Economic benefits of the recreational California halibut fishery: A travel cost analysis

DISCUSSION PAPER

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Manuel Barrientos[1]
Felip Vásquez Lavín[2]
Rhona Barr[3]
Aaron Bruner[3]
Kim Bonine[3]

[1] Universidad del Desarrollo, Chile
[2] Universidad de Concepción, Chile
[3] Conservation Strategy Fund

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1 Introduction

Fishing is an important recreational activity for 33.1 million US residents aged 16 years or older. Saltwater fishing attracted 8.9 million anglers in 2011, accounting for 86 million trips and $10.3 billion in trip and equipment spending. Flatfish, which includes halibut, comprised more than a fifth of all recreational saltwater trips, accounting for 22 million fishing days and two million anglers (FWS, 2011).

Across the US, California ranks second in terms of recreational saltwater fishing participation, second only to Florida (Pendleton & Rooke, 2006). California halibut, *Paralichthys californicus*, is one of the most important flatfish species for both recreational and commercial fishing in California (CDFG, 1990). Halibut is a prized catch for recreational anglers due not only to its taste and size as one of the largest fishes in state waters, but also because its ambush feeding behavior makes it a challenging catch.

The purpose of the present study is to estimate the economic benefits of California halibut fishing to recreational anglers along the Californian coast. Unlike commercial fisheries, in which economic benefits can be directly observed through market transactions, recreational fisheries provide substantial non-market benefits to users. In the past, these have been omitted from management plans and other considerations due to difficulties in quantification. Determining the economic value of the recreational California halibut fishery can therefore highlight a previously invisible value that can be taken into account as the California Department of Fish and Wildlife (CDFW) continues to give California halibut high management priority.

2 Species and fishery description

California halibut are commonly caught in shallow soft bottom habitats at depths of less than 30 meters, but larger individuals have been caught as deep as 100 meters. These larger individuals can grow up to 1.5 meters in length and weigh as much as 72 pounds (CDFG, 1990; OST, 2013).

Recreationally, fishing for California halibut is permitted in all marine and estuarine waters, except in certain Marine Protected Areas, as long as fishers are in possession of a valid sport fishing license. Fishing for halibut without a license is permitted on a public pier in ocean or bay waters, or if you are under 16 years of age. California halibut is taken by all three main modes of fishing: shore, private/rental boats and party/charter boats (Maunder et al., 2011). The majority (77–79%) is taken from private and rental boats (CDFG, 2003), and is primarily caught using hook and line (CDFG, 2012). In 2011, 316.7 tons (t) of California halibut were landed, of which 117 t were caught recreationally (James, 2013).

The California halibut's range extends from as far north as Quillayute River in Washington to as far south as Magdalena Bay in Baja California, although the species is most common from Bodega Bay south. California's central coast population is considered healthy, showing growth since 1995. The southern population is considered depleted to approximately 14% of its unexploited spawning biomass level due to low recruitment since 1999 (Maunder et al., 2011). This appears to be driven by a decline in the availability of suitable shallow water nursery habitats in southern California as a result of dredging and filling of bays and wetlands (CDFG, 2003). However, California halibut, like many other flatfish, have high reproductive potential, and when environmental conditions are favorable their biomass can increase rapidly (Maunder et al., 2016). Recent observations by the CDFW and by recreational and commercial fishermen suggest strong recruitment of young-of-the-year and juvenile California halibut in central and southern California in 2016 and 2017 (P. Reilly, *pers. comm*., 2017).

The commercial California halibut fishery in California is regulated through limited entry permits for trawl and gill net fisheries, restrictions on gear, minimum size limits, and area restrictions (OST, 2013). For recreational fishers, regulations include a minimum size limit of 22 inches total length and a daily bag limit of three fish north of Point Sur in Monterey County, and five fish south of Point Sur (OST, 2013; CDFG, 2012).

3 Methodological approach

This study uses the travel cost method (TCM). Travel cost analysis is frequently used to estimate the monetary value of the non-market benefit that accrues to participants in recreational activities.

The approach uses two main types of information. First, it takes into account the costs of participation. These include direct costs such as fees, fuel or equipment rental. The opportunity cost of time is also typically included. The TCM also considers the factors that influence the choice to visit a given site as opposed to other possible sites for the same or comparable activities. This information is used to estimate a demand curve, from which the economic benefit of the activity for each participant can be calculated.

Travel cost studies follow one of two approaches: single-site models and multi-site models. Single site models construct a demand curve based on the relationship between the cost of visiting a site and the frequency of visits. The resulting implicit demand function is illustrated in Figure 1. At travel cost p, a participant takes X trips. The participant's benefit, or economic value, from taking those trips is the shaded area above the price and below the demand function, and is referred to as consumer surplus. Of note, a consumer's welfare gain from the activity, her consumer surplus, is not the same as her spending, which is p times X (p*X).

