

Economic Impacts of Washington State Resident Scuba Divers

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Prepared by



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Abbreviations

MPA	Marine Protected Areas
I-O	Input Output Model

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Abstract

While its scuba diving conditions may not resemble those of the tropics, Washington State provides some of the most spectacular diving in the United States. The flora, fauna, and seafloor topography of this area are sensational. However, there is little, if any, information regarding the economic impacts that this recreational sector provides the state of Washington. To fill this gap, we designed and implemented a survey of resident divers and dive shop owners in order to collect data on perceptions of the quality of sites, attributes of preferred sites, number of dives made annually, number of shop employees, expenditures to participate in the sport or run a dive business, and demographic information. The survey was designed to ask pertinent questions needed to characterize the role of scuba in inland waters to the Washington State economy. Using the IMPLAN™ model, we generated estimates of the direct, indirect, and induced economic impacts of participation in scuba. Our results suggest that in 2014 resident club divers in Washington State spent approximately \$2.4 million in the study area with a total of \$3.9 overall. Estimated expenditures in Washington State generated in turn nearly \$5 million in total output, or 1.8 times the activity. In addition, total expenditures by Washington's resident club divers generated nearly an additional \$1.9 million in labor income paid in state. The resident club diver population was responsible for approximately 49 additional jobs in Washington State. These results suggest that for every dollar spent by a resident diver, a total of \$1.8 worth of economic activity is generated in Washington State. In addition, every \$1 spent by resident divers generates \$0.70 in wages in the state and for every \$1 million worth of spending, nearly 17 jobs are generated. The information generated by this assessment will help inform effective coastal and marine resource management and policy decision-making, especially as relates to marine protected areas and marine spatial planning.

1 Introduction

Washington State provides some of the most spectacular diving in the United States. The flora, fauna, and seafloor topography of this area are sensational. PADI, a dive certification agency, indicates that currently Washington State ranks fourth in the nation in terms of resident participant user days and third in the number of certified divers per capita. According to an Earth Economics report, “Economic Analysis of Outdoor Recreation in Washington State”, in 2014 there were 1,094,000 resident diving participant days in public waters. Expenditures associated with those days equaled \$130,242,000 (excluding equipment) or, or \$119 per day (Earth Economics 2015). Out of state scuba diving participant days equaled 18,992 with expenditures of \$157,028 or \$8 per person per day. According to Rick Stratton (2015) there are 65,000 divers in Washington State, with only 10 to 20 percent (9,750 divers) active. These divers dive locally, regionally (Oregon or British Columbia), or internationally. The dive community is made up of independent divers, dive clubs, charters, and dive shops which provide training, retail goods, and dive travel. The predominate characteristics of preferred dive sites include structures (natural and manmade) that provide habitat to marine life, access to the water, parking, and bathroom amenities. The startup costs to engage in scuba diving are high due to the need to purchase equipment and get certification classes; once certified, the general categories of expenditure include travel, equipment maintenance, and tank fills.

Divers in Washington State engage with the marine environment through recreational wildlife viewing of unique and diverse species such as the Giant Pacific Octopus and Wolf Eel, identification and photography, marine harvest, and wreck diving. In doing so divers spend money on goods and services provided by the local economy. The industry’s dive shop operators supply diving classes and instruction, scuba diving equipment, equipment rentals, tank refills and guided scuba activities. It is clear that scuba diving generates value for participants and local business that support these activities. Currently the only data readily available about the economics of the scuba industry are found in the January 2015 Earth Economics report for the Washington Recreational and Conservation Office mentioned above. This study does not, however, calculate economic impacts associated with industry expenditures. Given the limitations of this work, we have designed and implemented a survey of resident divers and dive shop owners in order to collect data on perceptions of the quality of sites, attributes of a preferred sites, number of dives or number of shop employees, expenditures to participate in the sport or run a dive business, and demographic information. The survey was designed to ask pertinent questions needed to characterize the role of the scuba diving industry to the Washington State economy. Unfortunately we received limited responses from local dive shop operators despite several methods of engagement. Therefore, using the IMPLAN™ model, we generated estimates of the direct, indirect and induced economic impacts of resident participants in scuba diving. Our report also describes the general characteristics of regional dive shop operations. This work establishes an original baseline assessment of how much scuba divers contribute to the local economy or the economic impacts of the scuba industry

generally in Washington, and provides a repeatable instrument for further such analyses. The information generated by this assessment will help inform effective coastal and marine resource management and policy decision-making, especially as relates to marine protected areas and marine spatial planning.

This report includes a literature review of related attempts to address the benefits of scuba diving to an economic system, a discussion of the survey design and approach, an outline of the model used, data analysis, and the resulting economic impacts estimates. We conclude with a discussion of how this information can be used in coastal management decision-making.

2 Review of the Literature

The quantification of economic values associated with scuba diving is complicated by the fact that this activity generates both market and nonmarket values. The market impacts of diving are usually assessed by examining how much money divers contribute to the local economy through spending related to access, equipment and services. Commonly, the focus of market-based studies is on gross expenditures with some focusing on profits and taxes. Sometimes these gross expenditure assessments are the drivers of an economic impacts analysis. While gross expenditures do not represent net benefits to the economy, gross expenditures do capture the magnitude of importance that dive recreation and tourism have on the overall economy. The non-market value of scuba is more difficult to determine. Non-market values represent the value divers place on the marine resources they use, beyond what they have to pay to access them. Non-market values are often associated with outdoor recreational resources including dive sites. These non-market values represent a true net economic value to divers of good quality diving opportunities; these values capture the added economic well-being that divers enjoy as a result of access to areas with high quality diving.

The literature related to the benefits of scuba diving is therefore divided roughly into three areas. First there is the literature that analyzes the environmental impacts of scuba diving especially on MPA. The second addresses the economic impacts of creating dive sites through artificial reefs or sunken ships or economic impacts of the industry to the regional economy more generally. And third is a relatively significant national and international literature on the economic non-market value (as opposed to regional impacts) of scuba diving.

MPAs are a management tool used to protect and maintain biological values and ensure ecological sustainability while also keeping human use options open. Harriott et al. (1997), Abidin and Mohamed (2014), Tratalos and Austin (2001) and Barker and Roberts (2004) outline the impacts that scuba has on coral reefs and other MPA in Caribbean and South Pacific waters. Divers' contact with the reef, typically through fins, leads to damage to this fragile environment. At coral dominated sites the potential exists for considerable environmental impact as the number of divers increase (Harriott et al. 1997). The key to mitigating these impacts is through education and implementation of best practices by divers (Baker and Roberts, 2004).

There are few actual economic impact analyses of scuba reported in the literature (Table 1). The literature does include a number of analyses that consider the expenditures (and in some cases) economic impacts of scuba diving in other regions of the world. In the United States the predominance of expenditure studies are for the Atlantic and Gulf coasts. (Leeworthy et al. (2001), Bell et al. (1998), Stoll and Ditton (2002), Leeworthy and Bowker (1997) and Hazen and Sawyer (2004) report expenditures per day ranging from \$205.74 to \$447.27 for dive charters (non-resident divers) and \$40.10 to \$119.43 for resident divers. Expenditure analyses for the Pacific Coast (California) have been conducted by Leeworthy and Wiley (2002) with ranges from \$157.33 to \$219.63 for charter dives and \$76.16 to \$224.65 for resident divers.

Ivanova (2004) surveyed British Columbia operators that have clients engaged in recreational scuba diving (operators who offer dive charters, live-aboard, recreational dive instruction or engaged in retail, wholesale or manufacturing of scuba diving equipment. He estimates that gross revenues from British Columbia recreational scuba diving is just over \$15 million with a range of average gross revenues earned directly from scuba diving between \$98,000 and \$166,700 per operator. The British Columbia dive industry is composed of small businesses that provide part-time summer employment to their owners to full-fledged manufacturers with considerable revenues and over 30 employees. Note that no such studies have been conducted for Washington State.

Table 1. Expenditures for Pacific Coast, Atlantic and Gulf Coast Diving

Author	Region	Location	Natural Setting ⁽²⁾	Resident/ Non Resident	Activity and Mode of Access ⁽³⁾	\$/Day (\$2015) (unless otherwise specified)
Leeworthy and Wiley (2002)	Pacific Coast	Santa Barbara County, CA	NS	N/A	NC	214.23
		Ventura County, CA	NS	N/A	NC	274.07
		Los Angeles County, CA	NS	N/A	NC	333.16
		CINMS, CA ⁽⁴⁾	N	N/A	C, Ch	191.94-267.95
		CINMS, CA	N	N/A	C, P	92.92
		CINMS, CA	N	N/A	NC	214.23-274.07
Ditton and Baker (1999)		Texas Coastal Communities	A	R	Ch	251.00
		Texas Coastal Communities	A	NR	Ch	263.40
		Texas	A	R	Ch	326.92
		Texas	A	NR	Ch	388.90
Leeworthy et al. (2001)		Southeast Florida	A	R		90.21
		Southeast Florida	N	R		85.24
		Northwest Florida	A	R		63.95
Bell et al. (1998)	Atlantic and Gulf Coast	Northwest Florida	A	NR	O	125.93
		Northwest Florida	A	NR	P; Ch; R	98.09
Stroll and Ditton (2002) (Secondary source)		Gulf of Mexico	A	R and NR	Ch	545.67/trip
		FGBNMS, Gulf of Mexico	N	R and NR	Ch	544.73/trip
Leeworthy and Bowker (1997)		Florida Keys/Key West	N	R and NR		145.70
Hazen and Sawyer (2004)		Martin Country, FL	A/N	R		48.92

Notes: (2) - N=Natural Reef; NS=Not Specified; A = Artificial Reef; (3) - Ch=Charter Boat; P=Private Boat; C=Consumptive Diving; NC=Non Consumptive Diving; R = Rental Boat; O = visitors or residents using their Own Boat; (4) - Channel Islands National Marine Sanctuary
Source: Pendleton and Rooke, 2006

A subset of the economic impacts literature on scuba focuses on the potential economic impacts of creation of artificial reefs. Pendleton (2005) and Ditton et al. (2002) indicate that some coastal communities

are sinking ships as a means of protecting shoreline, creating habitat for fish and sea life, and providing new destinations for recreational fishing and scuba diving tourists. While sinking ships to create artificial reefs can be costly—\$46,000 to \$2 million depending on the size of the ship (Hess et al. 2001)—Pendleton suggests that the economic impact of sinking ships could well exceed the costs of creating a new dive site. Pendleton states that the potential net present value of expenditures associated with using ships as artificial reefs in Southern California could be on the order of \$46 million. According to a NOAA Florida Keys National Marine Sanctuary report (Bell et al. 1998) the economic impact of the sinking of the USS Vandenberg on the Monroe County economy resulted in a 40.1 percent increase in total number of users (Scuba and Snorkel) with recreational expenditures increasing by \$6.5 million and the creation of 106 new jobs. In this case, visitors accounted for a much larger share of this growth than residents (86.4 percent vs 13.6).

