

**Utah Waterfowl Hunting:  
2011 Hunter Survey  
Hunter Attitudes and Economic Benefits**

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**by:**

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Of course, the approximately 500 Utah hunters who participated in our survey to one degree or another provide the backbone of the study. Their participation was essential, and is much appreciated.

# Executive Summary

## Introduction and Objectives

The Great Salt Lake (GSL), located in north-central Utah, is the largest terminal lake in North America and the namesake for Utah's largest city. It is also an important natural resource. Its wetlands and open waters are a bird and wildlife resource of hemispheric importance, and support significant fractions of the continent's total populations of a number of shorebird species. The lake is also one of the most important waterfowl breeding areas remaining in the United States, with annual waterfowl use exceeding three million birds, which is about 30 percent of all waterfowl in the Pacific and Central Flyway.

Despite the hemispheric significance of this saline lake and the potentially imminent threats to the viability of ecosystem function and integrity, there has been little work to date on the value of the ecosystem services this resource provides.

The primary objective of this study was to conduct a direct use mail survey of Utah waterfowl hunters with a goal of collecting sufficient information to provide estimates of the socioeconomic importance of waterfowl hunting on and around the Great Salt Lake and the State of Utah to the economy of Utah and the Salt Lake region. A secondary objective was to gather information on GSL hunter opinions, perceptions and concerns relating to possible threats to the long term health and productivity of the GSL ecosystem. Existing data on the economics of waterfowl hunting in Utah is primarily derived from the USFWS National Survey of Fishing, Hunting and Wildlife Watching, which is conducted every five years (U.S. Fish and Wildlife Service, Division of Economics 2008). A limitation of the USFWS survey is that the results and associated estimates of economic impact are based on a very small number of survey responses from Utah Waterfowl Hunters (19 hunters in the 2006 survey). By comparison, this study utilizes survey responses from 556 Utah Waterfowl hunters and enthusiasts.

While the USFWS no longer tracks or records Federal Duck Stamp sales by state, data from the most recent year this information was published (2004), combined with estimates by USFWS of the average ratios of active waterfowl hunters in Utah to Duck Stamp sales suggest an estimated 33,000 Duck Stamps were sold in Utah in 2009.<sup>1</sup> Only a portion of those purchasing stamps are active hunters, and the USFWS estimates that in 2009 there were 15,000 active duck and goose hunters in the state (Raftovitch, et al. 2010). A specific focus of this study is hunting in and around the Great Salt Lake. This area received during the 2010-11 season an estimated 64% of total statewide combined duck/goose hunting trips, and 50% of statewide goose-only trips.<sup>2</sup> A unique aspect of Great Salt Lake waterfowl hunting relates to the large number of private waterfowl hunting clubs located on and around the lake. While no comprehensive list of club memberships exists, based on information

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<sup>1</sup> The influence of large national retailers, such as Walmart, who sell Federal duck stamps, and the large amount of effort necessary to assign national sales to individual states led the USFWS Federal Duck Stamp Office to stop tracking sales by state in 2004. (Pers. Comm. Laurie Shaffer, Federal Duck Stamp Office. July 19, 2011.)

<sup>2</sup> Pers. Comm. Justin Dolling, Utah Division of Wildlife Resources, Waterfowl and Large Game Coordinator. July, 18, 2011)

from individual clubs, club managers, and members, it is estimated that there are approximately 750 club members, a small percentage of whom may hold membership in more than one club. These clubs and their membership represent the longstanding tradition of hunting in the area as well as reflect the substantial investment in hunting equipment and related land improvements, both in habitat quality and in infrastructure.

A comprehensive economic evaluation of the contribution of waterfowl hunting needs to include two accounting frameworks. One is regional economics or economic significance, focused on identifying cash expenditures that drive income and job levels in the regional economy. The other is a net economic value framework that includes all potential benefits from a broader social (usually national) perspective. The latter necessarily includes nonmarket and indirect benefits, such as the benefits wildlife viewers and hunters derive from their recreational activity, over and above their actual expenditure. Both perspectives are important for policy discussions and generally both accounting frameworks are utilized in evaluating public decisions, for example through an EIS process or in informing public opinion. The current study provides estimates for the direct regional economic importance of waterfowl hunting in the GSL region, and the net economic value of these activities over and above the actual cost to the hunters.

## **Data Collection**

The 2011 Utah Waterfowl Hunter Survey was designed as an end-of-season survey targeting individuals most likely to have hunted waterfowl in Utah in general and in the Great Salt Lake vicinity in particular. This survey had two distinct target populations: 1) individuals identified through membership lists of organizations tied to use or advocacy of the Great Salt Lake ecosystem, or waterfowl preservation and habitat protection (Public Sample), and 2) individuals identified as belonging to one of a number of private duck hunting clubs located on The Great Salt Lake (Duck Club Sample). The survey utilized a standard survey research procedure of repeated contacts in order to increase the final response rate (Dillman 2000).

Table ES-1 outlines the details of the survey administration for the pretest, as well as for the public and the duck club samples. Since the duck club sample consisted of verified members of the clubs, there were no undeliverable surveys in this group. The overall response rate for the survey was 61.5%, with a Public Sample response of 64.6%. This rate is well within the range of response rates for similar surveys of recreational participants, and compares favorably to the final mail participation rate for the extremely high profile and well financed 2010 U.S. Census of Population for the state of Utah of 75%. The response rate for the duck club sample (55%) was somewhat lower due to two clubs (Bear River and Ambassador) only receiving one survey mailing. These clubs were only contacted once since the first survey contact was delayed due to late annual meeting dates (Ambassador), and delays in finalizing the logistics of distributing the surveys (Bear River).

**Table ES-1. Survey Administration Statistics and Final Response Rates.**

| <b>Sample</b> | <b>Initial Mailing</b> | <b>Undeliverable</b> | <b>Delivered</b> | <b>Returned</b> | <b>Response Rate</b> |
|---------------|------------------------|----------------------|------------------|-----------------|----------------------|
| Pretest       | 81 <sup>a</sup>        | 9                    | 72               | 58              | 80.6%                |
| Public Sample | 448                    | 27                   | 421              | 272             | 64.6%                |
| Duck Club     | 411                    | 0                    | 411              | 226             | 55.0%                |
| <b>All</b>    | <b>940</b>             | <b>36</b>            | <b>904</b>       | <b>556</b>      | <b>61.5%</b>         |

<sup>a</sup> The initial pretest sample was 100. Nineteen of these were club members included in the Duck Club sample. Therefore, they are included in the club sample in this accounting.

### **Data Consistency and Weighting**

In order to check our samples for consistency with the greater Utah waterfowl hunter population we used data provided by the US Fish and Wildlife Service (Raftovitch, et al. 2010). This document reports for the State of Utah the seasonal average duck and goose harvest per hunter as well as the average duck hunting and goose hunting days afield for Utah hunters. The 2011 Utah Waterfowl Hunting Survey was designed to gather information on the number of waterfowl bagged during the season. The responses to these questions were compared to the reported USFWS statewide averages for Utah in the most recently reported year to detect any significant differences in avidity and harvest between our samples and the statewide hunter population.

A comparison of the distributions of our sample and that of the USFWS random statewide survey of Duck Stamp (HIP number) holders showed that our public sample includes a higher percentage of more avid duck hunters than does the statewide population. In order to correct for this avidity, weights were calculated based on five ranges of reported duck harvest for the year. These weights over-weighted the responses of hunters in our sample who reported bagging either no ducks or a low number, and underweighted those reporting bagging large numbers of ducks. Our weighted Public Sample is expected to be representative of Utah waterfowl hunters and has the approximate same average per hunter duck harvest as the USFWS sample.

### **Key Results – Hunter Expenditures and Economic Significance**

Utah waterfowl hunters were asked a number of questions regarding the amount they spent on their most recent hunting trip, and where they spent that money. Additionally, hunters were asked to list their total investment in equipment they specifically purchased for waterfowl hunting, and to also list what equipment purchases they have made for waterfowl hunting equipment in 2010 in the Salt Lake Area. Table ES2 shows the calculation of estimated total 2010 waterfowl hunter spending in the Salt Lake City Area and in the state. The estimates in Table ES2 utilize information from both the Public and the Private Duck Club survey expenditure questions. While Private Club hunters are estimated to comprise less than 2.5% of Utah Duck Stamp holders, this group hunts on average more days per year,

and spends nearly three times the amount per day as do non-club hunters. For this reason, separate expenditure estimates were generated using the Public hunter sample with no club members included, and the Private Club sample. These estimates of hunter trip and equipment spending are combined to estimate total waterfowl hunting trip expenditures in the SLC area, and in the state, as well as total 2010 hunting-related equipment spending in the SLC area.

Overall, it is estimated that Utah waterfowl hunters from the public sample spent an average of \$180 per trip (day) on their 2010-11 hunting trips. This estimate is similar to other studies of waterfowl hunting expenditures. In 2001 (Grado, et al.) estimated the Mississippi waterfowl hunters in 1998-99 spent \$144/day (\$194 in 2011 dollars). (Lewis, Leitch and Meyer 1998) found that North Dakota waterfowl hunters spent \$193/day (\$270 2011 dollars), and (Adams, Leifester and Herron 1997) found that Texas waterfowl hunters spent \$121/day (\$166 in 2011 dollars). The estimated spending per day is substantially higher than that reported by (U.S. Fish and Wildlife Service, Division of Economics 2008). However, the USFWS estimates were based on data from a very small number of Utah hunters (19 hunters). Other researchers have also noted the differences between their own higher waterfowl hunting expenditure estimates and that of USFWS (Grado, et al. 2001). It is estimated that Private Club hunters spent an average of \$563 per day for their 2010 waterfowl hunting trips.

The Utah Division of Wildlife Resources estimates that Duck and Goose hunters in the state hunted approximately 210,000 days during the 2010-11 waterfowl season.<sup>3</sup> Overall in 2010 it is estimated that waterfowl hunters spent \$26.5 million in direct hunting trip expenditures and \$35.4 million in other hunting equipment expenditures in the Salt Lake City Area. The estimated 2010 total is \$61.9 million in waterfowl hunting-related spending in the year in the local SLC area.

In addition to the annual spending shown in the table, Utah hunters invest in equipment. These hunters report that the total estimated value of equipment they have purchased and own specifically for waterfowl hunting (all equipment not just that purchased in 2010) cost \$157 million. These estimates do not include the very substantial market values of private duck club memberships, as well as all land and improvements owned by the clubs. These later numbers may also be conservative in that they include only the estimated 15,000 active Utah hunters estimated by USFWS for the year, and not all of those (~33,000) who bought duck stamps in 2010, but may not have actively hunted in that year.

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<sup>3</sup> Pers. Comm. Justin Dolling, Utah Division of Wildlife Resources. July 18, 2011.

**Table ES2. Estimated Utah Waterfowl Hunter Expenditures, by Location (2010 estimates)**

| Spending Area  | Expenditures per day per Hunter |              | Estimated Expenditures |              | Total Spending      |
|--|---------------------------------|--------------|------------------------|--------------|---------------------|
|  | Public Sample                   | Club Members | Public Sample          | Club Members |                     |
| <b>A) Trip Spending</b>  |                                 |              |                        |              |                     |
| Spending per day in the SLC Area   | \$104                           | \$402        | \$20,295,000           | \$6,231,000  | \$26,526,000        |
| Spending per day in Utah outside the SLC Area                                  | \$75                            | \$162        | \$14,636,000           | \$2,507,000  | \$17,143,000        |
| Total Spending   | \$180                           | \$563        | \$34,931,000           | \$8,738,000  | \$43,669,000        |
| <b>B) Equipment Spending</b>   |                                 |              |                        |              |                     |
| 2010 Equipment purchases in SLC Area   | \$2,287                         | \$3,703      | \$32,590,000           | 2,777,000    | \$35,367,000        |
| <b>C) 2010 SLC Area Spending</b>   |                                 |              |                        |              |                     |
| <i>Total Estimated 2010 Waterfowl Hunting-related Spending in the SLC Area</i> |                                 |              |                        |              | <b>\$61,893,000</b> |
| <b>D) Total Investment in Waterfowl Hunting Equipment</b>                      |                                 |              |                        |              |                     |
| Total Investment in Waterfowl Hunting Equipment                                | \$8,925                         | \$40,275     | \$127,181,000          | \$30,206,000 | \$157,387,000       |

<sup>a</sup> Total active hunter numbers for Utah are for 2009, the most current year for which estimates are available. Source: (Raftovitch, et al. 2010).

Table ES3 shows the estimated total local area economic contribution associated with the 2010 trip and equipment spending of \$61.9 million on waterfowl hunting in the SLC area. These estimates are based on total estimated direct spending of \$61.89 million and output, income, and employment multipliers for the state of Utah reported by (U.S. Fish and Wildlife Service, Division of Economics 2008). Overall, in 2010 it is estimated that spending related to waterfowl hunting in the SLC area accounted for over \$97 million in total economic output, \$37 million in personal income, and 1,600 full-time equivalent jobs.

**Table ES3. Estimated Economic Impact in the Salt Lake City Area of Waterfowl Hunting-related Expenditures, 2010**

| <b>Total Estimated 2010 Waterfowl Hunting-related Spending in the SLC Area</b> | <b>Total Output<sup>a</sup></b> | <b>Total Job Income</b> | <b>Total Full-time Equivalent Jobs</b> |
|--|---------------------------------|-------------------------|--|
| \$61,893,000   | \$97,100,000                    | \$36,800,000            | 1,600                                  |

<sup>a</sup> Output, Income, and Job multipliers are based on data presented for Utah in (U.S. Fish and Wildlife Service, Division of Economics 2008).

## Key Results – Hunter Net Economic Value (NEV)

The contingent valuation method (CVM) uses survey techniques to determine the values which people would place on traditionally nonmarket goods and services if markets did exist for these commodities. In this study, the value of a day spent waterfowl hunting in Utah is measured through the use of contingent valuation. This is the value, or benefit, that a hunter derives from hunting that is over and above what they must actually spend on their hunting trip.

The essence of the CVM approach is to ask individuals their willingness to pay (WTP) for a given service or commodity contingent on their acceptance of a hypothetical but plausible and realistic payment situation that could range from a vote in a referendum to a decision to make a donation. In the 2011 Utah Waterfowl Hunter Survey, respondents were asked the specific contingent valuation question of how they valued their most recent Utah waterfowl hunting trip.

A feature of all CVM applications is the method by which the resource value is elicited from respondents. There are several basic genres of CVM elicitation techniques including payment card CVM questions and dichotomous choice CVM questions (Champ, Boyle and Brown 2004). In the payment card CVM respondents are asked to identify the maximum amount they would be willing to pay for a good or resource from a list of amounts presented to them in the survey (Duffield and Patterson 1992). This study utilized the payment card CVM in the current trip valuation question.<sup>4</sup>

The waterfowl hunting trip contingent valuation question included in the Utah survey asked respondents their willingness to pay an additional amount in expenses to have made their trip to hunt waterfowl in Utah. The text of the CV question reads:

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The costs of going hunting change over time. For example, gas prices and other travel costs and equipment rise and fall. Was your recent waterfowl hunting trip **worth more to you than what you actually spent?**

- Yes       No

**If YES**, If your total trip costs were to increase, **what is the maximum extra amount** you would be willing to pay and still take this trip? (please choose one)

- |                                |                                  |   |
|--------------------------------|----------------------------------|---|
| <input type="checkbox"/> \$10  | <input type="checkbox"/> \$250   | <input type="checkbox"/> \$1,500        |
| <input type="checkbox"/> \$ 25 | <input type="checkbox"/> \$500   | <input type="checkbox"/> \$2,000        |
| <input type="checkbox"/> \$50  | <input type="checkbox"/> \$750   | <input type="checkbox"/> Other \$ _____ |
| <input type="checkbox"/> \$100 | <input type="checkbox"/> \$1,000 |   |

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<sup>4</sup> The payment card question format was chosen as it generally results in a conservative estimate of WTP compared to the dichotomous choice CV format (Champ, Boyle and Brown 2004).

Table ES4 shows the estimated group willingness to pay estimates derived from use of the increased travel cost payment vehicle. The interval model of willingness to pay, which was estimated using the SAS LIFEREG procedure, resulted in a good model fit.

Table ES4 shows the median WTP to take the hunters' most recent trip for both the Public Sample and for the Private Duck Club Sample. It is important to note that almost all of the trips in our sample were day trips to hunt. Accordingly, these per-trip values are also per-day values. The median WTP, which is the amount at which 50% of individual's WTP are above and 50% below, for the Public Hunter Sample is estimated at about \$76 per trip (day). For the Private Duck Club Member Sample the Median WTP is \$131 per day. The median WTP is a conservative estimate of WTP as it is often less than the mean WTP because of the influence of a relatively low percentage of individuals who are willing to spend quite high amounts for their trips.

The estimated \$76/day NEV for this study of Public Sample hunters is in the same range as other studies findings (adjusted to 2010 dollars). A study of Alberta waterfowl (Adamowicz, Phillips and Pattison 1986) estimates the mean NEV of a day of Alberta duck hunting (for U.S. residents) at \$82/day (2010 dollars). In a study of Montana Waterfowl hunting (Duffield and Neher 1991) the authors estimated median WTP per day of waterfowl hunting (in 2010 dollars) at \$61 for Montana residents and \$72 for all Montana hunters. In 2005, a study for the U.S. Fish and Wildlife Service estimated NEV/day of waterfowl hunting in Minnesota at \$42/day (again, 2010 dollars). Given the estimated 210,000 waterfowl hunting trips in Utah in 2010, the median WTP estimates for waterfowl hunting trips implies that total annual WTP is on the order of \$16.8 million. This value is over and above the amount actually spent for hunting in the state. Utah Division of Wildlife resources estimated that in the 2010-11 waterfowl season, approximately 57% of statewide duck and goose hunting days occur in the vicinity of the Great Salt Lake.<sup>5</sup> Based on this allocation it is estimated that the total NEV to hunters associated with hunting waterfowl in the vicinity of the GSL during the 2010-11 season is approximately \$9.5 million. This estimate is likely conservative in two respects. First, the measure of central tendency used is median WTP, which often is less than the estimated overall mean WTP. Secondly, the estimate assumes that Club Members spend the same proportion of their days hunting in the GSL area as do non-club members. Since club membership is specifically tied to the GSL, this likely understates that actual percentage of total Utah trips by this group taken to the GSL area.

It should also be noted, however, that the annual NEV estimate of \$9.5 million only reflects the additional value hunters place on a specific use (waterfowl hunting) of this resource. Non-hunter values which are not represented in the estimate are potentially large, and are a subject for future research.

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<sup>5</sup> Utah Division of Wildlife resources estimates that 64% of duck and combined duck-goose days are in the GSL vicinity, and 50% of goose-only days are in the GSL vicinity. The weighted average for all duck and goose hunting in 2010-11 is 57% of total days.

**Table ES4. Estimated Net Willingness to Pay per Person for a Utah Waterfowl Hunting Trip: Public Hunter Sample and Private Duck Club Member Sample.**

| <b>Statistic</b>                                   | <b>Public Hunter Sample</b> | <b>Private Duck Club Member Sample</b> | <b>Total</b> |
|--|-----------------------------|--|--------------|
| Sample Size  | 138                         | 206                                    | 344          |
| Estimated Median WTP per                           | \$75.76                     | \$130.90                               | --           |
| Estimated Days Hunted                              | 194,500                     | 15,500                                 | 210,000      |
| Total Estimated NEV-Utah Waterfowl Hunting 2010-11 | \$14,735,000                | \$2,029,000                            | \$16,764,000 |
| Total Estimated NEV-Great Salt Lake Area           | \$8,420,000                 | \$1,159,000                            | \$9,579,000  |

### **Key Results – Hunter and Trip Characteristics and Opinions**

A consistent result of the survey was that both the public hunter sample and the duck club member sample of Utah waterfowl hunters are engaged recreational populations with very high levels of participation and enthusiasm for their activity. The average public hunter had been hunting waterfowl for nearly 29 years and the average Duck Club member 38 years. Of those in the samples who reported hunting waterfowl in Utah in 2010-11, the average public hunter hunted waterfowl for 12.5 days while the average duck club member hunted 20.7 days. Further, nearly 80% or more of both groups stated that waterfowl hunting was either their favorite or one of their favorite outdoor recreational activities (Table ES5).

**Table ES5. Comparison of Duck Club Member and Public Hunter Sample, General Hunter Characteristics.**

| <b>Hunter Characteristic</b>  | <b>Statistic</b> |                      |
|---|------------------|----------------------|
|   | <b>Duck Club</b> | <b>Public Hunter</b> |
| <b>(A) All Respondents</b>  |                  |                      |
| Mean number of years waterfowl hunting  | 37.6 years       | 28.7 years           |
| Percentage of sample hunting waterfowl in Utah in 2010-11   | 98.8%            | 59.7%                |
| <b>(B) Respondents who Hunted in 2010-11</b>  |                  |                      |
| Average Number of Days Hunted in 2010-11 Season   | 20.7 Days        | 12.5 Days            |
| Average number of Ducks Bagged in 2010-11 Season  | 60.6 Ducks       | 15.5 Ducks           |
| Average number of Geese Bagged in 2010-11 Season  | 5.6 Geese        | 2.7 Geese            |
| Percent saying Waterfowl Hunting is either their Favorite, or one of their Favorite Outdoor Recreation Activities | 87.8%            | 79.5%                |

The survey also asked hunters to rate the importance of a number of possible reasons for them choosing a particular location to hunt waterfowl. Table ES6 shows the percentage of respondents in each sample who rated each of the potential reasons either “important” or “very important” to them in choosing a waterfowl hunting site. The most important reasons for both sample groups were hunting in an uncongested location, hunting in a relatively natural setting, and seeing abundant waterfowl. The least important among the reasons presented were bagging limits of ducks and geese, and the area having good “jump” or “pass” shooting.

**Table ES6. Comparison of Duck Club Member and Public Hunter Sample, Responses to Reasons for Choosing an Area to Waterfowl Hunt.**

| Reason for Choosing A Waterfowl Hunting Area   | Percent responding that the Reason was either “Very Important” or “Important.” |                      |
|--|--|----------------------|
|  | Duck Club Sample   | Public Hunter Sample |
| Bagging a limit of ducks                       | 64.8%  | 49.7%                |
| Bagging a limit of geese                       | 47.7%  | 43.1%                |
| Seeing abundant waterfowl                      | 98.8%  | 94.6%                |
| A relatively natural setting                   | 98.8%  | 95.5%                |
| Close to home                                  | 73.3%  | 71.4%                |
| Hunting over decoys                            | 95.5%  | 84.4%                |
| Good pass shooting                             | 46.7%  | 47.1%                |
| Good jump shooting                             | 15.8%  | 34.3%                |
| Uncongested with good distance between parties | 98.0%  | 98.2%                |
| Available boat launch                          | 49.8%  | 72.4%                |
| Hunting with a dog                             | 77.1%  | 58.7%                |

Both Public Sample hunters and Duck Club Member Sample hunters were asked about their level of concern regarding a number of current or potential environmental conditions that have the potential to impact the quality of waterfowl hunting on The Great Salt Lake. Overall, there was a high level of concern regarding all the presented environmental conditions (Table ES7). The highest level of concern was associated with invasive phragmites vegetation (94.7% and 96.8% either concerned or very concerned), and reallocation of waterflows from wetlands to residential or industrial development (91.1% and 92.5% reporting concern).