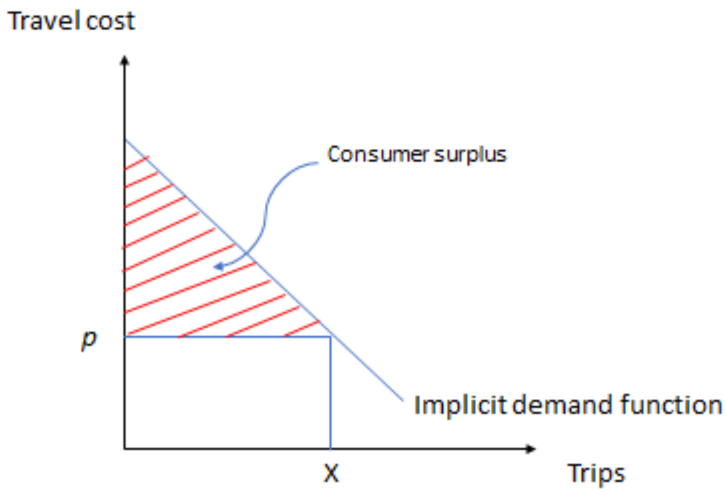

Figure 1: Demand curve and consumer surplus in a single-site travel cost study

The sum of all visitors' consumer surplus is equivalent to what economists call the "access value" of the site. Access value captures the total welfare loss to visitors if the site is completely lost to the public. The demand curve also permits estimation of the change in consumer surplus resulting from changes in price (for instance related to fees), or other attributes that determine visitation.

Multi-site models are appropriate when there are several sites where the same recreational activity can take place. Given that California halibut is taken at many different sites in the State study area, a multi-site model was adopted for this study. Modern multi-site models rely on discrete choice models that explain people´s decision to visit a particular site from among a set of alternative sites for the same recreational purpose, and tease out the impact of site characteristics on the choice of sites. These relationships are then used to estimate economic values. Such models are significantly more complex to estimate empirically than single-site models. Discussion of the relevant econometrics is beyond the scope of this paper, but see Parsons (2003) for a full treatment of relevant issues. For the purposes of this study, it is useful to note that the overall value of the recreational activity (in this case fishing for California halibut) is determined by the sum of the consumer surpluses at all sites, which is equivalent to the welfare loss associated with losing all sites at the same time.

4 Data

4.1 California Recreational Fisheries Survey databases

Fishery data used in this study come from the California Recreational Fisheries Survey (CRFS), provided by CDFW. In particular, we used two databases: 1) the Private and Rental boat fishing 1 (PR1) database, which covers public and accessible fishing sites where at least 90% of the effort and catch of important species occurs on private or rental boats, and 2) the Party and Charter boat fishing database, which is divided between PCOnboard (the sampler goes aboard the boat, obtaining data from interviews, observation, measurement, and GPS locations, while avoiding interaction with anglers as much as possible to avoid bias) and PCDockside (the sampler interviews anglers when they return to port, capturing information from fishing trips on which a surveyor could not embark for various reasons including trip duration). Anglers in California also fish for California halibut from shore, but due to data limitations these fishing trips were not included in the study.

To create a single database for analysis, we first selected records containing anglers that declared to the CDFW interviewer that California halibut was their primary target species. We then merged databases and removed records that met any of the following criteria:

- Duplication of other entries.
- Sites (combination of port and water area, see below) where California halibut was not observed during the data collection period of the CRFS, or where there were less than 10 trips with California halibut as the primary target of fishing.
- No zip code reported, or zip code below 80000. The zip code cutoff used resulted in consideration of anglers from Texas, Colorado, Wyoming, Idaho, Utah, Arizona, New Mexico, Texas, Nevada, California, Oregon, Washington, and Alaska. Hawaii is in the range considered, but no anglers from that state were recorded.
- Overnight fishing trips (due to low frequency in the data).

The final set of ports used, along with their frequency in the data during the period between January 2015 and October 2016, are shown in Table 1.

