

Understanding the Potential Economic Value of SCUBA Diving and Snorkeling

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I. INTRODUCTION

The California Marine Life Protection Act requires that the Department of Fish and Game, working with local stakeholders, develop a series of marine protected areas along the coast of California. One goal of this initiative is to “improve recreational, educational and study opportunities provided by marine ecosystems.” A second goal of the Act states that marine protected areas ought to be designed “To help sustain, conserve, and protect marine life populations, including those of ECONOMIC VALUE...” Identifying marine life populations with substantial economic value is not always straightforward. Commercially valuable fish populations are often easily and readily identified as having “economic value” because economic data on commercial fishing already is collected by state and federal agencies. Increasingly, though, more attention has been given to the recreational use value of marine resources; recreational fishing, diving, and wildlife viewing are among many coastal and marine recreational activities that contribute significantly to local and regional economic wellbeing. The question of just “how valuable these uses are” remains largely unanswered. Nevertheless, a large and growing literature is available that can provide insight into the potential economic value of marine and coastal recreation. Bibliographic databases and information networks like the National Ocean Economics Program’s “Non-market Literature Portal” (www.oceaneconomics.org) and the National Oceanic and Atmospheric Administration’s Marine Economics website (www.marineeconomics.noaa.gov) now make it possible for researchers to quickly locate relevant studies from the literature. In the paper that follows, we review the literature to provide an overview of the economic value of one important use of non-fishery resources – *recreational scuba diving and snorkeling*. We also provide a discussion of the potential value of similar resources in California.

II. THE IMPORTANCE OF SCUBA DIVING AND SNORKELING?

In 1999 and 2000, more than 43% of all Americans participated in some form of marine recreation¹. Americans flock to beaches and shores to swim, fish, boat, and view the natural

¹ Estimates are based on a national survey of outdoor recreation known as the National Survey on Recreation and the Environment (Leeworthy et al. 2001)

scenery (see Table 1). While the proportion of the population that participates in marine recreation is expected to decline over the coming decade, population growth in the coastal zone is expected to offset this trend. Overall, the total number of people participating in all forms of marine recreation is expected to increase with the largest increases expected for beach going activities (Leeworthy et al. 2005). California ranks second only to Florida in the number of participants in coastal recreation (17.6 million participants). While California also ranks second to Florida in the percent of its population that participates in marine recreation (10.7% for Florida, 8.7 % for California), its large population places California first in the nation in the number of residents that participate in marine recreation annually (12.2 million).

Snorkeling and diving represent a large portion of marine recreation in the United States. More than 5 percent of the population age 16 or older snorkeled at least once and 1.35 percent went SCUBA diving (Leeworthy and Wiley, 2001). Snorkeling and diving are ranked the eighth and thirteenth most popular activities in marine recreation in the United States (Table 2, Leeworthy and Wiley 2001). Although the forecast estimates provided by Leeworthy et al. (2005) project that the percent of the population participating in snorkeling is expected to decrease through the year 2010, the participation rate of scuba diving is expected to increase, and the number of participants in each activity is projected to rise. Snorkeling is expected to attract over 11 million participants by 2010, and scuba diving is anticipated to gain nearly half a million participants between the years 2000 and 2010, totaling 3.34 million.

California ranks third in the nation in terms of participation in any coastal diving activity with more than 870,000 participants annually (Leeworthy, 2001). California also is ranked third in the United States in terms of number of participants of any coastal diving activity falling behind only Florida and Hawai'i.

III. THE ECONOMIC CONTRIBUTION OF SCUBA DIVING AND SNORKELING

SCUBA diving and snorkeling in coastal and marine waters generate value for participants and the local businesses that support these activities. (Herein, we often will refer to divers and snorkelers as simply “divers.”) The quantification of the economic values associated with diving

is complicated by the fact that these activities generate both market and non-market values. The market impact of diving usually is assessed by examining how much money divers and snorkelers 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 fewer studies focusing on profits or taxes. 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 in the overall local economy. Further, gross expenditures represent the base upon which tax revenues can be generated.

