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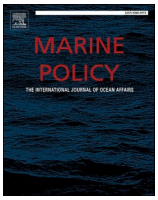

Identifying, defining and exploring angling as urban subsistence: Pier fishing in Santa Barbara, California

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A B S T R A C T

Subsistence fishing is almost exclusively recognized within rural, indigenous and Native fishing traditions; yet research indicates many underprivileged, non-indigenous urban communities also derive social, nutritional, and cultural benefits from coastal resources. In California, pier fishers are an often overlooked and potentially vulnerable community of practitioners who may include subsistence fishers. Pier fishers' informal, unlicensed status means their rates of catch and consumption of fish are scarcely documented, and scant research probes the demographics, motivations, and practices of the pier fishing community. Using survey data collected at active fishing piers in Santa Barbara County, we examine the perceptions, practices, and characteristics of pier fishers. We present common attributes used to define subsistence fishing in the literature and discuss their application in a "recreational" urban context. Although the specific qualities will vary across contexts, we suggest three suitable and interdependent factors for recognizing urban subsistence fishing: 1) reported consumption frequency, 2) fishers' socioeconomic status, and 3) the social, cultural and psychological "process benefits" identified by fishers. Our findings indicate that pier fishing is a form of subsistence, particularly benefiting low-income, Latino and Asian/Pacific Islander fishers in Santa Barbara County. These results challenge commonly used criteria and assumptions about subsistence practices, and demonstrate the flexibility of fishers to meet multiple individual and collective needs. We propose that marine regulations and policies recognize subsistence fishing as a dimension of coastal resource use in California, and consider its potential contributions to urban food security and community well-being.

1. Introduction

Coastal marine fishing represents a livelihood, a tradition, and a connection to nature for communities in diverse parts of the world. In the United States and other industrialized nations, marine capture fisheries are frequently divided into distinct categories: commercial, recreational, and subsistence fishing [1]. Commercial fisheries include all fish and shellfish sold for profit, including both the large-scale industrial fishing that contributes primarily to global markets and the small-scale artisanal fishing that sells to local markets and restaurants. Non-commercial fishing practices may include recreational fishing, often described as angling, and subsistence fishing for personal consumption or sharing with family and community members [2]. Subsistence fishing is generally defined as a practice vital for the economic, material, or cultural survival of a group or individual, though the term can have many different, context-specific meanings [3,4]. In the United States, subsistence fishing is primarily associated with pre-colonial societies [5] and the customary practices of contemporary indigenous communities, and is only legally recognized for some Alaskan communities, Native American tribal nations and Native Hawaiians [6–8].

However, in practice, these discrete categories mask the co-existence of subsistence fishing by non-indigenous groups with commercial and recreational practices [2]. Fishing behaviors are highly adaptable to meet multiple needs within a dynamic social-ecological environment, and commercial, recreational and subsistence fishing can share the same space, gear, and even motivations [9,10]. In contrast to commercial fishing, subsistence is broadly characterized as self-caught, small-scale fishing using low-tech gear, with catch supplementing the diet of the fisher and local community members [6–8]. Yet commercial fishers in California suffer their own vulnerabilities [14] and have been found to regularly take a portion of their catch for "personal use" [15]. Fishers can also flexibly participate in mixed economies, shifting between sharing and selling their catch [16]. Food fisheries and human relationships with marine environments are especially overlooked in

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urban settings, where recreational fishing is exclusively considered to be a leisure activity [17], yet recreational fishers catch about 10% of marine fish harvested in the US (about 103,780 tons), with clear indications that catch is consumed more often than released for sport [18]. Given the overlap and multidimensionality of practices and motivations that can occur simultaneously in the same space, a disaggregated and nuanced understanding of fishing communities is needed to better inform sustainable and just coastal resource governance.

The spatial distribution of recreational fishers is one underutilized factor for capturing that nuance. Fishers who use a pier or jetty rather than a boat have proven to be distinctive from other non-commercial fishers: they identify different motivations, consumption practices, and socioeconomic identities [19–22]. The location is especially relevant in California, where pier fishing has remained both popular and free for over a century [5]. In 2016 there were nearly 1.8 million fishing licenses purchased in California, more than half by state residents [23]. However, pier fishers are not required to buy the $49.94 resident sport fishing license[1] [24]. The accessibility and low-cost of pier fishing may make it an especially attractive option for poor, undocumented, and underprivileged members of urban communities [25]. Studies in Southern California found that pier fishers have higher representation of immigrant communities, ethnic and racial minorities, and those who speak English as a second language than the local population [19,26]. Compared to licensed fishers who used boats, pier fishers were more likely to be motivated by consumption and to self-identify as subsistence fishers [27]. Despite these differences, studies of anglers frequently focus on licensed fishers and often do not discern between pier, shore, and boat fishing [28]. The aggregation among licensed anglers and the lack of data on unlicensed fishers obscures a potentially vulnerable population, creating challenges for their inclusion in policy and governance processes [3,29,30].

To address this understudied community of practice and its relationship to coastal marine resources, we examine pier fishing in an urban area of Santa Barbara County, California. We begin with a review of common characteristics used for identifying subsistence fishing around the world. We then present the findings of a 2016 field survey of Santa Barbara County pier fishers, in which we collected data on the perceptions, practices, motivations, and characteristics of local pier fishers. Our discussion then turns to the evidence for subsistence practices among Santa Barbara pier fishers and considers which attributes present the most meaningful and reliable indicators of subsistence fishing in our urban context. We argue that informal pier fishers exhibit subsistence behaviors, and that their practices and the nutritional and sociocultural benefits they derive from subsistence fishing should receive greater recognition in coastal resource management processes and policies.

