Testing the feasibility of urban coastal direct seafood markets
A final report for Collaborative Fisheries Research West

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EXECUTIVE SUMMARY

BACKGROUND

Despite the ecological, economic, social and human health benefits of local and diverse sources of seafood, over 90% of seafood consumed in California (and the U.S.) is imported, while much local catch is sent overseas. Further, diets are species poor with 56% of all seafood consumed in the U.S. coming from three species. Diversification of catch and more efficient use of local seafood can increase stability of local fisheries and food supply chains, and the benefits they reap. Attaining diverse fisheries is dependent on diverse supply and demand. The rich ethnic and cultural diversity in cities like San Diego, and the high biodiversity in coastal waters, gives tremendous potential for diverse market demand that could drive diversification of local fisheries.

GOAL

Identify and begin to address the barriers to getting locally sourced seafood from our waters to our plates. We leveraged San Diego's ethnic diversity and desire for healthier lifestyles, and the Unified Port of San Diego Commercial Fisheries Revitalization Plan to fulfill four objectives.

1. Determine public demand and feasible supply of seafood needed to support a direct market.
2. Identify the main barriers to the public consuming (more) seafood and begin to address them.
3. Raise public awareness of the diversity of local fisheries by connecting the public and fishing community.
4. Identify species of emerging public interest in order to plan next steps before demand increases.

METHODS

We held two survey and tasting events at Tuna Harbor on 9/7/2013 for San Diego's East African community (am) and foodie public (pm). We partnered with fishermen for local catch and to develop educational materials for each species profiled. Fishermen hosted an outreach table with live animals and one of the chef stations. Chefs, scientists, aquaculturists and nutritionists also hosted tables introducing local species. Over 250 people attended; 177 took the survey that collected data on diet and shopping habits, and awareness, demand and barriers to local direct seafood sales. A follow up survey 6-8 weeks later tested impacts of the event. On 12/16 -17/2013 we interviewed 20 fishermen to identify potential supply and barriers to selling directly to the public. Five follow up events presented results, distributed materials and initiated interactions among the communities.

KEY FINDINGS

1. There is a supply and demand for San Diego seafood and direct markets, but public preferences do not align with local catch.
2. The main public barriers are unfamiliarity with local catch and habit of buying imported seafood; increasing familiarity with San Diego's seafood producers and their products changed habits and increased adventurousness.
3. The main seafood producer barriers are lack of social capital and infrastructure, which can be overcome by collaboration among fishermen, high-level champions to help with meeting regulatory requirements and infrastructure, and grassroots economic and political support.
4. This project helped to launch San Diego's first fishermen's market through collection of supply and demand data, identification of barriers and initial efforts to overcome them, including strengthening connections among the public, fishermen, and other market stakeholders.

MAIN CONCLUSIONS

SEAFOOD SUPPLY EXISTS

Most (75%) fishermen sell or wish to sell directly at one or more of San Diego's open air markets. They get 10-500% more for directly sold catch with highest increases for less-mainstream species (e.g., invertebrates, lingcod). A diversity of seafood is available every month with over 10 year-round and at least 20 seasonal species.

FISHERMEN'S BARRIERS

All fishermen agreed that the main barrier to directly marketing their products was the lack of social capital, namely producer-based groups committed to establishing a reliable and diverse seafood supply for sales, and to coordinating catch and sales to reduce competition, costs and effort associated with marketing. All fishermen agreed that lack of producer-owned and operated waterfront infrastructure, such as offloading, processing and storage facilities, was limiting direct sales. Most agreed that some current regulations, such as expensive, non-transferrable fishing permits, and lack of permits for fishermen's only markets limit direct marketing. It was acknowledged that strict regulations are also what makes local catch responsible and may be used to market products. Fishermen also noted the lack of personal sustainability; the inability to fish long days and then market, as a limitation.

SOLUTIONS FOR FISHERMEN

With long hours and individual operations, producers need help connecting with each other and marketing opportunities, securing producer-owned and operated waterfront infrastructure, and building grassroots support. Local media reporting on permitting challenges, and high-level, local champions were part of the solution to permitting snags that allowed the Tuna Harbor Dockside Market to open.

PUBLIC DEMAND EXISTS

San Diego wants fresh, eco-friendly, healthy seafood; knowledge of source; and to support the local economy and fishermen. Finfish topped the list of preferred San Diego products, but 25% or more were interested in every species landed in San Diego. Most (90%) were willing to pay more and ¾ were willing to travel 10-30 min for direct seafood. Most said they would visit a direct market at least once per month and buy a pound or more of seafood; and most were willing to try a new seafood if offered at a direct market.

SAN DIEGO'S SEAFOOD HABITS DON'T MATCH LOCAL CATCH

Fig. 1. The most common seafood consumed in San Diego (left cart), and some examples of common year round catch (right).

PUBLIC BARRIERS

The most obvious barrier was that our food habits do not match local catch (Fig. 1). The most commonly purchased seafood are largely imported into Southern California and include salmon, tuna and shrimp. Many people were unfamiliar with and had not tried most of San Diego's local products, especially invertebrates and less-mainstream fish (Fig. 2). Other reasons given by the public for not eating more seafood were that it is too expensive and that fishing may harm the environment. Barriers to the public attending dockside markets on San Diego Bay were distance from home, not enough parking and inconvenient hours. People preferred weekend markets.

LOCAL SEAFOOD IS LARGELY UNFAMILIAR TO THE PUBLIC

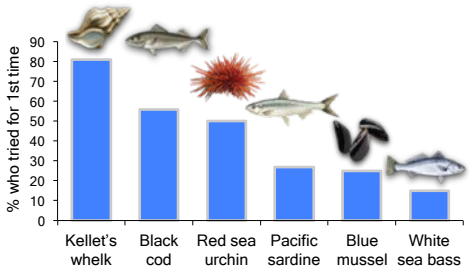

Fig. 2. % of attendees who tried local seafood species for the first time at the 9/7/13 event.

TRYING A NEW SEAFOOD, EVEN ONCE, INCREASES COMFORT LEVELS

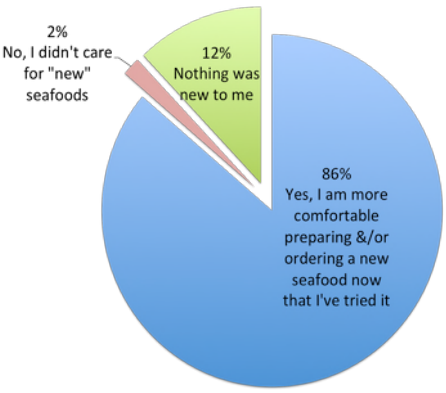

Fig. 3. Proportion of responses of people who were asked how willing they were to buy a seafood that they had tried for the first time 6-8 weeks earlier at the 9/7 event.

PUBLIC SOLUTIONS

Raising public awareness about San Diego's environmentally, economically and socially responsible producers and products increased comfort (Fig. 3), preferences for, and value of local seafood, and nurtured adventurousness to try new seafood. We used collaboratively developed informative materials and interactive events (tastings, touch tanks, interactions with fishermen, scientists and chefs). Culturally-sensitive communication with a diversity of communities, and increased convenience and access to seafood will help to overcome many of the barriers to people choosing local seafood.

Testing the feasibility of urban coastal direct seafood markets

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INTRODUCTION

The growing popularity of farmer's markets indicates a shift in public and producer choices for supporting local, diverse food systems, but this shift has been slower to catch on for sources of protein such as seafood (O'Hara 2011). Over 90% of the seafood consumed in California, and the U.S, is imported from outside our waters (NOAA 2014); and over one third our local catch is exported overseas (NMFS 2014). Further, our diets are species poor with 56% of seafood consumed in the U.S. coming from three often-imported species (tuna, salmon, shrimp; NFI 2014). **Understanding the social barriers to keeping more of the seafood caught in local waters on local plates will help to prioritize solutions for overcoming the barriers and will strengthen local, diverse fisheries and the benefits they confer**. In San Diego, like other coastal urban centers, there is a movement toward healthy lifestyles including seafood-based diets, but there is little connection between the public and the dwindling fishing industry (Crawford 2009, Felando and Medina 2012, Golden 2012). Revitalization of commercial fisheries depends upon the strengthening of these connections.

The benefits of local seafood. Strong local and diverse fisheries benefit the environment, the economy and society. To start, the U.S. and, in particular, California, have some of the strictest regulations in the world protecting the environment, such as fishery catch limits, aquaculture rules and habitat protections, the health and safety of seafood, and the rights of workers' along the food supply chain resulting in some of the most responsibly sourced and processed seafood in the world. Further, local seafood sources can have less impact on the global environment than sources farther away due to less energy requirements and pollution associated with less processing and shorter transport distances (Paxton 1994, Weber and Matthews 2008). Local ecosystems are valued and protected more when relied upon such as for food sources, and the familiarity with the environment leads to healthier life styles and (e.g., Louve 2008). The local economy is bolstered by local food sources via jobs all along the food supply chain (O'Hara 2011), and a general willingness to pay more for local food as shown by agricultural goods (Darby et al. 2007). Locally sourced seafood provides opportunities for direct sales between the public and producers, who can earn slightly higher wages for a portion of their products. Direct sales are crucial for commercial fisheries revitalization in urban areas like San Diego where the once thriving fishing industry has dwindled over the past several decades due to decreased awareness about the fishing community, its long heritage and its products (Golden 2012). Finally, local, diverse foods helps to maintain distinct cultures, local traditions and identities, and provide a unique sense of place (Nabhan 2009).