The third category of studies related to scuba diving is non-market valuation. As indicated in Table 2, several economic value studies have been conducted for California, the Gulf of Mexico and Florida. These studies use a variety of methods including travel cost, contingent valuation, and benefits transfer. Estimates range from \$13.78 to \$110 per day in California (Leeworthy and Wiley, 2003; Pendleton, 2005; Kaval and Loomis, 2003). In the Gulf of Mexico, including Texas, values range from \$3.52 to \$157.2 per trip (Roberts et al. 1985; Stoll and Ditton 2002; Ditton and Baker 1999; Ditton et al. 2001). In Florida value estimates range from \$4.63 to \$131.88 per diver per year (Melon 1988) and \$3.62 to \$16.16 per person (Bell et al. 1998; Leeworthy et al. 2001; John et al. 2003). In the Northeast region, Kaval and Loomis (2003) report a non-market value of \$18.96 per day. In all cases, where measured, consumer surplus is estimated to be higher for non-residents than residents.

Table 2. Non-Market Values for U.S. and Other Americas Diving

Region	Author and Date	\$/Day(\$US 2005) (unless otherwise specified)	Study Methodology
United States			
All US National Parks	Kaval and Loomis, 2003	\$34.25	
Western Continental U.S.			
California	Leeworthy and Wiley, 2003	\$13.78	(Benefit transfer, Santa Barbara and Ventura Counties)
California	Leeworthy and Wiley, 2003	\$41.35 - \$42.95	(Channel Islands National Marine Sanctuary)
California	Pendleton 2005	\$110/day	Ship diving on the Yukon
Pacific Coast	Kaval and Loomis, 2003	\$55.66	
Gulf-shore Southern U.S.			
Gulf of Mexico	Roberts et al., 1985	\$350.49/year/diver	CV (petroleum structures)
Gulf of Mexico	Stoll and Ditton, 2002	\$121.20/trip	(secondary source; artificial reef)
Gulf of Mexico	Stoll and Ditton, 2002	\$157.20/trip	(secondary source; natural reef)
Florida	Milon, 1988	\$30.02 - \$44.22/year/diver	CV (fishing and diving on 7 artificial reefs)
Florida	Milon, 1989	\$4.63 - \$131.88/year/diver	CV (fishing and diving on ships and steel debris)
Florida	Bell et al., 1998	\$11.36	TC (ships, reef balls, other structures)

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Florida	Bell et al., 1998	\$3.62 - \$4.40(residents); \$6.51 - \$7.96(visitors)	CV (ships, reef balls, other structures)
Florida	Leeworthy et al., 2001	\$4.02(residents) - \$16.16(non-residents)	(artificial reef)
Florida	Johns et al., 2003	\$3.52(residents) - \$14.47(visitors)	CV (maintain existing artificial reefs)
Texas	Ditton and Baker, 1999	\$49.53 - \$83.48	CV (diving on artificial reefs)
Texas	Ditton et al., 2001	\$46.52	CV (diving on artificial reefs)
Northeastern U.S.			
Northeast Region	Kaval and Loomis, 2003	\$18.96	
Southeast Asia			
Thailand	Tapsuwan, 2005	\$27/diver/day	CVM
Thailand	Asafu-Adjaye and Tapsuwan	\$3,233/person/trip, \$27.02-62.64/person/year	
Americas (Non-U.S.)			
Caribbean	Dixon et al., 1993	\$17.40/person/year	CVM
Caribbean	Dixon et al., 1995	\$121/person/trip, \$31/person/year	CVM

Notes: CVM = contingent valuation methodology; TC =Travel Cost model.

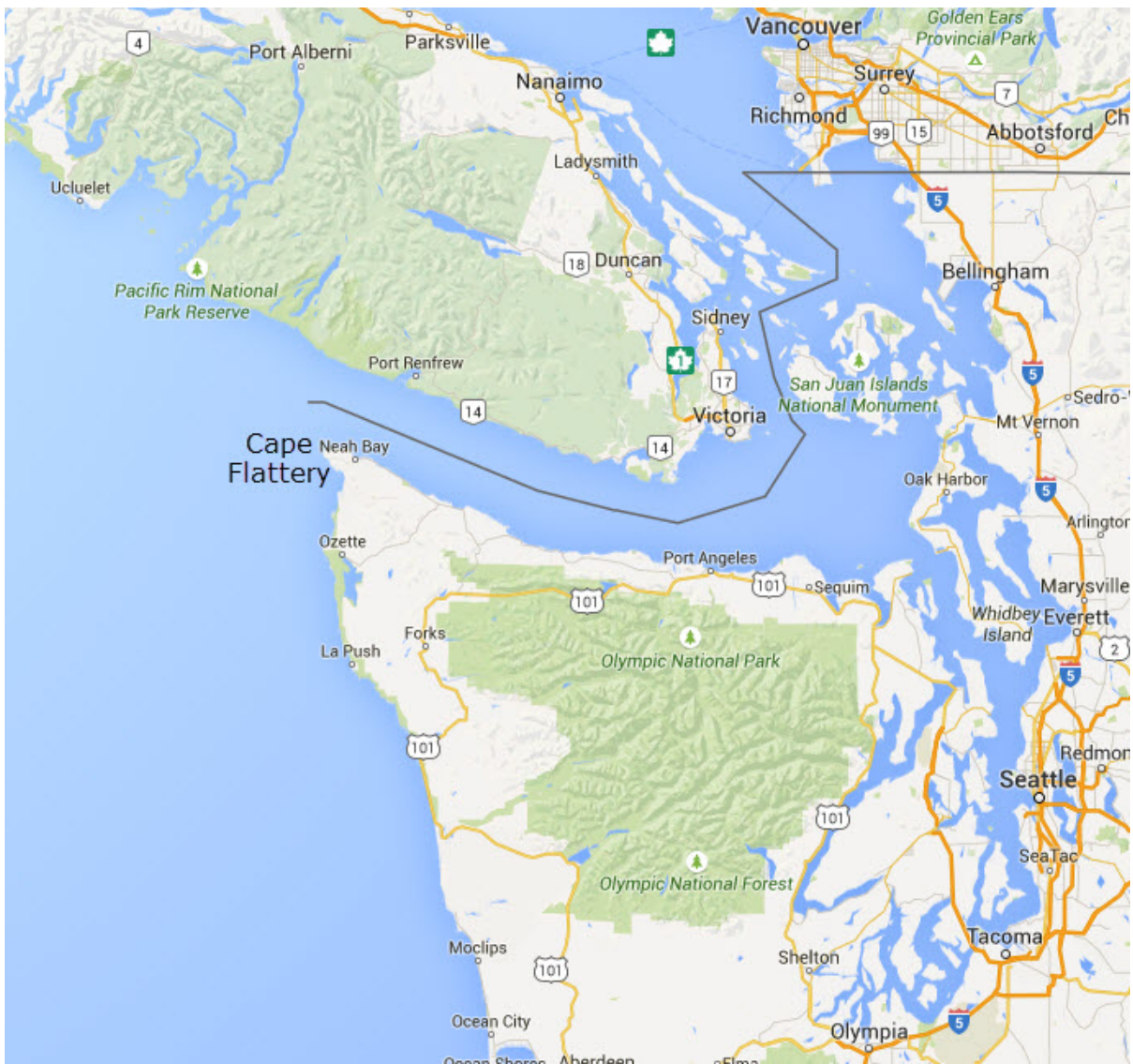
Source: Pendleton and Rooke, 2006

Outside of the United States Asafu-Adjaye and Tapsuwan (2008) estimate the economic value or consumer surplus per person per trip to dive on the Similan Islands of Thailand to be \$3,233. Tapsuwan (2005) estimates a value of \$27 per diver per day. Dixon et al (1993; 1995) in looking at the joint production of economic and natural systems using the contingent valuation method, report willingness to pay to dive in marine parks in the Caribbean to range between \$17.4 and \$31 per person per year or \$121 per person per trip.

3 Methods

In order to estimate the economic impacts of scuba diving to the Washington State economy we conducted a survey of both resident divers and diver shop operators in the region. Our case study region was defined as the inland waters of Washington State from Cape Flattery to Olympia including the San Juan Islands, Point Roberts and associated waters (See Figure 1). With the data collected, we were able to conduct an input output (I-O) analysis using the IMPLAN model for the resident divers only. Our analysis resulted in estimates of direct impacts, indirect impacts, induced labor income, and employment accruing to the State of Washington and the study region. Details of the approach are outlined below.

Figure 1. Case Study Region



Source: Google Maps, 2015

3.1 Survey

In order to capture the complete scuba diving industry (including non-resident divers) we designed and implemented two separate surveys: one for resident divers and one for dive shop operators. The resident diver survey included questions such as sociodemographic information, dive site preferences and amenities, number of dives in the year 2014, dive activities, and 2014 expenditures made in order to engage in the sport and whether those expenditures were made in the study area or elsewhere in Washington. The dive shop operator survey included questions such as total revenues, services provided, whether they engaged in charter dives or offered scuba instruction, geographic residence of customers, employment, and expenditures related to scuba equipment and activity sales. As per federal and State of Washington laws and administrative rules, survey participants were assured of strict confidentiality of data gathered by the survey and that State of Washington government agencies and members of the general public would see only aggregated, summary results of the analysis reported by project researchers. Both surveys were beta tested with resident divers and dive shop owners and feedback taken into account.

There is no public listing of individual certified divers in the State of Washington and because of resource constraints, intercept surveys of divers were not possible. Therefore, we used a Washington State database of dive clubs and dive shops provided by Rick Stratton, Publisher of Dive News Network. These data were mined and updated leaving us with 28 accessible dive clubs and approximately 40 dive shops. According to Rick Stratton (2015) there are approximately 9,750 active divers in Washington State, 10 percent of which belong to dive clubs. A letter of support was sent to all dive clubs for which we had email addresses explaining the purpose of the survey and endorsed by the Scuba Alliance, REEF Environmental Education Foundation, and the SeaDoc Society. The survey was implemented June through November 2015 via a Survey Monkey link sent to all dive club with a request to share the link with their membership. The initial letter was followed up by a phone call and three email reminders. This approach resulted in 271 survey responses, with 198 of Washington State residence. In order to eliminate potential bias, data were cleaned to include only those responses from resident divers which resulted in a 20 percent response rate.

As indicated above, there are currently approximately 40 dive shops in Washington State. Given the limited number of regional dive shops and known geographical locations, we initially attempted to do in-person structured interviews, leaving the survey protocol to be completed and mailed back. This proved to be problematic with only one operator willing to fill out the survey. Other operators said that the survey was too complicated and still others indicated that they would fill out the survey that was left with them but never did. We decided to greatly simplify the survey recognizing that the data we received would not allow us to do a full impact assessment given that we would not be collecting expenditure data at the level of detail we would need to develop a scuba production function to use in IMPLAN. We administered a survey via Survey Monkey from December 2015 through January 2016, and

received nine partially completed responses for a 23 percent response rate.