2. Identified characteristics of subsistence fishing: a literature review

The literature on subsistence fishing is broad, often ambiguous, and generally focused on developing nations and indigenous and Native contexts. From sources that explicitly try to define subsistence fishing, we identify seven common themes attributed to subsistence practices: 1) lack of market participation; 2) socioeconomic characteristics and cultural identity of fishers; 3) residential proximity to the resource; 4) gear type; 5) fishing effort and frequency; 6) catch consumption; and 7) non-economic sociocultural and psychological benefits of participation in fishing activities (Table 1) [4,7,9,11,12,26,27,29,31–33,33–37].

Subsistence is primarily considered to be non-commercial, meaning that fishers are not selling their catch to large export markets [12,31,32]. While in practice many fishers participate in mixed economies and move between different forms of use and exchange [16], the literature defining subsistence suggests that the primary purpose of fishing should be consumption for food [12,33] with some occasional sale of excess catch to local markets. As noted, some definitions of subsistence are tied to a fisher's identity as part of a Native or indigenous community [3,8]. However, given that fishing practices are embedded in social relationships and cultural traditions [34,35], identity can be an equally important factor in fishing behaviors among non-native groups, such as African Americans and members of urbanized immigrant communities, as well as other underserved or marginalized communities [22,26,36]. Subsistence fishers are also characterized as "local" resource users, and while that is a highly subjective and situated factor, it implies fishers living in close physical proximity to the resource [12,36].

Subsistence and small-scale fishing definitions correspond significantly. In contrast to large-scale, high-tech commercial fishing enterprises, subsistence fishing is considered low-tech and small-scale [11,31]. All fish are self-caught (i.e., no paid employees) [36], with consistent or seasonal fishing activity [4,37]. In addition, personal consumption or sharing catch within the fishers' close social network is a well-accepted distinguishing feature of subsistence. In some cases, researchers have tried to quantify specific consumption amounts (grams/day) or frequency (times/week) to identify subsistence [7,13]. However, these factors can fluctuate greatly across a community, and depend on the catch species, seasonality and effort of fishing, and societal norms for fish consumption.

Fishing practices and catch consumption can also be essential for the continuation of cultural practices and the reinforcement of community identity and resilience [3,38,39]. Brown et al. [37] call these social, cultural, and psychological benefits derived from fishing "process benefits"- in addition to reinforcing social relationships, fishing provides relaxation, stress management, and connection to nature. These normative values and benefits are embedded in experiences of place and practice and are shared among other modes of fishing, including commercial forms [15,40–42], though they are most often associated with traditional cultures or recreational fishing.

Table 1
Themes and characteristics identified when defining subsistence fishing, as drawn from the literature.

Theme	Identified Characteristics of Subsistence	Example Literature
1. Market participation	• Non-commercial • Artisanal (sale only to local markets) • Small-scale	Berkes 1988; FAO 2015; Pauly & Zeller 2016; Young et al., 1994
2. Fishers' socioeconomic characteristics and cultural identity	• "poor" • Indigenous, Native • Ethnic minorities • Low-income	Burger 2002, Clark 2002; Stevenson et al., 2012; Toth & Brown 1997; Young et al., 1994
3. Proximity	• "local" • Resource <20 km from fisher's residence	Berkes 1988; Branch 2002
4. Gear type	• Low-tech (e.g., line & reel, small nets, and traps)	Pawson et al., 2008; World Fisheries Trust 2008
5. Fishing effort and frequency	• Self-caught • Engaged in regularly	Branch 2002; Brown, Toth, Xu 1998; Islam & Berkes 2012
6. Catch consumption	• Fishing for food • Consumed by fisher, family and/or community • 142.4 g/day (EPA)	Berkes 1988; Freeman 1993; Islam & Berkes 2012; Pitchon & Norman 2012; EPA 2000
7. Social, cultural, psychological benefits	• "process benefits" • Cultural continuity, reinforcement of social ties	Brown Toth & Xu 1998

[1] There are reduced-fee and free licenses available for disabled veterans, low-income seniors, and Native Americans, and higher rates for non-resident licenses. Licenses are only required for fishers over 16 years old.

2.1. Non-commercial fishing: are recreation and subsistence different uses of marine spaces and resources?

The intersection of recreational and subsistence fishing is especially understudied and underrecognized [43]. Recreational fishing is defined as the "pursuit of fish for sport rather than for commercial or monetary purposes" [44]. However, a recent review of recreational fishing around the world [18] argues that "recreational" is misleading, as it assumes that non-commercial fishing must be purely for leisure, disregarding how it can contribute to food security and social well-being in developed and developing nations alike. In the Pacific Islands, communities have raised issue with the characterization of their multidimensional fishing practices as recreational, which they find diminishes its cultural, social, and nutritional importance [2]. Fishing that is neither explicitly commercial nor recreational but supports cultural traditions and "heritage" are acknowledged in Europe, but legally considered recreational [9].

In the United States, coastal resource governance rarely addresses subsistence fishing as a potential component of recreational fishing, rendering it largely invisible with significant implications for stakeholder engagement and resource access. Some definitions of subsistence explicitly exclude recreational fishing [4], and regulatory agencies have tried to use specific consumption measures to parse it from other fishing activities [7]. Yet even where leisure may be the primary pursuit, food fishing can be a concurrent secondary motivation [18,45]. Subsistence can also include diverse and culturally important non-food uses of catch that change over seasons; Alaska's subsistence statue is a rare example of their recognition in policy [8]. In this study, we treat subsistence and recreational fishing as potentially simultaneous, rather than mutually exclusive, non-commercial fishing behaviors, and seek out the identifying characteristics of subsistence practices that may support greater recognition of plural use in a coastal urban environment.