Table 1: Ports of embarkation for anglers targeting California halibut, ordered by frequency of use

Port Code	Port name	County	Number of observations	Relative frequency
BER	Berkeley PC	Alameda	680	18.96%
SHL	Shelter Island Launch Ramp	San Diego	481	13.41%
SCR	Santa Cruz Marina Launch Ramp	Santa Cruz	427	11.91%
SBA	Santa Barbara Launch Ramp	Santa Barbara	266	7.42%
EUR	Woodley Is. Marina	Humboldt	200	5.58%
MOS	Moss Landing Launch Ramp	Monterey	156	4.35%
OXN	Channel Islands Launch Ramp	Ventura	145	4.04%
WAR	Dana Wharf Sportfishing	Orange	134	3.74%
DBN	Dana Basin Launch Ramp	San Diego	111	3.10%
MOR	Morro Bay Launch Ramp	San Luis Obispo	104	2.90%
VEN	Ventura Sportfishing	Ventura	103	2.87%
MDR	Marina Del Rey Launch Ramp	Los Angeles	94	2.62%
DLR	Dave's Launch Ramp	Los Angeles	93	2.59%
AVI	Avila Boat Sling	San Luis Obispo	88	2.45%
OCN	Helgren's Sportfishing	San Diego	78	2.18%
MOH	Monterey Marina Launch Ramp	Monterey	68	1.90%
CLR	Cabrillo Launch Ramp	Los Angeles	67	1.87%
BOD	Porto Bodega PC	Sonoma	62	1.73%
MOC	Coast Guard Jetty Launch Ramp	Monterey	53	1.48%
SNF	SF Fisherman's Wharf PC	San Francisco	33	0.92%
PRI	Princeton-Pillar Point Launch	San Mateo	32	0.89%
EME	Emeryville PC	Alameda	31	0.86%
FLD	Fields Landing Launch Ramp	Humboldt	18	0.50%
SAU	Sausalito PC	Marin	14	0.39%
SHC	Shelter Cove Launch	Humboldt	14	0.39%
FIS	Fisherman's Landing	Glenn	13	0.36%
SUN	Sunset Aquatic launch ramp	Orange	11	0.31%
LBS	Long Beach Sportfishing	Los Angeles	10	0.28%
Total			3,586	100%

Physical location of the ports is shown in Figure 2.

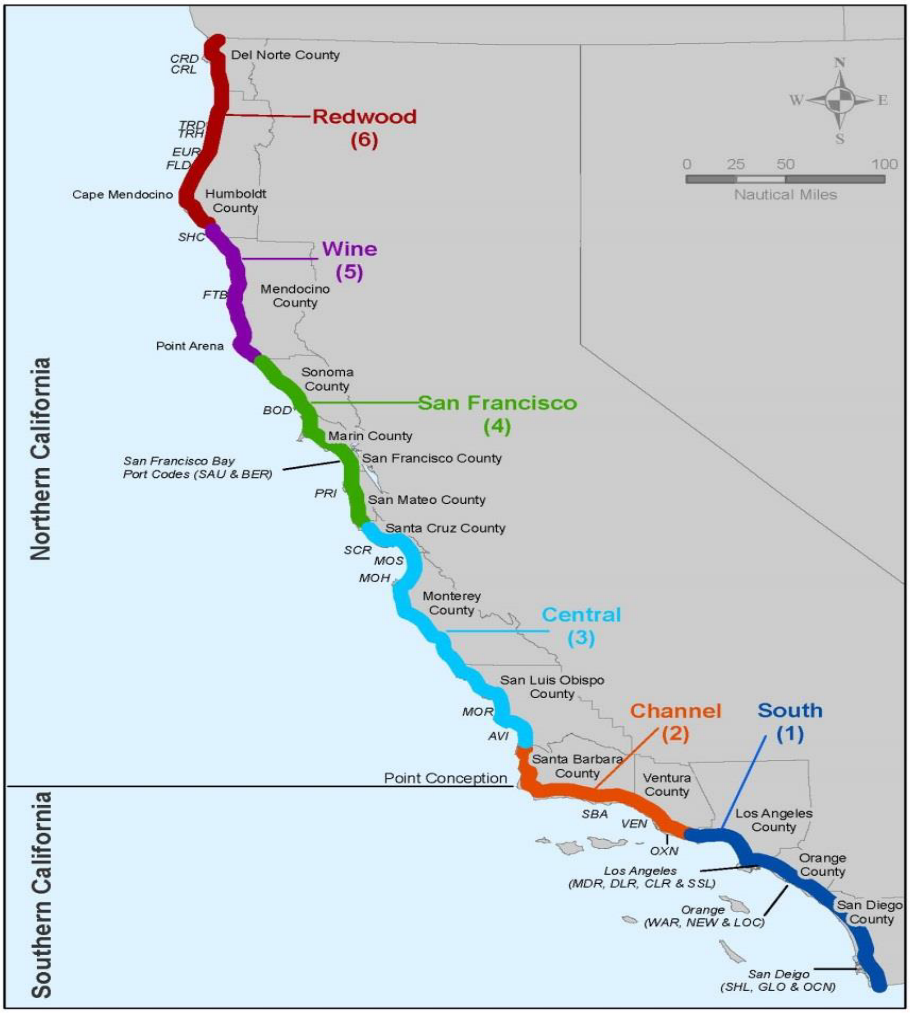

Figure 2: Location of California Recreational Fisheries Survey districts and ports
(Source: CRFS Sampler Manual, 2015)

