Understanding the Potential Economic Value of Marine Recreational Fishing:

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January 3, 2006

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 recreational use of marine resources– marine recreational fishing. We also provide a discussion of the potential value of these resources in California.

II. The Importance of Fishing

In 1999 and 2000, more than 43% of all Americans participated in some form of marine recreation[1]. Americans flock to beaches and shores to swim, fish, boat, and view the natural scenery (see Table 1). While the proportion of the population that participates in marine

[1] Estimates are based on a national survey of outdoor recreation known as the National Survey on Recreation and the Environment (Leeworthy and Wiley 2001)

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).

Fishing represents a large portion of marine recreation in the United States. Saltwater fishing alone draws nearly 21.3 million participants nation wide which accounts for 10.3 percent of the population age 16 or older (Leeworthy, 2001). Saltwater fishing ranked third most popular activity in marine recreation in the United States (Leeworthy, 2001). Although the forecast estimates provided by Leeworthy et al. (2005) project that the percent of the population participating in fishing will decrease through the year 2010, a larger population will offset this drop in percentage, thus causing the number of saltwater fishing participants to rise. Saltwater fishing is expected to attract over 24 million participants by 2010. California ranks second in the nation in terms of participation in saltwater fishing with more than 2.7 million participants, falling only behind Florida. Texas is ranked third with more than 1 million fewer saltwater fishing participants than in California (Leeworthy, 2001).

III. THE ECONOMIC CONTRIBUTION OF MARINE RECREATIONAL FISHING

Recreational fishing in coastal and marine waters generates value for participants and the local businesses that support these activities. The quantification of the economic values associated with recreational fishing is complicated by the fact that these activities generate both market and non-market values. The market impact of marine recreational fishing usually is assessed by examining how much money anglers contribute to the local economy through spending related to access, equipment, and goods and services (e.g. ice and bait). 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 recreational fishing expenditures 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 fishing is more difficult to determine. Non-market values represent the value anglers 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 recreational fishing sites, and have been shown to generate substantial economic value beyond the expenditures generated by these resources. These non-market values represent the net economic value to the angler of fishing opportunities; these values capture the added economic well-being that anglers enjoy as a result of access to areas with high quality fishing. At a minimum, funds raised directly from anglers to protect marine resources reflect a lower bound for these non-market values. These funds are only a lower bound, however, because most marine recreational fishing sites are open access public resources; many anglers could "free ride" on the conservation efforts of others.

In the literature, two primary methods are used to estimate the non-market value of recreational fishing. Travel cost methods are used to estimate the trade-offs anglers make between travel costs (time and out of pocket expenses) and recreational fishing opportunities. (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 angler behavior to estimate the

non-market value of recreational fishing (the value anglers place on a recreational fishing trip beyond what they have to pay), but because the method requires considerable variation in the travel costs faced by anglers, the method works best when applied to non-resident anglers (those living outside the immediate area). When travel cost methods are inappropriate, authors have used contingent methods to estimate values for fishing although the application of this method to fishing is much less frequent than travel cost based methods.

Below we summarize studies that provide estimates of both market values (expenditures) and non-market values associated with recreational fishing in the United States, with a special focus on fishing in California. Because the goal of this paper is to provide values that may be similar to values for fishing in California, we limit our review to studies of fishing 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 fishing in California.

THE MARKET VALUE OF RECREATIONAL FISHING

Gross expenditures by fishers generate net revenues for local firms and businesses. We are unaware, however, of any cost and earnings analysis of recreational fishing. As a result, we are unable to provide good estimates of the net economic market value of recreational fishing. The literature, however, does provide numerous estimates of the gross economic value of expenditures made by recreational anglers. Expenditures by fishers support jobs and wages for 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 fishing (see for instance Leeworthy and

Wiley 2002). In this section, we review the literature to find estimates of expenditures by marine recreational anglers in the United States with a focus on California. To help the reader better use these values to understand the economic impact of recreational fishing 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 made by anglers in Alaska, the Gulf Coast, select states on the East Coast, and California. Table 2 summarizes recreational fishing expenditures in California, and Table 4 provides expenditures for locations outside California.

Expenditures on fishing in California range from $21 to $564 per day. Daily expenditures (Table 2) tend to be higher for non-resident fishers than for resident fishers and higher for fishers using a party or charter boat than for those using private boats. The literature shows that daily expenditures for fishers using a party or charter boat range from $94 to $564 in Southern California, but fishers using private boats only spend from $21 to $251 in Southern California. Results provided by Gentner et al (2001) show that daily expenditures for resident fishers range from $21 in Southern California to $128 in Northern California. Daily expenditures for non-resident fishers range from $143 in Northern California to $564 in Southern California.