The benefits of diverse seafood. Besides detracting from cultural and social diversity, reliance on just a few seafood species is ecologically and economically risky. Unfavorable oceanic or weather conditions, long-term overharvesting, commercial competition or changing dietary fads can shut down an industry and increase the occurrence of population crashes (e.g., Pauly et al. 2000, Seelye and Bidgood 2013). Natural community- and ecosystem-level repercussions are also more likely as a result of the intensive harvesting of single species, especially top predators, keystone species or other strongly interacting species (e.g., Paine 1966, Estes and Palmisano 1974, Power 1990, Coleman and Williams 2002), compared with less intensive harvesting of multiple species (i.e., more, weaker interactions; e.g., McCann et al. 1998, Sala and Graham 2002). Stabilization and rebuilding of the fishing industry and fished populations may begin with a more diversified catch—

with less fishing pressure on each of the more fished species, in particular the diversity of lesser known or appreciated seafood such as invertebrates and coastal pelagic fish. This is of course dependent upon a diverse demand for these species, and producer willingness to supply the market.

Fisheries revitalization in San Diego. San Diego holds great potential for the revitalization of its commercial fisheries. First, the city has a rich ethnic diversity that can potentially provide the diverse market base needed to support a diverse fishing industry. Second, the local, healthy food movement is strong evidenced in part by the 52 weekly farmer's markets in the county (SDCFB 2014, Cone 2012), two Slow Food programs (www.slowfoodusa.org), and multiple community health and wellness programs including a recent county-wide initiative (CSD 2014) that encourage diets with seafood. Third, State and local officials recognize the value of local commercial industries with a recent State bill requiring explicit labeling of seafood to identify seafood name and source (Simmons 2014) and the 2009 San Diego Bay Commercial Fisheries Revitalization Plan, which calls for two direct fish markets (UPSD 2009). While anecdotal evidence indicated interest in local, direct seafood markets, there was a lack of the quantitative supply and demand data needed to demonstrate the likelihood of market success and to boost confidence of stakeholders. In particular, there was uncertainty about the magnitude and type of demand, the barriers limiting demand, and whether the supply could reliably meet the demand and allow for growth.

The overarching goal of this CFRW project was, therefore, to identify and begin to address barriers to diverse and local (i.e., sustainable) fishing industries in coastal cities like San Diego. We used an inductive approach by leveraging San Diego's ethnic diversity and desire for healthier diets, and the Port of San Diego's collaborative plan for two direct seafood markets, to address these four objectives.

1. Determine the public demand and feasible supply of seafood needed to operate direct markets.
2. Identify the main limitations to the public consuming (more) seafood in order to prioritize efforts to address each limitation.
3. Raise public awareness of the local fishing industry and diversity of products by connecting the public and the fishing community through discussions and demonstrations at the survey events
4. Identify species of emerging public interest in order to plan for collaborations that will collect scientific data and develop management strategies before demand increases.

METHODS

Geographic and demographic focus. This project focused on better connecting the metropolitan area of San Diego, California, USA with its fishing community We worked with two groups of the public, the Foodies, or those who are likely supporters of direct market seafood sales in San Diego because of familiarity with the industry, the local food movement and/or proximity to the market; and the East African Community who offer great potential for diversifying demand but have little familiarity with the local industry. Most of the East African residents are immigrants or first generation Africans originating from coastal countries (e.g., Somalia and Eritrea) where local seafood used to be a part of daily life but is an uncommon commodity in the U.S. Further, most live in mid city San Diego, only 5-10 miles from proposed locations of dockside markets. We worked with the women in this community since they do the majority of the household shopping and are actively involved in health and wellness efforts for their community. They therefore represented diverse, potential consumers of local direct seafood who would also likely provide insights into any unique barriers to local seafood faced by some of San Diego's lower income, ethnic and culturally diverse neighborhoods.

<u>Collection of public demand data and outreach</u>. Data on public demand for direct markets and products (Obj. 1), and the main barriers to buying local seafood (Obj. 2) were collected using in-person surveys administered at two dockside seafood tasting and survey events held on 07 September 2013 at Tuna Harbor, one of the working wharves in San Diego Bay. A morning session hosted the East African women, and an afternoon session hosted San Diego's Foodies.

The 50 question survey included questions collecting data on participant demography, shopping and dietary habits, interest in dockside markets and products, and current fishing industry and local seafood awareness (Obj 1-4). The survey questions ranged from choose the best answer(s), ranking multiple options using an agreement scale of 1-5, where 1 is disagree and 5 is strongly agree, and a few free answer questions. To test people's interest in a seafood after tasting it, we also set a ballot box at each chef station showing the species served and asking the participant to rate interest in trying the species again on a scale of 1-5.

These events also served to raise awareness of local fisheries (Obj. 3) by featuring chef stations where seven local chefs and two fishermen (Z. Roach and L. Halmay) prepared samples with local catch for the public to try. There were also four outreach stations hosted by volunteer experts from partner organizations who could discuss and provide information on local seafood species ecology, nutrition, aquaculture and fisheries. These events also had an added benefit of putting local chefs in touch with fishermen and raising their awareness of products. See Fig. 1 for a list of partners.

Fig. 1. Recruitment poster for the 9/7/2013 survey and dockside tasting event aimed at the foodie public, those who were likely customers of a direct fish market in San Diego. Logos show the project partners who helped support, prepare for and/or host the event.

We recruited participants for the Foodie event, those who would be likely customers of a dockside market, by posting an event announcement (Fig. 1) to the Slow Food Urban San Diego (SFUSD), Scripps Ancient Mariners, Scripps Institution of Oceanography Forum, UC Center for Marine Biodiversity and Conservation list server databases, in the California Sea Grant Newsletter (Our Ocean) and in uptown and downtown restaurants. Women from the East African Community were

recruited in person by United Women's East African Support Team, a local non- profit public benefit organization. Chefs were recruited through the SFUSD network and in person by the PI. for access to their mailing list and help with recruiting chefs for the event.

We administered an on-line follow-up survey to both the Foodies and the East African group 6-8 weeks after the event to collected data on demography, interest and barriers to attending the two proposed dockside markets in San Diego Bay, interest in local species, and changes in awareness and habits because of the 9/7 event (Obj. 1, 2, 4).

Fishermen's supply data collection and outreach. Data on what seafood could reliably be provided to direct markets, fishermen barriers to selling direct, and fishermen perceptions of 'sustainability' were collected during a survey and dinner event on 16 December 2013 at Fiddler's Green Restaurant. The attendees included fishermen, and wives and girlfriends involved with the business. A total of 14 surveys were completed that night. The following day, the PI, Theresa Talley, went down to the docks to survey 4 more returning fishermen who had been unable to attend the event the night before. Two more surveys were also completed by phone by T.S. Talley with guys who were unable to attend for a total of 20 surveys. The event also put like-minded fishermen in touch with each other to work on direct market strategies (Obj. 1,2). Fishermen were recruited using event announcements posted at the four working docks in San Diego County, and by word of mouth among the fishermen.

Data analyses and presentation. Data for each group were analyzed separately to determine differences in preferences and experiences, and due bias associated with the groups and their experiences before and during this project. Data are summarized using descriptive statistics, including averages and errors, and % of all people or responses, as appropriate. ***The Results section of this report presents all or most of the information from each question asked in surveys and interviews as a way of making available all items of interest to various direct market stakeholders. The discussion recaps and synthesizes main findings.***

RESULTS

Public demand and awareness. There were 35 attendees from the East African community and 142 attendees from San Diego's localvore community, referred to as Foodies, who completed surveys. Many more people attended the events. East African women brought their children (about 20-25 kids), and a handful of women came and sampled the food but did not feel comfortable taking the survey. In the afternoon, we registered about 190 people but received only 142 surveys.

Demographics of public survey participants

Age, family, origin and current address. There were 142 foodies who took the survey ranging in age from 18-77 yrs old, with an average (±1SD) age of 46±15 yrs. There were 1.9±0.7 adults per household and, when kids were present, 1.3±0.5 kids per household. About 25% were born in California, 55% from other U.S. states and 20% from other countries (mostly Asia and Europe). Participants currently live as far south as Imperial Beach and as far north as Oceanside, with most (47%) from downtown, uptown and the college area of San Diego, and 20% from La Jolla, Del Mar and Carmel Valley.