The non-market value of recreational diving 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 these resources. Non-market values are often associated with outdoor recreational resources, including dive sites, and have been shown to generate substantial economic value beyond the expenditures generated by these resources (see Cesar 2000 and Pendleton 1995). 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 and snorkeling. At a minimum, funds raised directly from divers to protect marine resources (e.g. contributions to REEF Check or REEF Relief) reflect a lower bound for these non-market values. These funds are only a lower bound, however, because most dive sites are open access public resources.

In the literature, two primary methods are used to estimate the non-market value of recreational diving and snorkeling. Travel cost methods are used to estimate the trade-offs divers make

between travel costs (time and out of pocket expenses) and dive trips. (Travel cost methods include single and multiple site travel cost models and a variety of site choice models including random utility models.) Travel cost methods use real diver behavior to estimate the non-market value of recreational diving (the value divers place on a dive trip beyond what they have to pay), but because the method requires considerable variation in the travel costs faced by divers, the method works best when applied to non-resident divers (those living outside the immediate area). When travel cost methods are inappropriate, authors have used contingent methods to estimate values for diving although the application of this method to fishing is much less frequent than travel cost based methods. Specifically, several authors use contingent valuation methods to ask divers to place a value on their current recreational use of dive resources.

Below we summarize studies that provide estimates of both market impacts (expenditures) and non-market values associated with recreational SCUBA diving and snorkeling in the United States, with a special focus on diving along the Pacific Coast of the continental United States. Because the goal of this paper is to provide values that may be similar to values for diving and snorkeling in California, we limit our review to studies of diving and snorkeling in the continental United States and Hawaii. It is important for the reader to note that the methods for finding these market and non-market values often differ between studies. In the following we provide these estimates (all converted to US\$ in 2005, all figures greater than \$10 are rounded to the nearest dollar) with brief explanations of the basic methods. Further, when possible, we break down the value estimates based on the value per visitor per day. By doing so, we hope the reader will be able to better compare these results across studies and also understand how these

values may compare to the values that are generated by SCUBA diving and snorkeling in California.

THE MARKET IMPACTS OF RECREATIONAL DIVING

Gross expenditures by divers generate net revenues for local firms and businesses. We are unaware, however, of any cost and earnings analysis of recreational diving. As a result, we are unable to provide good estimates of the net economic market value of recreational diving. The literature, however, does provide numerous estimates of the gross expenditures made by recreational divers. Expenditures by divers support jobs and wages for dive charter captains and crews, employees at local hotels and eateries, and numerous other ancillary services. Using ratios derived from the United States Economic Census, analysts have estimated the taxes, wages, and jobs supported by recreational diving (see for instance Leeworthy and Wiley 2002). In this section, we review the literature to find estimates of expenditures by divers in the United States. To help the reader better use these values to understand the economic impact of diving in California, we provide estimates in terms of 2005 dollars per person per day when possible (otherwise we provide estimates in terms of 2005 dollars per trip).

The literature contains estimates of daily expenditures for snorkeling in Florida and Hawaii and for SCUBA diving along coastal Florida, the Gulf Coast, and the temperate Pacific West Coast of the United States. Table 2 summarizes expenditures estimated for snorkeling and SCUBA along the Pacific West Coast, Table 3 covers expenditure estimates for diving outside of the Pacific West Coast of the United States.

Expenditures on snorkeling in warmer waters range from \$51 to \$112 per day. Not surprisingly, daily expenditures on SCUBA diving tend to be higher with spending by non-resident divers far exceeding those of resident divers. Daily expenditures for resident divers range from \$40 for divers in Florida to \$268 in Texas. Daily expenditures for non-resident divers range from \$80 in Florida to \$319 in Texas. Leeworthy and Wiley (2002) also draw on the literature and a survey of local prices to estimate the likely expenditure of SCUBA divers and snorkelers making visits to the Channel Islands of California. The authors estimate that daily expenditures by divers visiting the Channel Islands National Marine Sanctuary ranges from \$76/day for consumptive divers using private vessels to \$225/day for non-consumptive divers.