The same pattern of fishing-related expenditures is found for sites outside of California (Table 4). Daily fishing expenditures for residents range from $44 in Washington to $250 in Alaska whereas daily fishing expenditures for non-residents range from $116 in Oregon to $359 in Alaska.

Based on the 2000 participation estimates from Leeworthy and Wiley (2001) and an estimated value range of $75 to $200 per participant per year (from the estimates given in tables 2 and 4), the annual value of recreational fishing in California ranged from $205 million to $545 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 does the value of the activity. Leeworthy et al. (2005) estimates 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 fishing participation of 12%. Based on these national estimates, the value of marine recreational fishing in California could increase to between $230 million and $610 million annually by 2010.

THE NON-MARKET VALUE OF MARINE RECREATIONAL FISHING

Recreational fishing also generates direct economic benefits to anglers, beyond the costs associated with fishing. These non-market values reflect the net benefit of coastal and marine fishing resources to anglers. Changes in these non-market values, for better or for worse, reflect changes in the net economic value of the resource. Changes in value could result from changes in access to fishing sites, changes in catch per unit effort at sites, or changes in interactions with other users at fishing sites (including congestion and conflicts with other users). In this section, we review the literature to summarize estimates of the non-market values of marine recreational fishing in the United States. As before, we present our findings in two tables: Table 3 provides estimates from the literature for California, Table 5 provides estimates for locations outside of California.[2]

Estimates of the non-market values for a recreational day of fishing in California range from $15 to $97 per day, or from $34 to $536 per trip. Non-market values (Table 3) tend to be higher for anglers using a party or charter boat than for those using private boats. Estimates provided by Wegge et al. (1986) show that the non-market value of a day of fishing for fishers using a party or charter boat ranges from $24 to $97 in Southern California, but fishers using private boats have a daily non-market value ranging only from $15 to $59 in Southern California. Nationally, non-market values for marine recreational fishing are similar with values ranging from $17 per day in Delaware to $146 per person day in Alaska.

[2] Table 5 is divided into two parts: estimates from original research and estimates from secondary data sources that cite value estimates from other papers. Secondary estimates come from databases where value estimates are given, but we were not able to locate the original research.

Based on the 2000 participation estimates (20.3 million person days) from Leeworthy and Wiley (2001) and an estimated value range of $15 to $90 per person day, the annual value of recreational fishing in California likely ranged from $305 million to 1.83 billion in the year 2000. The annual non-market value of marine recreational fishing will likely increase as participation in recreational fishing increases, much like the previously discussed market value. Leeworthy et al. (2005) estimates the nation wide 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 recreational fishing activity of 12%. Based on these national estimates, the non-market value of marine recreational fishing in California could increase to $342 million to over $2 billion annually by the year 2010.

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 marine recreational fishing in the United States. Fishing is the third most popular water-based recreation activity in the United States after beach going and swimming and the fourth most popular coastal activity in California (Leeworthy 2001). Not surprisingly, marine recreational fishing contributes substantially to local economies both in direct revenues (and the jobs these revenues support) and in the overall economic wellbeing of coastal users. Marine recreational fishing also represents important economic resources for individual states like California. We estimate that marine recreational fishing in California, statewide, probably generates on the order of $205 million to $545 million in expenditures related to fishing trips. Note these estimates are significantly less than those of the American Sportfishing Association (ASA). The ASA includes in its estimates expenditures on items that are not directly related to

fishing trips, but are related to fishing generally (e.g. magazine subscriptions and vehicles). Marine recreational fishing also generates non-market benefits for the many anglers along the California coast. Even though the per person per day non-market value of marine fishing is similar to that of SCUBA diving, and somewhat higher than wildlife viewing, the large number of marine anglers and their high avidity result in very high overall non-market values for marine recreational fishing in California. We estimate the non-market use value for California anglers at between $304 million and $1.83 billion As the population of California and the nation grows, so too will the number of people participating in recreational fishing. Leeworthy et al. (2005) estimate that participation in marine recreational fishing nationwide should increase by 12% in year 2010 from 2000 levels. 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 recreational fishing will continue to grow.

V. References

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Table 1: National Projections of Marine Recreation (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 Fishing and Ocean Fishing (2000)

	*Participation Rate (%)**	*Number of Participants (millions)*	*Number of Days (millions)*
United States			
Saltwater Fishing	*10.32*	*21.28*	*258.81*
California			
Saltwater Fishing	*1.32*	*2.73*	*20.32*

From Leeworthy and Wiley (2001)

*Participation rate is the percent of all non-institutionalized Americans age 16 or over that did the activity in each state. Note figures differ from Leeworthy et al. (2005 due to the use of different base population levels..