3. Methods

3.1. Research site

For our research, we chose to study fishing activities from piers in Santa Barbara County, located in Southern California (Fig. 1). Santa Barbara County has a socially and economically diverse population similar to other areas of California, and fishing piers are easily accessible from urban areas. Its high cost of living presumably increases potential for food insecurity among residents. The Channel Islands National Marine Sanctuary is located just a few kilometers offshore, part of a network of marine protected and conservation areas along the Santa Barbara County coastline [46]. There is a small commercial fishery operating out of Santa Barbara Harbor, and several inshore pelagic species are accessible to pier fishers throughout the year.

We identified two local piers in Santa Barbara County currently in active use for fishing – Goleta Pier, in the city of Goleta, and Stearns Wharf near the downtown area of the city of Santa Barbara. The piers are similar in their restrictions and health advisories; however, Sterns Wharf is located in the central business district of downtown Santa Barbara, while Goleta Pier is at the edge of a wetlands area near the suburban area of Goleta and the University of California, Santa Barbara campus, with ample free parking.

3.2. Surveys

To understand the characteristics of fishing activity on Santa Barbara County piers, we designed a 20-question survey collecting information on demographics, fishing practices and targeted species, catch consumption, and perceptions of health risks, the environment, and regulations. The survey included quantitative and qualitative questions and observations of the social and physical environment at the time of data collection. Survey administrators were trained in Institutional Review Board (IRB) approved protocols and identified themselves as researchers from the University of California, Santa Barbara (UCSB). Laminated cards with images of popular sport fishing species were used to help respondents classify their catch. Similar to other studies of informal coastal resource users [19,21,47], we identified and recruited survey respondents while they were actively engaged in fishing at the pier, in order to reliably engage resource users; where there were multiple people fishing together, we interviewed one adult respondent per household. We sought to approximate a random sample inclusive of diverse social and ethnic groups, though the transient nature of pier fishing precludes a formal representative sample.

Surveys were conducted by two graduate students and two undergraduate interns between May and September 2016. The survey was offered in English (76%) and Spanish (24%); a small number of fishers declined because the survey was not offered in their preferred language (e.g., Tagalog). Our sample included fishers who identified as White, Latino, Black, Native American, Asian/Pacific Islander, though our

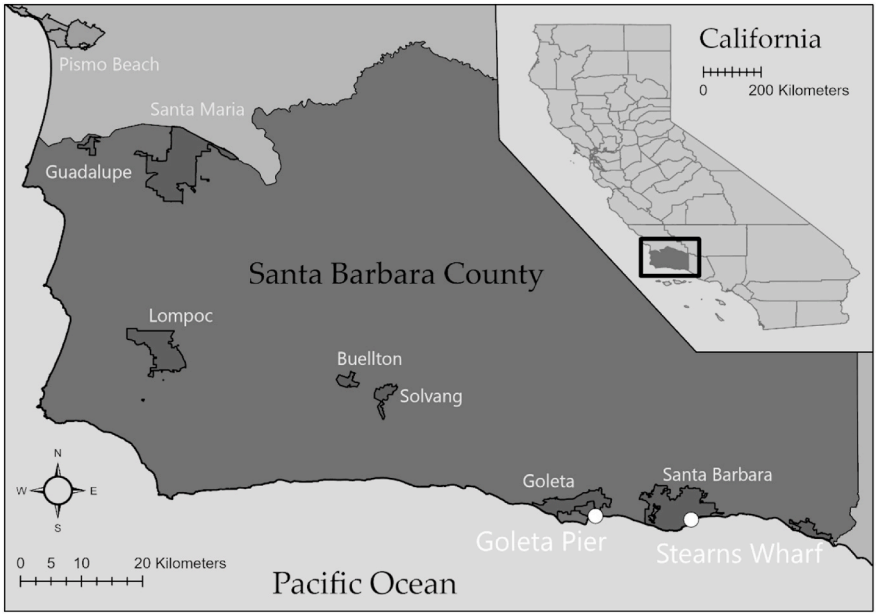

Fig. 1. Study Area. Map of Santa Barbara County with Goleta Pier and Sterns Wharf marked.

racial and ethnic categories hide variability within these groups, such as non-English speaking Latinos and individuals who identified specifically as Hmong, Vietnamese, Filipino, or other ethnicities. We also varied the time of day and day of the week of sampling but collected the most surveys in the late afternoon-early evening period (between 3 and 7 pm). Surveys took approximately 15 min to complete, with each research trip to the pier lasting about 1–2 h. We collected a total of 106 surveys, primarily at Goleta Pier, at an approximate participation rate of 74% of all fishers we solicited.

3.3. Analysis

We conducted an analysis of fishers' demographic and behavioral characteristics, with additional comparative analysis for categories of ethnicity, income, fishing frequency, and consumption including chi squared using SPSS and Excel. These categories reflect the most common factors used in the literature to define subsistence and the most relevant for confirming subsistence practices in our heterogeneous coastal urban context. Not all survey respondents answered every question, so the total responses for each category were used rather than the total sum of surveys. Due to sample size limitations, we only ran comparisons of means when salient results emerged from preliminary analysis.

4. Results

A majority of pier fishers in our study presented all seven of the characteristics of subsistence fishing suggested in the literature (Table 2).

4.1. Market participation

Pier fishing in California is legally restricted to non-commercial, small-scale practices. Only a small number of survey respondents indicated that they have sold any catches (see Table 4).