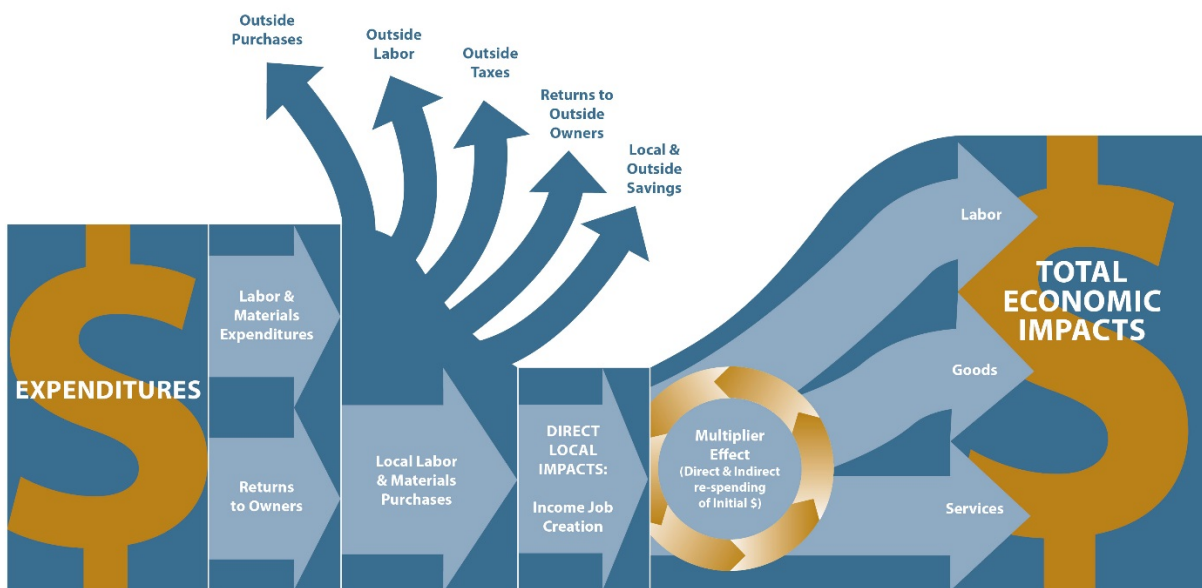
3.2 Model

Economies are complex networks of relationships among businesses and people. I-O analysis is a modeling approach that economists use to map these complex relationships. An I-O model portrays an economy as a matrix of inputs and outputs. It allows economists to understand and quantify how regional industries interact with one another. For the purpose of our analysis, I-O allows us to estimate what impact resident scuba diving has on the Washington State economy.

Figure 2 illustrates conceptually how an I-O analysis calculates economic impacts. In our case, the dollar sign on the left represents resident diver expenditures. This money is spent on goods and services. Only a portion of this spending is retained within the I-O framework; as indicated by the upward arrows, money distributed outside of the study area is considered a leakage. The I-O framework only uses the purchase of local labor and materials to calculate direct local impacts.

Once we determine direct local impacts, we can use an I-O model to estimate how this spending affects other businesses within the study area economy. The direct expenditures create additional activity referred to as indirect and induced impacts. Indirect impacts quantify the effect of spending within the study region on supplies, services, labor, and taxes. Induced impacts measure the spending of wages in the study area as a result of the direct and indirect impacts. Direct, indirect, and induced impacts sum to the total economic impacts of a project or industry. This analysis presents total impacts as economic output, jobs created, and labor income generated within the study area.

Figure 2. Framework for Evaluating the Total Economic Effects or Impacts of Local Spending



Source: Northern Economics, Inc. 2011

We used IMPLAN™ software to estimate economic impacts to Washington State's economy. IMPLAN combines a set of extensive databases from federal, state, and local sources, which are updated annually. IMPLAN allows users to develop local or regional-level I-O models that can estimate the economic impact of a change in economic activity in a region or determine the contribution of an economic sector to the regional or local economy. The database includes information on over 500 industries and over 20 economic variables.

IMPLAN is one of the most widely used and accepted economic impact modeling systems in the U.S. IMPLAN has been accepted in the U.S. court system and in many regulatory settings, and is widely used by federal and state governments, universities, and economic consulting firms. The combination of the detailed database, flexibility in application, and the ability to customize the analysis has made IMPLAN one of the most widely used and accepted economic impact modeling systems in the U.S. This analysis used IMPLAN 2014 data for Washington State and counties adjacent to the waters of the study site.

Because there is no IMPLAN Sector for scuba diving or anything close to scuba diving, we sought a more accurate sector profile for diving. To this end, we identified the spending patterns unique to resident scuba divers (as noted below, data received from dive shops were not at an adequate level of resolution to include in the I-O analysis) using the information obtained through the survey effort. The resident diver purchasing patterns tells us which industries divers purchase inputs from and the location of those suppliers. We then mapped these spending patterns to IMPLAN support sectors, generating the I-O multipliers used to calculate the indirect and induced effects on jobs, income, and business sales/output generated per dollar of spending on various types of goods and services in the study area.

4 Data Analysis: Resident Divers and Dive Shop Operators

The resident diver survey was distributed to 18 local dive clubs. As mentioned in section 3.1, this method effectively sampled divers who are members of dive clubs, generating responses from 271 divers. In addition, a survey of dive shop operators in Washington State yielded nine responses.

This section will summarize data collected from both surveys. We start by summarizing the resident diver survey, including information pertaining to dive site preferences and amenities, number of annual dives, dive activities, and expenditures made by recreational divers. This section finishes with a synopsis of data collected from the dive shop operator survey including total revenues, services provided, geographic residence of customers, employment, and expenditures related to scuba equipment and activity sales.

It is important to note that not all surveys returned were fully completed; therefore, many of the questions asked received fewer than the total maximum number of responses. However, when preparing the resident diver expenditure data, we employed analytical techniques to impute missing values and reflect both the total number of dive club members and the full population of Washington State's active resident divers. These computations are discussed in section 4.3.

4.1 Demographics

The resident diver survey instrument asked respondents to share their demographic information. The survey included questions pertaining to residency, age, gender, experience, race and ethnicity, education, and income. Table 3 summarizes respondent's residence. The majority of respondents (73 percent) reported living in Washington State. In addition, 16 percent of respondents reported living in Oregon, while 9 percent of respondents did not report. As indicated above, for the purpose of this analysis, only responses from Washington State residents were included, leaving us with a population of 198.

Table 3. Respondents by Area of Residence

State	Respondents	Percent
WA	198	73
OR	43	16
Other	6	2
Not Reported	24	9
Total	271	100

Source: Northern Economics (2016)

As shown in Figure 3, the majority of survey respondents reported being male (70 percent). Age distributions by gender are presented in Figure 4. Although the majority of survey respondents reported being male, the age distribution of male and female respondents is similar, with the majority of survey respondents for both genders reporting being between

46 and 55 years of age. For males, the second largest age group of respondents was between 56 and 65 years of age. However, the second largest age distribution for females was younger, falling in the 36-45 age range.

Figure 3. Diver Gender Proportion

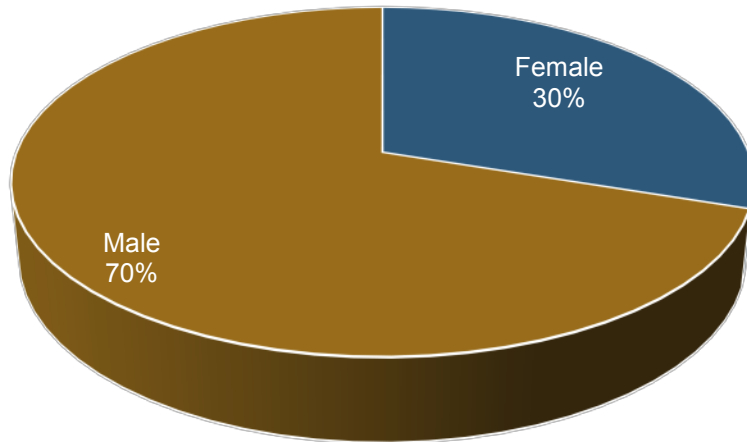
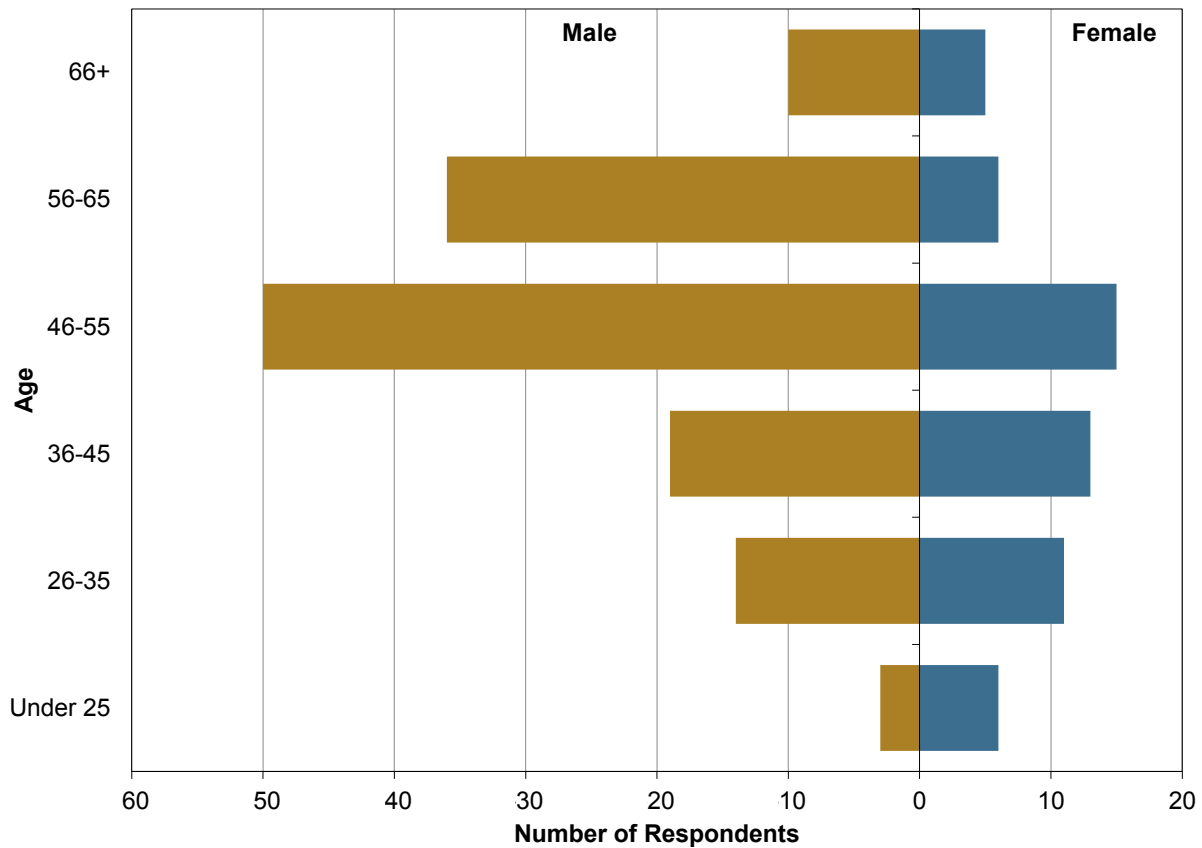
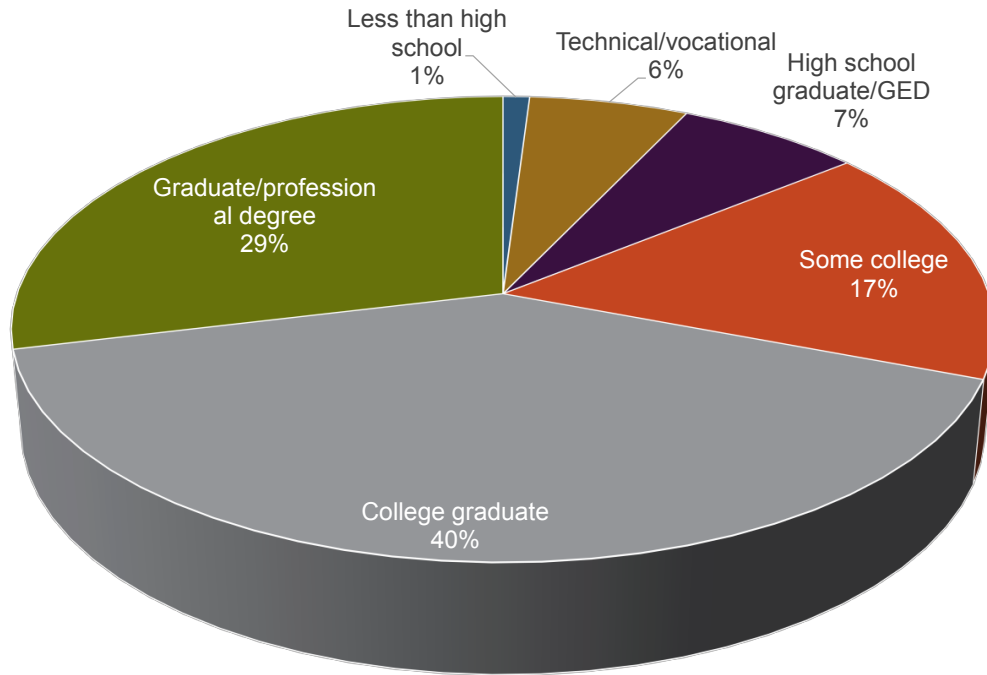


