral reefs as an essential component to the marine ecosystem. The most common reason given by divers that were not willing to pay to protect coral reefs was that they could not afford to donate, 90.5%, followed by they had already seen intact corals, 57.1%.

In the regression model, three variables were statistically significant ( $p < 0.05$ ) to explain the variation in willingness to pay to protect coral reefs: lifetime dives, gender, and income (Table 7).

Table 7. Censored regression output for the coral WTP question using the model:  $wtp = \beta_0 + \beta_1 \text{state} + \beta_2 \text{years since certification} + \beta_3 \text{dives completed} + \beta_4 \text{gender} + \beta_5 \text{age} + \beta_6 \text{education} + \beta_7 \text{income} + e$ .

|                 | coefficient | z-value |
|-----------------|-------------|---------|
| intercept       | 1.2851      | 15.073  |
| state           | 0.0192      | 0.336   |
| years certified | -0.0414     | -0.935  |
| life dives      | -0.1039     | -2.799* |
| gender          | -0.1006     | -3.628* |
| age             | -0.0337     | -0.925  |
| education       | 0.0503      | 1.311   |
| income          | 0.0587      | 2.067*  |

\* indicates  $p < 0.05$

The number of lifetime dives a respondent had completed significantly explained variation in coral reef WTP values. The less experienced divers were willing to pay the most (Figure 6).

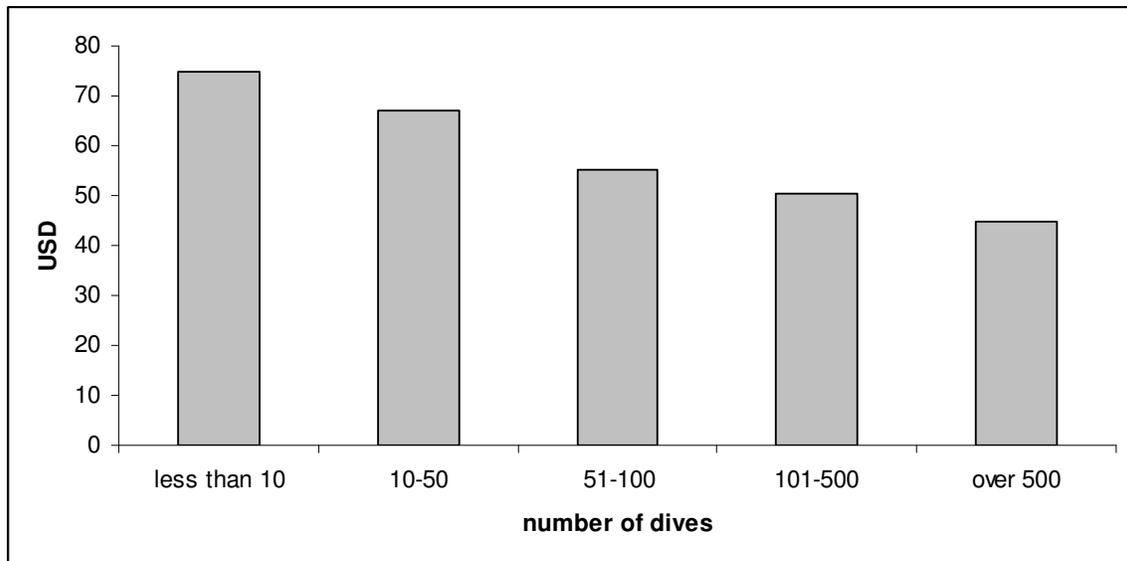


Figure 6. Divers' mean WTP to protect coral habitat based on the number of lifetime dives completed (n=484).

Females were willing to pay more on average than males. Female mean willingness to pay to protect coral habitat was US\$66.14 and male was US\$49.00

(n=465). This may be an artifact of over-sampling females, since our female diver sample was twice what DEMA found in their survey.

The income coefficient was positive, indicating that willingness to pay increases with income. The higher income respondents were willing to pay more to the coral reef habitat protection fund.

### 3.6 Discussion

#### 3.6.1 Demographics

Overall the demographic results indicated our sample of divers was representative. The respondents were fairly representative of U.S. divers in comparison to a Diving Equipment and Marketing Association (DEMA) survey of active divers (DEMA, 2006). Our survey and DEMA's found the highest proportions of divers were from Florida and California. The median age DEMA found was 46 and our median range was 30-39. Our median income range was US\$60,000-79,999, which overlapped with the DEMA median income range, US\$75,000-100,000. The only major discrepancy between the two studies was that females were over-represented in our survey. DEMA's gender ratio was 76:24 males to females and our ratio was 50:50.