**Table ES7. Comparison of Duck Club Member and Public Hunter Sample Reported Levels of Concern over Environmental Issues Potentially Affecting GSL Hunting**

| Issues Affecting Waterfowl Hunting   | Percent of Sample Hunters Saying they were either “Concerned” or “Very Concerned” |                      |
|--|---|----------------------|
|  | Duck Club Sample  | Public Hunter Sample |
| Water levels in the Great Salt Lake  | 85.3%   | 85.5%                |
| Invasive phragmites vegetation   | 94.7%   | 96.8%                |
| Absence of the native marsh vegetation that attracts and feeds waterfowl                             | 89.8%   | 91.5%                |
| Loss of waterfowl habitat due to expansion of the mineral salt industry                              | 82.5%   | 86.2%                |
| Reallocation of waterflows from wetlands to residential or industrial developments                   | 91.1%   | 92.5%                |
| Algae mats due to nutrients from sewage, farm, or city runoff  | 78.4%   | 83.3%                |
| Risk associated with sewage-related toxins such as <i>e coli</i> or cyanobacteria (blue-green algae) | 70.2%   | 74.7%                |

### Key Results – Conjoint (Choice) Question Analysis

Many recreational activities, such as waterfowl hunting, are best characterized as multi-attribute. That is, decisions on whether or not to take a certain trip or engage in a specific activity at a certain time in a specific location may be influenced by many factors. The decision to hunt waterfowl may be influenced, for instance, by the expected success level of the hunt, the expected congestion to be encountered at the hunting location, the natural setting of the hunt, and, of course, the personal cost of the hunting trip. For members of the Duck Club sample, there is also a “sunk cost” factor in their choice of a hunting location in that they have a membership or hunting rights for a specific hunting location.

The results of the contingent valuation question and analysis reported above asks hunters to remember their most recent hunting trip and to assume that everything about that trip remained the same but only the cost of the trip increased. They are asked whether they would, in retrospect, have still taken that trip at that increased cost. This contingent valuation method using the payment card vehicle is an effective way to elicit willingness to pay for an overall trip experience.

An extension of this type of contingent valuation method is the choice (or conjoint) question format which recognizes that a number of trip attributes in addition to the cost of the trip may play a role in trip decisions. The specific design of the choice question, which asks respondents to choose between two hunting trips with different characteristics and costs, allows the researcher to estimate the marginal value of each specific attribute to the overall net economic value of a waterfowl hunting trip. This type of question formulation therefore moves beyond the question of what the net economic value of the entire trip is to the more refined and specific question of which attributes of a hunting trip either enhance its net

economic value or detract from that value for an individual. For example, this study investigates the marginal value of the number of ducks or geese bagged, crowding, presence of toxins and invasive plant species, and the availability of a boat launch. Figure ES1 shows a version of the choice question that was presented to Utah hunters.

**Which do you prefer—Trip A, Trip B, or “Not Hunt”?**

**Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B, or Not Hunt.** (Note that some trip characteristics conditions may be the same for Trip A and Trip B.)

| <b>Trip Characteristic</b>             |   | <b>Trip A</b>                             | <b>Trip B</b>                                   | <b>Not Hunt</b>  |
|--|---|---|---|--|
| <b>Conditions during trip</b>          | Ducks Bagged per day                        | 1 Duck                                    | 3 Ducks   | <b>I would not choose to take a waterfowl hunting trip if these were my only choices</b> |
|  | Geese Bagged per day                        | No Geese                                  | No Geese  |  |
|  | Closest other hunting party                 | 200 Yards                                 | 50 Yards  |  |
|  | Feasibility of hunting over water or decoys | Yes                                       | No  |  |
|  | Natural marsh setting                       | No, mostly vegetated with phragmites      | Yes, mostly bull rush, salicornia, and cattails |  |
|  | Water quality                               | No sewage-related toxins                  | No sewage-related toxins                        |  |
|  | Availability of dock or boat launch         | Yes                                       | Yes   |  |
|  | Your individual trip costs                  | \$50                                      | \$100   |  |
| <b>I would choose (check one only)</b> |   | <b>Trip A</b><br><input type="checkbox"/> | <b>Trip B</b><br><input type="checkbox"/>       | <b>Not Hunt</b><br><input type="checkbox"/>  |

**Figure ES1. Sample Utah Waterfowl Hunting Survey Choice Question Format.**

Many of the estimated coefficients in the estimated multinomial logit models for both the Public and Duck Club samples are statistically significant. As was expected, price has negative effect so that the higher the cost of a given trip, the less likely it will be chosen, other things equal. Bagging additional ducks and geese has a positive effect, hunting in an area of natural marsh vegetation has a positive effect, the presence of sewage-related toxins

or algae has a negative effect, and (for the Public Hunter Sample) the availability of a boat launch or dock has a positive effect on trip value. The coefficients for distance between hunting parties and the feasibility of hunting over water and decoys were not statistically significant for either sample.

Table ES6 shows the estimated marginal utility (change in WTP per trip) associated with the statistically significant attributes for the choice model estimation. The model predicts that on average an additional bagged duck is worth \$44.63 for public hunters and \$113.49 for club members, and an additional goose \$113.49 for the public sample and \$161.90 for club members. It is estimated that it is worth \$108 to Public sample hunters (and \$92.20 to Club members) to hunt in an area of natural vegetation, and that the presence of sewage-related toxins detracts substantially from the value of a trip (-\$363 for public sample and -\$558 for club members). Another way to interpret this latter value is that since the negative effect of poor water quality (-\$363 to -\$558) is so large, and substantially exceeds the average value of a trip (~\$75 to \$131), very few, if any, hunters would choose such a trip. Finally, the model predicts that it is worth \$157 to the average Public Sample hunter to hunt in an area where a dock or boat launch is available.

**Table 1. Comparison of Estimated Utility Associated with Marginal Changes in Choice Question Trip Attribute Levels: Duck Club Members and Public Hunter Sample.**

| <b>Trip Attribute</b>             | <b>Marginal Utility</b> |                             |
|-----------------------------------|-------------------------|-----------------------------|
|                                   | <b>Duck Club Sample</b> | <b>Public Hunter Sample</b> |
| Ducks bagged                      | \$ 77.44                | \$ 44.63                    |
| Geese bagged                      | \$ 161.90               | \$ 113.49                   |
| Distance to next party            | n/a                     | n/a                         |
| Hunting over water or decoys      | n/a                     | n/a                         |
| Natural marsh vegetation          | \$ 92.20                | \$ 108.10                   |
| Presence of sewage-related toxins | \$(558.19)              | \$(363.59)                  |
| Available Boat launch or dock     | n/a                     | \$ 157.22                   |

## Conclusions

The results highlighted in this Executive Summary focus on the primary objectives of the study: 1) estimation of the economic contribution of waterfowl hunter spending to the Utah and SLC economy, 2) estimation of the Net Economic Value (over and above actual trip spending) associated with Utah waterfowl hunting trips, and 3) estimation of the relative economic importance (in terms of NEV) of different characteristics of Utah waterfowl hunting trips.

Key results include a total annual economic significance in the GSL area associated with waterfowl hunting expenditures of \$97.1 million and 1,600 full-time equivalent jobs, total cumulative hunting-related equipment purchases of \$157 million, and annual net economic benefits over and above expenditures of \$9.5 million.

Key attributes associated with higher valued waterfowl hunting trips were increased ducks and geese bagged, natural marsh vegetation (no invasive phragmites), the absence of sewage-related water toxins, and the availability of a boat launch.

The tables and discussion above compare and contrast the “Public Sample” and “Private Duck Club Sample” results. Additional information on hunters’ trips, preferences, and opinions are detailed in the results sections and Appendix C of this report.

## 1.0 Introduction

The Great Salt Lake, located in north-central Utah, is the largest terminal lake in North American and the namesake for Utah's largest city. It is also an important natural resource. Its wetlands and open waters are a bird and wildlife resource of hemispheric importance, and support significant fractions of the continent's total populations of a number of shorebird species including white pelican, Wilson's phalaropes, American avocets, black stilts, white-faced ibis, eared grebes, snowy plovers, and tundra swans. The lake is also one of the most important waterfowl breeding area remaining in the United States, with annual waterfowl use exceeding three million birds, which is about 30 percent of all waterfowl in the Pacific and Central Flyway. A number of sites on the lake, including the Bear River National Wildlife Refuge and Antelope Island, are important recreational resources. There are also a number of duck hunting clubs and wildlife management areas, primarily on wetlands and open water on the south, east, and northeast shore.

The viability of this lake's ecosystem is under threat. (Adler 1999) provides an overview of past management and issues. Current threats include the possibility of additional mineral development, which entails diking of open water and wetlands and significant water withdrawals, and potential reductions in the fresh water input from the lake's primary tributary, the Bear River, due to proposed residential development, as well as proposals to build one or more dams on the Bear River. In the longer term, it is possible that climate change may also impact this resource. Reduced fresh water inputs can lower the lake level, putting island rookeries at risk from predators, and increase the salinity of the lake. This can disrupt the biological production cycle which includes brine shrimp and brine flies. Brine shrimp cysts are a sustainably-managed commercial product provided by this ecosystem.

Despite the hemispheric significance of this saline lake and the potentially imminent threats to the viability of ecosystem function and integrity, there has been little work to date on the value of the ecosystem services this resource provides. It is essential that the value of these services be estimated to inform future resource allocation decisions. While the values associated with market-related uses of water in this basin are relatively easily identified, for example for mineral extraction, residential development, or irrigation, the values provided directly by the ecosystem, including the support of avian and other wildlife, recreation, and aesthetics are largely nonmarket in nature.

It is likely that the key values provided by this lake are associated with two general types of use: direct recreational use and passive use. Direct recreational use would include birding and other wildlife observation, duck hunting, boating, and direct contact recreation. Passive use values would include the value individuals place on protecting this ecosystem, independent of their direct use, and could have several motivations. This report presents the results of a survey and analysis of one aspect of direct recreational use of the lake, waterfowl hunting.

## ***1.1 Study Objectives***

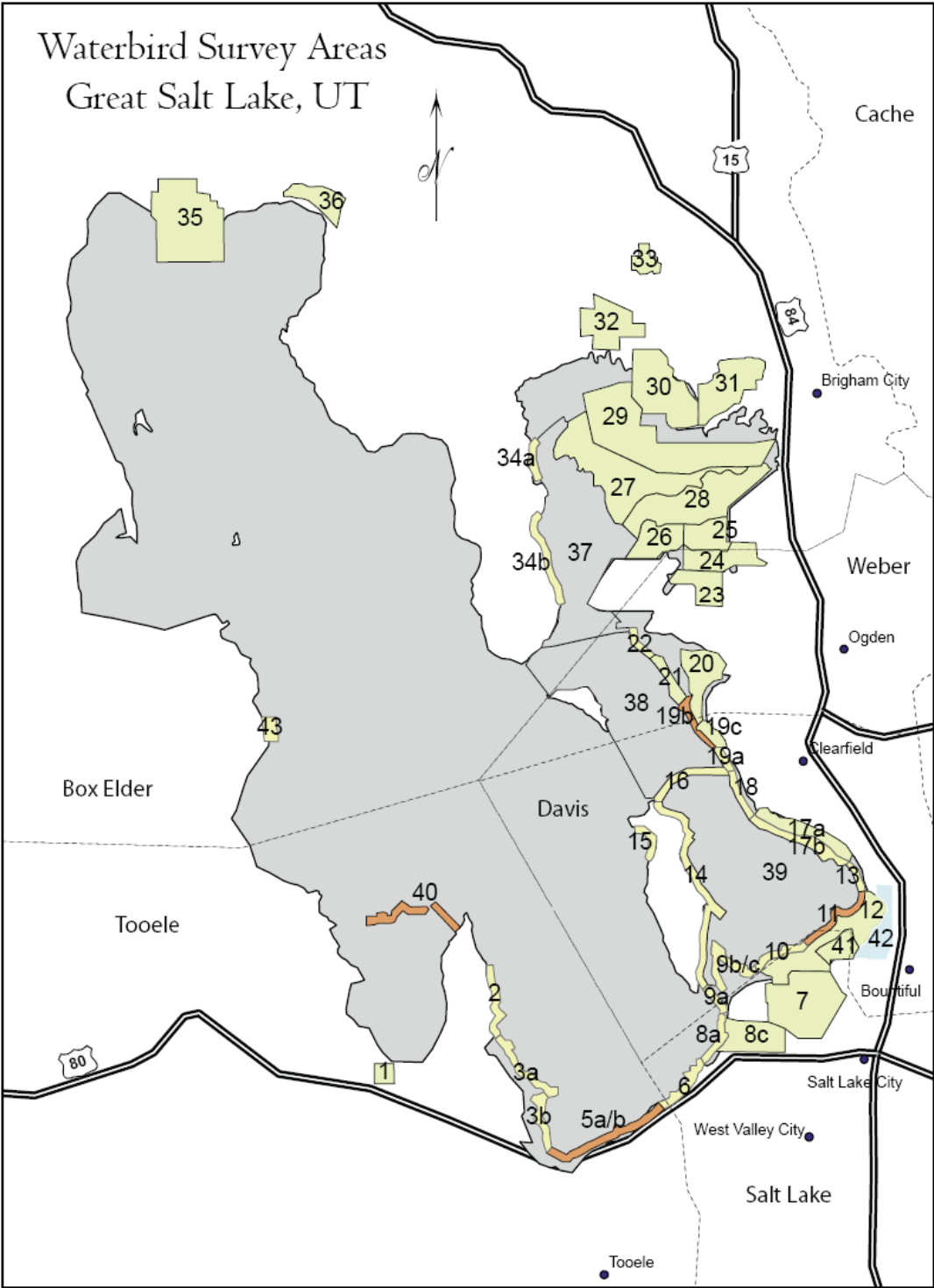
The primary objective of this study was to conduct a direct use mail survey of Utah waterfowl hunters with a goal of collecting sufficient information to provide estimates of the socioeconomic importance of waterfowl hunting on and around the Great Salt Lake to the economy of Utah and the Salt Lake region.

A secondary objective was to gather information on GSL hunter opinions, perceptions and concerns relating to possible threats to the long term health and productivity of the GSL ecosystem.

## ***1.2 Definition of Study Area***

While the 2011 Utah Waterfowl Hunting Survey asked respondents questions about their 2010-11 season hunting throughout the state of Utah, the primary focus of the survey dealt with issues and locations specific to the Great Salt Lake and its local environment. Figure 1 shows the locations of specific hunting areas on and around the Great Salt Lake. Appendix A shows the survey instrument sent to hunters, and includes a key identifying the names of the numbered hunting areas shown in the figure.

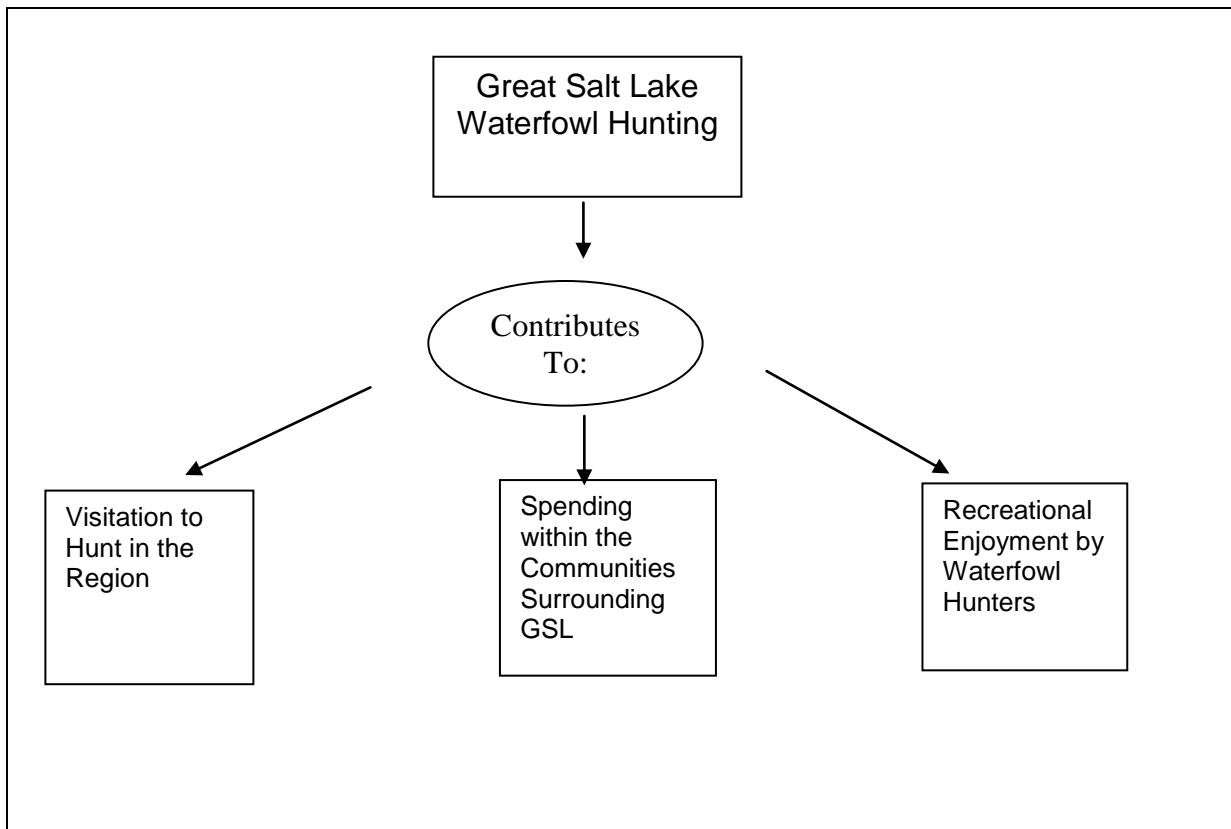
Questions on direct spending associated with hunting waterfowl included questions designed to isolate the portion of waterfowl spending that occurs within the primary economic analysis area, the Greater Salt Lake Area.



**Figure 1. Map of the Great Salt Lake Hunting Areas (Appendix A shows the names of the numbered hunting areas)**

### 1.3 Focus of Study-Economic Values

This study focuses on the economic values associated with the longstanding tradition of hunting waterfowl in the Greater Salt Lake Area. These values include the benefits associated with visitation to the region by non-local hunters, the local-area importance of hunter spending, and the local values associated with hunting on the GSL (Figure 2).



**Figure 2. Linkage of Waterfowl Hunting to Positive Economic Values.**

The National Research Council in their 2005 publication “Valuing Ecosystem Services: Toward Better Environmental Decision Making” provided a general overview of the benefits that derive from ecosystem services. Figure 3 diagrams this generic flow of ecosystem services.

As can be seen in Figure 3, several kinds of services, or uses, derive from natural systems. One dichotomy is between on-site use and passive use. On-site use includes seeing and hunting waterfowl. However, individuals who have no expectation to ever see or hunt the GSL waterfowl may still place a value on knowing that the Great Salt Lake has a complete ecosystem supporting a wide range of migratory species. Such values are termed passive use

values and are not dependent on direct on-site use. Several of the possible motives for nonuse values were first described by (Weisbrod 1964) and (Krutilla 1967), and include existence and bequest values. Existence values can derive from merely knowing that a given natural environment or population exists in a viable condition. Bequest values are associated with the knowledge that a resource will be available for future generations.

While direct use services may or may not have associated developed markets for them, nonuse services are exclusively non-market services. When nonuse and direct use values are estimated together, the estimate is referred to as total valuation. This concept was first introduced by (Randall and Stoll 1983) and has been further developed by (Hoehn and Randall 1989).

Some values associated with healthy waterfowl populations can be estimated from market data. This includes money spent for hunting trips and associated with belonging to duck hunting clubs. However, many of the significant values associated with wildlife are not exchanged in markets and must be estimated using valuation methodologies specifically designed for valuing services not traded in traditional markets. The values associated with these services are referred to as nonmarket values. The specific nonmarket values at issue for this study include the value of the waterfowl hunting experience.

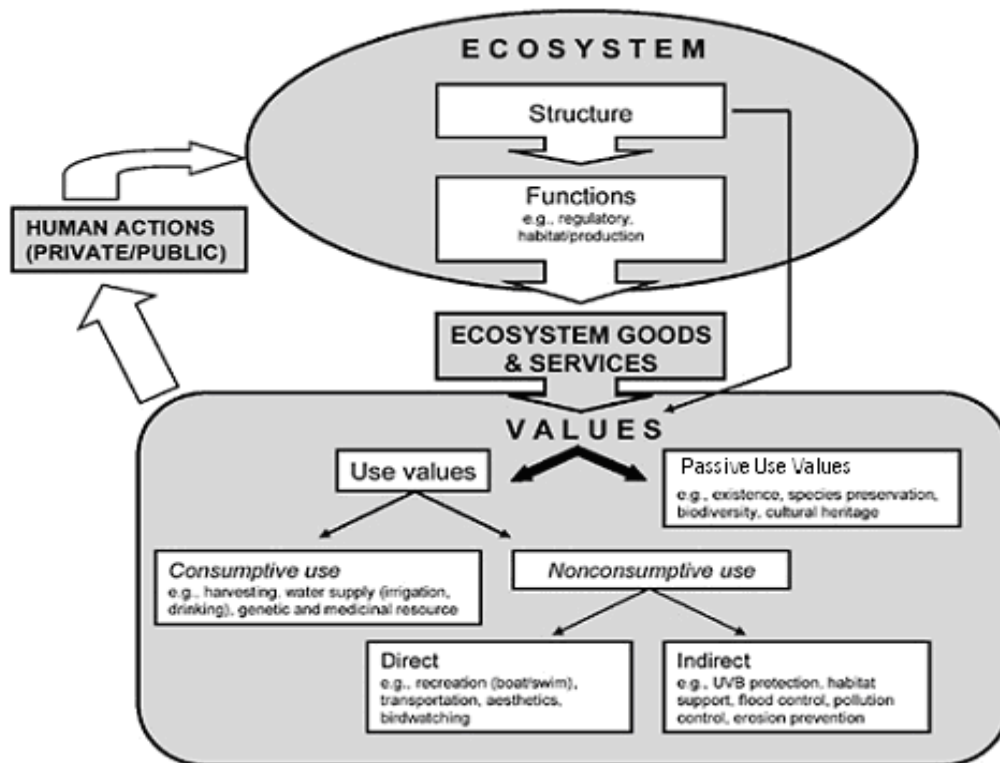


Figure 3. Flows of Ecosystem Services (adapted from (National Research Council 2005))

A comprehensive economic evaluation of the contribution of waterfowl hunting needs to include two accounting frameworks. One is regional economics or economic significance, focused on identifying cash expenditures that drive income and job levels in the regional economy. The other is a net economic value framework that includes all potential benefits from a broader social (usually national) perspective. The latter necessarily includes nonmarket and indirect benefits, such as the benefits wildlife viewers and hunters derive from their recreational activity, over and above their actual expenditure. Both perspectives are important for policy discussions and generally both accounting frameworks are utilized in evaluating public decisions, for example through an EIS process or in informing public opinion. The current study provides estimates for the direct regional economic importance of waterfowl hunting in the GSL region and the net economic value of these activities over and above the actual cost to the hunters.