Figure 4. Diver Age Distribution by Gender



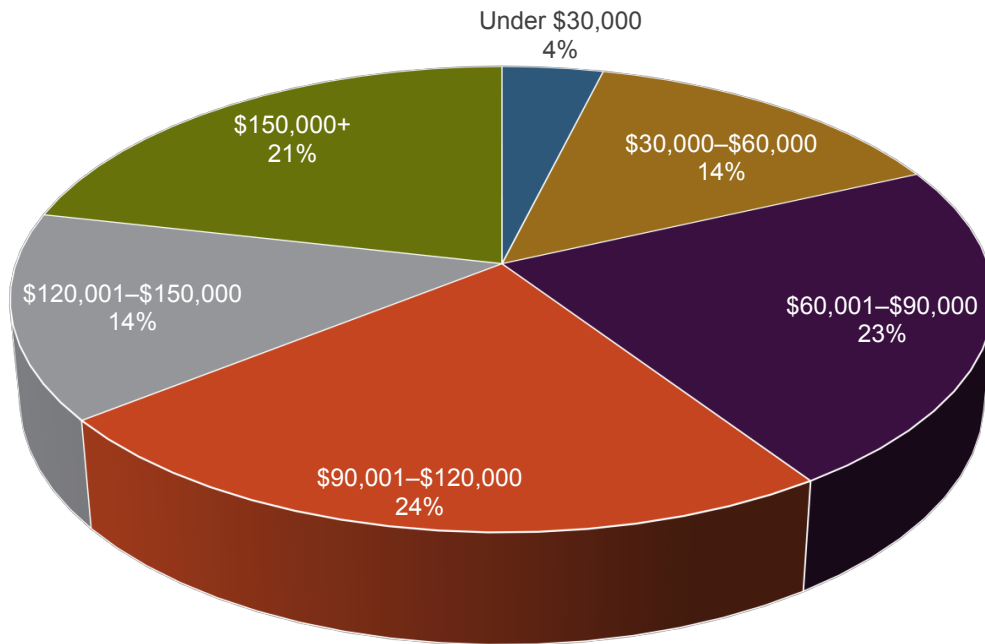
Educational attainment among survey respondents is high, with nearly 70 percent of respondents reporting as college graduates, 29 percent having earned graduate or professional degrees (Figure 5).

Figure. Diver Education Attainment



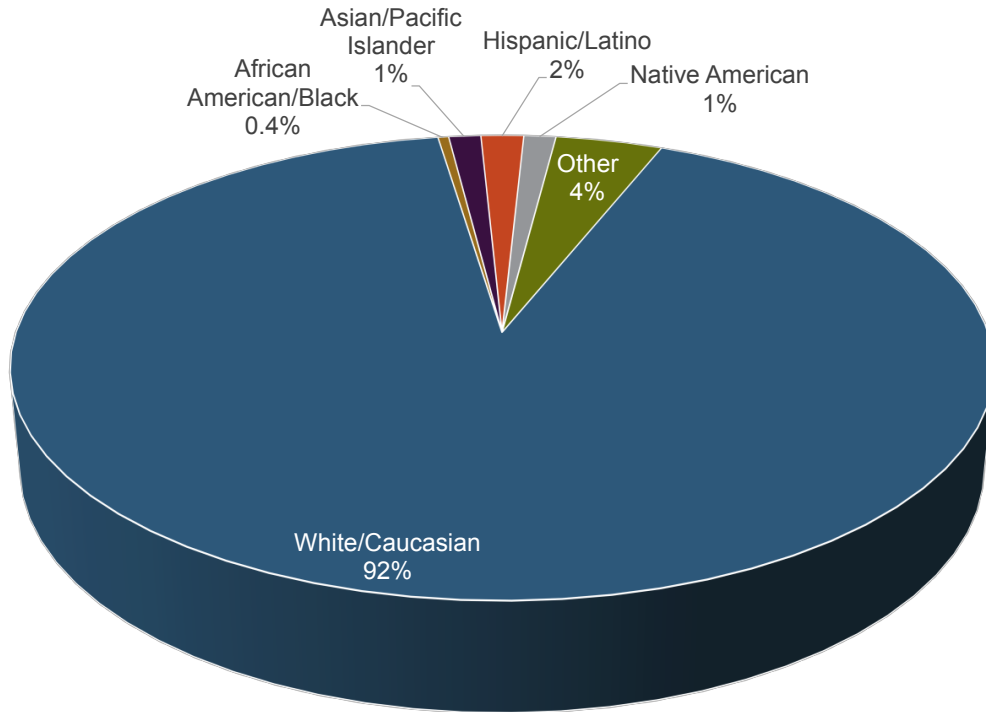
The distribution of diver's household income is more evenly distributed for incomes of \$30,000 and greater (see figure 5). Over three quarters of respondents reported household incomes over \$60,000, with nearly a quarter reporting household incomes between \$90,000 and \$120,000.

Figure 5. Diver Annual Income



As indicated in Figure 6, the vast majority of respondents reported being white/Caucasian (92 percent). The other category includes respondents who reported being a combination of races.

Figure 6. Diver Race/Ethnicity



The average number of years of experience among respondents is just under one year. However, the survey also captured responses from many of the sport's experienced divers, as shown in Figure 7. In fact, nearly 13 percent of respondents reported having 31 years of experience or more. Figure 8 summarizes the annual number of dives made by survey respondents, with most respondents reporting diving less than 100 times per year.

Figure 7. Diver Years of Experience

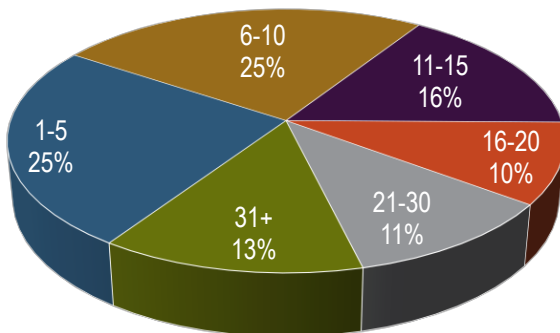
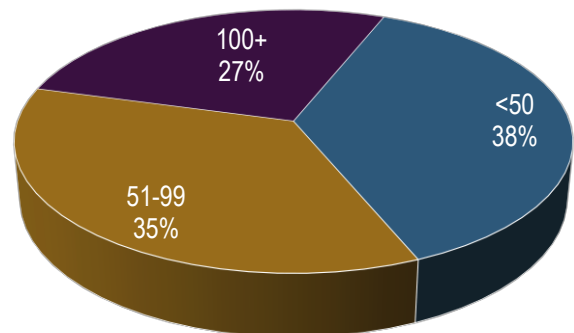
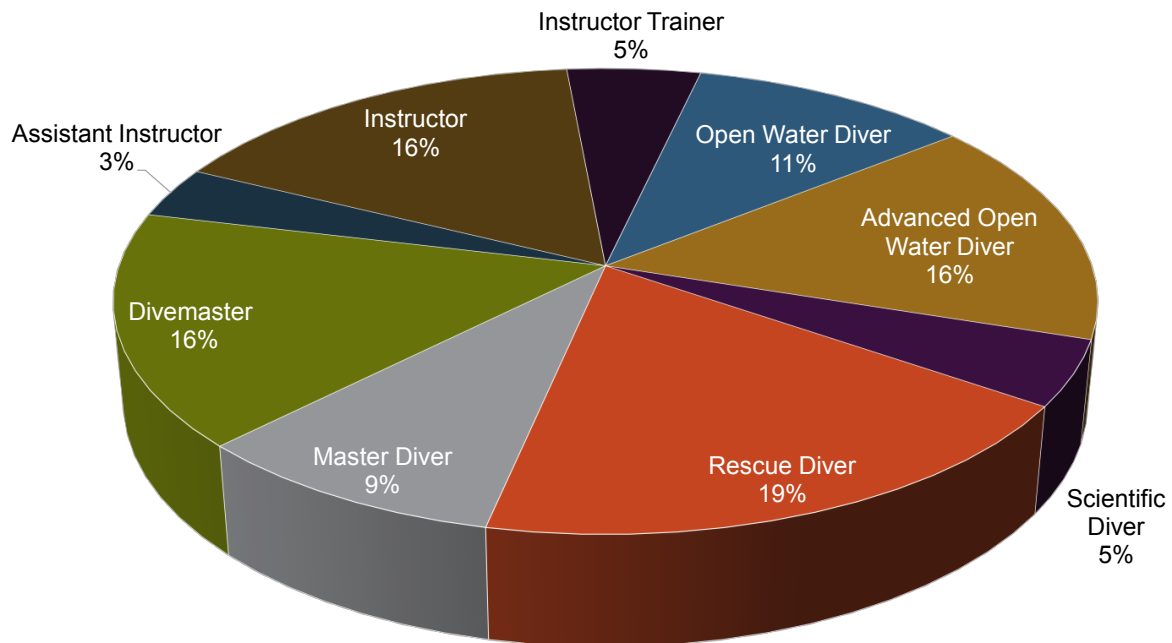


Figure 8. Diver Annual Number of Dives



The survey captured a wide array of certification types held by resident divers. Most divers reported having a rescue diver certification (19 percent). Advanced open water and divemaster certification were the next largest certification groups, each with 16 percent of the survey total. Survey respondent certifications are shown in Figure 9 below. The high proportion of rescue diver and divemaster certifications is a good indicator that our survey sample consists mainly of Washington's active resident diver community and not certified non-active divers.