#### 3.6.2 Attitudes

Divers' perceptions of the environment and their sport revealed interesting preferences. Cottrell and Meisel (2003) found "perceived knowledge about marine environmental issues" was a strong predictor for diver responsibility. From the environmental attitude questions we learned that respondents see divers as active

conservationists. This indicates that there is diver interest in conservation and that divers could be a good community to reach out to for supporting conservation efforts.

Divers' views about the effect of scuba diving on the ocean's health were not clearly positive or negative. This ambiguity about the effect of their sport on the ocean shows that some divers are self-critical and admit that there are neutral or negative impacts of scuba diving. To minimize the negative impacts of diving, further research should be conducted on the ecological effects of diving and divers should be educated on safe diving practices. Divers told to be respectful of the marine environment in a face to face contact, rather than by reading it, are generally more responsible (Cottrell and Meisel, 2003).

Divers felt that the U.S. government did not sufficiently protect U.S. dive sites. This displeasure with government action, offers a direction at which to target the previously stated diver interest in conservation. Divers ranked pollution as the biggest threat to the health of the oceans. This highlights a potential campaign for which to draw support from divers.

### 3.6.3 Willingness to Pay

Although most divers did value conservation, with approximately 70% or more willing to pay an additional amount to see turtles, sharks, and corals; it was the less experienced divers who were willing to pay the most to see sea turtles and corals. Lower values for experienced divers may be explained by a possible checklist mentality and desire to see new species by the more experienced divers. The experienced divers may also have a better understanding that there is no guarantee of seeing a certain species on a given dive.

Divers were willing to pay more to see sharks than they were to see sea turtles. Perhaps, the dangerous persona of sharks is more alluring to thrill seeking divers or sea turtles are more commonly encountered. Males' mean willingness to pay to see sharks was slightly (but not significantly) higher than females, US\$52.07 and US\$47.89, respectively. Some divers questioned the basis of the sea turtle and shark questions because they interpreted an increased 'likelihood of seeing' as chumming or soliciting the animals in some unnatural manner. This interpretation may have lowered the WTP values for sea turtles and sharks.

The ecosystem-based coral reef question had the highest mean willingness to pay value. During the focus group, participants also lauded the concept of ecosystem protection. The coral reef question was clearer with a more detailed hypothetical scenario. The question phrasing may have encouraged divers to contribute more because it contained the most detail about how the money would be used (e.g. habitat protection fund). The coral reef question highlighted females, less experienced and wealthier divers as the most willing to pay to protect coral habitat.

#### **4.0 CONCLUSIONS**

This study has shown that divers have the potential to make valuable contributions to marine conservation. Aside from their consumer surplus, they see themselves as conservationists and are a good stakeholder group for non-governmental organizations to partner with. Another way to capture diver interest is for divers to mobilize themselves and form diver alliances. While valuable as partners in conservation, divers still need to be educated on the impacts of diving on the ocean; many divers stated neutral or negative feelings about whether dive tourism is good for the

ocean. The U.S. government is a target at which to direct diver interest, given diver dissatisfaction with U.S. government dive site protection.

Sea turtles and sharks do have a non-consumptive use value to divers and we need to develop ways to capture the value. Further research should also be conducted to understand the motivations behind those who were not willing to pay. Divers were willing to pay on a per dive basis, so one way to capture the value would be for NGOs to partner with private dive operators to establish conservation funds for the increased diving fees to go towards. Alternatively, NGO's could establish their own funds and solicit donations from divers.

Coral reef ecosystem protection is also valued by divers. Divers had many species of interest and were willing to pay the most for ecosystem-level protection. Therefore, ecosystem-based management strategies should be encouraged. Integrated management that incorporates complete economic analyses of both market and non-market values for ecosystem services should be promoted for better informed management decisions.

## ACKNOWLEDGEMENTS

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## APPENDIX A: DIVER CONTINGENT VALUATION SURVEY

We are conducting a research project to assess how divers value sea turtles, sharks and corals. If you choose to participate, it will take about 10 minutes to complete the survey. Your participation is voluntary and your responses will be kept anonymous. You are free to skip any questions that you do not feel comfortable answering. After submitting the survey you will have the option to enter a contest to win an Oceana t-shirt! The t-shirt contact information will be kept completely separate from your survey. If you have any questions please feel free to contact me at: [lisa.white@duke.edu](mailto:lisa.white@duke.edu). Thank you very much for your help!