In addition to port of embarkation, the final database contained the following information for each record:

1. Fishing mode: i.e., Private, Rental, Party or Charter (variable name *PCMode*).
2. Duration of trip: ½, ¾, and full day (*DurationType*).
3. Fishing time: Time on the water fishing, in minutes (*Fishingtime)*
4. Number of anglers: Number of anglers on the same boat as the interviewee (*AnglersTotal*)
5. Frequency of fishing: Number of times the person surveyed went fishing in the last twelve months (*FishedLast12Mo)*
6. Zipcode: Zip code associated with the surveyed angler (*Zipcode*)
7. Target species: Primary declared target species (*Targetspecies*).
8. Target water area: Which fishing area (primary and secondary) the angler planned to target as of leaving their home (*Waterarea*); Water areas are listed in Table 2.

Table 2: Water areas

Water area number	Water area
1	Catalina Island
2	Anacapa Island
3	Santa Cruz Island
4	Santa Rosa Island
5	Bay, Estuary or Harbor
6	Nearshore (less than 3 miles)
7	Offshore (greater than 3 miles)

4.2 Additional variables

Based on the CRFS data described above, we generated the following additional variables to permit estimation of the Travel cost model:

a) Travel distance and time to port: Using the function *g_distance* in Excel, we calculated the road distance between port and the angler's zip code, and then multiplied by two to get the round trip total distance traveled. We divided distance travelled by an assumed average velocity of 50 miles per hour (MPH) to calculate the round-trip time, in hours, from zip code to port.
b) Travel cost to port: Product of the round-trip distance and cost per mile to maintain and operate an average automobile ($0.55), following Kuriyama (2013).
c) Angler's estimated income: Annual average household income in the zip code associated with the surveyed angler, as reported in the 2010 American Community Survey (USCB, 2010). Where anglers did not report income, we assigned the average income from the full sample. We generated each angler's hourly income by dividing family income by 1,790, the average number of hours worked annually in the United States (OECD, 2017).
d) Opportunity cost: The value of the time the angler dedicated to the fishing trip, including both travel time and time spent on the water. Hourly opportunity cost is valued at 50% of the angler's hourly income, following common practice in valuation studies (Cesario, 1976; Parsons, 2003).
e) Total travel cost (TC): The sum of costs of travel to port and opportunity cost of time. Direct costs of fishing itself (boat, equipment, fuel, etc.) are excluded due to lack of data and potential problems related to autocorrelation. This constitutes an important limitation to this study. Figure 3 presents a schematic of the values that were and were not included.

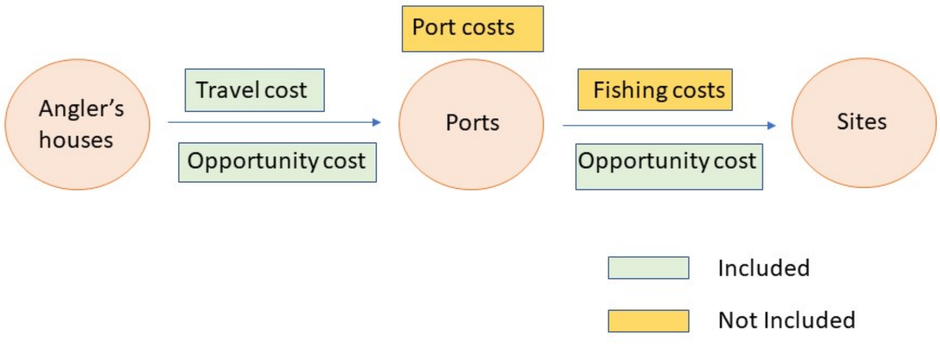

Figure 3: Elements of travel cost, coded according to whether or not they were included in this study

f) Catch per unit effort (CPUE): Again following Kuriyama (2013), this variable was generated by dividing the total California halibut catch per boat trip by the number of anglers per boat.

g) Choice: A series of dummy variables that coded anglers' decisions regarding each combination of ports, target water area, fishing mode, and duration of trip, assigning a value of 1 for option chosen, and 0 for the alternatives that were not (Figure 4).