## **2.0 Methods**

### **2.1 Structure of the 2011 Utah Waterfowl Hunting Survey**

The 2011 Utah waterfowl hunting survey was designed to collect a broad spectrum of information and opinions from Utah hunters (Appendix A). The survey instrument was divided into five sections each addressing one general aspect of the waterfowl hunting experience and the characteristics of those completing the survey.

Section I of the survey asked a general set of question about the respondents' waterfowl hunting experiences and preferences. This section also asked whether respondents belonged to one of the GSL private duck clubs and gathered some information on those clubs.

Section II included one multi-part question asking about where respondents hunted waterfowl during the 2010-11 waterfowl hunting season. This question asked for participants to identify each hunting location they went to and the number of days they hunted at that site.

Section III was the longest section of the survey and asked questions about the hunters' most recent hunting trip, with emphasis on trip expenditures, where they hunted, and details on how many birds they bagged and what type of environment they hunted in. This section of the survey also included the nonmarket valuation question designed to allow estimation of the net economic value of a waterfowl hunting trip. That is the value over and above expenses that visitors place on trips to the park.

Section IV of the survey asked hunters a series of questions about themselves. This section included questions on residency, gender, age, education, and income.

Section V of the visitor survey asks a series of four "choice" questions in which hunters were presented with descriptions of pairs of hunting trips having different characteristics and were asked to choose which of the two (or neither) they would rather take.

### **2.2 Sample Design Methods**

The goal of any survey effort is to collect information from a sample of respondents that is large enough to estimate statistically significant values. The primary goal of our survey was to gather information on the activities and spending of hunters using private or public hunting grounds around the Great Salt Lake. The 2011 Utah hunter survey faced a difficult choice in designing the sample. We could either draw a random sample of all households (Utah or from the GSL region) and accept that only a very small proportion of respondents actually hunted the area. Or we could *a priori* identify individuals who had a high likelihood of hunting the area and accept that the resulting sample may not represent a sample of average Utah waterfowl hunters. The second option was chosen in order to facilitate the most cost-

effective information collection. This method necessitates the application of weighting of the data in order to make the responses more representative of typical Utah waterfowl hunters.

Two specific sample groups were contacted. The first was a sample drawn from membership lists of organizations likely to include waterfowl hunters. These organizations included: Utah Waterfowl Association, Utah Wetlands Foundation, Utah Ducks Unlimited, Utah Mud Motor Association, Utah Airboat Association, and Delta Waterfowl Association. This sample is referred to as the “Public Sample.”

The second group that was contacted included names drawn from membership lists of a number of private duck hunting clubs on the Great Salt Lake. Participating clubs included: Chesapeake, Tri-State, Guns Up, Bear River, Ambassador, Lake Front, North Point, Rudy, and Harrison (Duck Club Sample).

The survey procedure followed a standard (Dillman 2000) mail survey methodology using initial contact and repeat follow-ups. Further detail is presented below in Section 3.

All analysis and data manipulation was completed using SAS statistical software (SAS Institute Inc. 2008) and Microsoft Excel.

## **2.3 Net Economic Value Analysis Methods**

Two methods were employed in the 2011 Utah Hunting Survey for eliciting information on the net economic value associated with Waterfowl hunting in Utah. The first was a question asking hunters to value their most recent hunting trip. The second was a set of four questions asking hunters to compare hunting trips with different characteristics (success, type of hunting, location, etc.) and choose between them. Analysis of these two different question types required two different statistical methods.

### **2.3.1 Current Trip Contingent Valuation Method**

Nonmarket values for hunting trip values were estimated using the contingent valuation method (Mitchell and Carson 1989). In contingent valuation potential respondents are asked about their willingness to pay for the particular service at issue. For current trip values, the estimation of willingness to pay models was implemented using a maximum likelihood interval approach (Welsh and Poe 1998) (Cameron and Huppert 1989). Respondents were asked to choose the highest amount he or she was willing to pay from a list of possible amounts. It is inferred that the respondent’s true willingness to pay is some amount located in the interval between the amount the respondent chose and the next highest amount presented. Let  $X_{il}$  be the maximum amount that the  $i$ th person would be willing to pay and

$X_{iu}$  be the lowest presented amount that person would not pay. Given this, WTP (willingness to pay) must lie in the interval  $X_{il}, X_{iu}$  If  $F(X_i; \dots)$  is the statistical

distribution function for WTP<sub>i</sub>, with parameter vector  $\theta$ , then the probability that WTP<sub>i</sub> lies between two given payment bid amounts is  $F(X_{iu}; \theta) - F(X_{il}; \theta)$  and the associated log-likelihood function is:

$$\ln(L) = \sum_{i=1}^n \ln [F(X_{iu}; \theta) - F(X_{il}; \theta)]$$

The SAS statistical procedure LIFEREG was used to estimate the parametric model of willingness to pay based on the underlying payment card responses (SAS Institute Inc. 2008).

### 2.3.2 Choice Question Modeling

The multinomial logit model is used to model relationships between a polytomous response variable and a set of explanatory variables (attributes, or characteristics of the waterfowl hunting trip in this application). This relationship was modeled using the SAS MDC (Multinomial Discrete Choice) procedure. Applied to discrete choice modeling, the underlying analytical model for this procedure is as follows:

Let  $m$  be the number of alternatives under consideration. Also, let each alternative be described by a set of  $n$  independent explanatory variables (attributes). Then, we can postulate the following utility function for each alternative:

where  $U_i$  = utility of  $i$ th alternative,  $i = 1, \dots, m$   
 $x_{kj}$  = value of  $k$ th explanatory variable (attribute) for  $j$ th alternative,  $j = 1, \dots, m, k = 1, \dots, n$   
 $\beta_k$  = linear parameter for  $k$ th explanatory variable (attribute),  $k = 1, \dots, n$

The probability  $P_i$  of choosing the  $i$ th alternative is calculated as follows:

---

It must be noted that the utility function assumes consistent preferences among individuals. In general, utility values for the same alternative will vary among different individuals. Nevertheless, this mathematical model assumes that one can estimate values of  $\beta_k$ ,  $k = 1, \dots, n$ , that would describe the utility preferences of the “average” decision-maker.

To calculate the WTP for each attribute the parameter estimate of that attribute should be divided by parameter estimate of price (with negative sign):

—

Given the final design of the choice questions used 8 attributes with as many as 5 attribute levels (implying a full factorial design of 2,880 question versions), a set of SAS Macros was used in order to identify an efficient allocation of attribute levels across a manageable number of survey/question versions. The Macro %Mktruns was employed to identify sizes of the experimental design that were efficient yet less than a full factorial design while optimizing D-efficiency (sometimes known as D-optimality), which is a standard measure of the goodness of the experimental design. As D-efficiency increases, the standard error of the parameter estimates in the linear model decrease. Next, the %ChoiEff macro was used to find and evaluate an efficient experimental design in which the variances of the parameter estimates are minimized, given an assumed parameter vector. Finally, we used the %Mktblock macro to efficiently group the choice sets constructed through the %ChoiEff macro into 10 blocks (survey versions) of 4 choice questions each with 2 alternatives (plus a null alternative).

## **3.0 Data Collection**

The 2011 Utah Waterfowl Hunter Survey was designed as an end-of-season survey targeting individuals most likely to have hunted waterfowl in Utah in general and in the Great Salt Lake vicinity in particular. This survey had two distinct target populations: 1) individuals identified through membership lists of organizations tied to use or advocacy of the Great Salt Lake ecosystem, or waterfowl preservation and habitat protection (Public Sample), and 2) individuals identified as belonging to one of a number of private duck hunting clubs located on The Great Salt Lake (Duck Club Sample). This section of the report details the design and implementation of the survey, including sample distribution statistics and response rates, sample weighting, and survey design.

### ***3.1 Survey and Sampling Design***

As noted, the 2011 Utah Waterfowl Hunter Survey was designed as an end-of-season survey targeting individuals most likely to have hunted waterfowl in Utah in general and in the Great Salt Lake vicinity in particular. The survey instrument was designed in stages, each informed by input from the last stage. Initially, a draft survey instrument was constructed based on 1) information regarding the resource and its use, and 2) past successful waterfowl hunting surveys. These draft surveys were sent to 6 “key informants” who had detailed knowledge and long experience with waterfowl hunting in Utah and around the Great Salt Lake. Each of these key informants participated in an extended phone discussion of the survey as they themselves completed it. The comments, corrections and suggestions of these reviewers were combined, and the draft survey was modified to incorporate their input.

#### **3.1.1 Pretest and Public Sample Administration**

The survey administration was timed to start as closely as possible to the end of the general waterfowl season (January 15). On January 11 an initial contact letter was sent to 81 individuals for the pretest of the survey. This letter explained the survey project, asked for the person’s cooperation, and let the person know a survey packet would be mailed to them within the next week or so. The full set of survey materials is included in Appendix A.

On January 24<sup>th</sup> the full survey packets were mailed the pretest sample. A reminder postcard was sent on February 10<sup>th</sup> to those not yet responding.

Based on the responses of 50% of the pretest sample, the survey instrument was modified very slightly, and a decision was made to begin mailings to the public sample. The major modification for the final survey design was in constructing an efficient number of survey versions for the four choice experiment questions at the end of the survey. This design methodology is discussed in the Section 4 results section. Ten survey versions were designed and were randomly assigned to the 448 individuals in the public sample.

The public sample members were mailed their initial contact letter on February 7<sup>th</sup>, their 1<sup>st</sup> survey packet on February 16<sup>th</sup>, their reminder postcard on February 23<sup>rd</sup>, and on March 10<sup>th</sup> all outstanding potential respondents (pretest and public samples) received a 2<sup>nd</sup> complete survey packet.

### **3.1.2 Duck Club Member Sample Administration**

A very unique user population relative to waterfowl hunting in Utah is the membership of a wide array of private duck hunting clubs on or around the Great Salt Lake. In order to gain insights into the demographics, hunting activities, and economic activity related to this group, contacts were made to a number of the clubs. These clubs were asked to participate in the administration of the survey to their membership and to endorse the survey and urge their members to participate.

The participating clubs included: Chesapeake, Tri-State, Guns Up, Bear River, Ambassador, Lake Front, North Point, Rudy, and Harrison. The administration of surveys to this population was complicated by the (understandable) privacy concerns of some clubs to not disclose their membership list. Therefore, there were several characteristics of the club sample survey administration that differed from that of the public sample.

1. No initial contact letter was sent. This step was deemed redundant since club leaders had already explained the survey to their members.
2. Some clubs wanted to distribute the surveys at their annual meetings (generally in March). These clubs had a group of numbered survey packets mailed to them with instructions on how to distribute them while keeping track of which member received which survey number (important for follow up mailings).

The administration of the survey process was more spread out for the duck club sample due to the differing times that the clubs held their annual meetings. In general, survey packets were sent to clubs or club members between February 23<sup>rd</sup> and 28<sup>th</sup>. The exception was the Bear River Club which was sent a box of surveys on March 9<sup>th</sup>. The second mailing of survey packets was sent out for non-respondents on April 22<sup>nd</sup>. The last date for entering received surveys in the database was May 17<sup>th</sup> (this date was chosen as no surveys had been received for 3 consecutive days).

## **3.2 Survey Response Rates**

Table 2 outlines the details of the survey administration for the pretest, as well as for the public and the duck club samples. Since the duck club sample consisted of verified members of the clubs, there were no undeliverable surveys in this group. The overall response rate for the survey was 61.5%. The response rate for the duck club sample (55%) was somewhat lower due to two clubs (Bear River and Ambassador) only receiving one survey mailing. These clubs were only contacted once since the first survey contact was delayed due to late

annual meeting dates (Ambassador), and delays in finalizing the logistics of distributing the surveys (Bear River).

**Table 2. Survey Administration Statistics and Final Response Rates.**

| <b>Sample</b> | <b>Initial Mailing</b> | <b>Undeliverable</b> | <b>Delivered</b> | <b>Returned</b> | <b>Response Rate</b> |
|---------------|------------------------|----------------------|------------------|-----------------|----------------------|
| Pretest       | 81 <sup>a</sup>        | 9                    | 72               | 58              | 80.6%                |
| Non-club      | 448                    | 27                   | 421              | 272             | 64.6%                |
| Duck Club     | 411                    | 0                    | 411              | 226             | 55.0%                |
| <b>All</b>    | <b>940</b>             | <b>36</b>            | <b>904</b>       | <b>556</b>      | <b>61.5%</b>         |

<sup>a</sup> The initial pretest sample was 100. Nineteen of these were club members included in the Duck Club sample. Therefore, they are included in the club sample in this accounting.

### **3.3 Sample Weighting**

As discussed above, in order to efficiently collect data on a sufficient sample of Utah waterfowl hunters, survey samples were drawn from membership lists of cooperating non-profit organizations whose members were judged likely to have hunted waterfowl in Utah in 2010-11. There were two alternative sampling strategies considered. One method of achieving a random sample of Utah waterfowl hunters would have been to conduct a general Utah household random sample. This sampling method was considered and rejected because given the ratio of Federal Duck Stamp purchases in Utah to the number of households it would most likely have yielded an unacceptably low sample of active waterfowl hunters.

A second sampling method directed at Utah waterfowl hunters specifically would be to randomly sample from the State (and USFWS) list of HIP number registrants. This would have been a preferable method to the one employed. Inquiries were made into accessing the HIP database. However, given the timeline of the study and the constraints associated with accessing the HIP data, the authors opted to sample hunters from a variety of non-profit conservation and waterfowl hunting organization membership lists in Utah.

The risk with using the sample we did is that our sample respondents are not representative of the entire population of Utah waterfowl hunters. That is, that they are either more or less avid hunters or differ demographically from the general hunter population. Since our public sample was drawn from mailing lists targeted toward waterfowl advocates and hunters in the Salt Lake region, our public sample may be biased to the inclusion of more avid waterfowl hunters than would a random sample of all Utah waterfowl hunters.

An additional concern related to our list being disproportionately representative of members of the Utah Airboat Association and the Utah Mud Motor Association. Owners of these types of relatively expensive hunting watercraft likely represent a very small proportion of all Utah waterfowl hunters, but made up a significant proportion of our public sample. Table 3 shows the reported memberships of the respondents in the public sample of respondents. Over 90% of respondents listed at least one organization that they were members of. The most frequently cited were Ducks Unlimited, and the Delta Waterfowl Association. As is implied by Table 3, many respondents listed multiple organizations of which they were members.

**Table 3. Public Sample Membership in Conservation Organizations.**

| <b>Organization</b>   | <b>Number of Respondents</b> | <b>Percent of Respondents belonging to Organization</b> |
|---|------------------------------|---|
| Ducks Unlimited   | 144                          | 67.6%   |
| Delta Waterfowl   | 124                          | 58.2%   |
| Utah Airboat  | 76                           | 35.7%   |
| Utah Waterfowl Assoc.   | 75                           | 35.2%   |
| Utah Mud Motor  | 42                           | 19.7%   |
| No Membership Selected  | 19                           | 8.9%  |
| Total Number of Public Sample Respondents who Hunted in 2010-11 | 213                          |   |

A final concern regarding our sample related to the number of respondents who reported being members of private duck hunting clubs in and around the Great Salt Lake. Based on information from club managers and USFWS estimates of total hunter participation in Utah, only approximately 2% of Utah waterfowl hunters are members of the GSL private duck clubs. In order not to over-represent these private club members in our sample, we calculated the appropriate number of private club members for our final public sample size (estimated at 6 members), and randomly drew six survey responses from among the reported club members in our complete sample set, for inclusion in the final public sample.

### **3.3.1 Weighting to Address General Avidity Bias in the Sample**

In order to check our samples for consistency with the greater Utah waterfowl hunter population we used data provided by the US Fish and Wildlife Service.<sup>6</sup> This document reports for the State of Utah the seasonal average duck and goose harvest per hunter as well as the average duck hunting and goose hunting days afield for Utah hunters. The report also provided 95% confidence intervals for these estimates. The 2011 Utah waterfowl Hunting Survey was designed to gather information on the number of waterfowl bagged during the

<sup>6</sup> U.S. Fish and Wildlife Service “Migratory Bird Hunting Activity and Harvest during the 2008 and 2009 Hunting Seasons.” July 2010. Table 1D, p.24

season. The responses to these questions were compared to the reported USFWS statewide averages for Utah in the most recently reported year to detect any significant differences in avidity and harvest between our samples and the statewide hunter population.

While the cited USFWS report provides estimated totals and averages for number of ducks harvested for Utah, in order to gain additional insight into the shape of the distribution across hunters of total ducks bagged, we contacted USFWS and acquired the raw survey data upon which the reported numbers were based.<sup>7</sup>

Table 4 shows a comparison of the distributions of our sample and that of the USFWS random statewide survey of Duck Stamp holders. Clearly, our public sample includes a higher percentage of more avid duck hunters than does the statewide population. For example, while only 7.7% of our respondents who hunted waterfowl during the year reported harvesting no ducks during the season, fully 22.3% of the USFWS sample of waterfowl hunters harvested no ducks during the year.

In order to correct for this avidity, weights were calculated based on five ranges of reported duck harvest for the year. These weights over-weighted the responses of hunters in our sample who reported bagging either no ducks or a low number, and underweighted those reporting bagging large numbers of ducks. Table 4 shows the calculated weights applied to our sample.

**Table 4. Comparison of Public Sample and USFWS Reported Numbers of Ducks Bagged During the Season, by Range of Number Bagged.**

| Ducks Bagged during Season | Percent of Sample within Range |               | Weight |
|----------------------------|--------------------------------|---------------|--------|
|                            | USFWS HIP Sample               | Public Sample |        |
| 0                          | 0.2235                         | 0.0769        | 2.906  |
| 1 to 10                    | 0.4992                         | 0.1846        | 2.704  |
| 11 to 30                   | 0.1575                         | 0.2257        | 0.698  |
| 31 to 100                  | 0.1054                         | 0.3743        | 0.282  |
| over 100                   | 0.0144                         | 0.1385        | 0.104  |

Table 5 shows the pre and post-weighting average number of ducks bagged per hunter for the current survey public sample and the USFWS sample. Before weighting the mean number of ducks bagged in the current sample was more than four times that of the USFWS random sample. The two means were statistically significant. Following application of the calculated weights, the two means were not significantly different at the 99% level of confidence.

<sup>7</sup> Data provided through personal communication from Bob Raftovich, Wildlife Biologist Branch of Harvest Surveys, Division of Migratory Bird Management, U.S. Fish and Wildlife Service, Laurel, MD. Mr. Raftovich also provided the stratification information needed to replicate the Agency's results from the raw survey data.

**Table 5. Comparison of Pre and Post-Weighting Average Number of Ducks Bagged in Season, USFWS and Public Samples.**

| <b>Statistic</b> | <b>USFWS HIPP Sample</b> | <b>Public Sample</b>  | <b>2-tail T-test confidence level</b> |
|------------------|--------------------------|-----------------------|---------------------------------------|
| Pre-weighting    | 12.47<br>(s.d. 199.95)   | 51.87<br>(s.d. 63.94) | 99.1%                                 |
| Post-weighting   | 12.47<br>(s.d. 199.95)   | 15.03<br>(s.d. 28.46) | 14.45%                                |
| Sample           | 199                      | 195                   | 392 d.f.                              |

### **3.3.2 Analysis of Possible Motor Boat Owner Bias in Sample**

As mentioned, the authors were concerned that the sources of the public hunter sample might lead to unspecified biases in study results. Specifically, the inclusion of a high percentage of hunters belonging to the Utah Airboat Association and the Utah Mud Motor Association resulted in a final public sample with a significantly higher proportion of owners of these specialized boats than would be expected from a random sample of all Utah hunters.

Table 6 shows a comparison of selected characteristics of the motor and non-motor club hunters. Prior to the previously discussed avidity weighting, members of the motorboat clubs hunted significantly more days, bagged significantly more ducks and spent significantly more on waterfowl hunting equipment than did the non-motor club respondents. As the table shows, after weighting for avidity, however, the two groups were only different in regards to the total amount they had invested in waterfowl hunting equipment. This makes some sense as these motor club members have investments in boats, trailers and often trucks to pull them.

**Table 6. Comparison of Un-weighted Characteristics of Members of Motorboat Associations and Non-members.**

| Variable   | Boat Org. Members      | Non-boat Org. Members | Significantly Diff. at 95% CL (un-weighted sample) | Significantly Diff. at 95% CL (Weighted sample) |
|--|------------------------|-----------------------|--|---|
|  | Mean (Std. Dev.)       | Mean (Std. Dev.)      |  |   |
| Number of years hunting Waterfowl                            | 27.3<br>(14.7)         | 27.1<br>(14.8)        | NO   | <i>NO</i>                                       |
| Days waterfowl hunting in 2010-11                            | 23.7<br>(16.3)         | 18.6<br>(13.8)        | YES  | <i>NO</i>                                       |
| Ducks Harvested in 2010-11                                   | 62.7<br>(71.0)         | 40.4<br>(52.7)        | YES  | <i>NO</i>                                       |
| Average Age  | 43.8<br>(14.2)         | 46.8<br>(15.8)        | NO   | <i>NO</i>                                       |
| Current Trip spending in SLC Area                            | \$177.70<br>(\$576.68) | \$136.93<br>\$365.88) | NO   | <i>NO</i>                                       |
| Current Trip Spending in Rest of Utah                        | \$102.31<br>(\$346.41) | \$87.87<br>(\$255.38) | NO   | <i>NO</i>                                       |
| Total cost of Waterfowl Hunting Equipment                    | \$25,260<br>(\$29,701) | \$12,206<br>(\$16141) | YES  | <i>YES</i>                                      |
| Total Waterfowl Hunting Equip. bought in SLC area in 2010-11 | \$5,829<br>(\$11207)   | \$3,049<br>(\$8,204)  | YES  | <i>NO</i>                                       |

With regard to the issue of over-representation of motor club members in our sample, avidity weighting appears to remove most potential statistical bias from this group with the exception of total equipment spending. Therefore, no additional weighting or exclusion of respondents from this motor boat club subsample was required, the exception being in the analysis of equipment expenditures, which is discussed below.