4.2. Socioeconomic characteristics and cultural identity

Socioeconomic status is used in the literature, often alongside catch consumption, to identify subsistence fishing [25,26] due to common assumptions that subsistence fishers primarily belong to indigenous and/or low-income communities; yet our findings suggest more complexity and diversity in fishers' characteristics. Survey participants were ethnically diverse (Fig. 2): the largest proportion of respondents were Latino (41%), followed by non-Latino White (27%), and Asian/-Pacific Islander (21%). Racial and ethnic minorities made up a larger proportion of pier fishers compared to the population county-wide, with significant numbers of Asian/Pacific Islanders, over-represented by a factor of four relative to Santa Barbara County population statistics [48], and significant underrepresentation of non-Hispanic white residents.

Reported income distribution of pier fishers skewed towards lower income levels (Fig. 3). The majority of our respondents (88%) reported income below the 2016 county median of $77,100 for a four-person household, and half were near or below the threshold for very-low-income of $42,100 [49]. The lowest household income category ($22,000 and below) indicated by 9% of respondents (only White and Latino) was well below the 2016 Federal poverty line of $24,300 for a U.S. household of four persons [50] and was considered extremely-low income for Santa Barbara County [49]. We considered households reporting annual income of $46,000 or less to be low-income in this context, which constituted more than half our sample.

Comparing ethnicity or racial identity and income, we found a significantly higher number of Latino respondents reported a household income under $46,000 (Table 3), indicating low-income status. Latinos in California experience a host of social vulnerabilities, with an estimated 12% of Santa Barbara Latinos living in poverty [51]. The high percentage (83%) of low-income Latinos in our sample is suggestive of the special importance of pier fishing for food security among this group. A majority of all other non-white ethnicities also reported low-income status; by contrast, three-fourths of white fishers reported household income above $46,000.

Table 2
Subsistence characteristics and Santa Barbara pier Fishers.

Theme	Criteria for Subsistence	Results
1. Market participation	• Non-commercial • Artisanal (Sale only to local markets) • Small-scale	100% of pier fishers are small scale and are generally non-commercial
2. Fishers' socioeconomic characteristics and cultural identity	• "poor", low-income • Indigenous, Native • ethnic minorities	88% of respondents reported income below the county median; about half were near or below threshold for "very-low income". Higher representation of ethnic minorities, especially Latinos and Asian/Pacific Islanders, compared to county statistics
3. Proximity	• "local" • Resource <20 km from fisher's residence	72% reside within 20 km of a pier; 85% reside within Santa Barbara County Fishers did not always use closest pier
4. Gear type	• Low-tech (e.g., line & reel, small nets, and traps)	100% of pier fishers use low-tech gear, mostly line & reel
5. Fishing effort and frequency	• Self-caught • Engaged in fishing regularly	100% of pier fishers catch their own fish 82% fished once a month or more
6. Catch Consumption	• Food Fishing • Consumed by fisher, family and/or community • 142.4 g/day	52% indicated pier fishing was a "good source of food". All but three species caught were regularly consumed by the fisher, family or social network
7. Social, cultural, and psychological benefits	• "process benefits" • Cultural continuity, reinforcement of social ties	88% find pier fishing "relaxing"; 82% enjoy being in nature; 68% have made friends at the pier; 60% consider it an important place to spend time with family and friends

Table 3
Contingency table of ethnicity and gross annual household income under and above $46,000 for 92 respondents, none response was not considered. Row percentages appear in **bold** and column percentages in *italics*.

		Ethnicity				
		Whites	Hispanics	Asian	African American, Native American & Other	Total
Income in USD	<$46,000	6	35	5	6	52
		11.5	67.3	9.6	11.5	100.0
		26.1	*83.3*	*29.4*	*60.0*	*55.9*
	≥$46,000	17	7	12	4	40
		42.5	**17.5**	**30.0**	**10.0**	**100.0**
		73.9	*16.7*	*70.6*	*40.0*	*44.1*
	Total	23	42	17	10	92
		25.0	**45.7**	**18.5**	**10.9**	**100.0**
		100.0	*100.0*	*100.0*	*100.0*	*100.0*

Chi-Squared test = 26.09 Degrees of Freedom: 3 $p < 0.01$.

4.3. Proximity

Overwhelmingly, the fishers we surveyed were Santa Barbara

Table 4
Reported catch and use of catch by species. Responses to the questions, *"Which species have you caught at this pier in the last year?"* and *"What do you do with your catch?" (n = 106)*. The most common uses are indicated in bold. Percentage of total responses for each species. *protected in California.

Primary Use	Species	Reported catch	Reported uses for catch					
			Throw it back	Eat it myself	Eat with family	Share or give away	Sell	Use for Bait
Consumption	Mackerel, Bonito	93%	23%	**86%**	80%	20%	1%	69%
	Sardine, Anchovy, Smelt	71%	20%	**89%**	85%	15%	1%	45%
	Surfperch	60%	39%	**67%**	59%	9%	0%	22%
	Bass	52%	25%	**84%**	82%	5%	5%	36%
	Sheepshead	41%	44%	60%	**63%**	2%	0%	28%
	Opaleye	39%	44%	**56%**	54%	12%	0%	29%
	Corbina	38%	30%	**68%**	**68%**	5%	10%	28%
	Crabs	27%	10%	**90%**	**90%**	3%	10%	0%
	Halibut & Flatfish	25%	58%	**54%**	46%	19%	0%	12%
Non-Consumption	Shark	52%	**85%**	33%	33%	0%	0%	5%
	Rockfish & Groupers	35%	**73%**	41%	32%	8%	5%	5%
	Skates/Rays	20%	**71%**	19%	19%	0%	5%	5%
	Queenfish, White Seabass, Croakers	13%	**50%**	36%	43%	0%	0%	14%
	Guitarfish	12%	**46%**	38%	38%	0%	8%	15%
	Cowcod, Canary or Yelloweye Rockfish*	8%	**78%**	33%	22%	0%	11%	11%
	Blacksmiths & Garibaldi*	7%	**57%**	43%	43%	0%	0%	0%
	Mussels	38%	0%	30%	33%	0%	0%	**93%**