There were 34 East African women who took the survey. The average (±1SD) age of the East African participants was 33±11 yrs with a range from 18-55 yrs old. There were 2.6±1.1 adults and,

when kids were present, 3.4±2.2 kids per household. Only one of the 34 East African women was born in California, the rest were born in East Africa. Participants mostly lived in mid-city (76%), and east San Diego cities and neighborhoods (24%).

Education, profession, income. About 60% of foodie participants held a Master's degree or higher, and less than 1% had little or no high school. Most (42%) of the participants were in academia or education. Other professions included business or finance (11%), research and development (11%), health or medical field and 5% of less each of homemakers, architecture or construction, environmental, public service, social service, legal, research and development, or retail fields, and under 5% unemployed. Most households (61%) earned over $75,000 with only 8% earning less than $25,000/yr.

In the East African community, 31% had little or no high school, 34% completed high school, 22% completed some college, 12% had a Bachelor's or Associate's degree. Most participants were in the health or medical field (17%), education and academia (14%) were homemakers (14%). About 10% or less were in social work, food service, or public service fields, and 32% were unemployed. Most (80%) of households earned <$25,000 with 3% (1 household) earning over $75,000.

Follow-up survey demographics. Of the foodies who attended the event, 58 took the follow up survey. We received 0 follow up surveys from the East African Women even though many had provided email addresses for this purpose. Most respondents were from academia (38%), 12% were students, 10% were in business or finance, 9% were in the health or medical field, and 9% in research and development. Only 3% of respondents were unemployed and 13% were in "other" professions (e.g., graphic design, retired, military). Almost one third of the respondents' households earned between $50,000-$74,999, another 41% earned between $75,000 and $149,999 (20% each $75-99.9, and $100-149.9K). Roughly 17% of households earned $49,999 or less, and the rest (12%) earned over $150,000. Most of the respondents received a college degree (36%) or higher (58%), and were mostly female (72%). Respondents ranged in age from 21-77 yr old, with an average age of 47 yr old.

Respondents live all over greater San Diego from as far north as Oceanside south to Imperial Beach, and from beach communities east to Rancho Bernardo, Escondido and La Mesa. About 36% of responses came from uptown and downtown San Diego, 26% each from coastal communities in San Diego, and north of San Diego (La Jolla to Oceanside), 9% from inland San Diego (College and Mid-City areas), and 3% from North County inland.

Shopping and diet trends

Grocery store preference. When the foodie participants were asked to select the 2-4 types of markets that they frequented most, the most commonly frequented stores were tied at 30% for both large chain grocery and small chain food stores. When asked to rank criteria used for store selection (agreement scale of 1-5), respondents most strongly preferred healthy, fresh choices (4.5), access (4.3), and food safety (4.2). This group gets 70% of its protein from fairly equal amounts of chicken, fish and vegetables (e.g., soy).

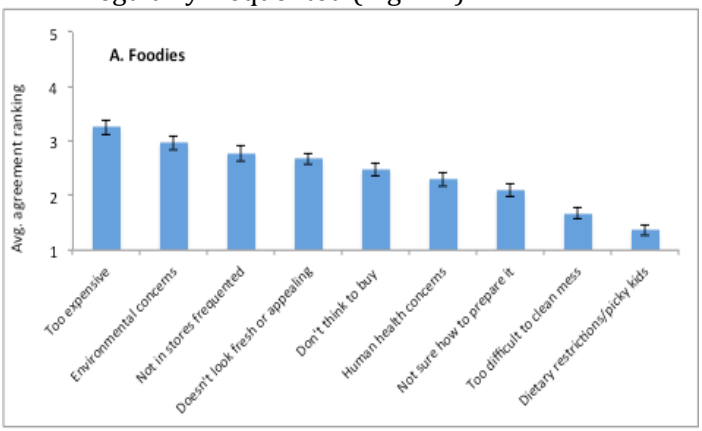
Amongst the East African women, discount warehouse stores were preferred by 32% of participants, followed by specialty or ethnic stores (17%). The top reasons for choosing these markets was cleanliness (4.6); specific items (4.5); and food safety (4.5). The women verbally stated Halal items as being the specific items of highest importance. Chicken makes up the largest source

(26% of responses) of protein in this community, followed by about 10-16% each of lamb, vegetable, fish, beef and goat.

Current seafood preferences. About 33% of foodie participants said they buy seafood at least weekly and 48% buy it once or twice per month When asked to chose a preferred form of seafood, most (41%) preferred fresh prepared (e.g., filleted or more processing), 20% preferred frozen prepared, and 28% preferred fresh whole or live. When asked to list their top three most commonly purchased seafood, salmon (26% of responses), tuna (11%) and shrimp or prawns (11%) were the most common responses. Nearly one half of participants stated that they spend $20-50 per month on seafood with another 20% spending $50-$100. About 5% say they spend $100-200, and 25% spend less than $20 per month on seafood.

About 25% of East African participants said they buy seafood at least weekly, 52% said once or twice per month. Half preferred seafood in fresh prepared forms, 25% said fresh whole or live, and 11% frozen whole. The frozen form may be correlated with the relatively infrequent purchase of seafood. When asked to list their three most commonly purchased types of seafood, salmon (26%), tilapia (24%) and tuna (16%) were the most common responses. About 44% of respondents said they spend $20-$50 per month on seafood, 8% said $50-$100 and 4% said over $200 per month on seafood. The last 44% spend under $20 per month on seafood.

Barriers to frequent seafood consumption. Of the Foodies who eat less frequently than weekly, the three most agreed upon barriers, identified using an agreement scale of 1-5, were that it is too expensive, concerns about the environment and sustainability, and that it is not available in stores regularly frequented (Fig. 2A.).



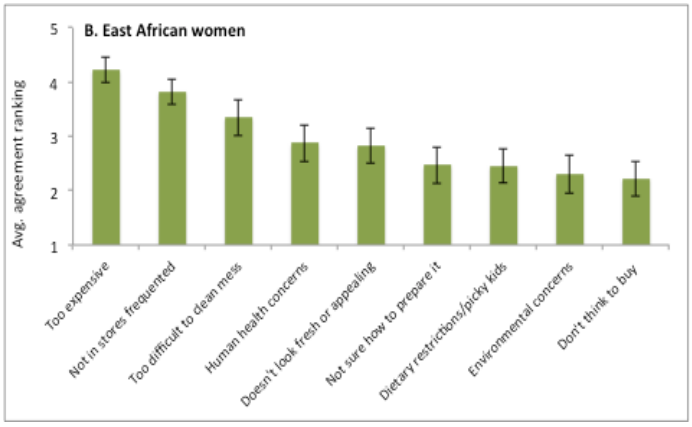


Fig. 2. Barriers to the Foodie (A.) and East African (B.) communities eating seafood on a regular, weekly basis. Participants ranked level of agreement with each barrier on a scale of 1-5 , where 1= don't agree and 5= strongly agree. N= 93-109 responses per question for foodies and 15-25 responses per question for the African women.

The East African women who do not eat seafood regularly most commonly agreed that seafood is too expensive, not available in the stores they frequent, and that it is too difficult to clean up the mess of seafood preparation and cooking (Fig. 2B).

Barriers to <u>local</u> seafood consumption. The main barriers to general seafood consumption likely hold true for local seafood, especially cost and availability in frequented stores given that most mainstream markets carry predominantly inexpensive imported products. Unfamiliarity with local species was common and a likely main barrier to local seafood consumption. At the 9/7 dockside tasting event, half or more of the foodies tried Kellet's whelk, red sea urchin, and blackcod for the first time (Fig. 3). About one quarter of the participants tried blue mussel and Pacific sardine for the

first time. White seabass and yellowfin tuna were the most familiar to people at the event. There was no one species that everyone had tried before (Fig. 3).

When asked to rank their interest (1-5) in a list of local species, foodies were most interested in the species that they were most familiar with, namely finfish California halibut and white seabass (4.3 of 5 for each); yellowfin tuna (4.2), and bluefin tuna (3.9).

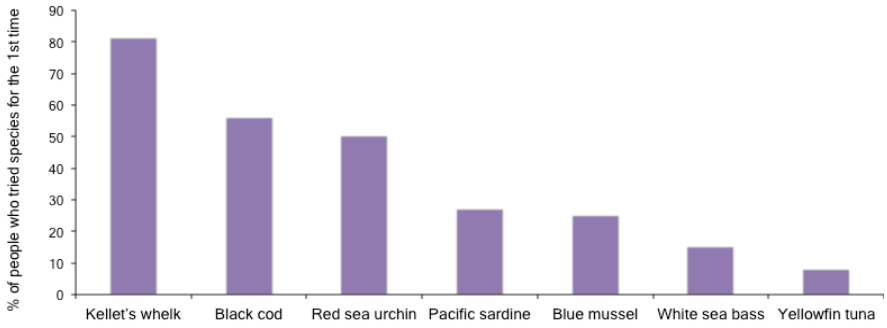


Fig. 3. Proportion of Foodie participants trying each of seven local seafood species for the first time at the 9/7 event. N= 60 responses.