Table 2: California Expenditures for Recreational Fishing per person

Party/Charter Boat

Residents

Species and Author	Region	Mode type/Site Characteristics[3]
Not Specified		
Gentner et al. (2001)	Southern California	None
	Northern California	None

Non-Residents

Species and Author	Region	Mode type/Site Characteristics
Not Specified		
Gentner et al. (2001)	Southern California	None
	Northern California	None

Private Boat

Residents

Species and Author	Region	Mode type/Site Characteristics
Not Specified		
Gentner et al. (2001)	Southern California	R
	Southern California	S
	Northern California	R
	Northern California	S

Non-Residents

Species and Author	Region	Mode type/Site Characteristics
Not Specified		
Gentner et al. (2001)	Southern California	R
	Southern California	S
	Northern California	R
	Northern California	S

[3] R = Rental boat; S = Shore; OS = Offshore; MM = Man Made Structures

Table 3: California Non-Market Measurements for Recreational Fishing per person

Party/Charter Boat

Residents

Species and Author	Region	Mode type/Site Characteristics[4]	Type of measurement[5] and Method[6]	$/Trip
Salmon/Halibut				
Huppert (1989)	San Francisco Bay Area	***PC; P; S***	*TC*	535.76
	San Francisco Bay Area	***PC; P; S***	TC	242.54
	San Francisco Bay Area	***PC; P; S***	TC	110.41

Both Residents and Non-Residents

Species and Author	Region	Mode type/Site Characteristics	Type of measurement and Method	
Other				
Wegge et al. (1986)	Southern California	O	TC	
	Southern California	NO	TC	
	Southern California	O	TC	
	Southern California	NO	TC	
Not Specified				
Huppert, Thomson (1984)	California		TC	33.54[7]
Pacific Mackerel, Kelp Bass, Rockfish				
Wegge et al. (1986)	Southern California		CVM	44.33

[4] PC = Party/Charter boat; P = Private boat; R = Rental boat; O = Boat Owner; NO = Non-Boat Owner; S = Shore; OS = Offshore; MM = Man Made Structure

[†] Information and values pertaining to this study were taken from Freeman III (1995)

[5] CS = Consumer Surplus; CV = Compensating Valuation

[6] CVM = Contingent Valuation Method; TC = Travel Cost Method

[7] This value is based on a travel cost method in which the time travel is valued at 1/3 the wage rate.

Table 3: California Non-Market Measurements for Recreational Fishing per person (continued)

Private Boat

Residents

Species and Author	Region	Mode type/Site Characteristics[8]	Type of measurement[9] and Method	$/Trip
Other				
Kling and Herriges (1995)	Southern California	OS	Welfare Loss from closure of all sites	27.46-44.45[10]
	Southern California	S	Welfare Loss from closure of all sites	10.84-21.35[7]
Both Residents and Non-Residents				
Other				
Wegge et al. (1986)	Southern California	R	CVM	
	Southern California	S	CVM	
	Southern California		CVM	
	Southern California	O	TC	
	Southern California	NO	TC	
Hanemann et al. (1986)	Southern California	S; O	TC	
	Southern California	S; NO	TC	

[8] PC = Party/Charter boat; P = Private boat; R = Rental boat; O = Boat Owner; NO = Non-Boat Owner; S = Shore; OS = Offshore; MM = Man Made Structure

† Information and values pertaining to this study were taken from Freeman III (1995)

[9] CS = Consumer Surplus; CV = Compensating Valuation

[10] Values given per undefined choice occasion

Table 4: Non-California Expenditures for Recreational Fishing per person

Species and Author	Location	Mode type/Site Characteristics[11]
Residents		
Not Specified		
Gentner et al. (2001)	Oregon	PC
	Oregon	P; R
	Oregon	S
	Washington	PC
	Washington	P; R
	Washington	S
Halibut, Salmon		
Hamel et al. (2000)	Alaksa‡	PC
	Alaksa‡	S
	Alaksa‡	P
	Alaksa§	PC
	Alaksa§	S
	Alaksa§	P
Other		
Bell et al. (1982)	All Florida Regions	PC; P; S
Not Specified		
Steinback (1999)	Maine	PC
Non-Residents		
Not Specified		
Gentner et al. (2001)	Oregon	PC
	Oregon	P; R
	Oregon	S
	Washington	PC
	Washington	P; R
	Washington	S
Halibut, Salmon		
Hamel et al. (2000)	Alaska	PC
	Alaska	S
	Alaska	P
Other		
Bell et al. (1982)	All Florida Regions	PC; P; S
Not Specified		
Steinback (1999)	Maine	NS

[11] PC = Party/Charter boat; P = Private boat; R = Rental boat; S = Shore; OS = Offshore; MM = Man Made Structures, NS=not specified.
‡ Regional Resident
§ Alaska Resident

Table 5a: Non-Market Values for Recreational Fishing Outside of California (primary data available)