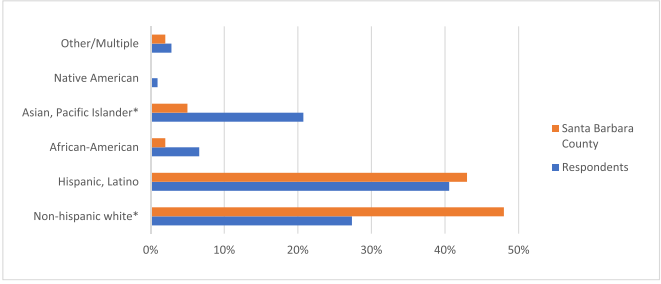

Fig. 2. Ethnicity or racial identity of survey respondents ($n = 105$, declined to state = 1) compared to Santa Barbara County Demographics. Asterisk indicates significance at the 0.05 level.

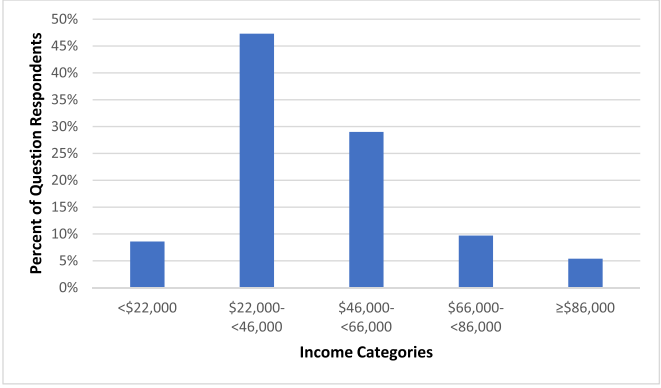

Fig. 3. Reported Household Income ($n = 93$). No response was not considered. Median household income for Santa Barbara County in 2016 was $77,100.

"locals": of the 88 respondents who provided their zip code, 85% resided in Santa Barbara County (Fig. 4). This is especially noteworthy considering that the Santa Barbara coast attracted an estimated 29,000 tourism visitors per day in 2016/17 [52]. Most respondents (72%) were residents of South Santa Barbara County, primarily from the cities of Santa Barbara and Goleta and their surrounding urban areas, living within 20 km of a pier. In addition, 32% of respondents were from zip codes associated with high poverty census tracts in downtown Santa Barbara, Isla Vista, Lompoc and Santa Maria. Asian/Pacific Islanders had the

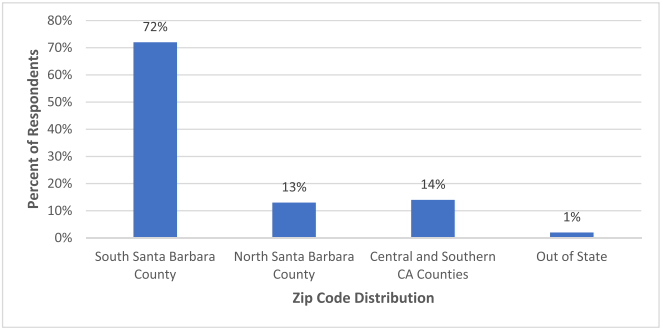

Fig. 4. Distribution of survey respondents according to reported zip codes ($n = 88$). No responses not considered. South Santa Barbara County includes the cities of Santa Barbara, Isla Vista, and Goleta. North Santa Barbara County includes the cities of Santa Maria and Lompoc.

greatest spatial range, with only 36% reporting zip codes in South Santa Barbara County, 32% from North Santa Barbara County, and 20% traveling from other parts of California.

Distance alone was not was not the most important driver, however. We interviewed many East Santa Barbara residents at Goleta Pier, who chose it over the closer Stearns Wharf location. Free all-day parking at Goleta Beach was a likely contributor to this outcome. Furthermore, most respondents indicated that they learned of the location from their social network, and some of those from inland locations told us they traveled specifically to fish and bring home food *(pers. comm.)*. This further complicates spatial proximity as a motivation for choice of location and dimension of subsistence behavior, with important implications for providing equitable resource access.

4.4. Catch and gear

California pier fishers are restricted by state regulations to low-tech gear such as reel and line, crab traps, and small nets, with an observed preference for reel and line [24]. Nearly two-thirds of respondents only use reel and line; those who use 2 or 3 different gear types mostly belong to a lower average income group. The total reported catch per person was high compared to other studies, with 20% self-reporting regular daily catches of five pounds or more. This amount did not vary significantly by income, though there was a trend of higher incomes taking smaller amounts of fish.