No data on first time sampling of local species is available for the East African women but they anecdotally commented that they had only tried tuna (species unspecified) before the 9/7 event. Their local seafood preference also tended to be for more common, finfish such as yellowfin tuna (4.2 of 5), bluefin tuna (3.8), and swordfish (3.25).

Public motivations and demand for local, direct markets

Willingness to pay for local. Most commonly (35% of people), foodies said that they would pay 10-20% more on seafood if it was from a direct, local market. Almost 15% said they pay 20-30% more and 9% said greater than 30% more, and 22% said they'd pay 5-10% more. Only 13% said they' weren't willing to pay more and just under 4% actually wanted to pay less. Most people (43%) said they would travel 15-30 min for fresh, local seafood, 37% said 10-15 min, 9% said 30-45 min, 9% said 5-10 min. Everyone was willing to spend more than 5 min, and just over 1% thought they would travel 45-60 min.

One third of East African women (33%) said that they were willing pay 5-10% more and one third said 10-20% more. Just over 7% said they would pay 20-30% mo re and 11% said greater than 30% more. Only 4% said they weren't willing to pay more for seafood from a direct, local market. No one said they would want to pay less. Willingness to travel for fresh local seafood was evenly split between 5-10 min (31%), 10-15 minutes (31%), and 15-30 minutes (31%). Just under 8% of women would only travel 5 min.

Dockside market visits: frequency, amounts purchased and barriers. Almost 40% of foodies said that they anticipated attending a dockside market monthly, 25% said they would attend every week or two, 28% said every 3-4 months, 7% said once or twice per year. Most foodies (42%) anticipated buying 1-2 pounds of seafood per visit, 30% thought they would buy 0.5-1 lb and 20% said 2-4 lbs. Most (54%) would be buying for 2 people, or 3-4 people (23% of responses)

Most (42%) East African women said that they would attend a dockside market monthly, 8% said they would visit every week or two, 17% said every 3-4 months, 21% said once or twice per year, and 13% would not attend at all. Most of the women (31%) said they would purchase 4-6 pounds, about one quarter of women said they would buy 2-4 lbs while another quarter said 0.5-1 lbs per visit. Just over 75% of women would be buying for 3 or more people during each visit.

Tuna Harbor Dockside Market. Most people (45%) thought that they would attend a market at Tuna Harbor monthly, and 14% said they would come every week or two. About 30% would attend every 3-4 months and 12% said only 1-2 times per year. No one said they would never attend. The main limitations (≥10% of responses) to people more frequently attending this market would be the location (mostly distance from people's homes), lack of parking, inconvenient hours, and the lack of non-seafood items available. "Other" was specified as follows: One said not enough free parking, four said seafood too expensive, three said they live near other seafood vendor which is more convenient (Point Loma Seafood, Little Italy market), one prefers to catch own seafood and would only buy tuna, one said that going downtown is "annoying", one would buy enough to last a couple weeks, and one mentioned "dietary restrictions" with no explanation.

Fishermen's Farmers' Market at Driscoll's Wharf. The same number of people said that they would attend this market monthly and attend every 3-4 months (each category received 28% of responses). Just under 10% said they would attend frequently (weekly or biweekly), while 22% would attend only 1-2 times per year and 14% not at all. The main limitation for people attending this market more frequently are the hours being inconvenient, in particular conflicting with the Ocean Beach market, work schedule, and the worry about weekday traffic and parking challenges. About 33% of responses stated that the market was too far from place of residence, and 17% worried about a general lack of parking. "Other" was specified as follows: Three said seafood is too expensive, two said the market hours conflict with the nearby OB Market, one said it conflicts with work schedule, two said getting to that area on is difficult due to traffic, with a comment about weekday traffic and parking limitations being worse than on a weekend morning.

Motivators for shopping dockside. The top three motivators for foodies attending the dockside market, as assessed with an agreement scale 1-5) were access to a fresh seafood supply (4.6); supporting the local economy and fishermen (4.5); and getting an eco-friendly seafood supply (4.4). Most people want to be adventurous (70% of responses) saying that they would be willing to try new seafood if it was offered at a dockside market. Some people said that having preparation and cooking instructions (9% of responses) and prepared samples (18% of responses) would make them more willing to try new things.

The motivators for the East African women attending a dockside market were the health benefits of eating seafood (4.8), knowing where the seafood comes from (4.7), and reducing food miles (4.5). Almost 23% of the women said they would be willing to try new things if offered at a dockside market, almost one third said they would be more willing if offered cooking and prep instructions or prepared samples to try; 17% said they would buy something familiar instead if it was offered.

Products in demand. Foodie respondents rated a list of locally sourced species, including those served at the tasting event, on a preference scale of 1-5. Overall, the most desired species included white sea bass and California halibut (4.3); sablefish and yellowfin tuna (4.2) and bluefin tuna (3.9). If wild-caught seafood wasn't available, respondents said they would prefer (preference scale of 1-3) locally smoked Alaskan salmon (2.6) or smoked California tuna (2.5). Most people preferred their fish to be in filets or steaks (56%), while 11% said whole fish only, 32% had no preference

and 1% said they wouldn't buy fish. Half of foodies said they wanted their shellfish partially cleaned, 22% said live and 21% had no preference. About 7% said they wouldn't buy shellfish.

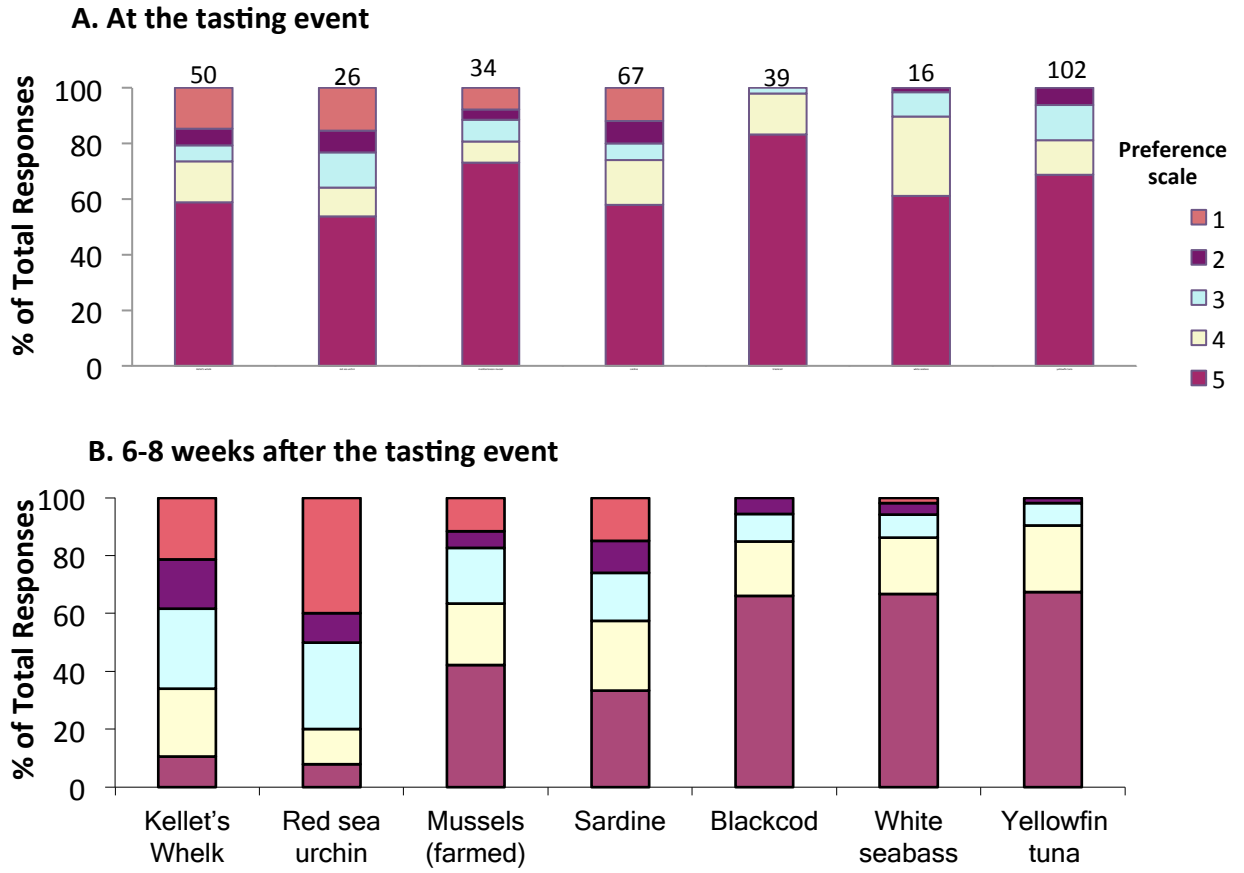


Fig. 4. Interest in each of seven seafood species just after tasting samples of them (A.) at the 9/7 event and 6-8 weeks later (B.) Number of responses to each species is shown above the bars in A. and was 58 for all species in graph B.