Of the two samples gathered (club member sample and public sample) only the public sample was weighted to more closely reflect the entire population. The club member sample is based on a sample of the existing duck clubs around the Great Salt Lake and as so is considered a snapshot of this unique population. The following results for the public sample reflect this weighting of responses unless specifically noted otherwise.

## 4.0 Results

Findings based on analysis of the Public Hunter Sample from the 2011 Utah Waterfowl Hunter Survey responses are presented in this section. This section is divided into 4 primary sub-sections: section 4.1 examines general hunter activities and preferences. Section 4.2 presents data on the most recent trip taken by hunters. This section is divided in subsections on general trip characteristics, spending, and estimation of trip net economic values. Section 4.3 looks at general demographic characteristics of the survey respondents. Finally, Section 4.4 describes the development of the choice format valuation questions and the results from that analysis.

### 4.1 General Hunter Activities and Preferences

A consistent result of the survey was that the avidity weighted public sample of Utah waterfowl hunters is an engaged recreational population with high levels of participation and enthusiasm for their activity. The average public hunter had been hunting waterfowl for nearly 29 years. Of the 60% of the sample who reported hunting waterfowl in Utah in 2010-11, the average hunter hunted waterfowl for 12.5 days. Further, nearly 80% of hunters stated that waterfowl hunting was either their favorite or one of their favorite outdoor recreational activities (Table 7).

**Table 7. Public Hunter Sample, General Hunter Characteristics.**

| <b>Hunter Characteristic</b>  | <b>Statistic</b> |
|---|------------------|
| <b>(A) All Respondents to Public Sample</b>   |                  |
| Mean number of years waterfowl hunting  | 28.7             |
| Percentage of sample hunting waterfowl in Utah in 2010-11   | 59.7%            |
| <b>(B) Public Sample Respondents who Hunted in 2010-11</b>  |                  |
| Average Number of Days Hunted in 2010-11 Season   | 12.5 days        |
| Average number of Ducks Bagged in 2010-11 Season  | 15.5 ducks       |
| Average number of Geese Bagged in 2010-11 Season  | 2.7 geese        |
| Percent saying Waterfowl Hunting is either their Favorite, or one of their Favorite Outdoor Recreation Activities | 79.5%            |

The survey asked hunters to rate the importance of a number of possible reasons for them choosing a particular location to hunt waterfowl. Table 8 shows the percentage of respondents who rated each of the potential reasons either “important” or “very important” to them in choosing a waterfowl hunting site. The most important reasons were hunting in an

uncongested location, hunting in a relatively natural setting, and seeing abundant waterfowl. The least important among the reasons presented were bagging limits of ducks and geese, and the area having good “jump” or “pass” shooting.

**Table 8. Public Hunter Sample, Responses to Reasons for Choosing an Area to Waterfowl Hunt.**

| <b>Reason for Choosing A Waterfowl Hunting Area</b> | <b>Percent of Public Sample responding that the Reason was either “Very Important” or “Important.”</b> |
|---|--|
| Bagging a limit of ducks                            | 49.7%  |
| Bagging a limit of geese                            | 43.1%  |
| Seeing abundant waterfowl                           | 94.6%  |
| A relatively natural setting                        | 95.5%  |
| Close to home                                       | 71.4%  |
| Hunting over decoys                                 | 84.4%  |
| Good pass shooting                                  | 47.1%  |
| Good jump shooting                                  | 34.3%  |
| Uncongested with good distance between parties      | 98.2%  |
| Available boat launch                               | 72.4%  |
| Hunting with a dog                                  | 58.7%  |

## **4.2 Information on Hunter’s Most Recent Hunting Trip**

Hunters were asked a series of questions about one specific waterfowl hunting trip from the 2010-11 season. Specifically, they were asked “questions about your most recent Utah waterfowl hunting trip during the general 2010-11 season.”

### **4.2.1 Characteristics of Most Recent Hunting Trip**

While hunters in the public sample reported having most recently hunted a wide spectrum of Utah locations, the three most frequently cited sites were the Great Salt Lake locations of Farmington Bay (Lakeside, WMA, and West), Ogden Bay (Lakeside, North, and WMA), and Willard Spur. The very large majority of hunters (88%) hunted most recently on public land, and the sample was almost entirely comprised of one-day trips from home (96%).

The survey, which was administered following the January 15<sup>th</sup> end of the general waterfowl hunting season, resulted in most recent trips that were (not surprisingly) skewed toward the last two months of the season (January (47.3%) and December (25.3%)). Finally, hunters traveled a relatively short distance for their hunts, averaging 32.5 miles each way of travel from their homes to their hunting sites.

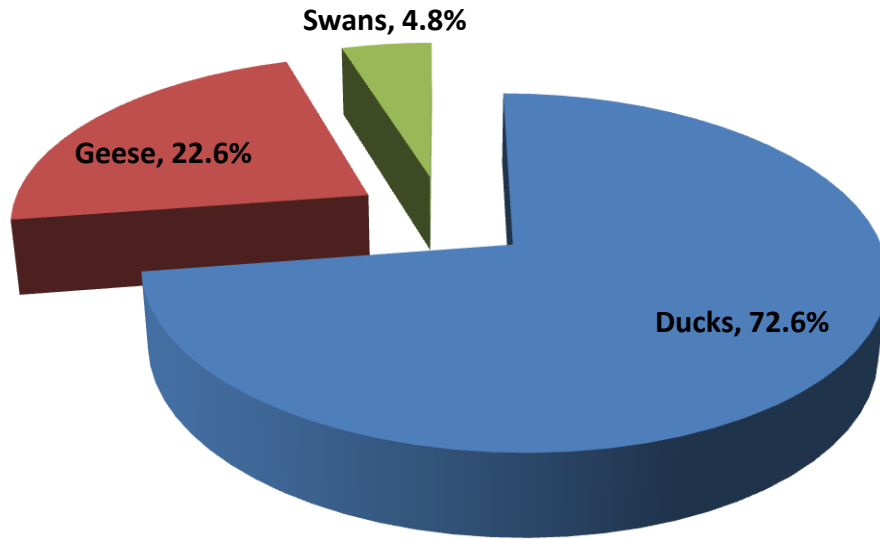
**Table 9. Public Sample Most Recent Trip Characteristics: Locations, Dates, and Distance.**

| <b>Characteristics of Hunters “Most Recent Trip”</b>       | <b>Statistic</b>  |
|--|---|
| Top three most Visited Hunting Sites                       | Farmington Bay (24.5%)<br>Ogden Bay (10.5%)<br>Willard (9.6%)   |
| Type of Area Hunted  | Private Club (4.6%)<br>Private Leased Ground (7.6%)<br>Public Land (87.8%)  |
| Percent of trips that were One-Day Trips from Home         | 95.8%   |
| Distribution of trips across months                        | September (1.4%)<br>October (12.1%)<br>November (12.4%)<br>December (25.3%)<br>January (47.3%)<br>February (1.4%) |
| Average number of One-Way Miles traveled from Home on Hunt | 32.5 miles  |

Hunters in the Public Sample reported bagging an average of 2.1 ducks and 0.7 geese on their most recent Utah hunting trip. The large majority of hunters reported hunting over water with decoys (71.6%) and hunting in a relatively natural setting (77.6%).

Hunters were asked how far away the closest other hunting party at their site was. Nearly 60% reported the closest party was over 400 yards away. About 13% said the closest hunting party was 100 yards or closer.

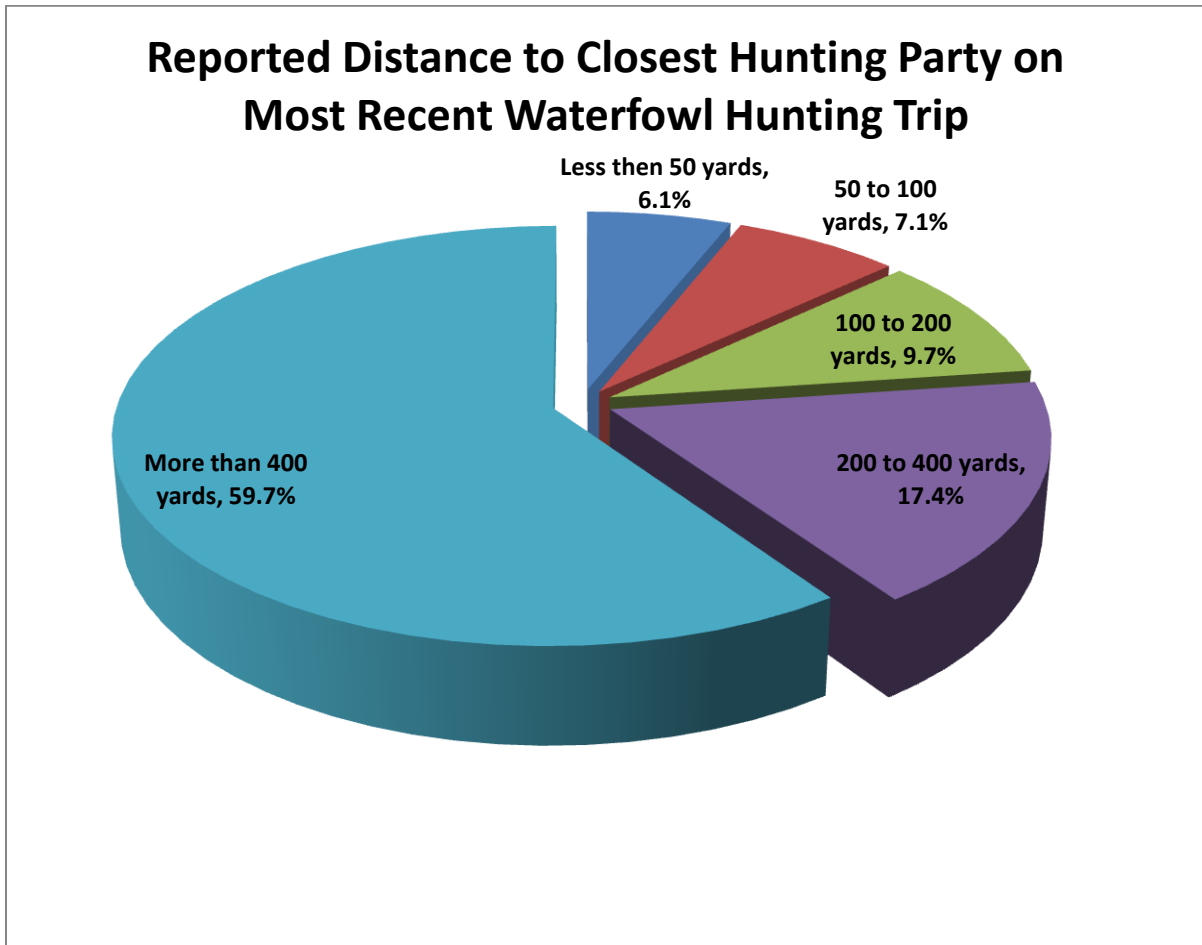
### Percent of Public Sample Hunters Primary Target Species on most Recent Trip



**Figure 4. Percent of Hunters Reporting Specific Species as their Primarily Targeted Species on their Most Recent Trip**

**Table 10. Public Hunter Sample Characteristics of Most recent Hunting trip.**

| <b>Characteristics of Most recent Hunting Trip</b>                             | <b>Statistics</b>   |
|--|---|
| Average Number of Ducks Bagged   | 2.1 Ducks   |
| Average Number of Geese Bagged   | 0.7 Geese   |
| Type of Hunting Engaged in   | Hunted over water and decoys (71.6%)<br>Hunted over decoys on land (17.7%)<br>Did mostly pass shooting (14.5%)<br>Did mostly jump shooting (8.1%) |
| Percent saying they Hunted in a Natural Setting                                | 77.6%   |
| Percent saying the Hunted in an Area of Natural Vegetation                     | 63.4%   |
| Percent Reporting Seeing Abundant Waterfowl on Trip                            | 41.9%   |
| Percent Saying they were Concerned about Risk of Sewage-related Toxins on Trip | 14.6%   |



**Figure 5. Reported Distance between Hunting Parties**

Public Sample hunters were asked about their level of concern regarding a number of current or potential environmental conditions that have the potential to impact the quality of waterfowl hunting on The Great Salt Lake. Overall, there was a high level of concern regarding all the presented environmental conditions (Table 11). The highest level of concern was associated with invasive phragmites vegetation (96.7% either concerned or very concerned), and reallocation of waterflows from wetlands to residential or industrial development (92.5% reporting concern).

**Table 11. Public Hunter Sample Reported Levels of Concern over Environmental Issues Potentially Affecting GSL Hunting**

| Issues Affecting Waterfowl Hunting   | Percent of Public Sample Hunters Saying they were either “Concerned” or “Very Concerned” |
|--|--|
| Water levels in the Great Salt Lake  | 85.5%  |
| Invasive phragmites vegetation   | 96.8%  |
| Absence of the native marsh vegetation that attracts and feeds waterfowl                             | 91.5%  |
| Loss of waterfowl habitat due to expansion of the mineral salt industry                              | 86.2%  |
| Reallocation of waterflows from wetlands to residential or industrial developments                   | 92.5%  |
| Algae mats due to nutrients from sewage, farm, or city runoff  | 83.3%  |
| Risk associated with sewage-related toxins such as <i>e coli</i> or cyanobacteria (blue-green algae) | 74.7%  |

#### 4.2.2 Trip Expenditures

Utah waterfowl hunters were asked a number of questions regarding the amount they spent on their most recent hunting trip and where they spent that money. Additionally, hunters were asked to list their total investment in equipment they specifically purchased for waterfowl hunting, and to also list what equipment purchased they have made for waterfowl hunting equipment in 2010 in the Salt Lake Area. **Error! Reference source not found.** shows the calculation of estimated total 2010 waterfowl hunter spending in the Salt Lake City Area and in the state. The estimates in Table ES2 utilize information from both the Public and the Private Duck Club survey expenditure questions. While Private Club hunters are estimated to comprise less than 2.5% of Utah Duck Stamp holders, this group hunts on average more days per year, and spends nearly three times the amount per day as do non-club hunters. For this reason, separate expenditure estimates were generated using the Public hunter sample with no club members included, and the Private Club sample. These estimates of hunter trip and equipment spending are combined to estimate total waterfowl hunting trip expenditures in the SLC area, and in the state, as well as total 2010 hunting-related equipment spending in the SLC area.

Overall, it is estimated that Utah waterfowl hunters from the public sample spent an average of \$180 per trip (day) on their 2010-11 hunting trips. This estimate is similar to other studies of waterfowl hunting expenditures. In 2001 (Grado, et al.) estimated the Mississippi waterfowl hunters in 1998-99 spent \$144/day (\$194 in 2011 dollars). (Lewis, Leitch and Meyer 1998) found that North Dakota waterfowl hunters spent \$193/day (\$270 2011 dollars), and (Adams, Leifester and Herron 1997) found that Texas waterfowl hunters spent \$121/day (\$166 in 2011 dollars). The estimated spending per day is substantially higher than that

reported by (U.S. Fish and Wildlife Service, Division of Economics 2008). However, the USFWS estimates were based on data from a very small number of Utah hunters (19 hunters). Other researchers have also noted the differences between their own higher waterfowl hunting expenditure estimates and that of USFWS (Grado, et al. 2001). It is estimated that Private Club hunters spent an average of \$563 per day for their 2010 waterfowl hunting trips.

The Utah Division of Wildlife Resources estimates that Duck and Goose hunters in the state hunted approximately 210,000 days during the 2010-11 waterfowl season.<sup>8</sup> Overall in 2010 it is estimated that waterfowl hunters spent \$26.5 million in direct hunting trip expenditures and \$35.4 million in other hunting equipment expenditures in the Salt Lake City Area. This estimated \$61.9 million in waterfowl hunting-related spending in the year in the local SLC area represents a small percentage of total economic output (less than one-tenth of one percent), but is still large in absolute magnitude.

In addition to the annual spending shown in the table, Utah hunters invest in equipment. These hunters report that the total estimated value of equipment they have purchased and own specifically for waterfowl hunting (all equipment, not just that purchased in 2010) cost \$157 million. These later numbers may be conservative in that they include only the estimated 15,000 active Utah hunters estimated by USFWS for the year, and not all of those (~33,000) who bought duck stamps in 2010, but may not have actively hunted.

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<sup>8</sup> Pers. Comm. Justin Dolling, Utah Division of Wildlife Resources. July 18, 2011.

**Table 12. Estimated Utah Waterfowl Hunter Expenditures, by Location (2010 estimates)**

| Spending Area  | Expenditures per day per Hunter |              | Estimated Expenditures |              | Total Trip Spending |
|--|---------------------------------|--------------|------------------------|--------------|---------------------|
|  | Public Sample                   | Club Members | Public Sample          | Club Members |                     |
| <b>A) Trip Spending</b>  |                                 |              |                        |              |                     |
| Spending per day in the SLC Area                                       | \$104                           | \$402        | \$20,295,000           | \$6,231,000  | \$26,526,000        |
| Spending per day in Utah outside the SLC Area                          | \$75                            | \$162        | \$14,636,000           | \$2,507,000  | \$17,143,000        |
| Total Spending per day   | \$180                           | \$563        | \$34,931,000           | \$8,738,000  | \$43,669,000        |
| <b>B) Equipment Spending</b>   |                                 |              |                        |              |                     |
| 2010 Equipment purchases in SLC Area                                   | \$2,287                         | \$3,703      | \$32,590,000           | 2,777,000    | \$35,367,000        |
| <b>C) 2010 SLC Area Spending</b>                                       |                                 |              |                        |              |                     |
| <i>Total Estimated 2010 Waterfowl-related Spending in the SLC Area</i> |                                 |              |                        |              | <b>\$61,893,000</b> |
| <b>D) Total Investment in Waterfowl Hunting Equipment</b>              |                                 |              |                        |              |                     |
| Total Investment in Waterfowl Hunting Equipment                        | \$8,925                         | \$40,275     | \$127,181,000          | \$30,206,000 | \$157,387,000       |

<sup>a</sup> Total active hunter numbers for Utah are for 2009, the most current year for which estimates are available. Source: (Raftovitch, et al. 2010).

Table 13 shows the estimated total local area economic contribution associated with the 2010 trip and equipment spending of \$61.9 million on waterfowl hunting in the SLC area. Overall, in 2010 it is estimated that spending related to waterfowl hunting in the SLC area accounted for over \$97 million in total economic output, \$37 million in personal income, and 1,600 full-time equivalent jobs.

**Table 13. Estimated Economic Impact in the Salt Lake City Area of Waterfowl Hunting-related Expenditures, 2010**

| <b>Total Estimated 2010 Waterfowl Hunting-related Spending in the SLC Area</b> | <b>Total Output<sup>a</sup></b> | <b>Total Job Income</b> | <b>Total Full-time Equivalent Jobs</b> |
|--|---------------------------------|-------------------------|--|
| \$61,893,000   | \$97,100,000                    | \$36,800,000            | 1,600                                  |

<sup>a</sup> Output, Income, and Job multipliers are based on data presented for Utah in (U.S. Fish and Wildlife Service, Division of Economics 2008)

### 4.2.3 Net Economic Value of Most Recent Hunting Trip

The contingent valuation method (CVM) uses survey techniques to determine the values which people would place on traditionally nonmarket goods and services if markets did exist for these commodities. In this study, the value of a day spent waterfowl hunting in Utah is measured through the use of contingent valuation. Well established markets for many public land activities do not exist. Therefore, the basic problem faced in determining the economic value of services, such as a day spent waterfowl hunting, is measuring the nonmarket values. Contingent valuation has been widely applied (Mitchell and Carson 1989) and is recognized by the (U.S. Water Resources Council 1983) as an appropriate method. This approach has also been designated in federal guidelines (U.S. Department of Interior 1986, 1991) as a best available procedure for valuation of damages arising in superfund natural resource damage cases. The contingent valuation method has been employed numerous times to inform state and federal agency decision makers on resource issues. Examples of applications similar to the case at hand include (Boyle and Bishop 1987) and (Champ, Boyle and Brown 2004). (Walsh, Johnson and McKean 1988) provide a literature review of recreational demand studies, including contingent valuation. For example, in Montana CVM has been used by the state fish and wildlife agency to value waterfowl hunting in the state (Duffield and Neher 1991) and to examine the relationship between stream flow and recreation values on the Bitterroot and Bighole Rivers (Duffield, Neher and Brown 1992). Additionally, federal agencies have used CVM to inform decision makers in several large-scale Environmental Impact Statements on wildlife issues such as wolf reintroduction to Yellowstone National Park (U.S. Fish and Wildlife Service 1994) and reintroduction of grizzlies to central Idaho and western Montana (U.S. Fish and Wildlife Service 2000). Other major Federal actions that rely on CVM include the decision to modify operations of Glen Canyon Dam, which was operated as a peaking facility and impacted downstream recreation and NPS resources in the Grand Canyon. Additionally, CVM was the basis of the State of Alaska's claim against Exxon in the *Exxon Valdez* oil spill case, which settled for \$1 billion.

The essence of the CVM approach is to ask individuals their willingness to pay for a given service or commodity (WTP) contingent on their acceptance of a hypothetical but plausible and realistic payment situation that could range from a vote in a referendum to a decision to make a donation. The application of the CVM involves three elements: 1) a description of the resource which is to be valued; 2) the "payment vehicle," or method by which the respondent will pay for the resource; and 3) the "question format" or specific method by which the value of the resource will be elicited. We will discuss how each of these elements is addressed in turn.

In the 2011 Utah Waterfowl Hunter Survey, respondents were asked the specific contingent valuation question of how they valued their most recent Utah waterfowl hunting trip.

A feature of all CVM applications is the method by which the resource value is elicited from respondents. There are several basic genres of CVM elicitation techniques including payment card CVM questions and dichotomous choice CVM questions. In the payment card CVM respondents are asked to identify the maximum amount they would be willing to pay for a

good or resource from a list of amounts presented to them in the survey. This study utilized the payment card CVM in the current trip valuation question.