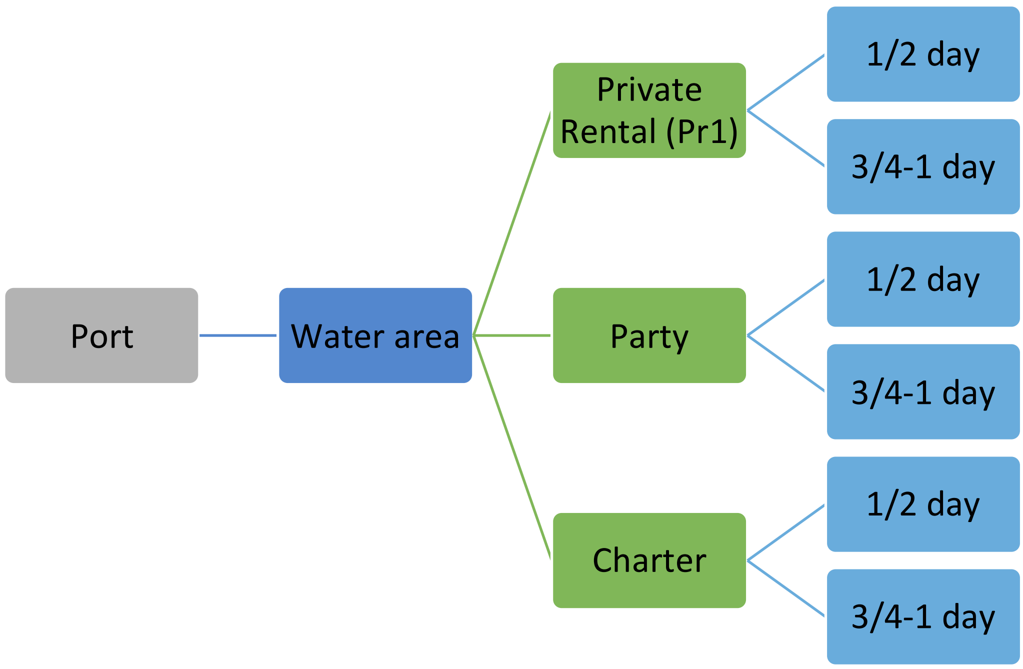

Figure 4: Different fishing experiences: a combination of port, water area, fishing modes and trip durations.

5 Travel cost modeling of the California halibut fishery

5.1 Fishing decision

We begin by seeking to understand anglers' decisions regarding the selection of fishing sites (combination of port and water area). We use a conditional logit model, which is a discrete choice model that in this case is used to describe, explain, and predict choices among a set of alternative fishing sites. In this model, we assume that the welfare obtained by an individual *i* from a trip to fishing site *j* on decision occasion *t* is given by the following utility function:

$$U_{ijt} = \beta_1 TC_{ij} + \beta_2 CPUE_i + \mu_{ijt}$$

In which $CPUE_i$ (catch per unit effort as defined above) is an indirect measure of halibut abundance in the fishing site, and TC_{ij} is the travel cost as defined above for individual *i* to fishing site *j*. Due to insufficient data, we were not able to include information on non-fish related port attributes (e.g., picnic facilities, bathrooms, etc.) for which anglers might also have a preference.

5.2 Welfare measures

Using the conditional logit model, it is possible to calculate two types of welfare measures based on the derivation of demand as described earlier. Welfare may usefully be described in terms of value, consumer surplus, or willingness to pay (WTP); the use of "WTP" does not imply that anglers were directly asked that question.

The first welfare measure that can be calculated relates to the value of changes in the quality of the fishing experience, represented in this case by CPUE. Quantifying realistic increases or decreases in CPUE depends on in-depth analysis of halibut management and biology, both of which are beyond the scope of this paper. Accordingly, we do not explore this issue.

The second welfare measure, which we calculate here, relates to the value to anglers of continuing to be able to fish at the current set of sites. Technically, these values are calculated as access value as described above, i.e., anglers' WTP to avoid losses associated with being unable to use one or more sites.

We begin by calculating the access value of each fishing site individually. Site level values can be interpreted either as the losses that anglers would face if the site were closed, or else the value of the site remaining open, *given that* all other sites remain open regardless. It is important to note that because anglers can reduce their welfare loss from closure by choosing to visit an alternative site, the value of each site alone can be small, even if the overall value of recreational fishing at all sites is large.

Next, we estimate the full access value of all sites in which anglers currently catch California halibut. This value can be understood as an estimate of the value of the recreational halibut fishery, and is calculated as anglers' WTP to avoid losing all access to the current fishery, (i.e., to all currently fished sites). Total recreational fishery value calculated this way is higher than the sum of the access values estimated for each site individually, since anglers cannot reduce their loss by traveling to a substitute site.

Values in both scenarios are calculated using the generic formula for WTP known as the *logsum formula,* which is given by:

$$WTP = \frac{1}{\theta}[ln\sum_{1}^{J} e^{V_j^1} - ln\sum_{1}^{J} e^{V_j^0}]$$

Where *j* is the fishing site, *j*=1, 2,...,J, and the superscripts 0, 1 represent the initial and final situations. θ is the coefficient of travel cost in absolute value from the conditional logit model given earlier. In the initial situation, all sites are available at the current level of quality. The final situation could include either losing one or more sites, increasing the quality of one or several sites at the same time, or a combination of losing sites and changes in quality. The two valuation scenarios calculated here involve removing each site individually from the sum of values in the final situation (for site specific access values), and removing all sites together (for the value of accessing the entire existing recreational fishery).