Leeworthy and Wiley (2001) estimate that 1.38 million dives were made in California in 2000. Using the dive activity estimates of Leeworthy and Wiley and an estimated range in potential expenditures per diver per day of \$100 to \$200, we estimate that the range of annual expenditures from SCUBA diving in California could have ranged from \$138 million to \$276 million in the year 2000. Leeworthy and Wiley (2001) also estimate that 3.82 million snorkeling days were enjoyed in California during the year 2000. Using a range in per person per day expenditures associated with snorkeling of \$40 to \$90 and the estimates of Leeworthy and Wiley, we estimate that the annual expenditures of snorkeling in California could have ranged from \$153 million to \$344 million in the year 2000. The number of people participating in coastal activities is expected to increase from the year 2005 to the year 2010 (Leeworthy, *et al.* 2005). As the number of participants increases, so should the expenditures associated with diving. Leeworthy, *et al.* (2005) estimates the nation wide participation change from the year 2000 to the years 2005 and 2010. The authors predict that in the span of ten years, the nation

will see an increase in SCUBA diving participation of 17% and an increase in snorkeling participation of 11%. Based on these national estimates, the value of SCUBA diving in California could increase to \$161 million to \$323 million annually by the year 2010. Similarly, the annual value of snorkeling in California could increase to \$170 million to \$382 million by 2010.

Non-market use values for a SCUBA diving or snorkeling day in warmer waters ranges from \$3 to \$199 per day for snorkeling and from \$31 to \$319 per day for SCUBA diving. Where estimated separately, the consumer surplus for non-residents was generally greater than that for residents. This is seen in the Florida recreation estimates provided by Leeworthy *et al.* (2001) in which diving consumer surplus ranges from \$3 to \$4 for residents and from \$8 to \$16 for non-residents. Once again, Leeworthy and Wiley (2002) conduct a review of literature in order to assess the consumer surplus for SCUBA diving and snorkeling recreation days in the Channel Islands National Marine Sanctuary. They estimate that the non-market use value of SCUBA diving ranges from \$41 to \$43 per day, and the non-market value of snorkeling ranges from \$76 to \$225 per day.

Based on the 2000 participation estimates in Leeworthy and Wiley (2001) and an estimated value range of \$15 to \$50 per diver per day, the annual value of SCUBA diving in California ranged from \$20.7 million to \$69 million in the year 2000. Using a range of \$5 to \$30 for the consumer surplus per snorkeling participant per person per day, the annual value of snorkeling in California could have ranged from \$19.1million to \$114.6million in the year 2000. The total annual non-market value of SCUBA diving and snorkeling ought to increase as the number of divers increases. As stated above, Leeworthy, *et al.* (2005) estimate the nationwide participation

change from the year 2000 to the years 2005 and 2010. These figures indicate that in the span of ten years, the nation will see an increase in SCUBA diving participation of 17% and an increase in snorkeling participation of 11%. Based on these national estimates, the value of SCUBA diving in California could increase to \$25 million to \$81 million annually by 2010. Similarly, the annual value of snorkeling in California could increase to \$21 million to \$128 million.

IV. Discussion

Marine protected areas are designed to protect marine wildlife in a way that meets important social goals. The California Marine Life Protection Act directs the Department of Fish and Game to protect wildlife and habitats while directly considering the economic and recreational impacts of protection. In this brief paper, we highlight the range of values that have been estimated for SCUBA Diving and snorkeling in the United States. Not surprisingly, diving contributes substantially to local economies both in direct revenues (and the jobs these revenues support) and in the overall economic wellbeing of coastal users. SCUBA diving and snorkeling also represent important economic resources for individual states like California. While it is not clear how SCUBA and snorkeling activities are distributed across the state, we estimate that diving in California, statewide, probably generates on the order of \$138 million to \$276 million in annual gross revenues from SCUBA diving alone. The potential magnitude of expenditures associated with snorkeling is similar. We estimate that snorkeling in California may have generated between \$153 million and \$344 million. Diving and snorkeling also generates non-market benefits for the many divers along the California coast. We estimate the non-market use value for California divers at between \$21 million and \$69 million annually and a range of \$19 million to \$115 million for snorkeling. As diving and snorkeling increases in popularity, these values are also likely to increase. Leeworthy et al. (2005) estimate that participation in diving

nationwide should increase by 17% in year 2010 from 2000 levels and participation in snorkeling should increase by 11% during the same period. As other sectors of the coastal economy continue to decline in value along the California coast (e.g. commercial fishing and marine construction), the importance of recreational activities like diving and snorkeling will continue to grow.