#### 4.2.4 Net Economic Value of Waterfowl Hunting Trips

The most recent waterfowl hunting trip contingent valuation question included in the Utah survey asked respondents their willingness to pay an additional amount in expenses to have made their trip hunt waterfowl in Utah. The text of the CV question reads:

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The costs of going hunting change over time. For example, gas prices and other travel costs and equipment rise and fall. Was your recent waterfowl hunting trip **worth more to you than what you actually spent?**

- Yes       No

**If YES,** If your total trip costs were to increase, **what is the maximum extra amount** you would be willing to pay and still take this trip? (please choose one)

- \$10       \$250       \$1,500  
 \$ 25       \$500       \$2,000  
 \$50       \$750       Other \$ \_\_\_\_\_  
 \$100       \$1,000
- 

The example above utilized a “payment card” question format, and a “travel cost” payment vehicle.

**Table 14. Public Hunter Sample Distribution of Contingent Valuation Payment Card Responses.**

| <b>Maximum Amount Extra Hunter Was Willing to Pay</b> | <b>Percent of Hunters</b> |
|---|---------------------------|
| 0   | 35.4%                     |
| \$10  | 7.7%                      |
| \$25  | 14.3%                     |
| \$50  | 17.4%                     |
| \$100   | 19.2%                     |
| \$250   | 3.1%                      |
| \$500   | 2.9%                      |
| \$750   | 0%                        |
| \$1,000   | 0.2%                      |
| \$1,500   | 0%                        |
| \$2,000   | 0%                        |

Table 15 shows the estimated group willingness to pay estimates derived from use of the increased travel cost payment vehicle. The interval model of willingness to pay, which was estimated using the SAS LIFEREG procedure resulted in a good parameter fit.

Two measures of WTP are shown in Table 15, median WTP and the truncated mean WTP. The median WTP, which is the amount at which 50% of individual's WTP are above and 50% below, is estimated at about \$76 per trip (day). The median WTP is often less than the mean WTP because of the influence of a relatively low percentage of individuals who are willing to spend quite high amounts for their trips.

**Table 15. Estimated Net Willingness to Pay per Person for a Utah Waterfowl Hunting Trip**

| Parameter            | Estimate     | Standard Error | 95% C.L. |        | Chi-Square | Pr. > ChiSq |
|----------------------|--------------|----------------|----------|--------|------------|-------------|
| Intercept            | 4.3276       | 0.0838         | 4.1633   | 4.4919 | 2664.97    | <.0001      |
| Scale                | 0.5352       | 0.0405         | 0.4615   | 0.6206 |            |             |
| Sample Size          | 138          |                |          |        |            |             |
| Distribution         | Log-Logistic |                |          |        |            |             |
| BIC                  | 453.44       |                |          |        |            |             |
| Estimated Median WTP | \$75.76      |                |          |        |            |             |

### **4.3 Socioeconomic and Demographic Characteristics**

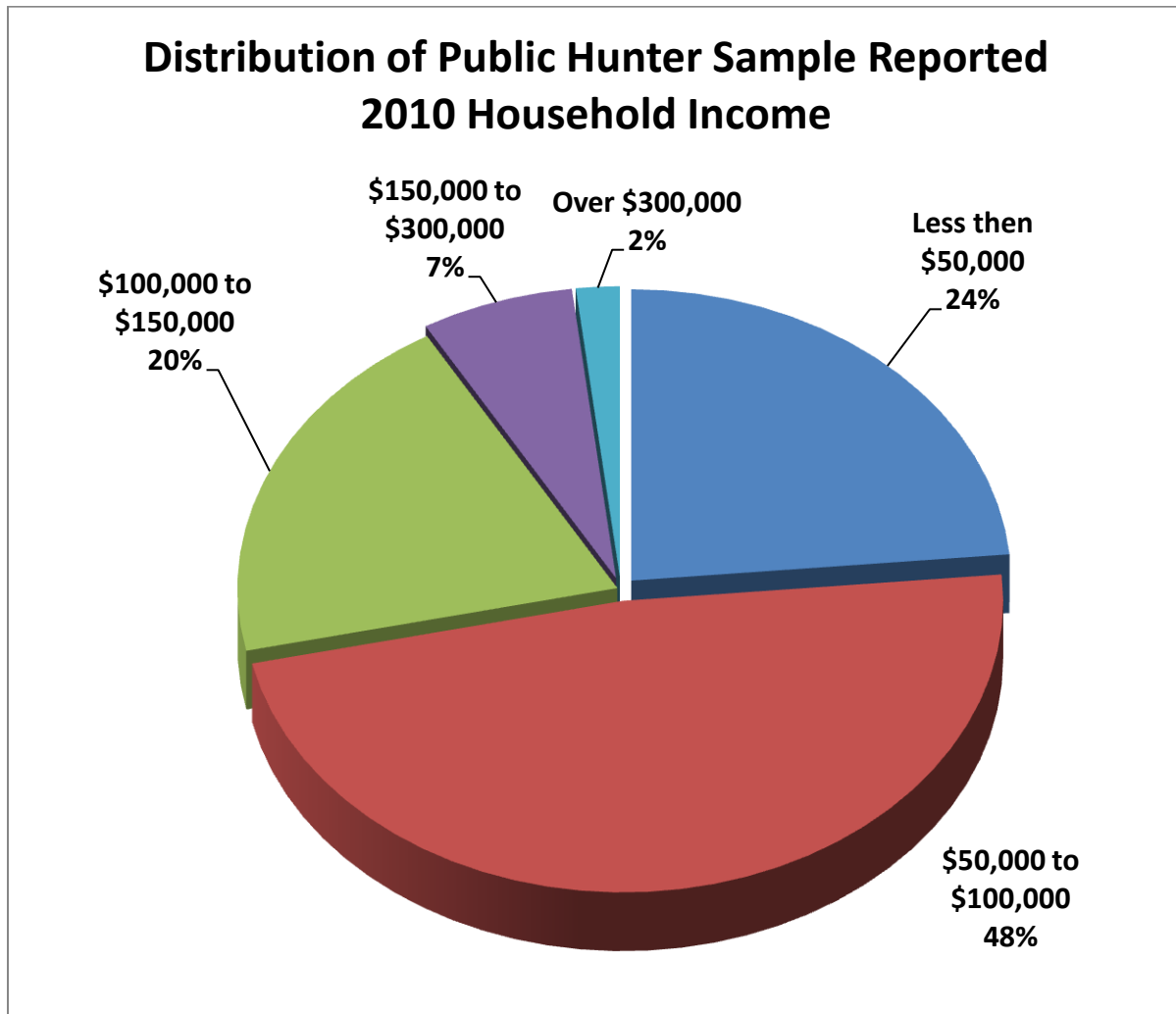
The survey included a section which asked questions on general socioeconomic characteristics of the respondents. Table 16 shows several key socioeconomics and demographic characteristics for the two sample groups. The Public hunter sample was almost entirely comprised of residents of Utah (99.7%). The average age of hunters was about 50 years<sup>9</sup>, with 70% employed full-time and 18% retired. The public hunter population was relatively higher income than the average Utah household. The U.S. Census Bureau reports that the 2009 median household income in Utah was \$55,143<sup>10</sup>. By comparison, the Public hunter sample reported that over 75% of the sample had household incomes in 2010 over \$50,000 (Figure 6).

<sup>9</sup> The average age of Public Sample hunters of 50 years was somewhat higher than the average age of Utah adults from the 2010 census of 42 years.

<sup>10</sup> U.S. Census State QuickFacts <http://quickfacts.census.gov/qfd/states/49000.html>

**Table 16. Socioeconomic Characteristics of Public Hunter Sample Waterfowl Hunters.**

| <b>Characteristic</b>      | <b>Statistic</b> |
|----------------------------|------------------|
| Percent Utah Residents     | 99.7%            |
| Average Age                | 50.1 years       |
| Percent Employed Full Time | 70.0%            |
| Percent Retired            | 18.8%            |



**Figure 6. Public Hunter Sample Reported 2010 Household Income before Taxes**

## **4.4 Choice Question Response Analysis**

Many recreational activities, such as waterfowl hunting, are best characterized as multi-attribute. That is, decisions on whether or not to take a certain trip or engage in a specific activity at a certain time in a specific location may be influenced by many factors. The decision to hunt waterfowl may be influenced, for instance, by the expected success level of the hunt, the expected congestion to be encountered at the hunting location, the natural setting of the hunt, and, of course, the personal cost of the hunting trip.

The results of the contingent valuation question and analysis reported in Section 4.2 above asks hunters to remember their most recent hunting trip and to assume that everything about that trip remained the same but only the cost of the trip increased. They are asked whether they would, in retrospect, have still taken that trip at that increased cost. This contingent valuation method using the payment card vehicle is an effective way to elicit willingness to pay for an overall trip experience.

An extension of this type of contingent valuation method is the choice (or conjoint) question format which recognizes that a number of trip attributes in addition to the cost of the trip may play a role in trip decisions. The specific design of the choice question, which asks respondents to choose between two hunting trips with different characteristics and costs, allows the researcher to estimate the marginal value of each specific attribute to the overall net economic value of a waterfowl hunting trip. This type of question formulation therefore moves beyond the question of what the net economic value of the entire trip is to the more refined and specific question of which attributes of a hunting trip either enhance its net economic value or detract from that value for an individual. An extension of estimating the values associated with specific attributes is to (like in the case of the payment card CV method) estimate the average trip value by setting attribute levels in the estimated model at averages for the sample population.

### **4.4.1 Choice Question Design**

The design of an effective choice or conjoint analysis valuation question begins with identification of the most important attributes of a trip that a hunter considers in making a decision about when, where, and how much to hunt. As described in the sections on survey design, the authors spent significant time talking to active Utah hunters about what attributes made for a good or bad hunting experience. Some attributes were clear from the outset; increased bags of ducks and geese were expected to be associated with higher quality hunting. Other potentially important attributes identified and included in the model design were:

- Distance between hunting parties (congestion)
- The feasibility of hunting over decoys
- Whether the hunting location had natural vegetation such as bull rush and cattails, or it was mostly vegetated with invasive phragmites

- Whether the water at the hunting location was relatively natural, or was contaminated with sewage-related toxins or algae
- Whether there was an available dock or boat launch at the hunting location
- The cost of the hunting trip to an individual.

As discussed in Section 2.2, statistical software was used to construct 10 version of the Utah hunting survey that each had four conjoint analysis questions, each presenting a hunter with a choice between two hunting trips with different attribute mixes, or the choice not to hunt at all. Appendix B shows the final attribute distribution for the 40 choice questions contained in the 10 survey versions. Survey versions were randomly assigned to individuals in the two sample frames.

Figure 7 shows a version of the choice question that was presented to Utah hunters.

**Which do you prefer—Trip A, Trip B, or “Not Hunt”?**

**Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B, or Not Hunt.** (Note that some trip characteristics conditions may be the same for Trip A and Trip B.)

| <b>Trip Characteristic</b>             |   | <b>Trip A</b>                             | <b>Trip B</b>                                   | <b>Not Hunt</b>  |
|--|---|---|---|--|
| <b>Conditions during trip</b>          | Ducks Bagged per day                        | 1 Duck                                    | 3 Ducks   | <b>I would not choose to take a waterfowl hunting trip if these were my only choices</b> |
|  | Geese Bagged per day                        | No Geese                                  | No Geese  |  |
|  | Closest other hunting party                 | 200 Yards                                 | 50 Yards  |  |
|  | Feasibility of hunting over water or decoys | Yes                                       | No  |  |
|  | Natural marsh setting                       | No, mostly vegetated with phragmites      | Yes, mostly bull rush, salicornia, and cattails |  |
|  | Water quality                               | No sewage-related toxins                  | No sewage-related toxins                        |  |
|  | Availability of dock or boat launch         | Yes                                       | Yes   |  |
|  | Your individual trip costs                  | \$50                                      | \$100   |  |
| <b>I would choose (check one only)</b> |   | <b>Trip A</b><br><input type="checkbox"/> | <b>Trip B</b><br><input type="checkbox"/>       | <b>Not Hunt</b><br><input type="checkbox"/>  |

**Figure 7. Sample Utah Waterfowl Hunting Survey Choice Question Format.**

#### 4.4.2 Choice Response Analysis

As shown in Table 17, many of the estimated coefficients are statistically significant at the 99% level of confidence. As it was expected, price has negative effect, bagging additional ducks and geese has a positive effect, hunting in an area of natural marsh vegetation has a positive effect, the presence of sewage-related toxins or algae has a negative effect, and the availability of a boat launch or dock has a positive effect on trip value. The coefficients for distance between hunting parties and the feasibility of hunting over water and decoys were not statistically significant.

These estimated coefficients, which are maximum likelihood parameter estimates, show how much the presence of each attribute increases the utility for an average hunter.

**Table 17. Estimated Public Hunter Sample Multinomial Discrete Choice Model of Willingness to Pay.**

| <b>Attribute</b>                  | <b>Estimated Coefficient</b> | <b>Standard Error</b> | <b>T-Statistic</b> | <b>P. Value</b> |
|-----------------------------------|------------------------------|-----------------------|--------------------|-----------------|
| Trip cost                         | -0.002543                    | 0.000239              | -10.65             | <.0001***       |
| Ducks bagged                      | 0.1135                       | 0.0213                | 5.33               | <.0001***       |
| Geese bagged                      | 0.2886                       | 0.0668                | 4.32               | <.0001***       |
| Distance to next party            | 0.000135                     | 0.000369              | 0.37               | 0.7145          |
| Hunting over water or decoys      | -0.0946                      | 0.1081                | -0.88              | 0.3814          |
| Natural marsh vegetation          | 0.2749                       | 0.1037                | 2.65               | 0.008***        |
| Presence of sewage-related toxins | -0.9246                      | 0.1182                | -7.83              | <.0001***       |
| Available Boat launch or dock     | 0.3998                       | 0.114                 | 3.51               | 0.0005***       |

\*\*\* Statistically significant at the 99% level of confidence

Table 18 shows the estimated marginal utility (change in WTP per trip) associated with the statistically significant attributes for the choice model estimation. The model predicts that on average an additional bagged duck is worth \$44.63 and an additional goose, \$113.49. It is estimated that it is worth \$108 to hunters to hunt in an area of natural vegetation, and that the presence of sewage-related toxins detracts substantially from the value of a trip (-\$363). Finally, the model predicts that it is worth \$157 to the average hunter to hunt in an area where a dock or boat launch is available.

**Table 18. Estimated Utility Associated with Marginal Changes in Choice Question Trip Attribute Levels**

| <b>Trip Attribute</b>             | <b>Marginal Utility</b> |
|-----------------------------------|-------------------------|
| Ducks bagged                      | \$ 44.63                |
| Geese bagged                      | \$ 113.49               |
| Distance to next party            | n/a                     |
| Hunting over water or decoys      | n/a                     |
| Natural marsh vegetation          | \$ 108.10               |
| Presence of sewage-related toxins | \$(363.59)              |
| Available Boat launch or dock     | \$ 157.22               |

## **5.0 Study Limitations and Future Research**

Any study of human behavior is subject to unforeseen real-world events that can frustrate the most carefully designed study protocols. The primary limitation of this study (primarily as it relates to the Public Hunter Sample) is that the original sample frame was not based on all licensed Utah waterfowl hunters. Section 3 of the report details efforts that were made to examine and discuss possible biases in the sample and correct for those where possible. A second possible source of bias is associated with the request for data on a hunter's "most recent trip." Since the survey was administered following the end of the 2010-11 general season the distribution of "most recent trips" is skewed towards late season trips. Several respondents pointed out that end-of-season waterfowl trips may not be the "best" trips of the season.

The 2011 Utah Waterfowl Hunter Survey was undertaken with full recognition of the limited timeframe for development and administration, and associated limited budget. Nevertheless, the survey returned consistent and interesting results within these acknowledged constraints. Of particular note were the engagement and interest of survey participants in the process, and interest in the survey results. Additional comments written on the survey forms showed consistently wide awareness and concern for issues such as invasive phragmites vegetation and declining waterfowl numbers. The results of this study, while able to stand on their own, could provide encouragement for future statewide random sampling of waterfowl hunters using the extensive direction and information garnered from the current survey.

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**Appendix A: Survey Instruments and Contact Letters**



## 2011 Utah Waterfowl Hunting Survey

February 8, 2011

Dear Fellow Hunter:

Our groups are helping to implement a **survey of Utah waterfowl hunters about their hunting experience in the 2010 season** with a focus on hunting on and around the Great Salt Lake. The information collected through the **2011 Utah Waterfowl Hunting Survey** will be used to help inform policy decisions regarding resource management, as well as to identify the positive economic impacts associated with waterfowl hunting. This survey is being implemented by Bioeconomics, Inc. of Missoula Montana. This independent economic research firm has a long history of conducting survey research for private, state, and federal entities.

**In approximately one week or so** you will receive by mail from **Bioeconomics** the **2011 Utah Waterfowl Hunting Survey** concerning your Utah waterfowl hunting experience and your opinions on management of the resource. The survey is completely confidential and your participation is voluntary. However, because your name was randomly selected, your response is vital to the success of the survey.

**Regardless of how often or where you hunt waterfowl in Utah, please complete the survey booklet.** We want to hear from a wide range of hunters. It will only take about fifteen minutes, and we will include a stamped addressed return envelope for your convenience. For our results to be scientifically sound, it is very important that we hear from everyone in our sample.

We think you will enjoy completing the survey, and we look forward to hearing from you. In advance, **thanks for your help** in gathering this information about waterfowl hunting in Utah and the Great Salt Lake. If you have any questions about this survey, please contact Chris Neher at 406-721-2265.

Sincerely,

Jack Ray  
Utah Waterfowl Association

Maunsel B. Pearce  
Utah Wetlands Foundation



## 2011 Utah Waterfowl Hunting Survey

February 14, 2011

Dear Fellow Hunter:

As you may recall from a letter sent you a week or so ago, our groups are helping to implement a **survey of Utah waterfowl hunters about their hunting experience in the 2010-11 season** with a focus on hunting on and around the Great Salt Lake. The information collected through the **2011 Utah Waterfowl Hunting Survey** will be used to help inform policy decisions regarding resource management, as well as to identify the positive economic impacts associated with waterfowl hunting. This survey is being implemented by Bioeconomics, Inc. of Missoula Montana. This independent economic research firm has a long history of conducting survey research for private, state, and federal entities.

**Enclosed is a copy of the 2011 Utah Waterfowl Hunting Survey** concerning your Utah waterfowl hunting experience and your opinions on management of the resource. This survey is completely confidential and your participation is voluntary. However, because your name was randomly selected, your response is vital to the success of the survey. The questionnaire has an identification number for mailing purposes only. This is so we may check your name off the list when your questionnaire is returned.

**Regardless of how often or where you hunt waterfowl in Utah, please complete the survey booklet.** We want to hear from a wide range of hunters. It will only take about fifteen minutes, and we include a stamped addressed return envelope for your convenience. For our results to be scientifically sound, it is very important that we hear from everyone in our sample.

We think you will enjoy completing the survey, and we look forward to hearing from you. In advance, **thanks for your help** in gathering this information about waterfowl hunting in Utah and the Great Salt Lake. If you have any questions about this survey, please contact Chris Neher at 406-721-2265.

Sincerely,

A handwritten signature in black ink, appearing to read "Jack Ray".

Jack Ray  
Utah Waterfowl Association

A handwritten signature in black ink, appearing to read "Maunsel B. Pearce".

Maunsel B. Pearce  
Utah Wetlands Foundation

## Reminder Postcard

**Dear Utah Hunter,**

In the last week or so, we mailed a survey to you from Bioeconomics, Inc. in Missoula MT, inviting you to participate in the **2011 Utah Waterfowl Hunting Survey**. The Utah Wetlands Foundation and the Utah Waterfowl Association are helping to implement **this survey of Utah waterfowl hunters about their hunting experience in the 2010-11 general season**, with a focus on hunting on and around the Great Salt Lake.

If you have already completed the questionnaire and returned it, please accept our sincere thanks. If not, please do so at your earliest convenience. We are especially grateful for your help because your response will help us to understand the role waterfowl hunting plays in the Utah economy.

If you did not receive a survey, or if it was misplaced, please call Chris Neher at (406) 721-2265, and we will send you another survey.