Upon sampling seafood at the 9/7 event, half or more of the foodies thought that they were very interested (interest=5 of 5) in trying all of the species of seafood served again (Fig. 4A). About 6-8 weeks later, most people were still very interested in finfish, especially the familiar tuna and white seabass, and blackcod, which over 20% of people had tried for the first time at the 9/7 event. About a third of the people were still interested in sardine. Interest in the invertebrates waned but 20-30% remaining at least fairly interested (interest of 4 or 5) (Fig. 4B).

The East African women were most interested in yellowfin tuna (4.2), bluefin Tuna (3.8), sablefish (3.5), swordfish (3.25) and red ogo seaweed (3.25). If wild caught species were not available, the women said they would prefer to buy smoked California tuna (2.8) or canned California tuna (2.6). Almost half of the women preferred their fish to be in fillets or steaks, 38% preferred whole fish only, 10% had no preference and 3% said they wouldn't buy fish. Most (70%) of the women wanted their shellfish partially cleaned, 15% said live, 4% said no preference and 12% said they wouldn't buy shellfish.

Upon sampling seafood at the 9/7 event, 65% or more of the women thought they were very likely (5 of 5) to try all of the species served again especially tuna, seabass, rock crab, sardine and seaweed (Fig. 5). No data in interest after 6-8 weeks are available.

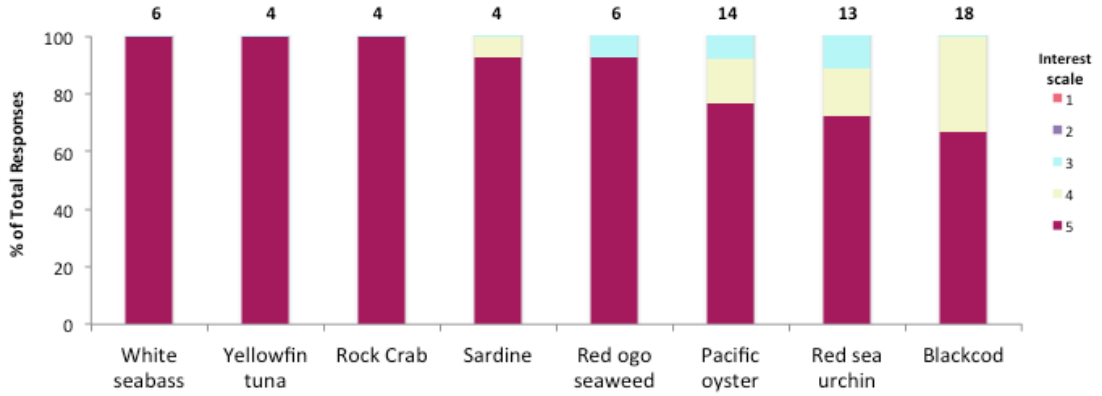


Fig. 5. Interest by the East African women in each of eight seafood species just after tasting samples of them at the 9/7 event. Number of responses to each species is shown above the bars.

Barriers to whole or live seafood. Amongst all foodies, the greatest drawbacks to preparing whole fish were that they can and would rather just pay more for the convenience of fillets (21%), the whole fish is too messy to clean up (19%), and/or they don't know how to prepare it (17%). In comparison to fish, far more participants (28%) reported that they are happy to handle live shellfish (e.g., crab). Many (16%) would still rather pay more for the convenience of cleaned shellfish.

About one quarter of the East African women indicated that they are happy to handle whole fish, the others said it is too time consuming to prepare (23%) or that it is too messy to clean up (18%). In comparison, 15% of women were happy to handle live shellfish, while one third stated not knowing what to do with shellfish as the biggest drawback to buying live.

San Diego fishing community and sustainability awareness baseline

Familiarity with the waterfront and fishing community. Just under one-half (46%) of foodies surveyed had not visited the Port of San Diego docks prior to the event on 9/7/2013. Only 11% of foodies were unaware of San Diego's fishing fleets before this study. Roughly 68% of participants had not spoken to a member of the fishing community before the event. Of those who had spoken to fishermen, some of the most commonly identified fishing community members are Peter Halmay (sea urchin fisherman and voice of the fishermen), and Tommy Gomes and Dave Rudie, previous fishermen and now owner/operators of Catalina Offshore.

Just over 86% of East African women had not visited the Port of San Diego docks before the 9/7 event. At a focus study of East African women before this project began, 25 out of 26 women had never been to the waterfront, the docks or the public fishing piers. Three quarters of the East African women did not know San Diego had a fishing industry. At the focus study of East African women before this project began, 25 of 26 women had not heard anything about the local fishing industry. The increased awareness may be due to exposure during the focus study as there were a handful of familiar smiling faces at the 9/7 event! All but one woman (97%) said they had never spoken to a member of the local fishing community.

What does "sustainable" mean to the public? This was an open answer question. Definitions given by the foodies generally closely matched those given by non-profit organizations focused on sustainable seafood awareness. Each definition usually contained one or more elements of what sustainability could be (so totals can equal more than 100%). Of the 142 foodies who completed surveys, 130 provided answers to this question (12, or 8.5%, answered "don't know" or they left this blank). Of all the responses (including "don't know"), 76% mentioned protection of population growth and/or persistence, species persistence and/or not overfishing the stock (Fig. 6). A focus on habitat, ecosystem, environmental and/or ocean health or stability appeared in 26% of the definitions. Consideration of particular fishing methods, especially hook and line, appeared in 8% of answers. Locally caught was an element in 10% of definitions. Mention of economic stability or growth appeared in 4% of answers with 1% stating the importance on sustaining the fishing community/industry. Consideration of human health and seafood safety (no toxins, nutritional value, fresh seafood) appeared in 6% of answers. About 3% of answers stated that the definition of sustainable was dependent upon classifications made by non-profit organizations (e.g., only fish on Seafood Watch would be considered "sustainable"). Less than 3% of answers included other insights such as science based management requirements, life history traits of the species, gear type, food justice (availability to all), or accepting that seafood availability will change seasonally.

The focus of the East African women's responses was more on their community and families. Only 6 of 32 East African women answered this question (26, or 81%, wrote "don't know" or left it blank). Human health considerations (seafood safety and nutrition) was the most common element (9% of answers; Fig. 6), and 6% of answers included consideration of food justice (access and availability). Three other elements, consideration of fish population size, economic stability (including affordability) and variety were mentioned one time each (3% or 1 response each).

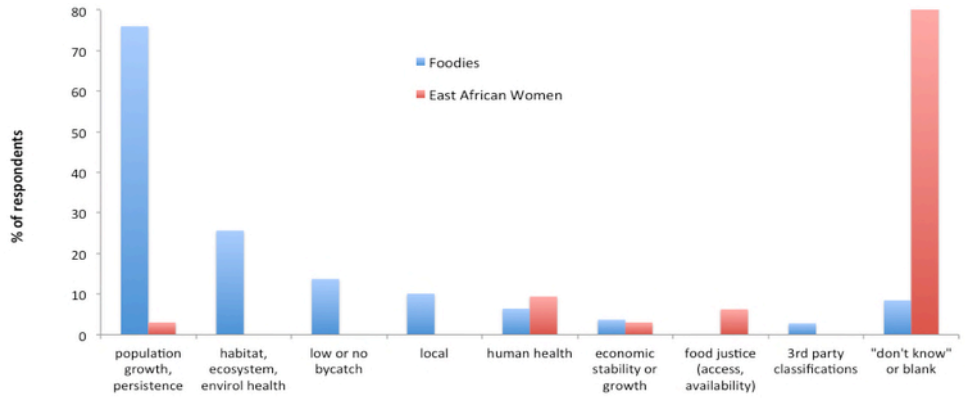


Fig. 6. Proportion of respondents who included each of these elements of sustainability in their open ended answer of "What does sustainability mean to you?"

Neither group included consideration of the rest of the food supply chain or the of the producers who would provide this food. Definitions were also frequently based on outcomes, with little or no focus on the processes behind environmental stewardship, scientific assessment, community responsibility and local food supply chains. For example, definitions included: "Having endless supplies", "local and plentiful", "Never ending supply w/o negatively impacting the environment", "fresh, local, not endangered", and "Nutritious/Readily available that is cheap & fresh". These answers reveal desired end states (products of sustainability practices) without consideration of how we get to that point.

Impact of familiarity.

Changing habits. Over half of foodies said that because they tried seafood at the event that was new to them, they have been more willing to both prepare and order at least one of the novel species (Fig. 7). Almost one third said they would try one of the new species, but only if it was prepared by someone else.