Figure 9. Diver Certification



4.2 Diving Sites and Quality Attributes

Respondents reported using over 226 unique diving locations including Washington, California, Oregon, British Columbia, Belize, Hawaii, Mexico, and the Bahamas. Of those listed, 87 percent are located within the study region (Figure 10). A small portion of the sites reported are located in other regions.

Figure 10. Dive Site Location by Region

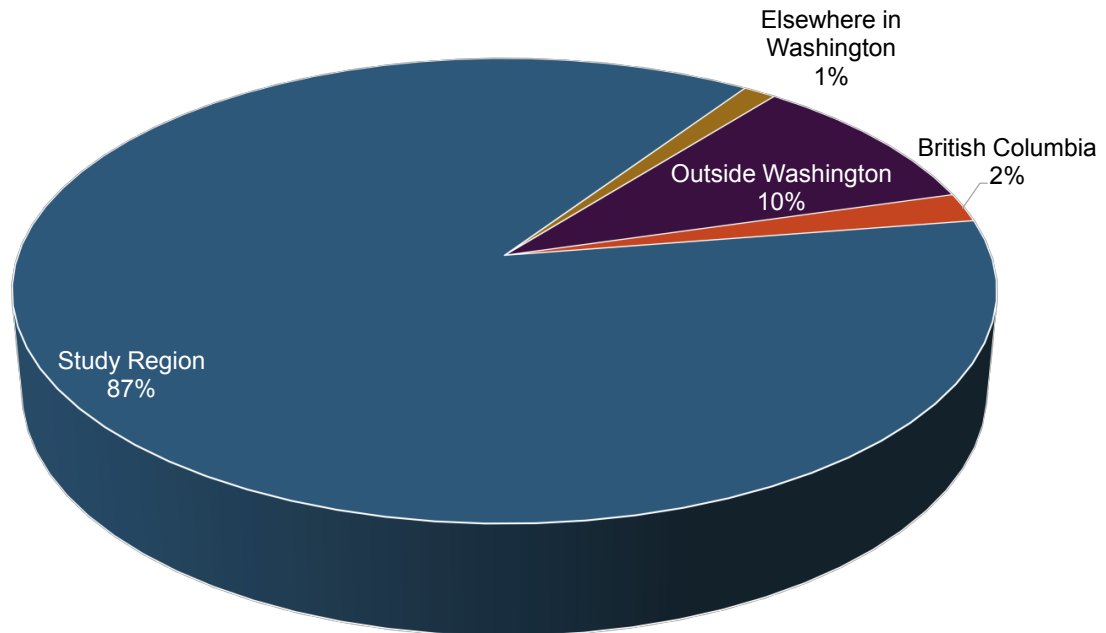
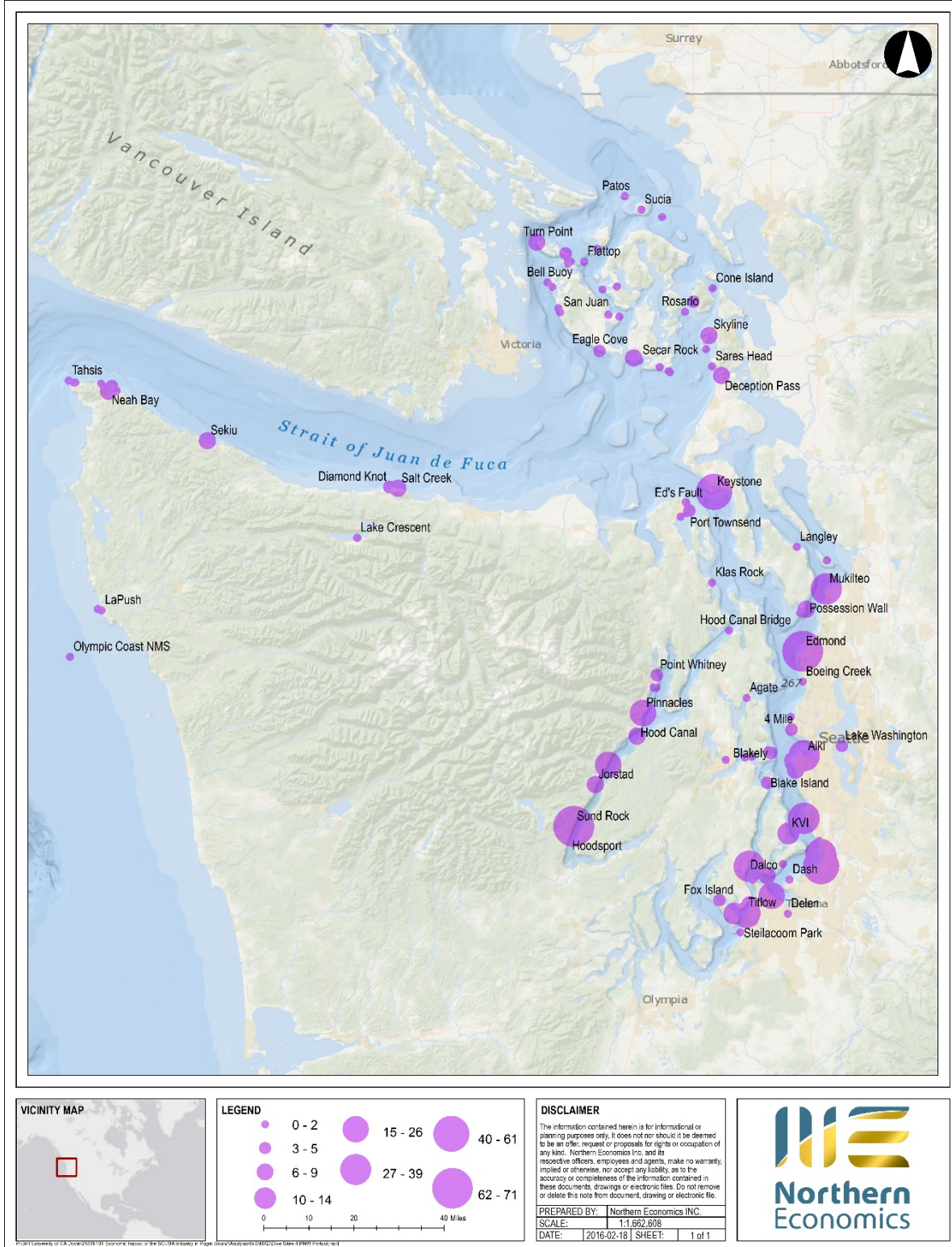


Figure 11 presents a map representing the frequency of sites listed by respondents as one of their top five dive sites. It is clear that the predominance of dive activity in Washington State occurs in central and south Puget Sound. The top ten rated sites (in order) include Sund Rock (Hood Canal), Redondo Beach, Keystone Edmond Underwater Park, Mukilteo, Salt Water State Park, 3 Tree Point, Alki Cove 2, Sunrise Beach Park (Gig Harbor), and Les Davis. These top ten sites accounted for 42 percent of all listed sites in Washington State. The top 21 sites represent 61 percent of all top five listed sites.

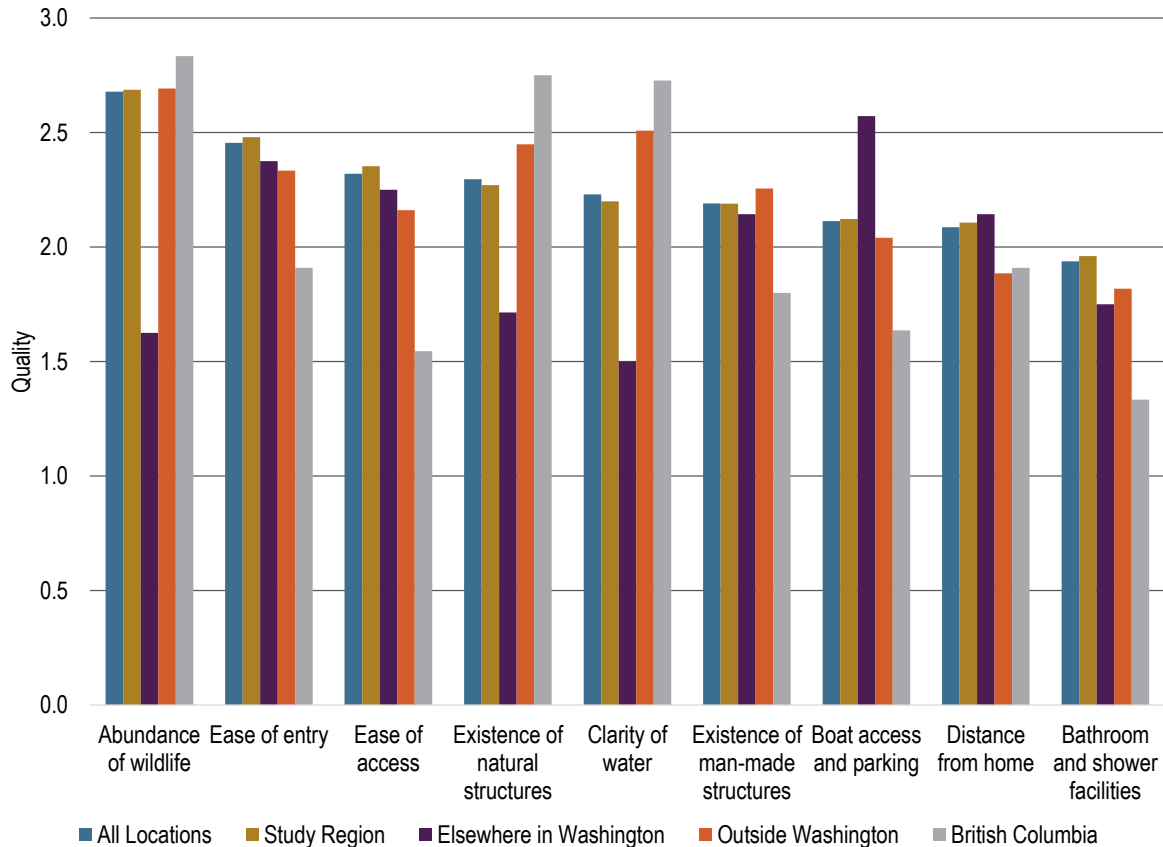
Figure 11. Top Five Dive Site Locations



Respondents were asked to rate the quality attributes of their top five dive sites as low (1), medium (2), and high (3). As indicated in Figure

11, abundance of wildlife, ease of entry and ease of access are the three top attributes of preferred diving sites in the study region. The top attribute for sites elsewhere in Washington was boat access and parking. The top attributes for sites located outside Washington, which are likely to be destination diving sites, are: abundance of wildlife, existence of natural structures and clarity of water. The reported quality for each characteristic, by region, is shown below in Figure 12.