Species and Author	Location	Mode type/Site Characteristics[12]	Type of measurement and method[13]	$/Trip
Residents				
Halibut, Salmon				
Hamel et al. (2000)	Alaska	PC	CVM and TC	
Not Specified				
Hausman et al. (1995)	Alaska	NS	TC	188.02
Other				
Bell et *al*. (1982)	Florida[14]	PC; P; S	CVM	
Not Specified				
Downing and Ozuna (1996)	Texas	General boating	CVM	60.23-407.69 (mea of counties 171.11
Non-residents				
Halibut, Salmon				
Hamel et al. (2000)	Alaska	PC	TC and CVM	
Other				
Bell et al. (1982)	Florida[5]	PC; P; S	CVM	
Both Residents and Non-Residents				
Halibut, Salmon				
Hamel et al. (2000)	Alaska	PC	TC and CVM	
Other				
Bell et al. (1982)	Florida	PC; P; S; MM	CVM	
Not Specified				
Bishop et al. (1990)	Wisconsin	NS	CVM	46.54
Residential Status Not Specified				
Other				
Bell, F.W. (1997)	East Florida Coast	NS	TC	
	West Florida Coast	NS	TC	

[12] PC = Party/Charter boat; P = Private boat; R = Rental boat; O = Boat Owner; NO = Non-Boat Owner; S = Shore; OS = Offshore, NS=not specified.

[13] CVM = Contingent Valuation Method; TC = Travel Cost Method, RUM = Random Utility Model, NRUM = Nested Random Utility Model

[14] Includes Northwest Gulf, West Gulf, Northeast Gulf, Southwest Gulf, and Southeast Atlantic

Table 5b: Non-Market Values for Recreational Fishing Outside of California (secondary data available only):

Residents

Species, Author	Location	Mode type/Site Characteristics	Type of measurement	$/Trip
Halibut				
Jones and Stokes Associates (1987)*	Alaska	PC; P; R	TC and RUM	33.90 (CO)
	Alaska	S	TC and RUM	6.21 (CO)
	Alaska	NS	TC and RUM	7.68 (CO)
King Salmon			TC and RUM	
Jones and Stokes Associates (1987)*	Alaska	PC: P; R	TC and RUM	30.82 (CO)
	Alaska	NS	TC and RUM	10.34 (CO)
Silver Salmon			TC and RUM	
Jones and Stokes Associates (1987)*	Alaska	PC; P; R	TC and RUM	23.38 (CO)
	Alaska	NS	TC and RUM	7.19 (CO)
Other species			TC and RUM	
Jones and Stokes Associates (1987)*	Alaska	PC; P; R	TC and RUM	18.20 (CO)
	Alaska	NS	TC and RUM	4.60 (CO)
Norton et al.* (1983)	CT, MA, ME, NH, RI	NS	TC	207.26
	DE, NJ, NY	S	TC	407.29
	MH, VA	PC ; P ; S	TC	93.99
	NC	NS	TC	277.15

Table 5b (continued): Non-Market Values for Recreational Fishing Outside of California (secondary data available only):

Non-Residents				
Salmon				
Rowe, R.* (1985)	Oregon	PC; P; S	TC and RUM	116.07
	Washington	PC; P; S	TC and RUM	100.52
Crutchfield and Schelle* (1978)	Washington	PC; P	CVM	
Other				
Bockstael et al.* (1986)	South Carolina	P	CVM	
McConnell et al.* (1993)	Mid-Atlantic/Eastern States[15]	PC; P; S	CVM	
McConnell and Strand* (1994)	New York	PC; P; S	TC and RUM	
	New Jersey	PC; P; S	TC and RUM	
	Delaware	PC; P; S	TC and RUM	
	Maryland	PC; P; S	TC and RUM	
	Virginia	PC; P; S	TC and RUM	
	North Carolina	PC; P; S	TC and RUM	
	South Carolina	PC; P; S	TC and RUM	
	Georgia	PC; P; S	TC and RUM	
	Florida	PC; P; S	TC and RUM	
	New York	PC; P; S	TC and RUM	
	New Jersey	PC; P; S	TC and RUM	
	Delaware	PC; P; S	TC and RUM	
	Maryland	PC; P; S	TC and RUM	
	Virginia	PC; P; S	TC and RUM	
	North Carolina	PC; P; S	TC and RUM	
	South Carolina	PC; P; S	TC and RUM	
	Georgia	PC; P; S	TC and RUM	
	Florida	PC; P; S	TC and RUM	
Residential Status Not Specified				
Pacific Salmon				
Rowe et al.† (1985)	Oregon	NS	RUM	8.65
	Washington	NS	RUM	0.63
Wegge et al.† (1988)	Alaska	NS	RUM	69.94
Other				
Leeworthy† (1990)	Florida	NS	TC	81.33

[15] This region includes the following states: DE, FL, GA, MD, NC, NJ, NY, SC, VA

* Information and values pertaining to this study were taken from www.indecon.com/fish/defualt.asp