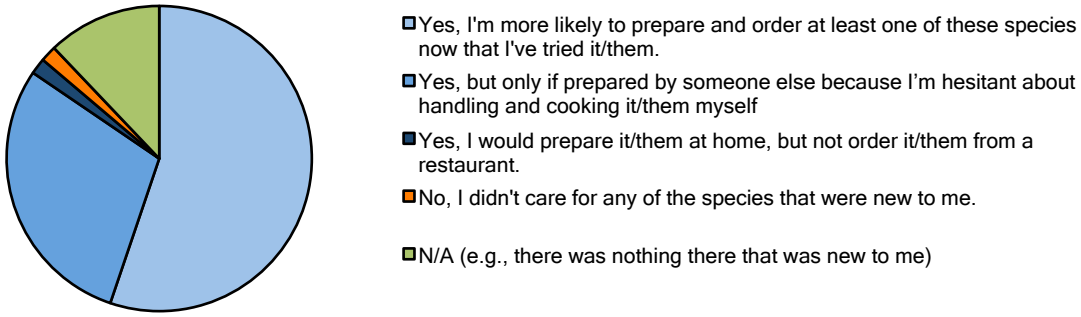


Fig. 7. Proportion of people who were willing or not willing to again eat a species of seafood that they had tried for the first time at the 9/7 event. N=58 responses.

Increasing adventurousness. Almost 1/3 of responses revealed that people had bought and prepared and/or ordered in a restaurant a type of seafood that was novel to them (Fig. 8). Another 1/3 of responses indicated that people hadn't done this yet but intended to over the next few weeks. Among the species mentioned by name that participants have tried or intend to try are blackcod (9), Kellet's whelk (5), blue mussel (5), red sea urchin (3), mackerel, anchovy and sardine (each 1), oyster (1) and lobster (1). The final third of the participants said that they probably would not buy or order a new type of seafood in the near future.

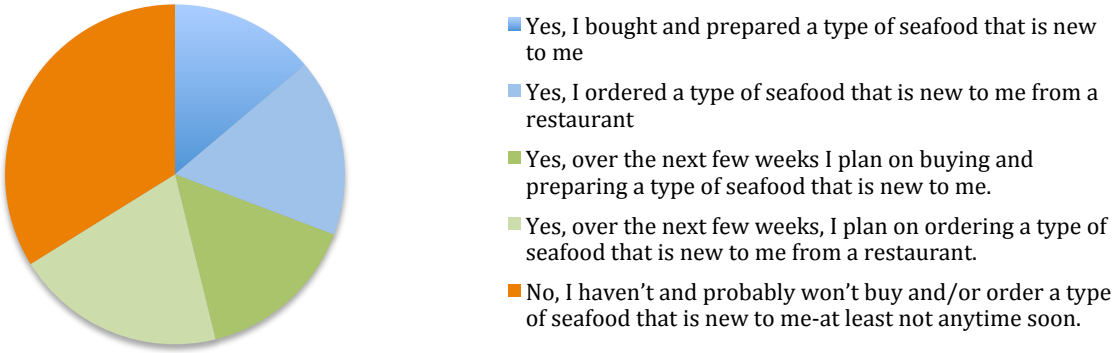


Fig. 8. Proportion of responses from people who were willing or not willing to try a type of seafood that was new to them since attending the 9/7 dockside event. N=65 responses.

Almost 42% of participants said that the 9/7 dockside event inspired and raised their awareness about the waterfront and fishing fleets so that in the 6-8 weeks after the event, they made special trips, gone out of their way and/or paid more attention to the waterfront, boats and docks. Nearly a third more said they had not visited the waterfront in that time, but had thought about doing it. About 10% of participants also talked to and/or bought seafood direct from fishermen in that time period, while 5% had not yet but intended to in the near future.

Seafood supply and producer direct marketing interest

Fishing community participants

The participants (not including partners) in the study were licensed San Diego County Commercial Fishermen from Driscoll's Wharf (14), Tuna Harbor (9), Mission Bay (2) and Oceanside Harbor (1).

Species available and season. The fishermen expressed interest in selling these species. Noted is potential availability for seasonal species.

Year round supply

Nearshore fish
Sardine

Nearshore inverts

Manila clam (f)
Market squid *
Mediterranean mussel (f)
Pacific oyster (f)
Red sea urchin
Rock crabs
Spider crab
Top snail

Seaweed
Red ogo (f)

Seasonal supply

Nearshore fish
California halibut (Mar-Sept)
Sablefish (spr-fall)
Rock cod/rock fish (May-Feb)
Lingcod (May-Feb)
Mackerel (Apr-Sept)
Sandabs (Apr-Sept)
Sheephead (May-Feb)

Open ocean fish
albacore tuna (Apr-Dec)
Bluefin tuna (Aug-Jan)
swordfish (Jun-Jan)
yellowtail (Apr-Dec)
Opah
Mako shark (Jun-Jan)
Thresher shark (Jun-Jan)
white seabass (May-Aug)

Nearshore inverts
Kellet's whelk (Jul-Mar)
Spot prawn (Feb-Oct)
Spiny lobster (Oct- Mar)

Level of processing on the boat & supplies needed to maintain high quality.
All of the invertebrates and a few of the smaller fish (sanddabs, California halibut, sablefish) are kept live on the boat requiring a live well and flowing water on the boat and at the dock. A cover is additionally needed at the dock as well as aeration and tubing. The exception is the Kellet's whelk, which can be kept in cage hanging from the dock. The smaller fish, such as mackerel, California halibut, rock cod/fish, lingcod and sheephead are kept whole and sometimes gutted requiring a cooler or hold with ice on the boat and coolers with ice for transport on land. The larger fish such as tunas, yellowtail, swordfish, sharks, are usually headed, bled, and gutted requiring a large hold with ice. Albacore tuna is sometimes sliced on the boat and put on ice or frozen, while albacore, dorado and wahoo may also be flash frozen whole. Notes were made that both bluefin tuna and swordfish need to be moved quickly to maintain high quality (we assume this is true of most of the species).

Minimum sales required to participate in a direct market. The amount that each fishermen wished to sell at a direct market varied, and often they stated that they wished to sell a few hundred pounds or a few hundred dollars of all fish and shellfish combined (vs. listing amounts for individual species). One participant offers spot prawns and wishes to sell at least 10 lb (which can sell for about $18-20/lb) each week. Four fishermen offered lobster; two wish to sell 2-10 lbs/week, and 2 wish to sell a 100-200 lbs. Sales of crab and Kellet's whelk, available from three fishermen, were grouped in with the desire to sell few hundred pounds or dollars of total seafood. Four sea urchin fishermen expressed interest in direct marketing with two wanting to sell 20-50 lb /week (at $5 /lb) and two wanting to sell 400-500 lb/week. One to three fishermen expressed interest in marketing each of the nearshore fish for a few hundred dollars total or 100-300 lb for all fish combined. Five fishermen have interest in marketing open ocean fish for $500 or more, or 100-

300 lb for all fish. One fisherman who also lands albacore, dorado and wahoo stated that he would sell any amount at a direct market because it's all bonus.

Working with processors. When asked whether they were willing to sell remaining fish to a 3rd party, 7 of 8 fishermen who answered expressed interest in selling fish leftover from direct sales to a 3rd party distributor. Most fishermen (12 of 14), however, expressed displeasure with working with processors because they are "dishonest" and cited actions such as offering unfair prices to the fishermen (too low), buying imports (e.g., from Mexico) and undercutting direct sales prices, stealing customers and buying all of a product so there is not enough for a direct market. The unfair prices particularly come into play when there is only one buyer for a particular species.

Current direct sales by fishermen. Three of 20 participants sell at one or more of San Diego's weekly farmer's markets (Little Italy, North Park, Point Loma) and four more are interested in Farmer's market sales. Two sell or have sold at the Fishermen Farmer's Market next to Driscoll's Wharf and five more are interested (although they stated an inability to attend with current weekday hours of the market). Nine participants sell to one or more restaurants- mostly Japanese, Italian and seafood restaurants; two more would like similar connections. Five sell to grocery stores with three more interested (Vien Dong, Stump's, Trader Joes). Three sold their fish at the Tuna Harbor off-boat sales (Fish Addiction) and six more were interested to join. Two also mentioned an interest in supplying fish to private parties.

Table 1. Estimated range of increase in ex-vessel value of catch sold direct compared with to a 3rd party buyer. N=1-3 fishermen per species, the range of responses is shown for each species.

species	approximate increase in ex-vessel value when sold direct vs. to a buyer
swordfish	0-500%
Spot Prawn	16-25%
spider crab	81-150%
yellowtail	20-100%
albacore tuna	35%
white seabass	50%
sanddabs or fluke	50-100%
sheephead	50-70%
rock crab	65-233%
California halibut	67-100%
sablefish	67-100%
cabezon	67-500%
lingcod	78- 500%
spiny lobster	81-100%
bluefin tuna	100%
barracuda	130-160%
rockfish	150-200%
rockcod	150-200%
thresher shark	150-200%
opah	200-250%
kellet's whelk	200-300%
top snail	200-300%
mako shark	200-300%
red sea urchin	400-500%

Ex-vessel value: direct vs. buyer. Fishermen who were selling direct to markets or restaurants, estimated ex-vessel value of their catch sold both ways revealing consistently higher prices when selling direct (Table 1).