4.5. Effort & frequency

The majority of respondents (59%) reported fishing at least once a week, with another 23% fishing at least once a month (Fig. 5a.). Lower-income groups reported fishing most often (Fig. 5a): the majority of fishers with incomes of $65,000 or less fished at least once a month, and the lowest income category (<$22,000) reported weekly fishing effort, though this is a small sample group ($n = 8$). Latino fishers reported the highest frequency, with more than half (53%) reporting they fish once a week or more (Fig. 5b). In contrast, higher income categories reported only occasional fishing over the year. We found highly significant (0.00) difference between the lowest income category (<$22,000) and the highest two groups (>$66,000), confirming the likelihood that unlicensed, no-cost pier fishing is benefiting the poorest in Santa Barbara, and that it may have more than recreational value to economically vulnerable communities.

4.6. Consumption

Catch consumption is used in the literature as a positive indicator of "food fishing" and about half of our respondents ate or shared their catch with family and friends, with even higher consumption rates among low-income residents and Latinos. Fishers were asked what they do with their catch by species and were given the options: 1) throw it back, 2) eat it themselves, 3) eat it with family, 4) share with friends/give away, 5) sell it or use it in food they sell, and/or 6) use it as bait (Table 4). Overwhelmingly, pier fishers reported that they eat their catch themselves or with family; about half of respondents reported eating their catch at least once a week, with slightly higher rates of consumption among low-income respondents. Catch and release was an uncommon practice – only 15% of fishers reported throwing back their catch, mostly protected species (cowcod, canary and yelloweye rockfish), skates, rays and sharks.

Sharing fish within a social network was more prevalent than selling catch, but not as common as personal or family consumption. Of low-income respondents, 62% reported eating their catch once a week or more, compared to 49% of those with higher incomes and 56% of all groups; those in the $22,000 and below category all reported weekly consumption (Fig. 6a). Across ethnic and racial categories, White and African-American respondents had similar frequencies of catch consumption, with about two-thirds eating pier caught fish at least once a month (Fig. 6b). About the same percentage of Asian/Pacific Islanders consumed their catch at least monthly, but had much higher rates of weekly consumption. The small samples of fishers who identified as Native American (1) and Other/Multiple (3) makes it prohibitive to draw comparisons for these groups. Consumption of fish was again dominated by mackerel and the baitfish (Table 4).

While consumption is fundamental to most definitions of subsistence, it cannot be separated from the experience of fishing and the social and cultural dimensions of catching, sharing, and eating pier-caught fish. Consumption can be part of recreational enjoyment and is not a stand-alone indicator of subsistence; nor does the absence of direct consumption indicate recreation, as the practice of fishing and sharing fish with others are also valuable for reinforcing community bonds and social networks, important dimensions of community subsistence [17]. Still, the high rates of consumption in our study may be an indicator of significant food insecurity among pier fishers and emphasizes the multidimensional nature of recreational fishing.

Latino fishers had a statistically significant ($p < 0.01$) higher rate of consumption than all other ethnic groups, with 79% reporting they eat their catch once a week or more (Table 5). Only 37% of white, non-Latino respondents and 44% of all other ethnicities reported

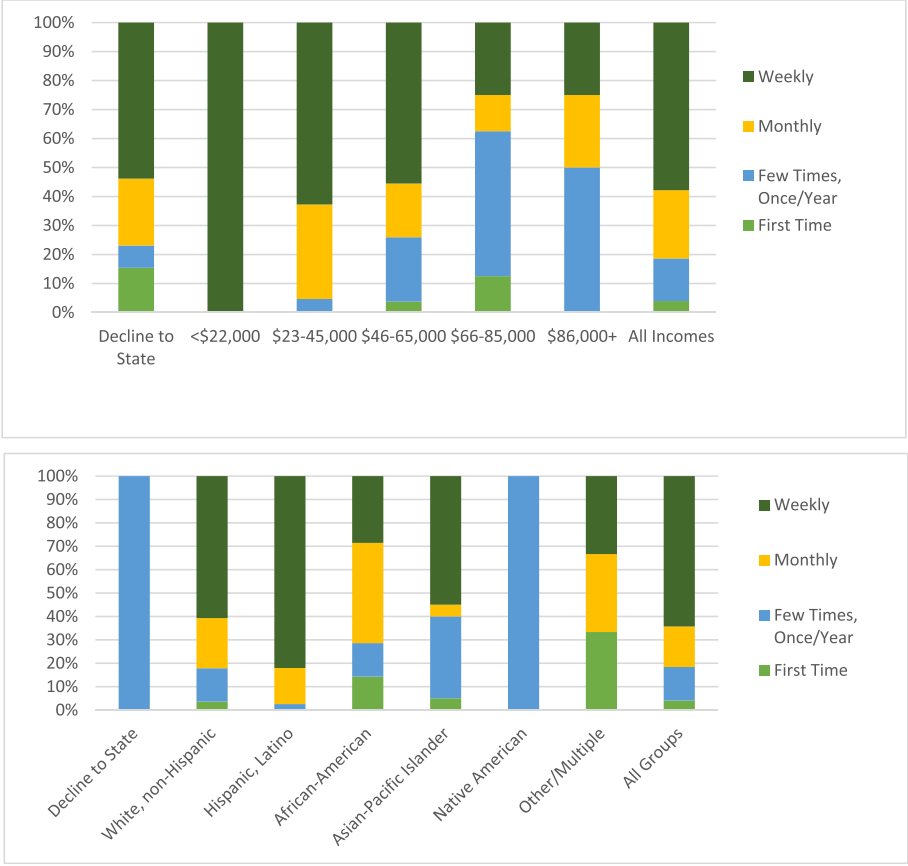

Fig. 5. Self-reported fishing frequency, a) by household income, and b) by ethnicity or racial identity.