V. References

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Table 1: National Participation Rates and Number of Participants by Activity/Setting and Year (from Leeworthy et al 2005)

Activity/Setting (by Rank)	2000 Number of Participants (millions)	2005 Number of Participants (millions)	Growth Rate (compared to 2000)	2010 Number of Participants (millions)	Growth Rate (compared to 2000)
Visiting Beaches	63.67	67.59	6%	70.94	11%
Swimming	54.13	57.21	6%	59.64	10%
Fishing	21.88	23.31	7%	24.54	12%
Viewing or Photographing Scenery	19.49	20.62	6%	21.62	11%
Bird-Watching	15.2	16.1	6%	16.86	11%
Motorboating	15.08	15.95	6%	16.7	11%
Viewing other Wildlife	13.68	14.41	5%	15.01	10%
Snorkeling	10.75	11.38	6%	11.88	11%
Visiting Watersides Besides Beaches	9.54	10.22	7%	10.84	14%
Sailing	6.32	6.69	6%	7	11%
Personal Watercraft Use	5.45	5.77	6%	5.99	10%
Surfing	3.37	3.63	8%	3.81	13%
Scuba Diving	2.86	3.12	9%	3.34	17%
Kayaking	2.82	3.01	7%	3.15	12%
Water Skiing	2.44	2.57	5%	2.69	10%
Canoeing	2.23	2.35	5%	2.45	10%
Rowing	1.12	1.21	8%	1.28	14%
Wind Surfing	0.83	0.89	7%	0.94	13%
Hunting Waterfowl	0.7	0.77	10%	0.83	19%

Participation in SCUBA and Snorkeling Recreation (2000)

	Participation Rate (%) *	Number of Participants (millions) **	Number of Days (millions) ***
United States			
<i>Snorkeling</i>	5.07	10.46	92.5
<i>Scuba Diving</i>	1.35	2.79	22.8
California			
<i>Snorkeling</i>	0.34	0.71	3.818
<i>Scuba Diving</i>	0.14	0.29	1.383

From Leeworthy and Wiley (2001), * Percent of the US population that participated in the activity, ** Number of Participants is equal to the participation rate multiplied by the non-institutionalized population 16 years or older in all households of the U.S. as of September 1999. *** The number of days the respondents participated in each activity over a year. Note figures from top and bottom of table differ due to the use of different base population levels in each report.

Table 2: Non-Market Values and Expenditures for Pacific Coast Diving and Snorkeling

Non-Market Value Estimates				
Author	Region	Natural Setting ²	Activity and Mode of Access ³	\$(2005)/Day
Snorkeling				
Kaval and Loomis (2003)	Pacific Coast	NS		31.58
Scuba Diving				
Leeworthy and Wiley (2002)	Santa Barbara County, CA	NS	NC	13.78
	Ventura County, CA	NS	NC	13.78
	CINMS ⁴ , CA	N	C, Ch	42.95
	CINMS, CA	N	C, P	41.35
	CINMS, CA	N	NC	42.95
Kaval and Loomis (2003)	Pacific Coast	NS		55.66
Expenditures				
Scuba Diving				
Author	Region	Natural Setting	Type	\$/Day
Leeworthy and Wiley (2002)	Santa Barbara County, CA	NS	NC	175.60
	Ventura County, CA	NS	NC	224.65
	Los Angeles County, CA	NS	NC	273.08
	CINMS, CA	N	C, Ch	157.33-219.63
	CINMS, CA	N	C, P	76.16
	CINMS, CA	N	NC	175.60-224.65