5.3 Number of anglers targeting halibut

The values estimated as described above are per angler, per trip. For the purpose of extrapolating to the total number of trips targeting halibut, we use data from NMFS (2013), which estimates total California recreational angler effort for all species at 1.6 million days, not including fishing from shore. The CRFS data show that 3.84% of anglers in this group targeted California halibut as their primary objective. We use the product, 59,866, as the total number of days dedicated to halibut fishing.

6 Results

6.1 Model

The conditional logit model, which explains anglers' choice of site, yielded the following results:

Choice	Coefficient	Std. Error	95% conf. Interval	
Travel Cost	-0.0248845	0.0008571	-0.0265644	-0.0232046
CPUE	1.092048	0.0321333	1.029068	1.155028

Both coefficients are statistically significant and with the expected sign. Travel cost has a negative sign because the higher the cost, the lower the probability of choosing a particular fishing site. Catch per unit effort has a positive sign, showing that the abundance of fish at a site increases the probability of choosing it.

6.2 Site values

The average per-angler per-trip value of avoiding closure of each fishing site individually is $0.11. Again, these values are calculated as the angler's WTP to avoid the loss associated with closure of that site alone, with all other sites remaining accessible. It is important to note that average values for every site include all anglers in the sample. The great majority does not fish at any given site so the value they obtain is 0. This must nonetheless be included because the site exists in all anglers' choice set. Ports with higher average access values are therefore typically those used by larger numbers of anglers. Maximum values, which are an order of magnitude higher, more accurately reflect values obtained by anglers who use a given site. Full site-level results are given in Appendix 1.

Aggregating mean per angler per site values according to the estimated total number of trips yields significant value for all ports. The average value per port is $44,800 per year. The highest values are observed at Shelter Island Launch Ramp ($131,390) Fisherman's Landing ($125,200), and Berkeley PC ($102,540).

Table 3: Access values by port, with access to all other ports remaining accessible

Port Code	Port Name	County	Average value per year ($)	Cum. % of value
SHL	Shelter Island Launch Ramp	San Diego	$131,000	10%
FIS	Fisherman's Landing	Glenn	$125,000	20%
BER	Berkeley PC	Alameda	$103,000	29%
DBN	Dana Basin Launch Ramp	San Diego	$78,000	35%
EME	Emeryville PC	Alameda	$75,000	41%
SNF	SF Fisherman's Wharf PC	San Francisco	$67,000	46%
LBS	Long Beach Sportfishing	Los Angeles	$56,000	51%
SCR	Santa Cruz Marina Launch Ramp	Santa Cruz	$53,000	55%
MOS	Moss Landing Launch Ramp	Monterey	$53,000	59%
SBA	Santa Barbara Launch Ramp	Santa Barbara	$48,000	63%
PRI	Princeton-Pillar Point Launch	San Mateo	$42,000	66%
WAR	Dana Wharf Sportfishing	Orange	$41,000	69%
DLR	Dave's Launch Ramp	Los Angeles	$36,000	72%

Port Code	Port Name	County	Average value per year ($)	Cum. % of value
MOH	Monterey Marina Launch Ramp	Monterey	$34,000	75%
VEN	Ventura Sportfishing	Ventura	$31,000	78%
OXN	Channel Islands Launch Ramp	Ventura	$31,000	80%
OCN	Helgren's Sportfishing	San Diego	$27,000	82%
SAU	Sausalito PC	Marin	$25,000	84%
MOC	Coast Guard Jetty Launch Ramp	Monterey	$25,000	86%
AVI	Avila Boat Sling	San Luis Obispo	$24,000	88%
BOD	Porto Bodega PC	Sonoma	$24,000	90%
FLD	Fields Landing Launch Ramp	Humboldt	$23,000	92%
EUR	Woodley Isl. Marina	Humboldt	$23,000	94%
MDR	Marina Del Rey Launch Ramp	Los Angeles	$21,000	95%
SHC	Shelter Cove Launch	Humboldt	$20,000	97%
MOR	Morro Bay Launch Ramp	San Luis Obispo	$16,000	98%
CLR	Cabrillo Launch Ramp	Los Angeles	$14,000	99%
SUN	Sunset Aquatic Launch ramp	Orange	$9,000	100%
Average / Total			$45,000	100%

6.3 Total value

As described above, the value of the entire fishery is not the sum of the port level results above. To the extent that a port has substitutes, its value is reduced as long as other ports remain open. The total value of the fishery (all ports together) is higher, because there are no substitutes.