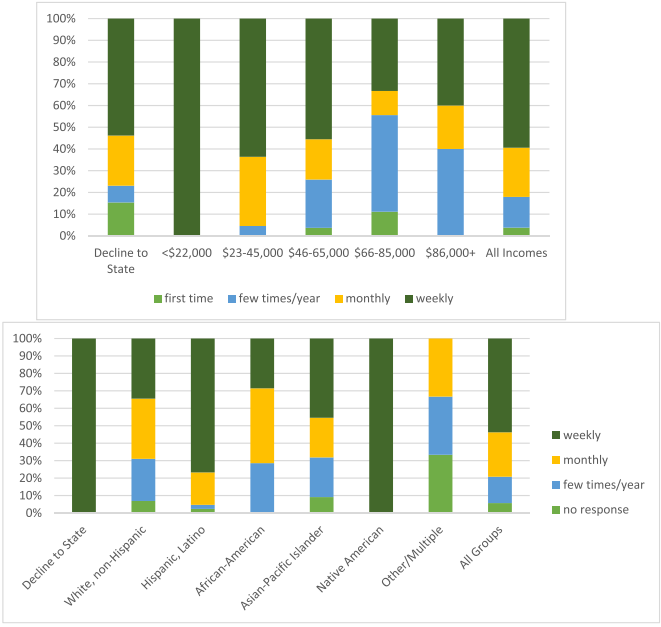

Fig. 6. *How often do you eat fish you catch from this (or other) piers?* Percent of responses a) by household income, and b) by ethnic or racial identity.

consuming their catch as frequently. Respondents who indicated they consume their catch only a few times of year or less were least likely to be Latino (only 6% of responses in that category). These findings suggest a strong relationship between race and ethnicity and consumption frequency throughout the year.

4.7. Social, cultural, and psychological benefits

When asked about the reasons that the experience of pier angling was important to them with multiple responses possible, fishers primarily indicated the free recreational and psychological benefits, but a majority also chose food fishing and socializing as motivations. The most frequent responses were that pier fishing was relaxing (88%), they enjoyed being in nature (82%) and that the activity was free (79%). Other common responses included appreciation of the atmosphere, the convenient location, and the social relations fostered by the activity (Fig. 7). When asked about how they found out about this fishing location fishers overwhelmingly indicated they knew about the spot through family and friends; no respondents reported learning of the spot through the internet, bait shop, or even from other fishers, indicating the important role of social networks in pier fishing behaviors. Slightly more than half responded that pier fishing offered a good source of food, with low-income fishers responding at the highest rate (69%). Our survey did not interrogate why these respondents perceived pier fishing to be a good source of food however, which requires more exploration. Few replied that fishing represented an important cultural or personal tradition, challenging conventional associations of non-commercial fishing with traditional or indigenous cultures.

Table 5
Cross-tabulation of ethnicity and fish consumption n = 101. Row percentages appear in **bold** and column percentages in *italics*. 'None' response was not considered. Chi-Squared test = 22.921 Degrees of Freedom: 6 $p < 0.01$.White-Latino: $p < 0.01$; White-Other: $p < 0.04$; Latino-Other: $p < 0.01$.

Reported consumption frequency	Ethnicity			Total
	White	Latino	Other	
2 or more per week	3	7	8	18
	17	**39**	**44**	**100**
	11	*17*	*25*	*18*
Once a week	7	26	6	39
	18	**67**	**15**	**100**
	26	*62*	*19*	*38*
1-3 times per month	10	8	9	27
	37	**30**	**33**	**100**
	37	*19*	*28*	*26*
A few times a year or less	7	1	9	17
	41	**6**	**53**	**100**
	26	*2*	*28*	*17*
Total	27	42	32	101
	27	**42**	**32**	**100**
	100.0	*100.0*	*100*	*100*

5. Discussion

We find that Santa Barbara pier fishers exhibit several indicators of subsistence behavior and that social factors provide the most distinctive and reliable means for recognizing subsistence practices. Among the seven attributes examined, there are three characteristics that *together* appear most meaningful and reliable for recognizing subsistence practices in our context, with relevance for similar coastal urban settings: consumption, socioeconomic characteristics/social identity, and social, cultural, and psychological benefits. Acknowledging subsistence practices among key socioeconomic groups who may be vulnerable to food insecurity and social marginalization is critical for equitable coastal resource management. Latino households consume pier-caught fish much more frequently than any other group. Low-income households were disproportionately represented among pier fishers, with the greatest number of respondents living in census tracks identified by the county as "high poverty areas". The lowest income group also fished significantly more often than incomes near or above the county median, suggesting the free activity is particularly valuable for communities living in poverty. While race or ethnicity and income were related factors in our study, we found ethnic identity to be a better explanatory factor for the high rates of Latino and Asian/Pacific Islander participation. Nearly all fishers who consumed their catch at least once a week indicated that "good fishing" and "food" were motivators, yet these responses lagged far behind social benefits like making friends, spending time with family, and the convenience and atmosphere of the pier. Spatial proximity of fishers' households to the pier was a relevant factor, but only in association with social and cultural factors. Although catch method and lack of market participation are often used to distinguish non-commercial fishers, they did not contribute to identifying subsistence among pier fishers, who meet these criteria by the nature of their practice. In all, the concurrent factors of economic status, ethnicity, and perceived non-material benefits presented the best confirmation of subsistence practices.