- 1      Where do you live?
  0. No answer
  - 1-51. states in alphabetical order plus DC
  52. Canada
  53. Caribbean
  54. Other
  
- 2      How many years has it been since you were first certified to dive?
  0. No answer
  1. I am not certified
  2. 0-5
  3. 6-10
  4. 11-20
  5. over 20
  
- 3      How many dives have you made in your life?
  0. No answer
  1. less than 10
  2. 10-50
  3. 51-100
  4. 101-500
  5. over 500
  6. Don't know
  
- 4      How many times do you go diving in a typical year?
  0. No answer
  1. less than 5
  2. 5-20
  3. 21-50
  4. over 50
  
- 5      What percentage of your dive trips have you done in the U.S.?
  0. No answer
  1. 0-25%
  2. 26-50%
  3. 51-75%

4. 76-100%
- 6 How much time do you spend researching your dive trips before you go?
0. No answer
  1. 0-2 hours
  2. 3-6 hours
  3. 7-10 hours
  4. over 10 hours
- 7 What influences you the most when selecting a dive location? (select one)
0. No answer
  1. Quality of ocean health at site
  2. Coordination with another trip
  3. Location
  4. Season
  5. Attractions in addition to diving
  6. Cost
  7. Other
- 8 Using each number only once, please rank the following seven types of marine life in terms of what you most want to see when you dive. Give your most desired species a rank of "1" and your least desired a rank of "7".

1      2      3      4      5      6      7

- Big fish (e.g. grouper)
- Sharks
- Rays
- Sea turtles
- Marine mammals
- Corals and other invertebrates
- Marine plants

Please select one response that best describes your feeling on the following three statements.

- 9 Divers play an active role in ocean conservation.
0. No answer
  1. strongly disagree
  2. disagree
  3. neutral
  4. agree
  5. strongly agree
- 10 Dive tourism is good for the health of the ocean.
0. No answer
  1. strongly disagree
  2. disagree

- 3. neutral
- 4. agree
- 5. strongly agree

11 Dive sites in the U.S. are sufficiently protected by the government.

- 0. No answer
- 1. strongly disagree
- 2. disagree
- 3. neutral
- 4. agree
- 5. strongly agree

12 Using each number only once, please rank the following 5 threats according to how damaging you feel they are to the health of the ocean. Give the most important a rank of “1” and the least important a rank of “5”.

1      2      3      4      5

Pollution

Loss of habitat

Unsustainable fishing

Climate change

Loss of biodiversity

\*\*For the following willingness-to-pay questions please answer each question separately as if you have not contributed to any other question.

13 Assuming that your dive expenses total \$100, what is the maximum amount, in addition to your current dive costs, that you would be willing to pay to increase your likelihood of seeing a sea turtle in the wild?

- 0. No answer
- 1. \$0
- 2. \$5
- 3. \$10
- 4. \$25
- 5. \$50
- 6. \$100
- 7. \$500
- 8. Other (please specify)

14 a If you are willing to pay an additional amount, why?

- 0. No answer
- 1. To enhance my diving experience
- 2. I have never seen a sea turtle in the wild before
- 3. I have seen sea turtles on a dive before and would like to continue to see them
- 4. Other (please specify)

14 b If you are not willing to pay an additional amount, why not?

- 0. No answer
  - 1. I have already seen sea turtles on a dive before
  - 2. There is no guarantee that I will see a sea turtle on my dive
  - 3. I cannot afford an additional cost
  - 4. Other (please specify)
- 15 Assuming that your dive expenses total \$100, what is the maximum amount, in addition to your current dive costs, that you would be willing to pay to increase your likelihood of seeing a shark in its natural state (i.e. without feeding)?
- 0. No answer
  - 1. \$0
  - 2. \$5
  - 3. \$10
  - 4. \$25
  - 5. \$50
  - 6. \$100
  - 7. \$500
  - 8. Other (please specify)
- 16 a If you are willing to pay an additional amount, why?
- 0. No answer
  - 1. To enhance my diving experience
  - 2. I have never seen a shark in the wild before
  - 3. I have seen sharks on dives and would like to continue to see them
  - 4. Other (please specify)
- 16 b If you are not willing to pay an additional amount, why not?
- 0. No answer
  - 1. I have already seen sharks on a dive before
  - 2. There is no guarantee that I will see a shark on my dive
  - 3. I cannot afford an additional cost
  - 4. Other (please specify)
- 17 a Are you more likely to return to a dive location if during your dive you saw a sea turtle?
- 0. No answer
  - 1. Yes
  - 2. No
  - 3. Unsure
- 17 b Are you more likely to return to a dive location if during your dive you saw a shark?
- 0. No answer
  - 1. Yes
  - 2. No
  - 3. Unsure