Challenges to selling direct. Only 4 of 20 fishermen answered this question on the survey but 15-20 provided answers when asked verbally. Below is a summation in order of level of agreement among fishermen of both written and verbal answers.

1. Lack of Social Capital. Needed is:
Commitment to establish a reliable and diverse supply for sales
Cooperative responsibility for environmental stewardship
Cooperation to find innovative, productive solutions to management challenges
Help in connecting with other fishermen, market opportunities and /or customers.

2. Lack of infrastructure. Needed are:
Fueling and offloading docks
Processing & storage facilities (HACCP-approved, waterfront)- selling large fish (e.g., 400 lb swordfish) is difficult, need facilities for cutting)
Storage and staging areas (waterfront)
Direct market space

3. Regulations
Limits to fishing ground access
Fishing permits are limited in scope, number and expensive to transfer
Imports flood market and undercut U.S. prices
Permits for fishermen only markets are tricky

4. Personal sustainability.
Long hours/days associated with fishing leaves little to no time to sell direct
Current direct buyers haggle to get lower prices even though prices were agreed upon before

Availability for running a market and advanced notice needed for species.
All 12 participants who answered this question included weekend days, with 10 stating that Sunday would be an ideal day, 4 stating Saturday, one for Friday and two for other week days (some people wrote down more than one day so responses total more than 12.) Mornings and/or afternoons were the desired times for weekend days. Those available on weekdays stated morning or afternoon, with one also citing evening. Fishermen required 1-2 days notice for most of the invertebrates and most nearshore fish. Notice for spiny lobster could take up to a week, and notice for most open ocean species was a minimum of a week. Albacore tuna requires 3-4 weeks notice.

How market organizers can help fishermen prepare for market.
Communication is key for planning, especially because many of the participants would not be able to attend. There was also a request that the market be run by fishermen, and two suggestions that organizers could also advertise the market.

What does "sustainability" mean to you? We asked this as a group question. In general, it was concluded that there is no one "correct" way to define it, it's a complex* moving goal.
(*multivariate, socially hierarchical)

All participants mentioned these criteria:

- local (fresh, lower C footprint)
- population growth/resilience
- economic stability/growth of community & individuals
- personal sustainability

These three general messages emerged with paraphrased comments in italics:

1. Sustainability can't be defined but we know it when we see it.

- *The lower end of sustainability can be defined, the upper end cannot.*

- *Local is always better than not local... even local frozen is better than 3,000 miles away as far as better taste, better for the environment and less fuel. You can determine the amount of fuel needed to bring fish in ("fish miles") and ask "what is the fishery doing to reduce carbon?" Counting fish is crap. Sometimes a species is heavily harvested and the next year it's all back, sometimes there is little harvest but it declines anyway.*

2. Sustainability is a moving target.

Sustainability is not a set standard, it can always be improved. It could be a goal to strive towards, but we should not settle on a definition since situations change. Pretty soon we will be faced with the effects of ocean acidification– with species disappearing. What are fisheries doing about ocean acidification?

3. We must account for personal sustainability.

- Competition within community

It's about personal sustainability. One guy starves and makes it viable for another guy. How starved will a fisherman be before he drops out?

- Lifestyle
  - *I do deliveries after diving all day. I get home at 9-10 pm. Back in water by 7 am.*

  - *Long hours (fishing and then doing own selling), buyers find complaints about fish and then offer me lower prices even though they end up selling fish for same price.*

DISCUSSION

Public demand exists. San Diego has spoken! On 02 August 2014, San Diego's first fishermen's only dockside market, Tuna Harbor Dockside Market, opened for business (THDM 2014). The Port of San Diego estimated more than 1300 people in attendance the first day of the market. As a comparison, the Saturday morning unadvertised off-boat sales that preceded this market generally served 25-40 people during an average morning. While big crowds were expected to be in attendance due to the media attention, a more than 25-fold increase in customers in just one week was truly telling of San Diego's demand for local product. Another sign of the fierce demand for local seafood was that the media deemed the opening of this market incredibly newsworthy with three different press conferences in the two weeks before and during the market opening (see list of media releases associated with this project).

Public demand for direct access to fresh, local seafood exists in San Diego across two socio-economic classes, the Foodies, who have relatively easy access to the waterfront, and the East

African community who has limited access. Seafood currently makes up 25% of foodie diets and 15% of East African diets, down from 25% in East Africa. Further, the variety local seafood is of interest in filling the demand for fresh, sources of Halal meats (Burks 2013). Both groups wanted direct markets to have access to fresh, ecologically responsible, healthy seafood; knowledge of food source; and to support the local economy and fishermen. Both said they were willing to pay more and willing to travel to get local seafood, and they'd be willing to try new types of seafood. Demand for seafood types was also similar between the groups with preferences for familiar species especially processed finfish, and with the potential for interest in invertebrates with increased familiarity. No less than 25% of all participants expressed interest in every species landed in San Diego.

The barriers to buying local, however, differ between the groups and may be related to cultural and socio-economic differences. The foodies were mostly U.S. born and currently live throughout coastal San Diego County. They were mostly middle to upper class, educated professionals, who were, on average (±1SD), 46±15 yrs old. The East African women consisted mostly of working class immigrants now living in mid-city San Diego. Most had some or complete high school education, held clerical and blue collar jobs, and were, on average (±1SD), 33±11 yrs old.

Public barriers. The most common reasons for foodies not buying seafood on a regular, weekly basis were that it can be expensive, that fishing may harm the environment and that seafood is not available in stores frequented. These were, however, ranked between 3.0-3.3 on a scale from 1 (don't agree) to 5 (strongly agree) suggesting that they are generally not strong limiters of seafood sales. The largest barrier to buying local seafood seemed to be that the public's seafood preferences do not match the local supply. The most commonly purchased seafood are all or mostly imported into Southern California and include fresh or frozen salmon, fresh or frozen tuna, canned tuna and shrimp, the same three species most commonly preferred by consumers across the U.S. (NFI 2014.) Many people were unfamiliar with and had not tried most of San Diego's local products, especially invertebrates and less-mainstream fish. This disconnect between seafood choices and local landings could be a function of low availability of local species especially in the small- and large chain grocery stores where most of the foodies shop, and/or people's habits of choosing what is most familiar, which tend to be the imported seafood that dominate chain grocery store selections. Convenience of local seafood access is also a barrier for this group; the main limitations to attending either of two dockside markets on San Diego were distance from home, inconvenient hours and schedule conflicts, not enough parking and traffic.

The East African women also cited expense but more strongly agreed with this (agreement rating of 4.2/5) than the foodies. They also cited the lack of seafood in the specialty stores (often ethnic and Halal) and discount warehouses that they commonly frequent, and that clean up is messy. Having seafood in frequented stores is likely more than a matter of convenience as mobility may be limited for this community. This is further evidenced by 70% of the women stating that they would travel no more than 15 min for local seafood and only 8% said that they would regularly go to a dockside market. Low household incomes and larger families limit the per capita number of vehicles per household (City Data 2014), and therefore transportation available for shopping outside of the neighborhood. Further, cultural norms discourage the women from interacting with men in public and informal conversations revealed that some of the immigrant women are just not comfortable traveling around town. Both factors reduce connectivity between this community and the waterfront, despite being <10 miles away. Finally, 81% of women didn't provide an answer when asked what sustainable seafood meant to them. This indicates that common messages about responsibly sourced seafood (environmental and fishery protections, economic and social stability

of seafood producers; e.g., NOAA 2014) are not reaching this demographic group; and the concerns of this group may not be met by seafood marketing and education groups.

Overcoming public barriers. Barriers can be overcome by addressing mismatches in public demand and local products through increased public awareness of the fishing community and its products.

Raising public awareness increases the value of local seafood**.** People value and are willing to pay more for responsibly sourced ("sustainable") food. By introducing them to San Diego's environmentally, economically and socially responsible producers and the sustainable seafood they provide, appreciation and value will rise. Greater awareness builds interest. Within 2 months of our 9/7 event, 42% of participants visited the docks again and 10% talked to &/or bought fish directly from fishermen when they may not have otherwise. More awareness nurtures adventurousness**.** About 75% of people said that since they learned more about local seafood, they are more willing to try something completely new. Raising awareness changes habits. Seafood preference increases with familiarity; 86% of people said that were more comfortable prepping or ordering a particular seafood once they had tried it.

To better connect mid-city and/or ethnic community groups to direct sources of local seafood, cultural and neighborhood based outreach may also be needed. Consideration of culture in determining and delivering outreach messages will help this community to maintain their culture and make messages more meaningful. For example, cooking demonstrations or classes can feature traditional spices and ingredients with local ingredients. Increasing availability of seafood in neighborhood markets and discount warehouses will improve access and increase interest in local seafood and support of the fishing community.