Figure 12. Dive Site Quality Ratings, by Region



In addition, the survey asked respondents if the quality of these sites has noticeably changed from previous years. Respondents were asked to rate changes in quality, if any, using a scale between -1 (worse), 0 (unchanged), and 1 (better). These results are shown in Figure 13. On average very little change is reported for any of the region's sites. The largest positive change was reported for dive sites elsewhere in Washington. Dive sites in both the study region and outside Washington were reported to have small declines in quality from previous years, while sites in British Columbia appear to remain unchanged.

Figure 13. Changes in Dive Site Quality Ratings, by Region

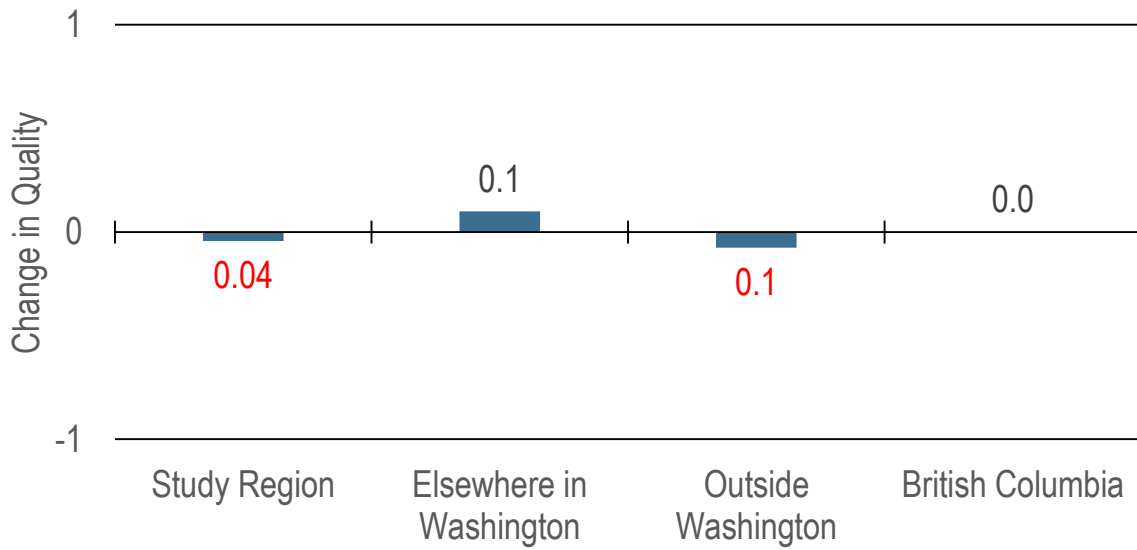
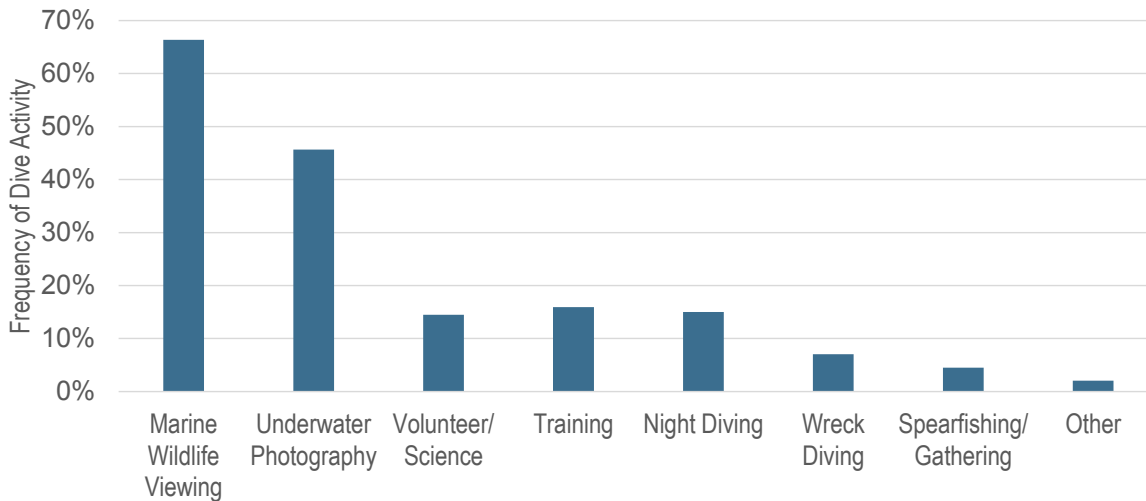


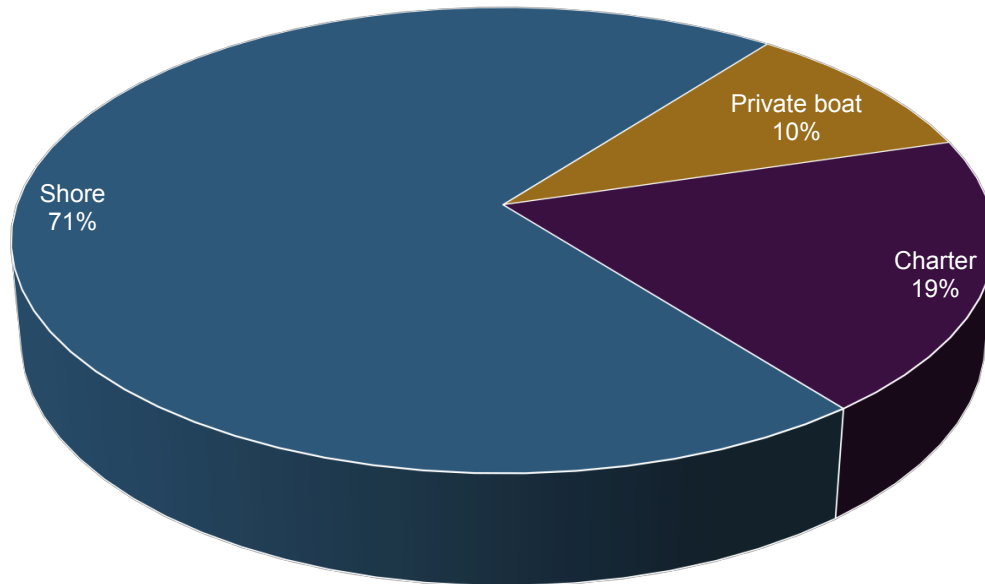
Figure 14 summarizes all activities reported while diving. Wildlife viewing is reported as the primary activity, while underwater photography is second. It is important to note that it is likely that multiple activities take place during one dive; therefore, the results add up to more than 100 percent.

Figure 14. Dive Activities



Access to dive sites is through shore and charter or private boat. Figure 15 summarizes the various access modes as reported by survey respondents. Dive sites are primarily accessed by shore (71 percent); chartering services were used 19 percent of the time, while only 10 percent of respondents reported using a private boat.

Figure 15. Dive Site Access Modes



4.3 Expenditures and Economic Impacts

4.3.1 Resident Diver Expenditures

The resident diver survey asked respondents to list total expenditures related to scuba participation in 2014, and the amount spent by category. In addition, respondents were asked about the geographic distribution of those expenditures: whether the expenditures were made (1) within the counties adjacent to Puget Sound, (2) elsewhere in Washington, or (3) outside of Washington.

In some cases, respondents only provided a value for total expenditures. To ensure expenditures by the total resident diver population are accounted for in the I-0 modeling, we applied geographic distributions using a weighted average of respondents who fully completed the survey to those who only reported total expenditures (omitting category distributions) or whose distributions did not equal 100 percent. Further, the sum of expenditure categories did not equate to the total expenditures reported by some respondents. Therefore, all categories were adjusted proportionately to sum to match the reported total expenditures.

In order to assess the economic impact of Washington's resident diver industry, we estimated total expenditures for the entire resident dive

club population (975, as discussed in section 3.1), including those divers who did not respond to the survey.

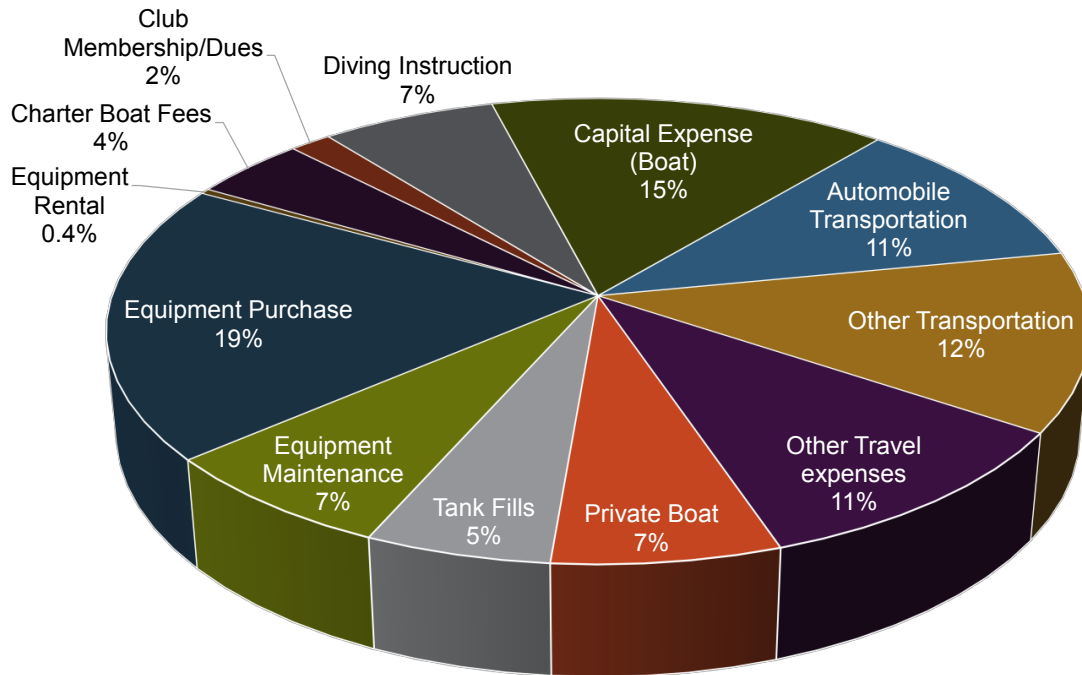
Table 4. Washington State Resident Diver Annual Expenditures

Expense Category	Study Region	Elsewhere in Washington	Outside Washington State	Total
Automobile Transportation	256,900	64,900	32,000	353,800
Other Transportation	295,200	22,900	386,400	704,500
Other Travel expenses ¹	248,600	56,300	434,500	739,400
Private Boat	155,300	62,500	1,400	219,200
Tank Fills	126,400	16,000	12,600	155,000
Equipment Maintenance	168,300	7,600	4,100	180,000
Equipment Purchase	459,000	107,200	40,900	607,100
Equipment Rental	8,600	1,500	22,700	32,800
Charter Boat Fees	103,200	29,400	183,300	315,900
Club Membership/Dues	37,700	3,700	14,200	55,600
Diving Instruction	157,900	6,000	21,900	185,800
Capital Expense (Boat)	360,100	4,200	0	364,300
Other	0	0	7,200	7,200
Total	2,377,200	382,200	1,161,400	3,920,600
Percent	60.6	9.7	29.6	100.0

Total 2014 expenditures made by respondents is estimated at over \$3.9 million, with nearly \$2.4 million (or 61 percent) in the study area and \$2.8 million in Washington State. Respondents reported a range of expenditure categories, by area. The greatest expenditures were made on transportation, travel expenses and equipment. It is important to note that the predominance of other transportation (55 percent) and other travel expenses (69 percent) are made outside Washington State; while 76 percent of equipment purchases are made with in the study area likely representing those that travelled out of state to dive. The extrapolated expenditures for non-survey respondents were distributed according to the spending pattern shown in Figure 16.