² N = Natural Reef; NS = Not Specified

³ Ch = Charter Boat; P = Private Boat; C = Consumptive Diving; NC = Non Consumptive Diving

⁴ Channel Islands National Marine Sanctuary

Table 3: Expenditures for Atlantic and Gulf Coast Diving and Snorkeling

Author	Location	Setting	Resident/Non Resident	Mode	\$/Day (unless otherwise specified)
Leeworthy, <i>et al.</i> (2001)	Southeast Florida	A	R		49.71
	Southeast Florida	N	R		54.42
Hazen and Sawyer (2004)	Martin County, FL	A/N	R		31.92
Utech (2000)	Big Island, Hawaii	NS	R and NR	Ch	73.16
	Kaua'i, Hawaii	NS	R and NR	Ch	112.10
	Maui, Hawaii	NS	R and NR	Ch	93.22
Scuba Diving					
Ditton and Baker (1999)	Texas Coastal Communities	A	R	Ch	205.74
	Texas Coastal Communities	A	NR	Ch	215.90
	Texas	A	R	Ch	267.97
	Texas	A	NR	Ch	318.77
Leeworthy, <i>et al.</i> (2001)	Southeast Florida	A	R		73.94
	Southeast Florida	N	R		69.87
Bell, <i>et al.</i> (1998)	Northwest Florida	A	R		52.42
	Northwest Florida	A	NR	O	103.22 ⁵
	Northwest Florida	A	NR	P; Ch; R	102.74-104.01 ⁶
Stoll and Ditton (2002) <i>secondary source</i>	Gulf of Mexico	A	R and NR	Ch	79.21-83.47
	FGBNMS, Gulf of Mexico	N	R and NR	Ch	447.27/trip
Leeworthy and Bowker (1997)	Florida Keys/Key West	N	R and NR		446.50/trip
Hazen and Sawyer (2004)	Martin County, FL	A/N	R		119.43
					40.10

⁵ Expenditures were averaged across counties of Northwest Florida (Bay, Walton, Okaloosa, Rosa, and Escambia Counties)

⁶ This is the range of expenditures for the counties of Northwest Florida

Table 4: Non-Market Values for Atlantic and Gulf Coast Diving and Snorkeling
Snorkeling

Author	Location	Natural Setting ⁷	Resident/Non Resident ⁸	Mode of Access ⁹	\$(2005)/Day (unless otherwise specified)
Leeworthy, <i>et al.</i> (2001)	Southeast Florida	A	R		3.02
	Southeast Florida	A	NR		8.37
Leeworthy and Bowker (1997)	Florida Keys/Key West	N	R and NR		118.96
Park, <i>et al.</i> (2002)	Florida Keys	N	R and NR		130.59/trip
Kaval and Loomis (2003)	All US National Parks	NS	R and NR		32.08
Scuba Diving					
Ditton and Baker (1999)	Texas	A	R and NR	Ch	83.48
	Texas	A	R and NR	Ch	49.53
Leeworthy, <i>et al.</i> (2001)	Southeast Florida	A	R		4.02
	Southeast Florida	A	NR		16.16
Bell, <i>et al.</i> (1998)	Northwest Florida	A	NR		11.27
Stoll and Ditton (2002) <i>secondary source</i> ¹⁰	Gulf of Mexico	A	R and NR	Ch	121.20/trip
	FGBNMS ¹¹ , Gulf of Mexico	N	R and NR	Ch	157.20/trip
Kaval and Loomis (1993)	All US National Parks	NS	R and NR		34.25
	Northeast Region	NS	R and NR		18.96

⁷ A = Artificial Reef; N = Natural Reef; NS = Not Specified

⁸ R = Resident; NR = Non Resident

⁹ Ch = Charter Boat; P = Private Boat; R = Rental Boat; O = visitors or residents using their Own Boat

¹⁰ Abstract from www.marineconomics.noaa.gov

¹¹ Flower Garden Banks National Marine Sanctuary