**Thank you!**

Sincerely,  
Dr. John Duffield, Survey Director

# Utah Waterfowl Hunting

## 2011 Hunter Survey



**Bioeconomics, Inc.  
Missoula, MT**

---

**The purpose of this survey is to obtain information about waterfowl hunting in the state of Utah during the 2010-11 general waterfowl season. We anticipate that this information could have a significant impact on future management of this resource.**

**We very much appreciate your participation in this survey, and hope you enjoy answering our questions and reflecting on your recent hunting experience.**

---

**Section I. General questions about your Waterfowl Hunting.**

1. How many years have you been waterfowl hunting?

\_\_\_\_\_ Number of years

2. Did you hunt waterfowl in Utah in 2010-11?

Yes    No **(If “NO” please skip to Section IV)**

3. How many days did you hunt for waterfowl during the 2010-11 season?

\_\_\_\_\_ Total days hunted

4. What was your total harvest of waterfowl in Utah this season?

\_\_\_\_\_ Number of ducks harvested

\_\_\_\_\_ Number of geese harvested

5. How would you rate waterfowl hunting as compared to your other outdoor recreation activities?

(please check one)

- It's my favorite outdoor recreation activity
- It's one of my favorite outdoor recreation activities
- It's just one of several outdoor recreation activities that I do
- I prefer other outdoor recreation activities

6. Are you a member of any organization that supports waterfowl conservation (check all that apply)?

- |  |   |
|--|---|
| <input type="checkbox"/> Ducks Unlimited | <input type="checkbox"/> Utah Waterfowl Association |
| <input type="checkbox"/> Utah Airboat    | <input type="checkbox"/> Utah Wetlands Foundation   |
| <input type="checkbox"/> Utah Mud Motor  | <input type="checkbox"/> Other _____                |
| <input type="checkbox"/> Delta Waterfowl |   |

7. The following list gives some reasons for choosing an area to waterfowl hunt. Please tell us whether the factors listed are important or unimportant to you

|   | Very Important           | Important                | Not Important            | Not at all Important     |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| a. Bagging a limit of ducks                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Bagging a limit of geese                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Seeing abundant waterfowl                      | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| d. A relatively natural setting                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Close to home                                  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Hunting over decoys                            | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| g. Good pass shooting                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| h. Good jump shooting                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| i. Uncongested with good distance between parties | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| j. Available boat launch                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| k. Hunting with a dog                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

8. Are you a member of a duck hunting club?

No → **If NO, Skip to Section II**

Yes Name of club: \_\_\_\_\_

**If YES** → How many days did you hunt at your club this season? \_\_\_\_\_ number of days.

9. What are the costs of belonging to this club?

\_\_\_\_\_ Initial membership cost \_\_\_\_\_ Year purchased

\_\_\_\_\_ Current market value of membership

\_\_\_\_\_ Annual dues

\_\_\_\_\_ Average additional per-day use fees

10. What are the services provided by your club? (check all that apply)

- |  |  |
|--|--|
| <input type="checkbox"/> Designate hunting locations                       | <input type="checkbox"/> Manage habitat for waterfowl  |
| <input type="checkbox"/> Private blind                                     | <input type="checkbox"/> Provide warming hut or cabins |
| <input type="checkbox"/> Provide on-site boat storage                      | <input type="checkbox"/> Full-time caretaker           |
| <input type="checkbox"/> Decoys  | <input type="checkbox"/> Boat                          |
| <input type="checkbox"/> Guide   | <input type="checkbox"/> Care of game                  |
| <input type="checkbox"/> Lodging and meals                                 |  |
| <input type="checkbox"/> Allow members to build storage shed and/or cabins |  |

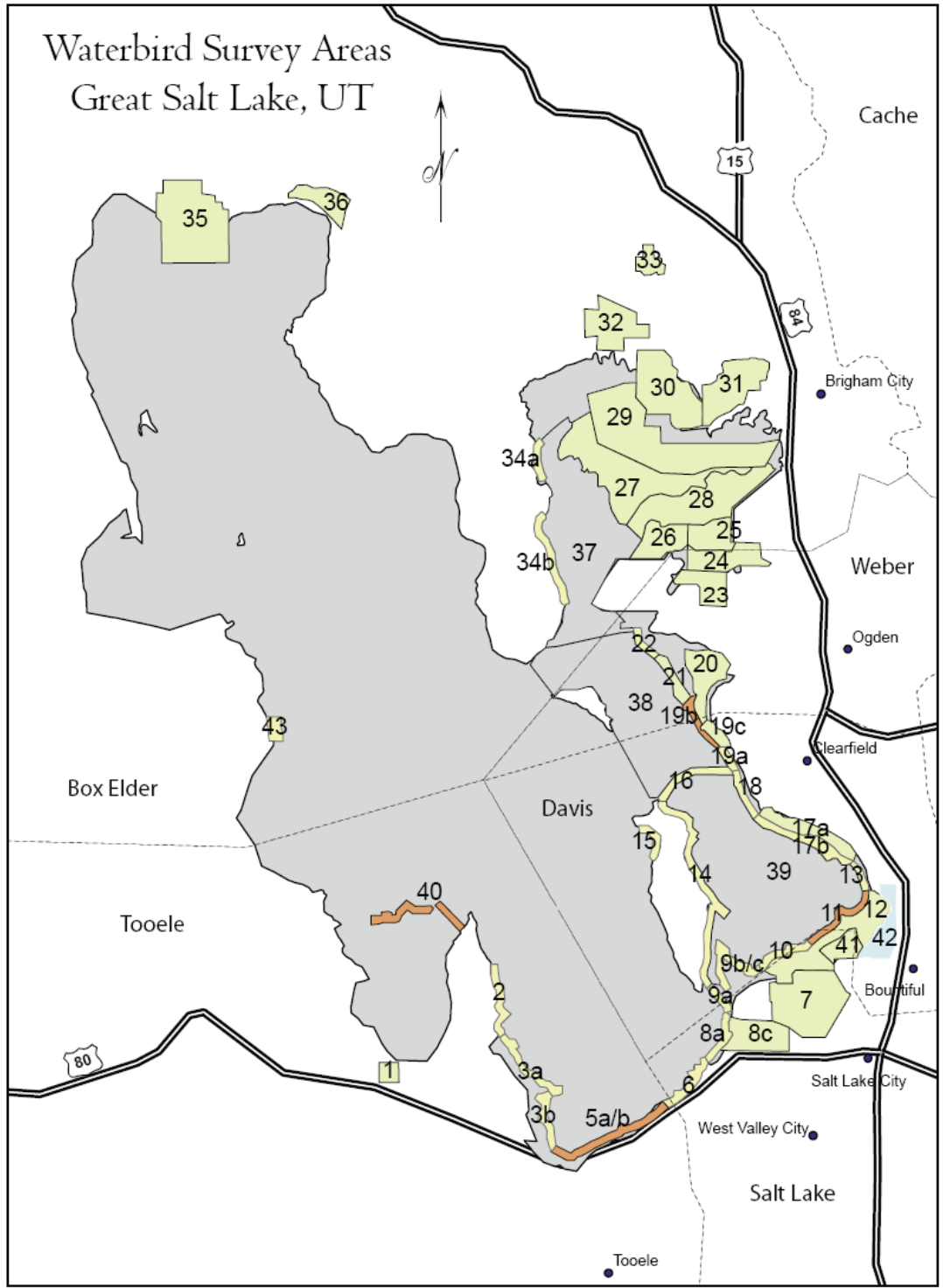
**Section II. Questions about your 2010-2011 waterfowl hunting trips in Utah.**

**11. Please list each specific Utah hunting location you hunted for waterfowl in the 2010-11 waterfowl season.** Please complete one line in the following table for each location. **For numbered sites proximate to Great Salt Lake please use the site number** (see map and list of sites and numbers below). **For other locations** on the Great Salt Lake or elsewhere in Utah, **please provide the name of the hunting site and the county** in which it is located. *The first two lines provide examples.*

| Site Number or Name of Hunting Site (use one line for each location hunted this season) | County    | Check if this is a Private Hunting Area | Number of Days Hunted this site in the 2010-11 season |
|---|-----------|---|---|
| 35  | Box Elder |   | 12  |
| Powell Slough   | Utah      |   | 3   |
|   |           |   |   |
|   |           |   |   |
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|   |           |   |   |

**Great Salt Lake Sites and Site Numbers**

|    |                      |     |                      |     |                     |
|----|----------------------|-----|----------------------|-----|---------------------|
| 1  | TIMPIE SPRINGS WMA   | 16  | ANT ISLAND CAUSEWAY  | 30  | BEAR RIVER CLUB     |
| 2  | STANSBURY ISLAND NO. | 17A | WEST KAYSVILLE       | 31  | CHESAPEAKE          |
| 3A | STANSBURY SOUTH- N   | 17B | WEST KAYSVILLE       | 32  | PUB SHOOT GRNDS WMA |
| 3B | STANSBURY SOUTH- S   | 18  | WEST LAYTON          | 33  | SALT CREEK WMA      |
| 5A | I 80 NORTH- N        | 19  | H SLOUGH WMA- D & P  | 34A | EAST PROMONTORY- N  |
| 5B | I-80 NORTH- S        | 19A | H SLOUGH WMA- BEACH  | 34B | EAST PROMONTORY- S  |
| 6  | SALTAIR              | 19B | H SLOUGH WMA- DIKE   | 35  | LOCOMOTIVE SPGS WMA |
| 7  | ASSOCIATED DUCK CLUB | 19C | H SLOUGH WMA- POND   | 36  | SALT WELLS FLAT WHA |
| 8A | KENNECOTT- GOGGIN    | 20  | OGDEN BAY WMA        | 36A | SALT WELLS- SHORE   |
| 8B | KENNECOTT- LEE CREEK | 21  | OGDEN BAY LAKESIDE   | 36B | SALT WELLS FLAT WHA |
| 8C | KENNECOTT- ISSR      | 22  | OGDEN BAY NORTH      | 37  | BEAR RIVER BAY      |
| 9A | AUDUBON LAKESIDE- S  | 23  | RAINBOW              | 38  | OGDEN BAY           |
| 9B | AUDUBON NORTH        | 24  | SOUTH H CRANE WMA    | 39  | FARMINGTON BAY      |
| 10 | CRYSTAL LAKESIDE     | 25  | HAROLD CRANE WMA     | 40  | MAGCORP             |
| 11 | FARM BAY LAKESIDE    | 26  | W. HAROLD CRANE      | 41  | NEW STATE DUCK CLUB |
| 12 | FARMINGTON BAY WMA   | 27  | SOUTH BEAR RIVER     | 42  | EAST FARMINGTON BAY |
| 13 | WEST FARMINGTON      | 28  | WILLARD SPUR         | 43  | DEARDENS KNOLL      |
| 14 | ANTELOPE ISLAND EAST | 29A | BEAR RIVER REFUGE    | 44  | JORDAN RIVER        |
| 15 | ANTELOPE ISLAND WEST | 29B | BEAR RIVER REFUGE RD |     |                     |



**Section III Questions about your most recent Utah waterfowl hunting trip during the general 2010-11 season, which ended January 15, 2011.**

12. Where did you hunt on this recent trip?

\_\_\_\_\_ Name of hunting area  
\_\_\_\_\_ Nearest town or landmark  
\_\_\_\_\_ If applicable, number of the Waterbird Survey Area from map

13. Which of the following best describes your hunting location on your most recent trip?

- Private club                       Public land  
 Private lease ground             Day Fee private land

14. Was this hunting trip a day-trip from home?

- Yes  
 No → **If NO**, what were your lodging arrangements? (check all that apply)  
 Stayed in a local motel/hotel  
 Stayed in a recreational vehicle  
 Stayed at a hunting club  
 Other:(please describe)\_\_\_\_\_

→ **If NO**, How many days did you hunt on this trip? \_\_\_\_\_ days hunted on trip

15. What was the date of the first day you hunted on your most recent trip?

\_\_\_\_\_ Month                      \_\_\_\_\_ Date

16. How many miles from your home (one-way) was it to your hunting area on this trip?

\_\_\_\_\_ Miles from my home

17. Please fill out the following table, listing all of your expenses associated with your most recent waterfowl hunting trip in Utah. The expenditures should be only those spent **while in Utah**. Approximately how much did you spend on:

| Expenditures for your most recent Utah Waterfowl hunting trip | Spent in the Salt Lake Area | Spent in rest of Utah |
|---|-----------------------------|-----------------------|
| Ammunition  | \$                          | \$                    |
| Other hunting supplies (decoys, clothing, etc.)               | \$                          | \$                    |
| Gasoline  | \$                          | \$                    |
| Food and beverages  | \$                          | \$                    |
| Lodging or camping fees                                       | \$                          | \$                    |
| Average daily or per-visit fees at a hunting club             | \$                          | \$                    |
| Commercial air travel   | \$                          | \$                    |
| Vehicle rental  | \$                          | \$                    |
| Boat rental   | \$                          | \$                    |
| Outfitter / Guide fees  | \$                          | \$                    |
| Other (please specify)  | \$                          | \$                    |

18. If you were in a hunting party on this trip, how many people including yourself were included in this total cost?

- These are just my costs
- \_\_\_\_\_ Total people covered by these costs including myself

19. The costs of going hunting change over time. For example, gas prices and other travel costs and equipment rise and fall. Was your recent waterfowl hunting trip **worth more to you than what you actually spent?**

- Yes
- No

**If YES**, If your total trip costs were to increase, **what is the maximum extra amount** you would be willing to pay and still take this trip? (please choose one)

- \$10
- \$ 25
- \$50
- \$100
- \$250
- \$500
- \$750
- \$1,000
- \$1,500
- \$2,000
- Other \$ \_\_\_\_\_

**20. In addition to money spent on waterfowl hunting trips, many hunters have invested significant amounts in equipment used to hunt waterfowl.** Please fill out the following table, listing any specific equipment you own for waterfowl hunting. In the last column list the cost of any of that equipment purchased in the past year in the Greater Salt Lake Area.

| Estimated market value of items acquired primarily for the purpose of waterfowl hunting | Estimated Market Value | New purchase in 2010 in the Salt Lake Area |
|---|------------------------|--|
| Ammunition  | \$                     | \$   |
| Guns  | \$                     | \$   |
| Hunting clothing & waders   | \$                     | \$   |
| Decoys  | \$                     | \$   |
| Portable blind  | \$                     | \$   |
| Dogs and dog training, dog food and vet services  | \$                     | \$   |
| Duck hunting boats and motors, and related boating gear                                 | \$                     | \$   |
| ATV or off-road vehicle   | \$                     | \$   |
| Other vehicle you own because of waterfowl hunting                                      | \$                     | \$   |
| Hunting cabin and/or storage shed you own   | \$                     | \$   |
| Other (please specify)<br>_____   | \$                     | \$   |

**21. What was the primary species of waterfowl you hunted on this trip? (check one)**

- Ducks                       Swans  
 Geese                         Other \_\_\_\_\_

**22. On this most recent waterfowl hunting trip in Utah, what was your total personal waterfowl harvest?**

\_\_\_\_\_ Number of ducks  
 \_\_\_\_\_ Number of geese  
 \_\_\_\_\_ Number of swans  
 \_\_\_\_\_ Number of other birds (describe) \_\_\_\_\_

**23. On this recent trip did you? (check all that apply)**

- Hunted over water and decoys       Did mostly pass shooting  
 Hunted over decoys on land         Did mostly jump shooting  
 Other \_\_\_\_\_

**24. How far away was the closest other hunting party at your site?**

\_\_\_\_\_ Yards away

**25. Were you hunting in a relatively natural setting with no obvious nearby man-made structures?**

- Yes                       No

26. Was your hunting location a marsh with mostly natural vegetation such as bull rushes, salicornia, and cattails?

- Yes       No       Don't know

IF NO → Was your hunting location a marsh dominated by invasive phragmites?

- Yes       No       Don't know

27. Did you see abundant waterfowl on this trip?

- Yes       No

28. Where you hunted were you concerned about the risk of sewage-related toxins such as *e coli* or cyanobacteria (blue-green algae) to your dogs or yourself?

- Yes       No

29. Look at the following list of environmental conditions that can affect waterfowl hunting, and indicate whether you are very concerned, concerned, not concerned, or have no opinion.

| Are you concerned about any of the following affecting your waterfowl hunting?                          | Very Concerned           | Concerned                | Not Concerned            | No Opinion               |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| a. Water levels in the Great Salt Lake  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Invasive phragmites vegetation   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Absence of the native marsh vegetation that attracts and feeds waterfowl                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Loss of waterfowl habitat due to expansion of the mineral salt industry                              | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Reallocation of waterflows from wetlands to residential or industrial developments                   | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Algae mats due to nutrients from sewage, farm, or city runoff  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| g. Risk associated with sewage-related toxins such as <i>e coli</i> or cyanobacteria (blue-green algae) | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

**Section IV. These questions will help us to compare respondents to the general population.**

30. Where do you live?

City: \_\_\_\_\_  
State \_\_\_\_\_  
Zipcode \_\_\_\_\_

31. How old are you? \_\_\_\_\_

32. Are you:     male                       female

33. What is the highest level of formal education you have completed? (please choose one)

- |  |   |
|--|---|
| <input type="checkbox"/> Some grade school     | <input type="checkbox"/> Some college           |
| <input type="checkbox"/> Finished grade school | <input type="checkbox"/> Finished college       |
| <input type="checkbox"/> Some high school      | <input type="checkbox"/> Some postgraduate work |
| <input type="checkbox"/> Finished high school  | <input type="checkbox"/> Finished postgraduate  |

34. During the hunting season this year, you were:

- |   |                                       |
|---|---------------------------------------|
| <input type="checkbox"/> Employed full time | <input type="checkbox"/> Homemaker    |
| <input type="checkbox"/> Employed part time | <input type="checkbox"/> Student      |
| <input type="checkbox"/> Unemployed         | <input type="checkbox"/> Other: _____ |
| <input type="checkbox"/> Retired            |                                       |

35. Please check your household's total income before taxes for 2010:

- |   |   |
|---|---|
| <input type="checkbox"/> Less than \$24,999     | <input type="checkbox"/> \$100,000 to \$149,999 |
| <input type="checkbox"/> \$25,000 to \$49,999   | <input type="checkbox"/> \$150,000 to \$199,999 |
| <input type="checkbox"/> \$50,000 to \$74,999   | <input type="checkbox"/> \$200,000 to \$299,999 |
| <input type="checkbox"/> \$75,000 to \$99,999   | <input type="checkbox"/> \$300,000 to \$999,000 |
| <input type="checkbox"/> \$100,000 to \$124,999 | <input type="checkbox"/> Over \$1,000,000       |

**Section V. These last few questions are about your preferences for different kinds of waterfowl hunting experiences**

For these last few questions, imagine you are trying to decide whether to go hunting and where. In each question please consider the two different trips (Trip A and Trip B) that vary in a number of ways including ducks and geese bagged, and trip cost. Assume that everything else about the trip is the same as your most recent trip, including time of year.

**Please consider differences in Trip A and Trip B as described and choose which trip you would prefer to take. You always have the option to choose to not take either trip .**

**Please continue on the next page**

**36. Which do you prefer—Trip A, Trip B, or “Not Hunt”?**

**Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B, or Not Hunt.** (Note that some trip characteristics conditions may be the same for Trip A and Trip B.)

| <b>Trip Characteristic</b>             |   | <b>Trip A</b>                             | <b>Trip B</b>                                   | <b>Not Hunt</b>  |
|--|---|---|---|--|
| <b>Conditions during trip</b>          | Ducks Bagged per day                        | 7 ducks                                   | No Ducks  | <b>I would not choose to take a waterfowl hunting trip if these were my only choices</b> |
|  | Geese Bagged per day                        | No Geese                                  | No Geese  |  |
|  | Closest other hunting party                 | 200 Yards                                 | 200 Yards                                       |  |
|  | Feasibility of hunting over water or decoys | Yes                                       | Yes   |  |
|  | Natural marsh setting                       | No, mostly vegetated with phragmites      | Yes, mostly bull rush, salicornia, and cattails |  |
|  | Water quality                               | No sewage-related toxins                  | Possible sewage-related toxins or algae         |  |
|  | Availability of dock or boat launch         | No  | Yes   |  |
|  | Your individual trip costs                  | \$250                                     | \$500   |  |
| <b>I would choose (check one only)</b> |   | <b>Trip A</b><br><input type="checkbox"/> | <b>Trip B</b><br><input type="checkbox"/>       | <b>Not Hunt</b><br><input type="checkbox"/>  |

**37. Which do you prefer—Trip A, Trip B, or “Not Hunt”?**

**Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B, or Not Hunt.** (Note that some trip characteristics conditions may be the same for Trip A and Trip B.)

| <b>Trip Characteristic</b>             |   | <b>Trip A</b>                             | <b>Trip B</b>                             | <b>Not Hunt</b>  |
|--|---|---|---|--|
| <b>Conditions during trip</b>          | Ducks Bagged per day                        | 1 Duck                                    | No Ducks                                  | <b>I would not choose to take a waterfowl hunting trip if these were my only choices</b> |
|  | Geese Bagged per day                        | No Geese                                  | 1 Goose                                   |  |
|  | Closest other hunting party                 | 400 Yards                                 | 50 Yards                                  |  |
|  | Feasibility of hunting over water or decoys | No  | Yes                                       |  |
|  | Natural marsh setting                       | No, mostly vegetated with phragmites      | No, mostly vegetated with phragmites      |  |
|  | Water quality                               | Possible sewage-related toxins or algae   | No sewage-related toxins                  |  |
|  | Availability of dock or boat launch         | No  | Yes                                       |  |
|  | Your individual trip costs                  | \$100                                     | \$250                                     |  |
| <b>I would choose (check one only)</b> |   | <b>Trip A</b><br><input type="checkbox"/> | <b>Trip B</b><br><input type="checkbox"/> | <b>Not Hunt</b><br><input type="checkbox"/>  |

**38. Which do you prefer—Trip A, Trip B, or “Not Hunt”?**

**Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B, or Not Hunt.** (Note that some trip characteristics conditions may be the same for Trip A and Trip B.)

| <b>Trip Characteristic</b>             |   | <b>Trip A</b>                             | <b>Trip B</b>                                   | <b>Not Hunt</b>  |
|--|---|---|---|--|
| <b>Conditions during trip</b>          | Ducks Bagged per day                        | 1 Duck                                    | 3 Ducks   | <b>I would not choose to take a waterfowl hunting trip if these were my only choices</b> |
|  | Geese Bagged per day                        | No Geese                                  | No Geese  |  |
|  | Closest other hunting party                 | 200 Yards                                 | 50 Yards  |  |
|  | Feasibility of hunting over water or decoys | Yes                                       | No  |  |
|  | Natural marsh setting                       | No, mostly vegetated with phragmites      | Yes, mostly bull rush, salicornia, and cattails |  |
|  | Water quality                               | No sewage-related toxins                  | No sewage-related toxins                        |  |
|  | Availability of dock or boat launch         | Yes                                       | Yes   |  |
|  | Your individual trip costs                  | \$50                                      | \$100   |  |
| <b>I would choose (check one only)</b> |   | <b>Trip A</b><br><input type="checkbox"/> | <b>Trip B</b><br><input type="checkbox"/>       | <b>Not Hunt</b><br><input type="checkbox"/>  |

**39. Which do you prefer—Trip A, Trip B, or “Not Hunt”?**

**Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B, or Not Hunt.** (Note that some trip characteristics conditions may be the same for Trip A and Trip B.)

| <b>Trip Characteristic</b>             |   | <b>Trip A</b>                             | <b>Trip B</b>                                   | <b>Not Hunt</b>  |
|--|---|---|---|--|
| <b>Conditions during trip</b>          | Ducks Bagged per day                        | No Ducks                                  | 3 Ducks   | <b>I would not choose to take a waterfowl hunting trip if these were my only choices</b> |
|  | Geese Bagged per day                        | No Geese                                  | No Geese  |  |
|  | Closest other hunting party                 | 50 Yards                                  | 400 Yards                                       |  |
|  | Feasibility of hunting over water or decoys | Yes                                       | Yes   |  |
|  | Natural marsh setting                       | No, mostly vegetated with phragmites      | Yes, mostly bull rush, salicornia, and cattails |  |
|  | Water quality                               | No sewage-related toxins                  | Possible sewage-related toxins or algae         |  |
|  | Availability of dock or boat launch         | No  | No  |  |
|  | Your individual trip costs                  | \$250                                     | \$1,000   |  |
| <b>I would choose (check one only)</b> |   | <b>Trip A</b><br><input type="checkbox"/> | <b>Trip B</b><br><input type="checkbox"/>       | <b>Not Hunt</b><br><input type="checkbox"/>  |

**Thank you for taking the time to complete and return this survey!**

Is there anything else you would like to tell us about your hunting experience or your concerns about the future of waterfowl hunting in Utah?