- 18 On previous dives have you been able to distinguish healthy coral reefs from damaged?
0. No answer
  1. Yes
  2. No
- 19 What is the maximum amount that you would be willing to pay as an entrance fee to dive in a protected location, assuming that the money is going to a coral reef habitat protection fund, to see an intact, healthy coral reef ecosystem rather than an unhealthy coral reef ecosystem?
0. No answer
  1. \$0
  2. \$5
  3. \$10
  4. \$25
  5. \$50
  6. \$100
  7. \$500
  8. Other (please specify)
- 20 a If you are willing to pay an additional amount, why?
0. No answer
  1. To enhance my diving experience
  2. I believe that healthy coral reefs are essential to the marine ecosystem
  3. I have seen healthy corals and would like to continue to do so
  4. Other (please specify)
- 20 b If you are not willing to pay an additional amount, why not?
0. No answer
  1. I have already seen intact corals on a dive before
  2. It is not my responsibility to pay for healthy reefs
  3. I cannot afford an additional cost
  4. Other (please specify)
- 21 What is your gender?
0. No answer
  1. Male
  2. Female
- 22 What is your age?
0. No answer
  1. 19 and under
  2. 20-29
  3. 30-39
  4. 40-49

- 5. 50-59
  - 6. 60 and over
- 23 What the highest level of schooling you have completed?
- 0. No answer
  - 1. Primary school
  - 2. Secondary school
  - 3. College/University
  - 4. Graduate degree
  - 5. Other
- 24 What was your total household income (before taxes) in 2006?
- 1. Less than 10,000
  - 2. 10,000-19,999
  - 3. 20,000-39,999
  - 4. 40,000-59,999
  - 5. 60,000-79,999
  - 6. 80,000-99,999
  - 7. 100,000-199,999
  - 8. More than 200,000
  - 9. Prefer not to answer
- 25 How did you hear about this survey? (check all that apply)
- Wavemakers' email
  - Divers' discussion board
  - Blog announcement
  - Oceana website
  - Dive Shop/Operation
  - Newspaper or Magazine
  - Friend/Relative
  - Other (please specify)

Additional comments.(open-ended)

Thank you for participating!

## APPENDIX B: IRB APPROVAL

### Duke University Institutional Review Board for the Protection of Human Subjects

FWA No. 00000265

#### Notice of Approval of Exemption Request

Investigator(s): Lisa White  
Advisor: Lisa Campbell  
Title: Value of Sea Turtles and Sharks in the U.S. Dive Tourism Industry  
Exemption Number: 1995  
Approval Date: Tuesday, June 05, 2007  
Sponsor: Foundation/Assoc.  
Sponsor Number (if applicable):

Please note: Approval is contingent upon maintaining certification to conduct research with human subjects.

This research is exempt from further review by the IRB unless a proposed change in the research makes it no longer eligible for an exemption. For example:

-- The researchers find that there is an unanticipated risk to the subjects. (There can be no risk to subjects in exempt research.)

-- The researcher wishes to add a protected subject population such as students in the Psychology Department Subject Pool or students of the researcher.

-- The researcher wishes to change the methodology so that it no longer fits an eligible category of research activity.

If the research is no longer eligible for exemption, please contact the Human Subjects Specialist at 684-3030.

Duke University adopted a set of ethical principles to cover all research with human subjects, even exempt research, regardless of the source of funding. The principles, respect for persons, beneficence, and justice, described in the Belmont Report, can be found at

<<http://ohrp.osophs.dhhs.gov/humansubjects/guidance/belmont.htm>>

#### **Data Retention**

In accordance with Duke's Data Retention Policy, signed consent forms and other research records must be maintained for five years after the completion of the research.

< <http://www.ors.duke.edu/policies/datarete.htm>>

#### **Completed Research**

Please inform the Office for Protection of Human Subjects when the research is completed. You may send notice of completion to [ors-info@duke.edu](mailto:ors-info@duke.edu).