Total access value is estimated by calculating the WTP equation given above, specifying an initial state with all sites available, and an end state with none available. This calculation yields a consumer surplus per angler per trip of US$43.51 for all sites. Considering the estimated 59,866 total trips per year for which California halibut is the primary target, the total value that recreational anglers derive from the fishery is $2.6 million per year.

These values are at the low end of the range of those reported in the literature. A 2006 review by Pendleton and Rooke found that the per-trip non-market values of recreational fishing in California across various species and for all species together were in the range of $43 to $683 (inflated to 2017 prices). We view our results as reasonable given the focus of our study on a single species, careful calibration of the TC model, and omission of potentially significant costs related to boats, gear and fuel.

The non-market value found here is also lower than the average expenditure on fishing trips. Our calculations from NMFS (2013) suggest average daily expenditure per angler for a party or charter trip is $225, while average daily expenditure per angler on a private or rental boat trip is $119. Again, we view our result as reasonable as there is no reason why expenditure should necessarily be close to the non-market value: TCM includes the value of time and generates a demand curve to quantify consumer surplus, whereas expenditures are part of the information needed to calculate producer surplus or flow-on effects to the local economy.

7 Conclusion

This study used government data sources, most notably the CRFS database, to estimate the non-market value of the recreational California halibut fishery in California. Valuation was carried out using a Travel Cost Methodology applied to multiple sites, which derives a demand curve for visitation based on observed choice.

In particular, we modeled anglers' choices based on vehicle costs incurred to reach their chosen site, opportunity cost of time, and the relative abundance of halibut at each site. Models were satisfactorily able to explain anglers' decisions, and therefore deemed useful for the purpose of economic valuation. Results should be considered conservative, in that we did not include costs related to boat rental or ownership, equipment, fuel or other on-the-water costs. We also did not include the value of fishing from shore.

Based on this modeling exercise, we estimate that the non-market value of California's recreational California halibut fishery is at least $2.6 million per year. This finding is based on an average angler's consumer surplus of $43.51 per trip, and an estimated 59,866 total trips. Stated more technically, $2.6 million is the access value for all sites where California halibut is currently fished, equivalent to the welfare loss if all sites were closed or otherwise lost at the same time.

It should also be noted that the value reported here captures only one element of the economic benefit generated by the recreational halibut fishery. Anglers also generate economic activity through their spending. These market values are not reflected here but have been shown in other studies to be significant. Economic activity and policies that affect recreational use of the California halibut fishery will therefore have impacts beyond those quantified in this study. A full assessment of expected welfare impacts of any change would need to include a broader economic valuation, as well as consideration of short and long-term effects on anglers' satisfaction and expected fishing choices. Further research tied to policy options, changes in fish stocks, and broader economic impacts of recreational fishing could quantify expected impacts of different management scenarios.

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9 Appendix: Per-angler per-trip values by site

Per-angler per-trip values by site

We present here results from the valuation of single sites (again, considering no change at any other site), using a notation that combines the port name abbreviations and water areas presented in Tables 1 and 2.

Table 4: Value in US dollars ($) per angler per trip of not losing access to each fishing site, considering no change in access to any other site. Minimum values, i.e., the lowest loss possible in each case, are 0 throughout and are not shown.