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## **Appendix B: Choice Question Attribute Levels**

**Final Adjusted Choice Question Sets**

**Generated with SAS Macros 1) fully dominated pairs had bids switched 2) when positive # Ducks the Geese set to "NO Geese"**

| Block | 1                                    |   | 1   |   | 1                                       |   | 1   |   |
|-------|--------------------------------------|---|---|---|---|---|---|---|
| Set   | 1                                    |   | 2   |   | 3                                       |   | 4   |   |
| Alt   | 1                                    | 2   | 1   | 2   | 1                                       | 2   | 1   | 2   |
| x1    | No Ducks                             | 3 Ducks   | 3 Ducks   | 7 ducks   | 7 ducks                                 | 1 Duck  | 1 Duck  | No Ducks  |
| x2    | 1 Goose                              | No Geese  | No Geese  | No Geese  | No Geese                                | No Geese  | No Geese  | 3 Geese   |
| x3    | 400 Yards                            | 50 Yards  | 200 Yards                                       | 400 Yards                                       | 200 Yards                               | 200 Yards                                       | 200 Yards                                       | 200 Yards                                       |
| x4    | Yes                                  | Yes   | Yes   | No  | Yes                                     | No  | Yes   | No  |
| x5    | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites            | No, mostly vegetated with phragmites    | Yes, mostly bull rush, salicornia, and cattails | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites            |
| x6    | No sewage-related toxins             | No sewage-related toxins                        | No sewage-related toxins                        | Possible sewage-related toxins or algae         | Possible sewage-related toxins or algae | No sewage-related toxins                        | Possible sewage-related toxins or algae         | No sewage-related toxins                        |
| x7    | No                                   | No  | No  | Yes   | Yes                                     | Yes   | Yes   | No  |
| x8    | \$50                                 | \$25  | \$100   | \$1,000   | \$25                                    | \$500   | \$500   | \$100   |
| Block | 2                                    |   | 2   |   | 2                                       |   | 2   |   |
| Set   | 1                                    |   | 2   |   | 3                                       |   | 4   |   |
| Alt   | 1                                    | 2   | 1   | 2   | 1                                       | 2   | 1   | 2   |
| x1    | 1 Duck                               | 1 Duck  | 3 Ducks   | 7 ducks   | 7 ducks                                 | 3 Ducks   | 7 ducks   | 3 Ducks   |
| x2    | No Geese                             | No Geese  | No Geese  | No Geese  | No Geese                                | No Geese  | No Geese  | No Geese  |
| x3    | 200 Yards                            | 400 Yards                                       | 400 Yards                                       | 50 Yards  | 200 Yards                               | 200 Yards                                       | 400 Yards                                       | 400 Yards                                       |
| x4    | Yes                                  | No  | No  | Yes   | No                                      | Yes   | Yes   | No  |
| x5    | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites            | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites            | No, mostly vegetated with phragmites            | Yes, mostly bull rush, salicornia, and cattails |
| x6    | No sewage-related toxins             | No sewage-related toxins                        | Possible sewage-related toxins or algae         | Possible sewage-related toxins or algae         | Possible sewage-related toxins or algae | No sewage-related toxins                        | Possible sewage-related toxins or algae         | No sewage-related toxins                        |
| x7    | No                                   | Yes   | Yes   | Yes   | No                                      | No  | Yes   | Yes   |
| x8    | \$250                                | \$50  | \$1,000   | \$100   | \$25                                    | \$250   | \$100   | \$25  |

| Block | 3   |                                      | 3                                    |   | 3                                    |   | 3                                       |                                      |
|-------|---|--------------------------------------|--------------------------------------|---|--------------------------------------|---|---|--------------------------------------|
| Set   | 1   |                                      | 2                                    |   | 3                                    |   | 4                                       |                                      |
| Alt   | 1   | 2                                    | 1                                    | 2   | 1                                    | 2   | 1                                       | 2                                    |
| x1    | 7 ducks   | No Ducks                             | 1 Duck                               | 7 ducks   | 3 Ducks                              | 7 ducks   | No Ducks                                | 1 Duck                               |
| x2    | No Geese  | 3 Geese                              | No Geese                             | No Geese  | No Geese                             | No Geese  | 1 Goose                                 | No Geese                             |
| x3    | 400 Yards                                       | 400 Yards                            | 50 Yards                             | 200 Yards                                       | 200 Yards                            | 400 Yards                                       | 200 Yards                               | 200 Yards                            |
| x4    | No  | Yes                                  | Yes                                  | No  | No                                   | Yes   | No                                      | No                                   |
|       | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites |
| x5    |   |                                      |                                      |   |                                      |   |   |                                      |
|       | Possible sewage-related toxins or algae         | No sewage-related toxins             | No sewage-related toxins             | No sewage-related toxins                        | No sewage-related toxins             | Possible sewage-related toxins or algae         | Possible sewage-related toxins or algae | No sewage-related toxins             |
| x6    | No  | Yes                                  | No                                   | Yes   | No                                   | Yes   | No                                      | No                                   |
| x7    | \$250   | \$1,000                              | \$1,000                              | \$500   | \$25                                 | \$100   | \$25                                    | \$100                                |
| x8    |   |                                      |                                      |   |                                      |   |   |                                      |

| Block | 4   |   | 4                                       |   | 4                                    |   | 4   |                                      |
|-------|---|---|---|---|--------------------------------------|---|---|--------------------------------------|
| Set   | 1   |   | 2                                       |   | 3                                    |   | 4   |                                      |
| Alt   | 1   | 2   | 1                                       | 2                                       | 1                                    | 2   | 1   | 2                                    |
| x1    | 3 Ducks   | 1 Duck  | 1 Duck                                  | 3 Ducks                                 | 3 Ducks                              | No Ducks  | No Ducks  | 7 ducks                              |
| x2    | No Geese  | No Geese  | No Geese                                | No Geese                                | No Geese                             | 3 Geese   | No Geese  | No Geese                             |
| x3    | 50 Yards  | 200 Yards                                       | 200 Yards                               | 400 Yards                               | 50 Yards                             | 200 Yards                                       | 50 Yards  | 50 Yards                             |
| x4    | Yes   | No  | No                                      | No                                      | Yes                                  | Yes   | Yes   | Yes                                  |
|       | Yes, mostly bull rush, salicornia, and cattails | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites |
| x5    |   |   |   |   |                                      |   |   |                                      |
|       | Possible sewage-related toxins or algae         | No sewage-related toxins                        | Possible sewage-related toxins or algae | Possible sewage-related toxins or algae | No sewage-related toxins             | No sewage-related toxins                        | No sewage-related toxins                        | No sewage-related toxins             |
| x6    | Yes   | Yes   | Yes                                     | No                                      | No                                   | No  | No  | Yes                                  |
| x7    | \$100   | \$250   | \$50                                    | \$100                                   | \$1,000                              | \$100   | \$25  | \$250                                |
| x8    |   |   |   |   |                                      |   |   |                                      |

| Block | 5   |   | 5                                       |                                      | 5                                       |   | 5   |   |
|-------|---|---|---|--------------------------------------|---|---|---|---|
| Set   | 1   |   | 2                                       |                                      | 3                                       |   | 4   |   |
| Alt   | 1   | 2   | 1                                       | 2                                    | 1                                       | 2   | 1   | 2                                       |
| x1    | 7 ducks   | 7 ducks   | 1 Duck                                  | No Ducks                             | 1 Duck                                  | No Ducks  | 3 Ducks   | 3 Ducks                                 |
| x2    | No Geese  | No Geese  | No Geese                                | 1 Goose                              | No Geese                                | 3 Geese   | No Geese  | No Geese                                |
| x3    | 200 Yards                                       | 400 Yards                                       | 400 Yards                               | 50 Yards                             | 200 Yards                               | 50 Yards  | 400 Yards                                       | 400 Yards                               |
| x4    | No  | No  | No                                      | Yes                                  | Yes                                     | Yes   | Yes   | Yes                                     |
|       | Yes, mostly bull rush, salicornia, and cattails | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites | No, mostly vegetated with phragmites    | Yes, mostly bull rush, salicornia, and cattails | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    |
| x5    |   |   |   |                                      |   |   |   |   |
|       | Possible sewage-related toxins or algae         | No sewage-related toxins                        | Possible sewage-related toxins or algae | No sewage-related toxins             | Possible sewage-related toxins or algae | Possible sewage-related toxins or algae         | No sewage-related toxins                        | Possible sewage-related toxins or algae |
| x6    |   |   |   |                                      |   |   |   |   |
| x7    | No  | Yes   | No                                      | Yes                                  | Yes                                     | No  | No  | Yes                                     |
| x8    | \$25  | \$1,000   | \$100                                   | \$250                                | \$25                                    | \$50  | \$500   | \$100                                   |

| Block | 6   |   | 6                                    |   | 6                                    |   | 6   |   |
|-------|---|---|--------------------------------------|---|--------------------------------------|---|---|---|
| Set   | 1   |   | 2                                    |   | 3                                    |   | 4   |   |
| Alt   | 1   | 2                                       | 1                                    | 2                                       | 1                                    | 2   | 1   | 2                                       |
| x1    | No Ducks  | 3 Ducks                                 | 7 ducks                              | 3 Ducks                                 | No Ducks                             | No Ducks  | 1 Duck  | 7 ducks                                 |
| x2    | No Geese  | No Geese                                | No Geese                             | No Geese                                | No Geese                             | No Geese  | No Geese  | No Geese                                |
| x3    | 400 Yards                                       | 50 Yards                                | 400 Yards                            | 50 Yards                                | 200 Yards                            | 50 Yards  | 200 Yards                                       | 400 Yards                               |
| x4    | No  | Yes                                     | Yes                                  | No                                      | Yes                                  | No  | No  | No                                      |
|       | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    |
| x5    |   |   |                                      |   |                                      |   |   |   |
|       | Possible sewage-related toxins or algae         | Possible sewage-related toxins or algae | No sewage-related toxins             | Possible sewage-related toxins or algae | No sewage-related toxins             | No sewage-related toxins                        | Possible sewage-related toxins or algae         | Possible sewage-related toxins or algae |
| x6    |   |   |                                      |   |                                      |   |   |   |
| x7    | No  | Yes                                     | Yes                                  | Yes                                     | Yes                                  | Yes   | No  | No                                      |
| x8    | \$250   | \$500                                   | \$1,000                              | \$250                                   | \$50                                 | \$1,000   | \$1,000   | \$100                                   |

| Block | 7   |   | 7   |   | 7                                    |   | 7   |   |
|-------|---|---|---|---|--------------------------------------|---|---|---|
| Set   | 1   |   | 2   |   | 3                                    |   | 4   |   |
| Alt   | 1   | 2                                       | 1   | 2                                       | 1                                    | 2   | 1   | 2   |
| x1    | 7 ducks   | 1 Duck                                  | No Ducks  | 3 Ducks                                 | 1 Duck                               | 1 Duck  | 1 Duck  | 3 Ducks   |
| x2    | No Geese  | No Geese                                | No Geese  | No Geese                                | No Geese                             | No Geese  | No Geese  | No Geese  |
| x3    | 50 Yards  | 50 Yards                                | 400 Yards                                       | 50 Yards                                | 200 Yards                            | 400 Yards                                       | 400 Yards                                       | 200 Yards                                       |
| x4    | No  | Yes                                     | No  | Yes                                     | Yes                                  | No  | Yes   | No  |
|       | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails | Yes, mostly bull rush, salicornia, and cattails | Yes, mostly bull rush, salicornia, and cattails |
| x5    |   |   |   |   |                                      |   |   |   |
|       | No sewage-related toxins                        | Possible sewage-related toxins or algae | Possible sewage-related toxins or algae         | Possible sewage-related toxins or algae | No sewage-related toxins             | No sewage-related toxins                        | No sewage-related toxins                        | Possible sewage-related toxins or algae         |
| x6    |   |   |   |   |                                      |   |   |   |
| x7    | Yes   | Yes                                     | No  | Yes                                     | No                                   | Yes   | No  | No  |
| x8    | \$100   | \$500                                   | \$250   | \$500                                   | \$250                                | \$50  | \$500   | \$1,000   |

| Block | 8   |   | 8                                    |   | 8   |                                      | 8                                    |   |
|-------|---|---|--------------------------------------|---|---|--------------------------------------|--------------------------------------|---|
| Set   | 1   |   | 2                                    |   | 3   |                                      | 4                                    |   |
| Alt   | 1   | 2                                       | 1                                    | 2   | 1   | 2                                    | 1                                    | 2   |
| x1    | 7 ducks   | No Ducks                                | 3 Ducks                              | No Ducks  | 3 Ducks   | 7 ducks                              | 1 Duck                               | 1 Duck  |
| x2    | No Geese  | No Geese                                | No Geese                             | 3 Geese   | No Geese  | No Geese                             | No Geese                             | No Geese  |
| x3    | 200 Yards                                       | 400 Yards                               | 50 Yards                             | 200 Yards                                       | 400 Yards                                       | 400 Yards                            | 400 Yards                            | 50 Yards  |
| x4    | Yes   | Yes                                     | No                                   | No  | Yes   | No                                   | No                                   | Yes   |
|       | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails |
| x5    |   |   |                                      |   |   |                                      |                                      |   |
|       | Possible sewage-related toxins or algae         | Possible sewage-related toxins or algae | No sewage-related toxins             | No sewage-related toxins                        | Possible sewage-related toxins or algae         | No sewage-related toxins             | No sewage-related toxins             | Possible sewage-related toxins or algae         |
| x6    |   |   |                                      |   |   |                                      |                                      |   |
| x7    | No  | Yes                                     | No                                   | Yes   | Yes   | No                                   | No                                   | No  |
| x8    | \$1,000   | \$100                                   | \$25                                 | \$250   | \$25  | \$500                                | \$500                                | \$50  |

| Block | 9                                       |                                      | 9                                    |   | 9                                       |   | 9                                       |   |
|-------|---|--------------------------------------|--------------------------------------|---|---|---|---|---|
| Set   | 1                                       |                                      | 2                                    |   | 3                                       |   | 4                                       |   |
| Alt   | 1                                       | 2                                    | 1                                    | 2                                       | 1                                       | 2   | 1                                       | 2   |
| x1    | 1 Duck                                  | 7 ducks                              | 7 ducks                              | 3 Ducks                                 | 1 Duck                                  | No Ducks  | 7 ducks                                 | 1 Duck  |
| x2    | No Geese                                | No Geese                             | No Geese                             | No Geese                                | No Geese                                | 3 Geese   | No Geese                                | No Geese  |
| x3    | 400 Yards                               | 200 Yards                            | 400 Yards                            | 50 Yards                                | 200 Yards                               | 50 Yards  | 50 Yards                                | 50 Yards  |
| x4    | Yes                                     | Yes                                  | Yes                                  | No                                      | Yes                                     | Yes   | No                                      | Yes   |
|       | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites | No, mostly vegetated with phragmites | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites    | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    | Yes, mostly bull rush, salicornia, and cattails |
| x5    |   |                                      |                                      |   |   |   |   |   |
|       | Possible sewage-related toxins or algae | No sewage-related toxins             | No sewage-related toxins             | Possible sewage-related toxins or algae | Possible sewage-related toxins or algae | Possible sewage-related toxins or algae         | Possible sewage-related toxins or algae | Possible sewage-related toxins or algae         |
| x6    | Yes                                     | Yes                                  | Yes                                  | Yes                                     | Yes                                     | No  | No                                      | Yes   |
| x7    | Yes                                     | Yes                                  | Yes                                  | Yes                                     | Yes                                     | No  | No                                      | Yes   |
| x8    | \$100                                   | \$50                                 | \$1,000                              | \$250                                   | \$25                                    | \$50  | \$500                                   | \$100   |

| Block | 10                                   |   | 10                                      |                                      | 10                                   |   | 10                                   |   |
|-------|--------------------------------------|---|---|--------------------------------------|--------------------------------------|---|--------------------------------------|---|
| Set   | 1                                    |   | 2                                       |                                      | 3                                    |   | 4                                    |   |
| Alt   | 1                                    | 2   | 1                                       | 2                                    | 1                                    | 2   | 1                                    | 2   |
| x1    | 7 ducks                              | No Ducks  | 1 Duck                                  | No Ducks                             | 1 Duck                               | 3 Ducks   | No Ducks                             | 3 Ducks   |
| x2    | No Geese                             | No Geese  | No Geese                                | 1 Goose                              | No Geese                             | No Geese  | No Geese                             | No Geese  |
| x3    | 200 Yards                            | 200 Yards                                       | 400 Yards                               | 50 Yards                             | 200 Yards                            | 50 Yards  | 50 Yards                             | 400 Yards                                       |
| x4    | Yes                                  | Yes   | No                                      | Yes                                  | Yes                                  | No  | Yes                                  | Yes   |
|       | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites    | No, mostly vegetated with phragmites | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails | No, mostly vegetated with phragmites | Yes, mostly bull rush, salicornia, and cattails |
| x5    |                                      |   |   |                                      |                                      |   |                                      |   |
|       | No sewage-related toxins             | Possible sewage-related toxins or algae         | Possible sewage-related toxins or algae | No sewage-related toxins             | No sewage-related toxins             | No sewage-related toxins                        | No sewage-related toxins             | Possible sewage-related toxins or algae         |
| x6    | No                                   | Yes   | No                                      | Yes                                  | Yes                                  | Yes   | No                                   | No  |
| x7    | No                                   | Yes   | No                                      | Yes                                  | Yes                                  | Yes   | No                                   | No  |
| x8    | \$250                                | \$500   | \$100                                   | \$250                                | \$50                                 | \$100   | \$250                                | \$1,000   |

## **Appendix C: Duck Club Member Sample Results and Comparison of Duck Club and Public Samples**

## ***C.0 Comparison of Public Sample and Private Duck Club Member Results***

In addition to the Public Hunter Sample, surveys were distributed to members of private duck hunting clubs on the Great Salt Lake. This unique population was sampled to the extent that clubs were willing to participate in distribution of the surveys to club members. As noted, the private club sample returned a significantly large sample size and had an overall response rate similar to the private hunter sample. This appendix presents the survey results for this specialized subsample of Utah waterfowl hunters. Additionally, where appropriate and informative, the club member results in this section are compared with the same results for the Public Sample of hunters. This section is divided into 4 primary sub-sections: section C.1 examines general hunter activities and preferences. Section C.2 presents data on the most recent trip taken by hunters. Discussion and estimates of expenditures for both the Public and Club Member samples are presented in both the Executive Summary and in Section 4 of this report. This section is divided in subsections on general trip characteristics, spending, and estimation of trip net economic values. Section C.3 looks at general demographic characteristics of the survey respondents. Finally, Section C.4 describes the development of the choice format valuation questions and the results from that analysis.

### ***C.1 General Hunter Activities and Preferences***

A consistent result of the survey was that the duck club member sample of Utah waterfowl hunters is an engaged recreational population with very high levels of participation and enthusiasm for their activity. The average public hunter had been hunting waterfowl for nearly 38 years. Of the 98.8% of the sample who reported hunting waterfowl in Utah in 2010-11, the average hunter hunted waterfowl for 20.7 days. Further, nearly 88% of hunters stated that waterfowl hunting was either their favorite or one of their favorite outdoor recreational activities (Table 19).

**Table 19. Comparison of Duck Club Member and Public Hunter Sample, General Hunter Characteristics.**

| Hunter Characteristic   | Statistic  |               |
|---|------------|---------------|
|   | Duck Club  | Public Hunter |
| <b>(A) All Respondents to Public Sample</b>   |            |               |
| Mean number of years waterfowl hunting  | 37.6 years | 28.7 years    |
| Percentage of sample hunting waterfowl in Utah in 2010-11   | 98.8%      | 59.7%         |
| <b>(B) Public Sample Respondents who Hunted in 2010-11</b>  |            |               |
| Average Number of Days Hunted in 2010-11 Season   | 20.7 Days  | 12.5 Days     |
| Average number of Ducks Bagged in 2010-11 Season  | 60.6 Ducks | 15.5 Ducks    |
| Average number of Geese Bagged in 2010-11 Season  | 5.6 Geese  | 2.7 Geese     |
| Percent saying Waterfowl Hunting is either their Favorite, or one of their Favorite Outdoor Recreation Activities | 87.8%      | 79.5%         |

The survey asked hunters to rate the importance of a number of possible reasons for them choosing a particular location to hunt waterfowl. Table 20 shows the percentage of respondents who rated each of the potential reasons either “important” or “very important” to them in choosing a waterfowl hunting site. The most important reasons for both samples were hunting in an uncongested location, hunting in a relatively natural setting, and seeing abundant waterfowl. The least important among the reasons presented were bagging limits of ducks and geese, and the area having good “jump” or “pass” shooting.

**Table 20. Comparison of Duck Club Member and Public Hunter Sample, Responses to Reasons for Choosing an Area to Waterfowl Hunt.**

| Reason for Choosing A Waterfowl Hunting Area   | Percent responding that the Reason was either “Very Important” or “Important.” |                      |
|--|--|----------------------|
|  | Duck Club Sample   | Public Hunter Sample |
| Bagging a limit of ducks                       | 64.8%  | 49.7%                |
| Bagging a limit of geese                       | 47.7%  | 43.1%                |
| Seeing abundant waterfowl                      | 98.8%  | 94.6%                |
| A relatively natural setting                   | 98.8%  | 95.5%                |
| Close to home                                  | 73.3%  | 71.4%                |
| Hunting over decoys                            | 95.5%  | 84.4%                |
| Good pass shooting                             | 46.7%  | 47.1%                |
| Good jump shooting                             | 15.8%  | 34.3%                |
| Uncongested with good distance between parties | 98.0%  | 98.2%                |
| Available boat launch                          | 49.8%  | 72.4%                |
| Hunting with a dog                             | 77.1%  | 58.7%                |

## C.2 Information on Hunter’s Most Recent Hunting Trip

Hunters were asked a series of questions about one specific waterfowl hunting trip from the 2010-11 season. Specifically, they were asked “questions about your most recent Utah waterfowl hunting trip during the general 2010-11 season.”

### C.2.1 Characteristics of Most Recent Hunting Trip

While hunters in the public sample reported having most recently hunted a wide spectrum of Utah locations including 15 different private duck clubs, the most frequently cited clubs hunted Harrison, Chesapeake, and Ambassador. The very large majority of Club Sample hunters (88.7%) hunted most recently at a private club, and the sample was dominated by one-day trips from home (77%). The survey, which was administered following the January 15<sup>th</sup> end of the general waterfowl hunting season resulted in reported most recent trips that were (not surprisingly) skewed toward the last two months of the season. Finally, club member hunters traveled an average of 91.4 miles each way of travel from their homes to their hunting sites while private sample hunters traveled an average of 32.5 miles.