Comparing our findings directly to two past studies of anglers in southern California reveals a pattern of pier fishing for personal consumption, particularly by California Latinos, during the past twenty

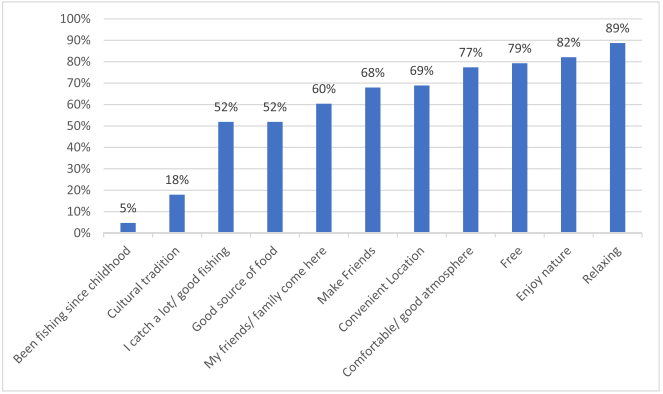

Fig. 7. *When you fish from the pier, what is important about the experience for you?* (multiple responses possible).

years. We find that Santa Barbara County pier fishers are overwhelmingly consuming their catch, with higher consumption rates among low-income and Latino community members. Allen et al. [19] similarly found that while the majority of Los Angeles area boat anglers were non-Latino whites, pier fishers were predominantly Latino. A survey of Los Angeles County pier fishers by Pitchon and Norman [26] found that 43% of respondents who consumed their catch at least 1–3 times or more in a two week period were Latino, also mirroring our findings that Latinos were the highest consumers of their catch. Our findings also concur with studies that found high rates of self-caught fish consumption among Asian/Pacific Islanders, and credit the social and cultural importance of fishing practices and seafood in these communities [53,54]. The degree to which angling was cited as a good source of food was also considerably higher here than in previous studies of recreational fishers (over 50% compared to 4%) [55], further suggesting that fishing for food is especially prevalent among Santa Barbara County pier fishers. In all, our study supports others in suggesting that community members vulnerable to social and economic disparities benefit from the unlicensed and informal nature of pier fishing, and broader recognition of subsistence practices is critical for developing and maintaining socially just and responsive coastal management policies.

Our research had several limitations which should be considered. We were more successful in recruiting participants at Goleta Pier with much fewer surveys conducted at Sterns Wharf. Future research would benefit from a larger sample size collected over a longer period to capture seasonal changes. However, our findings concur with several larger studies in California, suggesting that our data was sufficient to draw our conclusions, and the novel use of diverse subsistence characteristics in our study provides a holistic approach to understanding a dynamic social-environmental system. Our study further demonstrates the importance of recognizing social diversity and spatial relationships in resource use to understand how a heterogeneous urban community engages with their environment.

6. Conclusions

We suggest that non-commercial fishing, even when characterized as recreational, may serve a vital social and dietary function, especially for economically vulnerable members of urban communities. Subsistence can be understood as filling both the “belly and the soul” [3], and evaluating subsistence requires an acknowledgement that fishing is a highly variable and situated practice dependent on the specific social-ecological context [56]. Findings indicate that in California and similar coastal urban environments, socioeconomic status, consumption rates, and social, cultural, and psychological benefits may be used together to analyze patterns of subsistence fishing for different populations. However, more data is needed to provide insights into the benefits and risks of non-commercial fishing to coastal communities, especially unlicensed pier fishing. Specifically, more inclusive fisheries research and outreach design are required to explicitly address cultural and linguistic diversity [54], as well as the heterogeneity of immigrants, low-income, and ethnic minority communities participating in coastal resource use [25], and to understand the diversity of their needs, consumption patterns, and practices. Discerning and communicating potential health risks to specific groups is also critical, particularly households with children and pregnant women who are likely to have greater exposure to mercury and toxins due to high rates of seafood consumption from urban coastal waters.

Wider recognition of subsistence practices within recreational fishing is needed in coastal resource management. The informal, unlicensed nature of pier fishing in California is a key factor in its broad accessibility and contributes to its role in providing subsistence, but it also renders these fishers invisible within the formal processes of communication, community outreach, and decision-making used by fisheries management agencies. Schumann and Macinko [3] note that formalizing subsistence fishing in management is not always necessary or helpful, and dividing subsistence from recreational fishing may oversimplify the dynamics of pier fishers’ identities, behaviors, motivations, and needs. Still, our findings suggest that policy makers might usefully recognize the multiple and co-occurring social, economic, and cultural dimensions of non-commercial fishing practices, and acknowledge subsistence fishing as an important coastal resource use that supports community resilience and health. Examining recreational fishers’ use of coastal spaces and species with attention to different uses and subsistence characteristics will produce a more nuanced understanding of a complex social-environmental system, and avoid exacerbating informal fishers’ possible food insecurity, health risks, and marginalization in fisheries management planning [36,47,55,57,58]. This recognition requires shedding assumptions about recreational fishing as purely a leisure activity and increasing engagement with unlicensed fishers and stakeholders in fisheries data research and management planning. This work has already commenced in Pacific fisheries [2], and should be extended to consider non-indigenous informal fishers in coastal urban environments.

Credit author statement

Barbara Quimby: Conceptualization, Methodology, Formal analysis, Investigation, Writing- Original Draft, Writing- Review & Editing, Visualization, Supervision, Project administration, Funding acquisition. **Stephen ES Crook:** Methodology, Formal analysis, Investigation, Data curation, Writing- Review & Editing, Visualization. **Karly Marie Miller:** Methodology, Formal analysis, Writing- Original Draft, Writing- Review & Editing, Visualization. **Jorge Ruiz:** Methodology, Formal analysis, Project administration, Writing- Review & Editing, Visualization. **David Lopez-Carr:** Conceptualization, Methodology, Writing- Review & Editing, Supervision.

Declaration of competing interest

The authors declare no competing financial interests.

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