Site	*Mean ($)*	*Max ($)*	*Site*	*Mean ($)*	*Max ($)*	*Site*	*Mean ($)*	*Max ($)*
AVI1	0.02	0.91	FLD3	0.05	2.59	PRI7	0.10	3.26
AVI2	0.05	3.14	FLD4	0.04	0.97	SAU2	0.07	0.32
AVI3	0.05	3.30	FLD5	0.09	3.43	SAU3	0.07	0.32
AVI4	0.05	3.14	FLD6	0.05	2.59	SAU4	0.07	0.32
AVI5	0.07	11.95	FLD7	0.06	2.44	SAU5	0.13	0.95
AVI6	0.11	23.60	LBS5	0.47	1.85	SAU6	0.07	0.32
AVI7	0.05	11.95	LBS6	0.47	1.85	SBA1	0.03	2.27
BER1	0.14	1.94	MDR1	0.02	1.87	SBA2	0.04	3.37
BER2	0.15	2.87	MDR2	0.04	6.01	SBA3	0.16	6.22
BER3	0.16	4.85	MDR3	0.03	1.87	SBA4	0.12	9.15
BER4	0.13	4.39	MDR4	0.03	1.94	SBA5	0.05	8.82
BER5	0.38	14.46	MDR5	0.04	7.88	SBA6	0.32	18.08
BER6	0.56	15.63	MDR6	0.14	17.80	SBA7	0.08	8.82
BER7	0.19	4.42	MDR7	0.05	5.54	SCR1	0.07	0.63
BOD1	0.03	1.38	MOC1	0.02	0.42	SCR2	0.08	2.27
BOD2	0.03	1.12	MOC2	0.03	1.09	SCR3	0.10	2.28
BOD3	0.04	5.28	MOC3	0.04	1.50	SCR4	0.09	2.28
BOD4	0.03	5.28	MOC4	0.04	1.50	SCR5	0.10	2.28
BOD5	0.07	8.86	MOC5	0.04	1.50	SCR6	0.34	13.30
BOD6	0.17	18.87	MOC6	0.20	5.52	SCR7	0.11	1.54
BOD7	0.03	1.80	MOC7	0.04	0.94	SHC1	0.05	1.71
CLR1	0.05	2.55	MOH1	0.03	0.42	SHC2	0.05	1.71
CLR2	0.02	0.80	MOH2	0.04	0.86	SHC3	0.04	1.71
CLR3	0.02	0.80	MOH3	0.04	1.50	SHC4	0.04	1.70
CLR4	0.02	0.80	MOH4	0.04	1.50	SHC5	0.04	1.71
CLR5	0.06	5.93	MOH5	0.04	1.50	SHC6	0.08	4.85
CLR6	0.03	0.92	MOH6	0.31	8.45	SHC7	0.04	1.71
CLR7	0.03	3.73	MOH7	0.05	0.94	SHL1	0.07	1.87
DBN1	0.06	1.97	MOR1	0.01	1.64	SHL2	0.08	7.02
DBN2	0.07	1.97	MOR2	0.03	2.68	SHL3	0.09	6.54
DBN3	0.08	3.16	MOR3	0.03	2.71	SHL4	0.06	7.02
DBN4	0.05	1.41	MOR4	0.03	2.71	SHL5	1.49	57.53

Site	*Mean ($)*	*Max ($)*	*Site*	*Mean ($)*	*Max ($)*	*Site*	*Mean ($)*	*Max ($)*
DBN5	0.63	17.02	MOR5	0.05	6.66	SHL6	0.28	15.90
DBN6	0.33	22.16	MOR6	0.10	8.60	SHL7	0.13	11.41
DBN7	0.08	11.66	MOR7	0.03	1.65	SNF1	0.09	1.04
DLR1	0.07	2.17	MOS1	0.05	1.20	SNF2	0.10	1.56
DLR2	0.03	1.99	MOS2	0.07	2.65	SNF3	0.09	3.49
DLR3	0.03	1.65	MOS3	0.09	1.97	SNF4	0.08	1.04
DLR4	0.03	1.99	MOS4	0.08	2.65	SNF5	0.58	7.55
DLR5	0.21	47.91	MOS5	0.14	4.09	SNF6	0.09	3.49
DLR6	0.16	32.02	MOS6	0.34	8.93	SNF7	0.07	3.49
DLR7	0.06	5.89	MOS7	0.09	1.85	SUN1	0.03	0.68
EME1	0.16	0.39	OCN1	0.02	0.65	SUN2	0.02	0.77
EME2	0.15	2.59	OCN2	0.03	1.24	SUN3	0.02	0.77
EME3	0.17	2.59	OCN3	0.03	1.57	SUN4	0.01	0.38
EME4	0.15	0.95	OCN4	0.03	1.57	SUN5	0.03	1.13
EME5	0.28	6.98	OCN5	0.14	6.30	SUN6	0.03	1.34
EME6	0.17	2.59	OCN6	0.17	8.12	SUN7	0.02	3.48
EME7	0.17	2.59	OCN7	0.03	1.18	VEN1	0.03	1.04
EUR1	0.09	0.84	OXN1	0.03	1.32	VEN2	0.07	8.92
EUR2	0.05	1.67	OXN2	0.12	13.59	VEN3	0.13	19.17
EUR3	0.05	5.36	OXN3	0.07	5.72	VEN4	0.09	4.20
EUR4	0.05	5.36	OXN4	0.06	2.33	VEN5	0.08	27.75
EUR5	0.03	5.36	OXN5	0.07	8.78	VEN6	0.06	7.36
EUR6	0.05	5.36	OXN6	0.12	19.06	VEN7	0.06	7.36
EUR7	0.06	1.67	OXN7	0.04	5.63	WAR1	0.06	2.54
FIS3	0.16	0.49	PRI1	0.05	0.46	WAR2	0.03	1.79
FIS5	1.31	4.61	PRI2	0.06	2.20	WAR3	0.04	1.80
FIS6	0.45	1.49	PRI3	0.07	2.51	WAR4	0.03	1.79
FIS7	0.16	0.49	PRI4	0.07	2.20	WAR5	0.19	62.91
FLD1	0.06	0.97	PRI5	0.08	2.51	WAR6	0.28	41.02
FLD2	0.04	2.59	PRI6	0.27	11.98	WAR7	0.06	8.22