**Table 21. Comparison of Duck Club Member and Public Hunter Sample Most recent Trip Characteristics: Locations, Dates, and Distance.**

| Characteristics of Hunters “Most Recent Trip”              | Statistic  |   |
|--|--|---|
|  | Duck Club Sample   | Public Hunter Sample  |
| Top Most Hunted Locations in the Samples                   | Harrison (16.5%)<br>Chesapeake (10.5%)<br>Ambassador (8.5%)<br>Rudy (8.5%)<br>New State (6.0%)<br>North Point (4.0%) | Farmington Bay (24.5%)<br>Ogden Bay (10.5%)<br>Willard (9.6%)   |
| Type of Area Hunted  | Private Club (88.7%)<br>Private Leased Ground (7.1%)<br>Public Land (4.2%)   | Private Club (4.6%)<br>Private Leased Ground (7.6%)<br>Public Land (87.8%)  |
| Percent of trips that were One-Day Trips from Home         | 77.1%  | 95.8%   |
| Distribution of trips across months                        | September (1.0%)<br>October (18.0%)<br>November (17.5%)<br>December (20.9%)<br>January (39.8%)<br>February (0.5%)    | September (1.4%)<br>October (12.1%)<br>November (12.4%)<br>December (25.3%)<br>January (47.3%)<br>February (1.4%) |
| Average number of One-Way Miles traveled from Home on Hunt | 91.4 miles   | 32.5 miles  |

Hunters in the Duck Club Member Sample reported bagging more ducks and geese on their most recent Utah hunting trip than did members of the public hunter sample. The large majority of hunters reported hunting over water with decoys (>70%), and hunting in a relatively natural setting (~78 %).

**Table 22. Comparison of Duck Club Member and Public Hunter Sample Characteristics of Most Recent Hunting trip.**

| <b>Characteristics of Most recent Hunting Trip</b>                             | <b>Statistics</b>   |   |
|--|---|---|
|  | <b>Duck Club Sample</b>   | <b>Public Hunter Sample</b>   |
| Average Number of Ducks Bagged   | 4.3 Ducks   | 2.1 Ducks   |
| Average Number of Geese Bagged   | 1.06 Geese  | 0.7 Geese   |
| Type of Hunting Engaged in   | Hunted over water and decoys (78.2%)<br>Hunted over decoys on land (25.0%)<br>Did mostly pass shooting (15.7%)<br>Did mostly jump shooting (3.2%) | Hunted over water and decoys (71.6%)<br>Hunted over decoys on land (17.7%)<br>Did mostly pass shooting (14.5%)<br>Did mostly jump shooting (8.1%) |
| Percent saying they Hunted in a Natural Setting                                | 78.7%   | 77.6%   |
| Percent saying they Hunted in an Area of Natural Vegetation                    | 82.5%   | 63.4%   |
| Percent Reporting Seeing Abundant Waterfowl on Trip                            | 67.5%   | 41.9%   |
| Percent Saying they were Concerned about risk of sewage-related Toxins on Trip | 8.6%  | 14.6%   |

Both Public Sample and Duck Club Member Sample hunters were asked about their level of concern regarding a number of current or potential environmental conditions that have the potential to impact the quality of waterfowl hunting on The Great Salt Lake. Overall, there was a high level of concern regarding all the presented environmental conditions (Table 23). The highest levels of concern were associated with invasive phragmites vegetation and reallocation of waterflows from wetlands to residential or industrial development.

**Table 23. Comparison of Duck Club Member and Public Hunter Sample Reported Levels of Concern over Environmental Issues Potentially Affecting GSL Hunting**

| Issues Affecting Waterfowl Hunting   | Percent of Sample Hunters Saying they were either “Concerned” or “Very Concerned” |                      |
|--|---|----------------------|
|  | Duck Club Sample  | Public Hunter Sample |
| Water levels in the Great Salt Lake  | 85.3%   | 85.5%                |
| Invasive phragmites vegetation   | 94.7%   | 96.8%                |
| Absence of the native marsh vegetation that attracts and feeds waterfowl                             | 89.8%   | 91.5%                |
| Loss of waterfowl habitat due to expansion of the mineral salt industry                              | 82.5%   | 86.2%                |
| Reallocation of waterflows from wetlands to residential or industrial developments                   | 91.1%   | 92.5%                |
| Algae mats due to nutrients from sewage, farm, or city runoff  | 78.4%   | 83.3%                |
| Risk associated with sewage-related toxins such as <i>e coli</i> or cyanobacteria (blue-green algae) | 70.2%   | 74.7%                |

### C.2.2 Net Economic Value of Most Recent Hunting trip

The contingent valuation method (CVM) uses survey techniques to determine the values which people would place on traditionally nonmarket goods and services if markets did exist for these commodities. In this study, the value of a day spent waterfowl hunting in Utah is measured through the use of contingent valuation. Well established markets for many public land activities do not exist. Therefore, the basic problem faced in determining the economic value of services, such as a day spent waterfowl hunting, is measuring the nonmarket values. Contingent valuation has been widely applied (Mitchell and Carson 1989) and is recognized by the U.S. Water Resources Council (1983) as an appropriate method. This approach has also been designated in federal guidelines (U.S. Department of Interior 1986, 1991) as a best available procedure for valuation of damages arising in superfund natural resource damage cases. The contingent valuation method has been employed numerous times to inform state and federal agency decision makers on resource issues. Examples of applications similar to the case at hand include Boyle and Bishop (1987), and Champ et al. (1997). Walsh, Johnson, and McKean (1992) provide a literature review of recreational demand studies, including contingent valuation. For example, in Montana, CVM has been used by the state fish and wildlife agency to value waterfowl hunting in the state (Duffield and Neher 1991) and to examine the relationship between stream flow and recreation values on the Bitterroot and Bighole Rivers (Duffield et al. 1992). Additionally, federal agencies have used CVM to inform decision makers in several large-scale Environmental Impact Statements on wildlife issues such as wolf reintroduction to Yellowstone National Park (U.S. Fish and Wildlife

Service 1994), and reintroduction of grizzlies to central Idaho and western Montana (U.S. Fish and Wildlife Service 2000). Other major Federal actions that rely on CVM include the decision to modify operations of Glen Canyon Dam, which was operated as a peaking facility and impacted downstream recreation and NPS resources in the Grand Canyon. Additionally, CVM was the basis of the State of Alaska’s claim against Exxon in the *Exxon Valdez* oil spill case, which settled for \$1 billion.

The essence of the CVM approach is to ask individuals their willingness to pay for a given service or commodity (WTP) contingent on their acceptance of a hypothetical but plausible and realistic payment situation that could range from a vote in a referendum to a decision to make a donation. The application of the CVM involves three elements: 1) a description of the resource which is to be valued; 2) the “payment vehicle,” or method by which the respondent will pay for the resource; and, 3) the “question format” or specific method by which the value of the resource will be elicited. We will discuss how each of these elements is addressed in turn. In the 2011 Utah Waterfowl Hunter Survey, respondents were asked the specific contingent valuation question of how they valued their most recent Utah waterfowl hunting trip.

A feature of all CVM applications is the method by which the resource value is elicited from respondents. There are several basic genres of CVM elicitation techniques including payment card CVM questions and dichotomous choice CVM questions. In the payment card CVM respondents are asked to identify the maximum amount they would be willing to pay for a good or resource from a list of amounts presented to them in the survey. This study utilized the payment card CVM in the current trip valuation question.

### C.2.3 Net Economic Value of Waterfowl Hunting Trips

The most recent waterfowl hunting trip contingent valuation question included in the Utah survey asked respondents their willingness to pay an additional amount in expenses to have made their trip hunt waterfowl in Utah. The text of the CV question reads:

---

The costs of going hunting change over time. For example, gas prices and other travel costs and equipment rise and fall. Was your recent waterfowl hunting trip **worth more to you than what you actually spent?**

- Yes       No

**If YES,** If your total trip costs were to increase, **what is the maximum extra amount** you would be willing to pay and still take this trip? (please choose one)

- |                                |                                  |   |
|--------------------------------|----------------------------------|---|
| <input type="checkbox"/> \$10  | <input type="checkbox"/> \$250   | <input type="checkbox"/> \$1,500        |
| <input type="checkbox"/> \$ 25 | <input type="checkbox"/> \$500   | <input type="checkbox"/> \$2,000        |
| <input type="checkbox"/> \$50  | <input type="checkbox"/> \$750   | <input type="checkbox"/> Other \$ _____ |
| <input type="checkbox"/> \$100 | <input type="checkbox"/> \$1,000 |   |

The example above utilized a “payment card” question format, and a “travel cost” payment vehicle.

**Table 24. Comparison of Duck Club Member and Public Hunter Sample Distribution of Contingent Valuation Payment Card Responses.**

| Maximum Amount Extra Hunter Was Willing to Pay | Percent of Hunters |                      |
|--|--------------------|----------------------|
|  | Duck Club Sample   | Public Hunter Sample |
| 0  | 15.5%              | 35.4%                |
| \$10   | 7.3%               | 7.7%                 |
| \$25   | 13.1%              | 14.3%                |
| \$50   | 15.5%              | 17.4%                |
| \$100  | 24.8%              | 19.2%                |
| \$250  | 8.7%               | 3.1%                 |
| \$500  | 9.2%               | 2.9%                 |
| \$750  | 1.5%               | 0%                   |
| \$1,000  | 2.9%               | 0.2%                 |
| \$1,500  | 1.5%               | 0%                   |
| \$2,000  | 0%                 | 0%                   |

Table 25 shows the estimated group willingness to pay estimates derived from use of the increased travel cost payment vehicle. The interval model of willingness to pay, which was estimated using the SAS LIFEREG procedure resulted in a good parameter fit.

The median WTP, which is the amount at which 50% of individual’s WTP are above and 50% below, is estimated at about \$131 per trip (day) for club members and \$75 per day for hunters in the Public Sample.

**Table 25. Estimated Net Willingness to Pay per Person for a Utah Waterfowl Hunting Trip: Duck Club Member Sample**

| Parameter  | Estimate              | Standard Error | 95% C.L. |        | Chi-Square | Pr. > ChiSq |
|--|-----------------------|----------------|----------|--------|------------|-------------|
|  |                       |                |          |        |            |             |
| Intercept  | 4.8441                | 0.0954         | 4.657    | 5.0311 | 2575.9     | <.0001      |
| Scale  | 0.6991                | 0.0445         | 0.6171   | 0.7019 |            |             |
| Sample Size  | 206                   |                |          |        |            |             |
| Distribution                                       | Log-Logistic          |                |          |        |            |             |
| BIC  | 706.49                |                |          |        |            |             |
| Estimated Median WTP<br>(Public Hunter Median WTP) | \$130.90<br>(\$75.76) |                |          |        |            |             |

### ***C.3 Socioeconomic and Demographic Characteristics***

The survey included a section which asked questions on general socioeconomic characteristics of the respondents. Table 26 shows several key socioeconomic and demographic characteristics for the two sample groups. Both samples were largely comprised of residents of Utah. The average age of hunters was between 50 and 56 years, with approximately 70% employed full-time and 20% retired. The club member hunter population had significantly higher income than the average Utah household. The U.S. Census Bureau reports that the 2009 median household income in Utah was \$55,143<sup>11</sup>. By comparison, the Public hunter sample reported that over 64% of the sample had household incomes in 2010 over \$100,000 (Figure 6).

**Table 26. Comparison of Socioeconomic Characteristics of Duck Club Member and Public Hunter Sample Waterfowl Hunters.**

| Characteristic             | Statistic        |                      |
|----------------------------|------------------|----------------------|
|                            | Duck Club Sample | Public Hunter Sample |
| Percent Utah Residents     | 93.1%            | 99.7%                |
| Average Age                | 56.0 years       | 50.1 years           |
| Percent Employed Full Time | 71.4%            | 70.0%                |
| Percent Retired            | 19.6%            | 18.8%                |

<sup>11</sup> U.S. Census State QuickFacts <http://quickfacts.census.gov/qfd/states/49000.html>

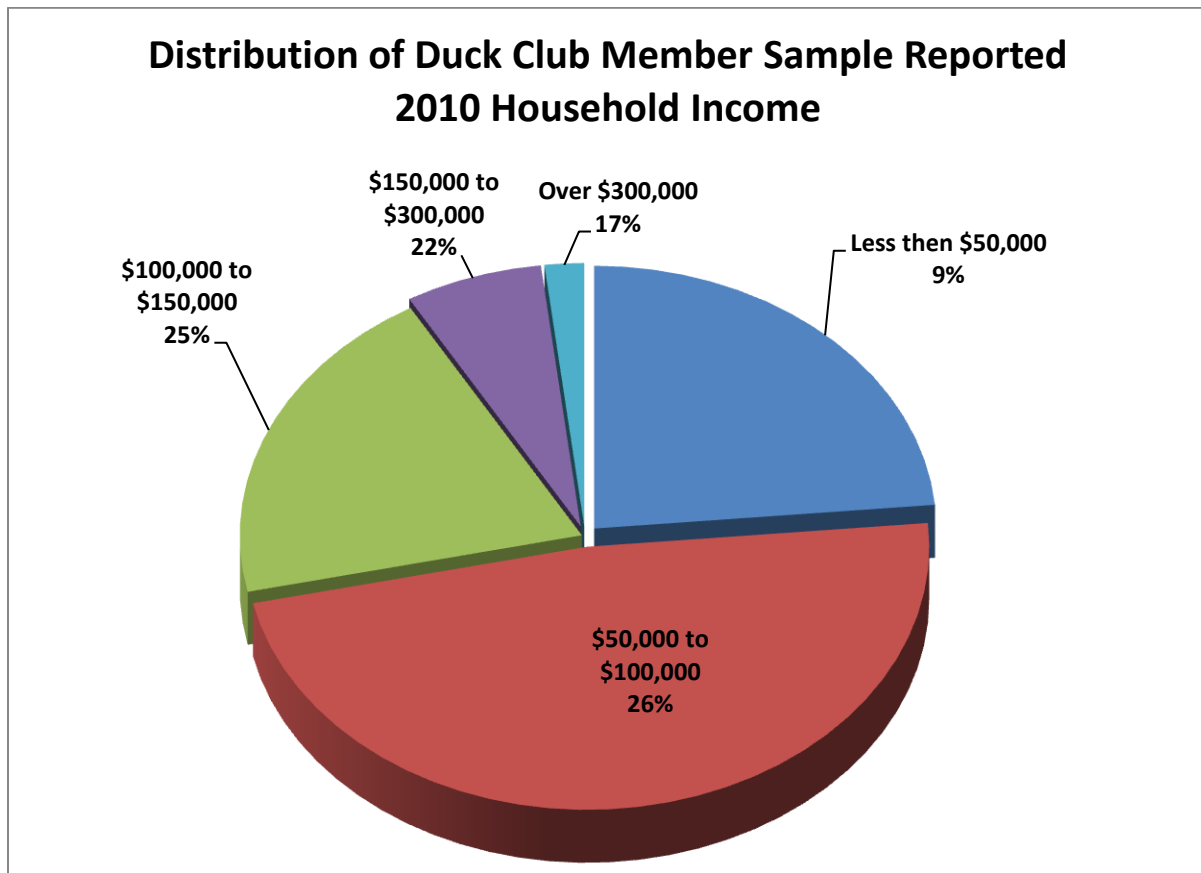


Figure 8. Duck Club Member Sample Reported 2010 Household Income before Taxes

### ***C.4 Choice Question Response Analysis***

Many recreational activities, such as waterfowl hunting, are best characterized as multi-attribute. That is, decisions on whether or not to take a certain trip or engage in a specific activity at a certain time in a specific location may be influenced by many factors. The decision to hunt waterfowl may be influenced, for instance, by the expected success level of the hunt, the expected congestion to be encountered at the hunting location, the natural setting of the hunt, and, of course, the personal cost of the hunting trip.

The results of the contingent valuation question and analysis reported in Section C.2 above asks hunters to remember their most recent hunting trip and to assume that everything about that trip remained the same but only the cost of the trip increased. They are asked whether they would, in retrospect, have still taken that trip at that increased cost. This contingent valuation method using the payment card vehicle is an effective way to elicit willingness to pay for an overall trip experience.

An extension of this type of contingent valuation method is the choice (or conjoint) question format which recognizes that a number of trip attributes in addition to the cost of the trip may play a role in trip decisions. The specific design of the choice question, which asks respondents to choose between two hunting trips with different characteristics and costs, allows the researcher to estimate the marginal value of each specific attribute to the overall net economic value of a waterfowl hunting trip. This type of question formulation, therefore, moves beyond the question of what the net economic value of the entire trip is to the more refined and specific question of which attributes of a hunting trip either enhance its net economic value or detract from that value for an individual. An extension of estimating the values associated with specific attributes is to (like in the case of the payment card CV method) estimate the average trip value by setting attribute levels in the estimated model at averages for the sample population.

### **C.4.1 Choice Question Design**

The design of an effective choice, or conjoint analysis valuation question begins with identification of the most important attributes of a trip that a hunter considers in making a decision about when, where, and how much to hunt. As described in the sections on survey design, the authors spent significant time talking to active Utah hunters about what attributes made for a good or bad hunting experience. Some attributes were clear from the outset; increased bags of ducks and geese were expected to be associated with higher quality hunting. Other potentially important attributes identified and included in the model design were:

- Distance between hunting parties (congestion)
- The feasibility of hunting over decoys
- Whether the hunting location had natural vegetation such as bull rush and cattails, or it was mostly vegetated with invasive phragmites
- Whether the water at the hunting location was relatively natural, or was contaminated with sewage-related toxins or algae
- Whether there was an available dock or boat launch at the hunting location
- The cost of the hunting trip to an individual.

As discussed in Section 2.2, statistical software was used to construct 10 versions of the Utah hunting survey that each had four conjoint analysis questions, each presenting a hunter with a choice between two hunting trips with different attribute mixes, or the choice not to hunt at all. Appendix B shows the final attribute distribution for the 40 choice questions contained in the 10 survey versions. Survey versions were randomly assigned to individuals in the two sample frames. Figure 9 shows a version of the choice question that was presented to Utah hunters.

Which do you prefer—Trip A, Trip B, or “Not Hunt”?

Please check ONE box at the bottom of the table to indicate whether you prefer Trip A, Trip B, or Not Hunt. (Note that some trip characteristics conditions may be the same for Trip A and Trip B.)

| Trip Characteristic                    |   | Trip A                                    | Trip B  | Not Hunt   |
|--|---|---|---|--|
| Conditions during trip                 | Ducks Bagged per day                        | 1 Duck                                    | 3 Ducks   | <b>I would not choose to take a waterfowl hunting trip if these were my only choices</b> |
|  | Geese Bagged per day                        | No Geese                                  | No Geese  |  |
|  | Closest other hunting party                 | 200 Yards                                 | 50 Yards  |  |
|  | Feasibility of hunting over water or decoys | Yes                                       | No  |  |
|  | Natural marsh setting                       | No, mostly vegetated with phragmites      | Yes, mostly bull rush, salicornia, and cattails |  |
|  | Water quality                               | No sewage-related toxins                  | No sewage-related toxins                        |  |
|  | Availability of dock or boat launch         | Yes                                       | Yes   |  |
|  | Your individual trip costs                  | \$50                                      | \$100   |  |
| <b>I would choose (check one only)</b> |   | <b>Trip A</b><br><input type="checkbox"/> | <b>Trip B</b><br><input type="checkbox"/>       | <b>Not Hunt</b><br><input type="checkbox"/>  |

Figure 9. Sample Utah Waterfowl Hunting Survey Choice Question Format.

### C.4.2 Choice Response Analysis

As shown in Table 27, many of the estimated coefficients are statistically significant at the 99% level of confidence. As it was expected, price has negative effect, bagging additional ducks and geese has a positive effect, hunting in an area of natural marsh vegetation has a positive effect, the presence of sewage-related toxins or algae has a negative effect, and the availability of a boat launch or dock has a positive effect on trip value. The coefficients for distance between hunting parties and the feasibility of hunting over water and decoys were not statistically significant.

These estimated coefficients, which are maximum likelihood parameter estimates, show how much the presence of each attribute increases the utility for an average hunter.

**Table 27. Estimated Duck Club Member Sample Multinomial Discrete Choice Model of Willingness to Pay.**

| <b>Attribute</b>                  | <b>Estimated Coefficient</b> | <b>Standard Error</b> | <b>T-Statistic</b> | <b>P. Value</b> |
|-----------------------------------|------------------------------|-----------------------|--------------------|-----------------|
| Trip cost                         | -0.00178                     | 0.000205              | -8.69              | <.0001***       |
| Ducks bagged                      | 0.138                        | 0.0213                | 6.48               | <.0001***       |
| Geese bagged                      | 0.2885                       | 0.0655                | 4.41               | <.0001***       |
| Distance to next party            | 0.000376                     | 0.000348              | 1.08               | 0.2802          |
| Hunting over water or decoys      | 0.113                        | 0.1019                | 1.11               | 0.2675          |
| Natural marsh vegetation          | 0.1643                       | 0.0967                | 1.7                | 0.0891*         |
| Presence of sewage-related toxins | -0.9947                      | 0.1165                | -8.54              | <.0001***       |
| Available Boat launch or dock     | 0.0852                       | 0.1095                | 0.78               | 0.4366          |

\* Statistically significant at the 90% level of confidence

\*\*\* Statistically significant at the 99% level of confidence

Table 28 shows the estimated marginal utility (change in WTP per trip) associated with the statistically significant attributes for the choice model estimation. The model predicts that on average an additional bagged duck is worth \$44.63 for public hunters and \$113.49 for club members and an additional goose \$113.49 for the public sample and \$161.90 for club members. It is estimated that it is worth \$108 to Public sample hunters (and \$92.20 to Club members) to hunt in an area of natural vegetation, and that the presence of sewage-related toxins detracts substantially from the value of a trip (-\$363 for public sample and -\$558 for club members). Another way to interpret this latter value is that since the negative effect of poor water quality (-\$363 to -\$558) is so large, and substantially exceeds the average value of a trip (~\$75 to \$131), very few, if any, hunters would choose such a trip. Finally, the model predicts that it is worth \$157 to the average Public Sample hunter to hunt in an area where a dock or boat launch is available.

**Table 28. Comparison of Estimated Utility Associated with Marginal Changes in Choice Question Trip Attribute Levels: Duck Club Members and Public Hunter Sample.**

| <b>Trip Attribute</b>             | <b>Marginal Utility</b> |                             |
|-----------------------------------|-------------------------|-----------------------------|
|                                   | <b>Duck Club Sample</b> | <b>Public Hunter Sample</b> |
| Ducks bagged                      | \$ 77.44                | \$ 44.63                    |
| Geese bagged                      | \$ 161.90               | \$ 113.49                   |
| Distance to next party            | n/a                     | n/a                         |
| Hunting over water or decoys      | n/a                     | n/a                         |
| Natural marsh vegetation          | \$ 92.20                | \$ 108.10                   |
| Presence of sewage-related toxins | \$(558.19)              | \$(363.59)                  |
| Available Boat launch or dock     | n/a                     | \$ 157.22                   |