¹ Other Travel expenses include retail expenditures for both food and lodging. Ideally, in an I-O analysis, if we know what the retail spending was in stores, we could subtract the value of the goods purchased from a retail store and only include the retail margins in the impact analysis. However, because retail expenditures are lumped with lodging and other travel costs, we did not marginalize the Other Travel category. This will slightly overestimate the impacts for the Other Travel expense category.

Figure 16. Washington State Resident Diver Expenditures, by Type



4.3.2 Economic Impact in Washington State

The most recent (2010) IMPLAN data for all the economic sectors within the state were applied, generating estimated output, labor income, and employment as shown in Table 5. These results illustrate the economic impacts of spending by Washington’s resident club divers. It is important to note that these results do not include any economic impacts generated by dive shop operators. While including these impacts was initially intended, a lack of data prevented us from completing this part of the analysis. The results from the dive operator survey are briefly summarized in section 4.4.

Table 5. Economic Impacts of Resident Club Diver Population Spending

Economic Total Impacts	Study Region	Total Washington State
Total Expenditure	2,377,200	2,759,400
Total Output	4,253,365	4,920,575
Total Labor Income	1,664,983	1,878,642
Total Employment	41	49

In 2014, resident club divers in Washington State spent approximately \$2.4 million in the study area and \$2.8 million in all of Washington State. Estimated expenditures in Washington State generated, in turn, nearly \$5 million in total output, or 1.8 times the activity. In addition, total expenditures by Washington’s resident club divers generated nearly an additional \$1.9 million in labor income paid in-

state. The resident club diver population was responsible for approximately 49 additional jobs in Washington State. These results suggest that for every dollar spent by a resident diver, a total of \$1.8 worth of economic activity is generated in Washington State. In addition, every \$1 spent by resident divers generates \$0.70 in wages in the state and for every \$1 million worth of spending, nearly 17 jobs are generated.

4.4 Dive Operator Survey Results

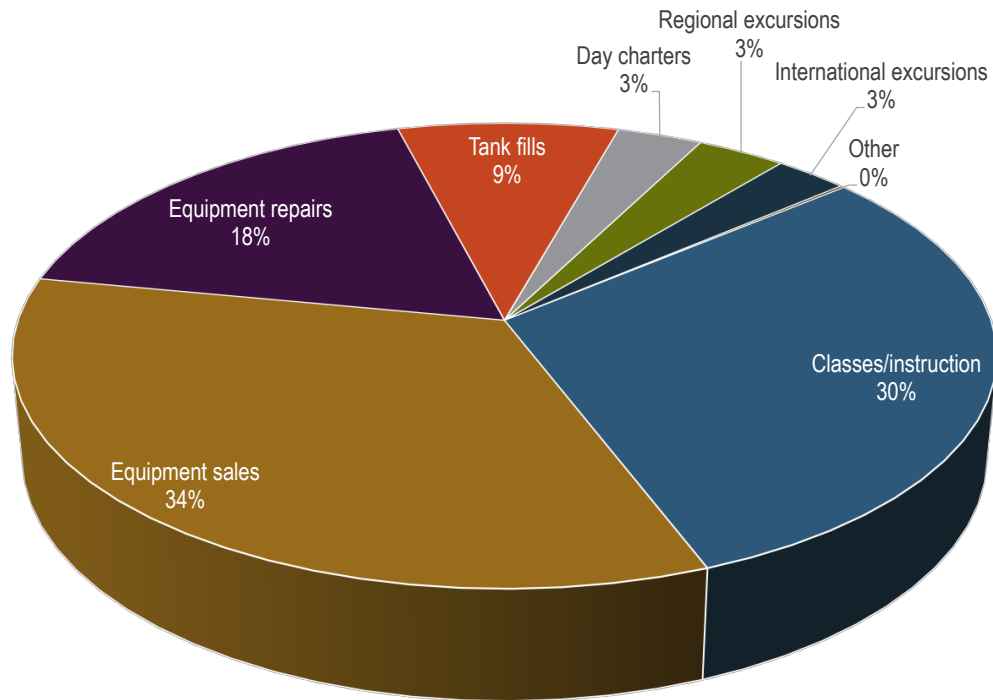
There are currently approximately 40 dive shops in Washington State. As indicated above, the dive operator survey was administered through Survey Monkey from December 2015 through January 2016 and produced only 9 partially completed responses. Therefore, the findings from the dive shop operator survey are not robust enough to perform any economic modeling. Instead, this section provides a synopsis of a small sample of dive shop operators in Washington State.

4.4.1 Location and Revenue

The majority of dive shop operators reported being located in King County; with all others reporting locations in other Puget Sound counties. On average, dive shop operators responding to the survey reported being in business for nearly 15 years, ranging between 2 and 24 years. In 2014, respondents reported an average of \$200,000 in total revenue. Figure 17 summarizes the proportion of revenues reported by dive shop operators by service. The vast majority of revenue comes from equipment sales (34 percent) and classes/instruction (30 percent). On average, two-thirds of class and instruction certification come from basic open water certification. Advanced trainings and certifications comprise the remaining classes and instruction. Together, these two services account for nearly two-thirds of total revenues.

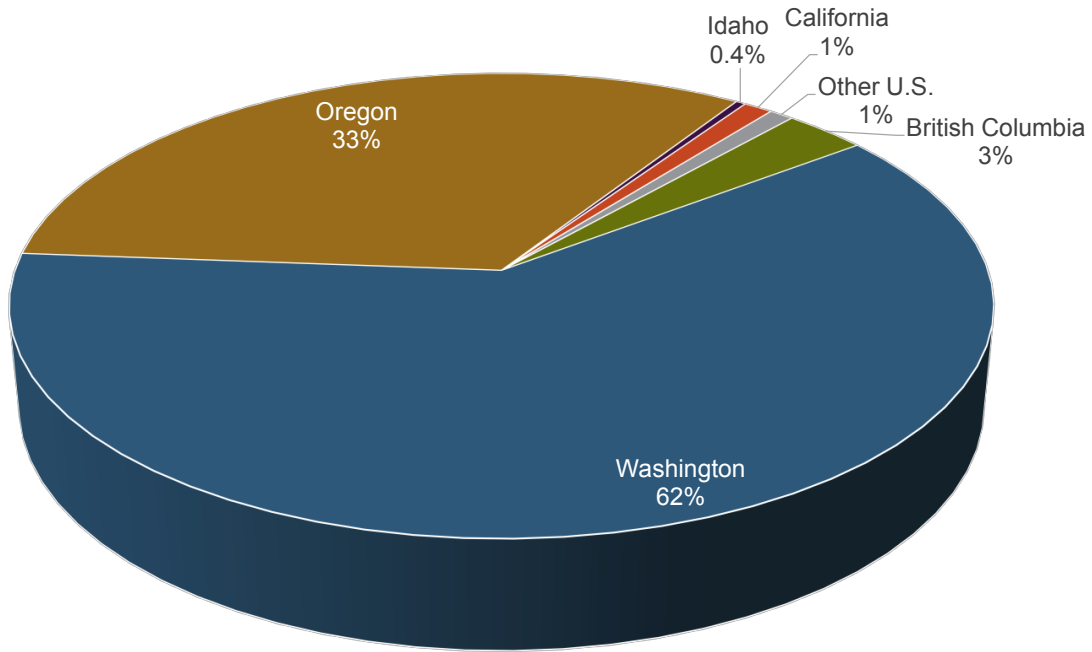
Only a few operators reported offering dive travel services. These day charters and regional/international excursions accounted for approximately nine percent of revenues.

Figure 17. Dive Shop Operator Revenue, by Service



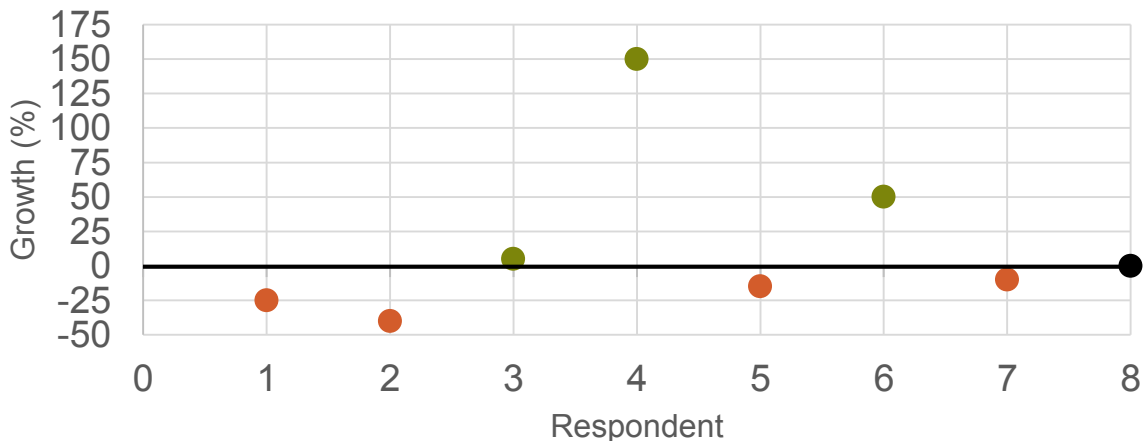
The majority of dive shop customers are Washington State residents (62 percent). Oregon residents make up approximately one-third of customers, while the other five percent come from British Columbia, Idaho, California, or other U.S. states. The composition of dive shop customers by geographic region is shown in Figure 18.

Figure 18. Dive Shop Operator Customers, by Region



When asked if business revenue has increased, decreased, or stayed the same over the past 10 years (or since opening), responses were nearly evenly split. Figure 19 summarizes the eight respondents randomly. Operator responses ranged from 40 percent decreases to 150 percent increases. One respondent indicated that revenues largely remain unchanged.

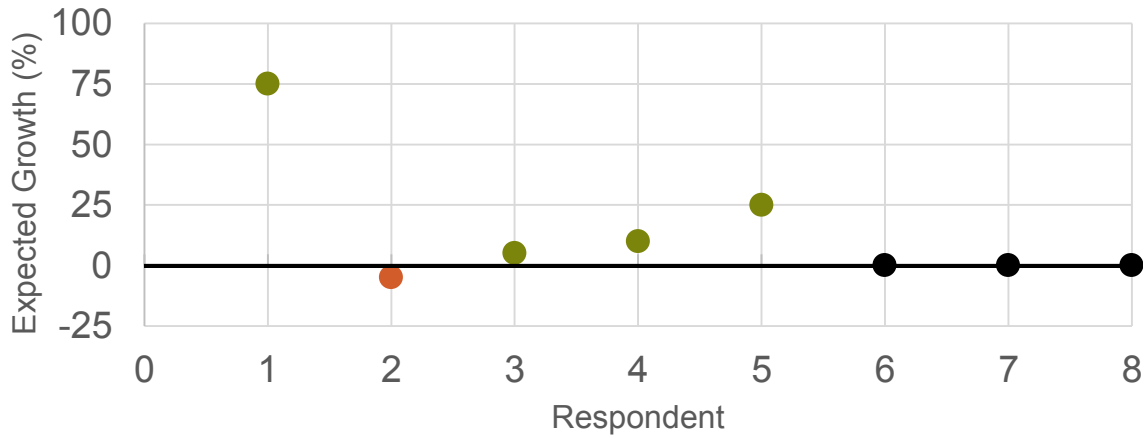
Figure 19. Dive Shop Operator Revenue Growth



Dive shop operator sentiment looking forward for the next five years is summarized in Figure 20. Here we see that most of the operators expect growth to be positive or to remain unchanged. Only one respondent expects business revenue to decline. This is somewhat contrary to information provided by Tom Ingram, Executive Director of Diving

Equipment and Marketing for the Diving Equipment & Marketing Association. Ingram suggests that nationwide the dive industry is down 40 to 70 percent in hard good sales and down 14 percent in overall certifications since 2012.

Figure 20. Dive Shop Operator Forecast



4.4.2 Expenditures

Dive shop operator expenditures ranged from \$30,000 to \$500,000 in 2014. Most of these expenditures appear to be made inside the Puget Sound region. However, due to limited responses, we are unable to model the economic impacts of dive shop operators, or provide meaningful results summarizing dive shop operator expenditures.

4.4.3 Employment

Average employment by dive shop operators is summarized in Table 6. Operators report relying mostly upon part-time employees and independent contractors. Average wages for part-time employees and contractors is \$9,100 and \$4,500, respectively—much less than the average full-time employee. On average, dive shop operators report employing just under two full-time employees, earning approximately \$27,000 annually.

Table 6. Dive Shop Operator Employment

Employee	Average Number of Employees	Average Annual Salary (\$)
Part-Time	2.8	9,100
Full-Time	1.8	27,300
Independent Contractor	3.8	4,500

5 Conclusions and Recommendations for Further Research

The purpose of this study was to quantify the characteristics and economic benefits of scuba diving in Washington State. We initially attempted to capture all aspects of the industry through a survey of both resident divers and regional dive shop operators (in the hope of capturing non-resident divers). Unfortunately, dive shop operators for the most part were unwilling to participate in our survey effort, so we were only able to generate statistics on that part of the industry based on 9 respondents (out of 40 potential). However, the results we were able to generate for the resident diver population can inform policy and coastal management decision-makers of critical trade-offs that should be considered and addressed. The method and model generated in this study can be easily replicated by local and state agencies and tourism bureaus as particular policy or management issues arise that may positively or negatively impact this important recreational sector.

As indicated above, there are certain critical limitations to our study, the greatest being that we clearly underestimate the total economic impacts of the industry given that we captured only 10 percent of the active dive population and were not able to include the dive shop operations in the final analysis of economic impacts. We did not extrapolate up to the level of all active resident divers since we received conflicting information as to whether the expenditure patterns of non-club divers are similar to divers belonging to a dive club. Clearly, if we did extrapolate to this larger number of divers, estimates of the economic impacts from resident diver expenditures to Washington State would be significantly greater than estimated in this study. We also recognize that there are several biases generated through our survey and sampling methodology. For example, the use of Survey Monkey may have biased against people who are not comfortable with on-line computer applications. In addition, the on-line survey may have led to conflating of quality of sites as respondents were not questioned in situ (at the dive site) where the essence of the activity is strongest. The survey itself had some limitations. The question regarding preferred sites needed to have clearly stated that we were interested in only regional sites. Finally, our economic estimates derived from IMPLAN may be slightly overstated because we were not able to break out the retail spending by divers from the other categories such as lodging and dining expenses. Recommendations for further research include modifications to the existing survey, an attempt to get additional information from dive shop operators, and implementation of an intercept survey to ground-truth findings.

In summary, our final results indicate that, in general, area club-divers tend to be predominately middle age, white males with a college education and belong to an income bracket ranging from \$30,000-150,000. Sixty-two percent of these divers make over 51 dives a year (mostly walk-in dives). Fifty percent of these divers have more than 10 years of experience, and 49 percent have advanced certifications. Eighty-seven percent of these divers preferred diving locally (in Washington State waters). Preferred sites include Sund Rock (Hood Canal), Redondo Beach, Keystone Edmonds Underwater Park, Mukilteo, Saltwater Sate Park, 3 Tree Point, Alkie Cove 2, Sunrise Beach Park (Gig Harbor) and Les

Davis, suggesting a predominance of activity in Central and South Puget Sound. Quality attributes of preferred sites include, in order, abundance of wildlife, ease of entry, ease of access, existence of natural structures, clarity of water, existence of manmade structures, boat access and parking, distance from home, and bathrooms and shower facilities. Predominate dive attributes at these sites are marine wildlife viewing and underwater photography.

Total economic expenditures made by resident club divers in 2014 equaled \$3.9 million, while expenditures made in the study region equaled \$2.4 million and \$2.8 in Washington State. The majority of these expenditures included travel and purchased equipment. Other expenditures, in order of magnitude, included capital expense (boats), private boat leases, equipment maintenance, dive instruction, tank fills, charter boat fees, club membership and dues, and rental equipment. Estimated expenditures made in Washington State in turn generated nearly \$5 million in total output, or 1.8 times the activity. Total expenditures by Washington's resident club divers generated nearly an additional \$1.9 million in labor income paid in state. The resident club diver population was responsible for approximately 49 additional jobs in Washington State. These results suggest that for every dollar spent by a resident diver, a total of \$1.80 worth of economic activity is generated in Washington State. In addition, every \$1 spent by resident divers generates \$0.70 in wages in the state and for every \$1 million worth of spending, nearly 17 jobs are generated.

These results may be compared with expenditures made to engage in other marine-related recreational activities in Washington State. To make such comparisons we turn to Earth Economics (2015) given the consistent methodology they use to estimate expenditures (including expenditures on equipment) attributable to popular outdoor recreational activities in Washington. They report total expenditures on scuba diving equaled \$173 million in 2014, significantly higher than the findings in this report given that they estimate all participation in state waters—residents and non-residents). This is in comparison to wildlife viewing/photography with total expenditures of \$7 billion² and recreational fishing with total expenditures of \$2 billion. Earth Economics indicates that the number of participants in scuba in 2014 was 82,000 (below that estimated by industry representatives for this study) as compared to 3 million in wildlife viewing, and 2 million in fishing and shellfishing. The Earth Economics report also indicates that when comparing total trip and equipment expenditures for outdoor recreational activities, wildlife viewing and fishing and shellfishing are larger than scuba in both categories. On the other hand, if one compares per-year, per-participant equipment expenditures and per-day, per-participant activity expenditures, scuba is highest in terms of per-day, per-participant activity expenditures and just below fishing and shellfish in terms of per-year, per-participant equipment expenditures.

Results from the resident diver survey and IMPLAN analysis suggest that resident diver activity in the inland waters of the State of Washington from Cape Flattery to Olympia including San Juan Islands and Point

² It is important to note that this estimate is based on all wildlife viewing (marine and terrestrial) and thus may not be comparable.

Roberts provides economic benefits to the Washington State economy. At the same time, individuals engaging in scuba in Washington State realize and acknowledge that the quality of the natural marine environment and the wildlife that inhabit it is at the heart of their experience and thus values. Not only do Puget Sound divers practice best management practices when diving so as to minimize their impact on the natural environment, they are active stewards through a number of regional efforts to conserve and protect the marine environment. Marine debris and trash collection dives both underwater and at the shoreline are organized by dive clubs or are coincident with celebrations such as Earth Day and local festivals. Many local divers volunteer their time to clean and maintain exhibit tanks such as at the Seattle Aquarium as well as educate and interface with the viewing public. Divers also volunteer as diving representatives for several committees supporting Washington Department of Fish and Wildlife efforts to protect the Giant Pacific Octopus. In addition, the dive community has been involved in The Invasive Tunicate Task Force and in the deployment and recovery of acoustic receivers that track bull trout and salmon in Hood Canal. Others have been involved in a joint pilot project with the National Oceanic and Atmospheric Administration and Washington Department of Fish and Wildlife to collect wild lingcod eggs to supply a pilot research study to see if marine bottomfish could be raised in a controlled environment. Lastly, the dive community also provides the region with a group of voluntary citizen scientists, constantly monitoring species abundance and changes that occur beneath the surface of our local waters. All of these activities are an indication of the benefits provided by this recreational sector, above and beyond its economic contributions.

The information presented in this report provides the economic value and impacts of the scuba industry that could enhance effective and efficient development and management decision making. This study could assist the Washington State Tourism Alliance in the promotion and development of an otherwise untapped recreational sector leading to participation of both resident and out-of-state divers. In addition, Washington State agencies such as the Washington Department of Fish and Wildlife and Washington State Parks Department could use this information in their deliberations over future investments in dive sites such as the creation of underwater man-made rocky reefs that draw fish and invertebrates, and are in the process of considering establishing a network of marine protected areas (MPA) under the 2011 Puget Sound Rockfish Conservation Plan.

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Appendix A: Resident Dive Survey

Appendix B: Dive Shop Survey

Appendix C: Map Production

Two approaches were used to locate dive sites mentioned by survey participants. A map of the most dived sites from Google Maps was downloaded in .kml form and uploaded into ArcGIS 10.3. Survey locations that provided a valid join with the uploaded Google Maps data were retained. Sites that were not depicted on the Google dive map were individually researched and placed on the map accordingly. Sources of online location information include, but are not limited to, The Perfect Dive, Dive Buddy, Emerald Diving and various local tourism and resort sites. Many dive locations are generalized to show relative location, or placed by public user input. As such, dive sites should not be used to pinpoint a specific dive.

Two different map symbologies were used to describe survey responses. Graduated symbols were used to indicate the number of times a particular site was mentioned. The larger the symbol, the more comments a site had received, the largest of which represents a range of 61 to 71 mentions. It is important to note that popular diving areas may be broken up into smaller individual sites, as is the case at Alki and the Hood Canal. This scenario is indicated by several smaller to medium size points that may overlap one another.

ArcGIS's equal area density tool was used to create areas of similar values, in this case site mentions, then calculate the average number of site mentions per square mile within similar areas. Dark red represents areas where site mentions were near one per square mile, while lighter colors denotes decreasing references. For example, the lightest shade on the map might represent a site mentioned once or twice, with no others within several hundred square miles.