Seafood supply and the will to direct sell it exists. The public isn't the only one wanting direct sales; fishermen and aquafarmers are enthusiastic about keeping more of their products local and having more face time with the public. Nine fishing vessels and one aquafarm participated in the first day of the Tuna Harbor Dockside Market, compared to the previous single boat operation**.** From this study, we found that diversity of San Diego sourced seafood can be available every month. In particular, producers were interested in marketing at least 10 year round species, and about 20 seasonal species.

Three quarters of fishermen sell or wish to sell at one or more of San Diego's open air markets (farmer's and/or fishermen's markets); 35% fishermen sell or wish to sell at grocery stores, while 55% have or want direct sales with restaurants. All fishermen stated that weekends, in particular morning &/or afternoon, were the best time for a dockside market with most (83%) expressing interest in Sunday due to their availability, low auto traffic, and increased foot traffic (bay visitors, nearby church goers). These preferences alleviate the very concerns of the public interested in visiting dockside markets.

Directly selling even a small proportion of total catch can be more profitable than selling all to a third party. Producers can get from 10 to 500% more for catch by selling direct with highest increases for many of the underappreciated, less-mainstream species (e.g., invertebrates, lingcod, cabezon). Many producers would want to sell ≥100 lbs or ≥$200 of combined product each week at a direct market which seems reasonable given the public demand. A quarter of fishermen would sell 10-50 lb of less-mainstream product taking advantage of the higher direct rate and the chance to harvest less. Most (88%) said they would sell any unsold product to third parties such as processors showing the potential for collaboration and the maintenance of current export markets.

Producer barriers: Unmet needs.

Social capital. All fishermen agreed that the main barrier to directly marketing their products was the lack of producer-based groups committed to establishing a reliable and diverse seafood supply for sales, and to coordinating catch and sales to reduce competition, costs and effort associated with marketing. Most (11 of 14) fishermen stated distrust current processors due to unfair prices, undercutting prices of local using cheaper imports, and would like to take charge of at least some of their own marketing using producers' associations. This indicates that interest in collaboration exists but the organization and establishment of connections may present challenges.

Lack of infrastructure. All fishermen cited a short supply of producer-owned and operated infrastructure, especially on the waterfront, as limiting direct sales efforts. This includes too few fueling and offloading docks, processing and storage facilities (HACCP-approved), tanks and aerators to maintain live invertebrates and smaller fish, storage and staging areas, and direct market space.

Regulations that limit flexibility and innovation. Most fishermen agreed that some current regulations make direct marketing more challenging. Limits to fishing ground access increase time on the water and fuel consumption. Fishing permits are limited in scope, number and are expensive to transfer making it difficult to portfolio fish and gain access to fisheries. Imports flood market and undercut U.S. prices. County and local permits for fishermen-only markets don't yet exist and have been a stumbling block to current efforts.

It was noted that strict regulations are also what makes San Diego's catch so responsible and may be able to be used to market products.

Little personal sustainability. Several fishermen noted several personal challenges as limits to direct marketing. In particular, the scarcity of customers increases competition within the fishing community, where one person's success often means another's decline. Further, long fishing days (or seasons) make it difficult or impossible to add marketing duties including finding customers, haggling over prices, and/or staffing open-air markets.

Overcoming producer barriers.
Barriers can be overcome by building top-down and bottom-up support of the fishing community and its products.

With long hours and many independent operations, San Diego's seafood producers can use help in connecting and with marketing. In particular, they need help with coordination and running of market efforts including dock and facility managers, market staff. The need supporters of a Community Fishing Association that collaboratively finds innovative, productive solutions to marketing (and fishery) challenges. More producer owned and operated infrastructure along waterfront is needed. Help in securing high level political support to find innovative solutions to regulatory barriers (e.g., co-management, portfolio fishing, fishermen's markets). Helping to build grassroots support in the form of sales and speaking out for green and blue economies.

LONG TERM RECOMMENDATIONS
Recommendations come both from the findings of this project and the lessons from the launching of San Diego's Tuna Harbor Dockside Market. As in other areas, there were conversations about a

fishermen's market for at least several years before the opening of the Tuna Harbor Dockside Market (THDM). There were several main barriers that were overcome in that time leading to the opening and initial success of the market.

First, the building of social capital is crucial. In San Diego, this included the establishment of a seafood producer-based entity, Tuna Harbor Dockside Market LLC, to manage and operate the market, and the commitment of a group of producers to contribute a small proportion of weekly harvest to direct sales at the market. Reaching this critical mass of interested producers was due mostly to several dedicated fishermen communicating with and recruiting others, including a couple of producers with experience in developing business plans. A business plan was developed that could then be used to gain the support of the regulatory agencies. Efforts such as this CFR West project helped by bringing together interested fishermen and by disseminating information about direct sales to the fishing community.

Second, the building of stakeholder confidence in the potential success of a direct market helped to gain their commitment. This CFR West project quantified the general feeling that a direct market was in demand by collecting and analyzing supply and demand data, and by bringing together interested parties.

Third, the producers had to work with both San Diego County and the Unified Port of San Diego to solve a permitting impasse. Neither agency had permits for a fishermen's only market, so temporary ones were issued and restructuring of current regulations is underway for the County and possibly the State. The challenge of getting past this impasse was garnering the attention of higher-level officials at these agencies; those with the authority to call for a change in protocol and initiate temporary solutions. In the case of THDM, the growing public and producer enthusiasm for a market that seemed to be stalled caught the attention of the local media who reported the story (Online newspaper: http://voiceofsandiego.org/2014/06/18/whats-stopping-fishermen-from-tackling-the-market-on-dry-land/). This story, and a follow up radio interview with fishermen (P. Halmay, Z. Roach and L. Halmay), in turn caught the attention of the higher-level champions at the Port and the County. Helping was that this market was consistent with a newly launched County initiative, Live Well San Diego, that promotes healthier lifestyles and diets including more seafood. The lesson here is that the support of high-level champions may be needed, and to gain that support there needs to be grassroots demand to raise the profile of the issue, communication with the champions and their organizations, and if possible a clear tie in with the broader goals of the organizations.

Fourth, the producers worked with the Unified Port of San Diego to secure waterfront infrastructure, including a market location on the docks, and nearby facilities (ice, live tanks). Facilities for cutting fish are still being worked out, so the market has so far been whole fish only.

The THDM has been a success so far. Over 1300 people came to the market in the first few weeks after opening. Crowds have subsided somewhat in the 2 months since, but the flow of customers is constant throughout each 4 hr market and all or most fish still sell out. A customer survey administered by the Market after 6 weeks revealed that half the people were still discovering the market and were 1st time visitors while half were returning customers. Almost ¾ of returning customers were now buying 50-100% of all their seafood at the THDM. Over half of the whole crowd was still saying they were more likely to try a new seafood if offered at the market than at their grocery store, and over half said they visited the market to get fresh local seafood, at a lower cost, and to support the local producers. Finally, people are coming from all around San Diego to this market (from 0-over 30 miles away). There has been no formal advertising, only initial media

coverage and word of mouth and social media. Targeted advertising, especially in nearby neighborhoods and in areas where Asian fish markets are common maybe draw in more customers.

LIST OF PUBLICATIONS AND DESCRIPTION OF OUTREACH EFFORTS
Publications and materials.
Raising public awareness. Web-based and hard copy informational materials were developed during this project to provide the public with information about local fisheries (e.g., species fact sheets, know your catch cards, trading cards with web resources, oral histories) and the value of local seafood (e.g., "Why buy local" sheet, blog post) (see http://ca-sgep.ucsd.edu/healthyocean , items 1,3-5; and Appendix 1 for samples). Hard copy sheets were distributed at all events and at the information table at the newly opened Tuna Harbor Dockside Market (Obj. 3).

Reporting back to market stakeholders. We used web-based and hard copy summaries to disseminate study findings and recommendations to study participants and direct market stakeholders, including the foodie public, the East African Community and other mid-city community groups, and those interested in marketing. Summary sheets can be found at the bottom of the project website here: http://ca-sgep.ucsd.edu/docksidemarket.

Outreach efforts.
Follow-up mixer: In collaboration with Slow Food Urban San Diego's Slow Sips Mixer Series, Fish Public- a local seafood restaurant, and San Diego fishermen, we hosted a follow-up event on 19 March 2014 that brought together members of the fishing community, public study-participants, the general public, and the restaurant and food community (total of 76 people: 68 public, 4 restaurant staff, 4 volunteers). We presented background, goals and results of our study in a poster (Fig. 9), and we discussed solutions to barriers and answered questions in an open, informal ('mixer') venue. Newly formed connections between the fishermen and restaurateurs were an extra bonus outcome of the event. Free samples of local seafood prepared by the restaurant's chef were provided to continue to expose the public to local seafood.

Fig. 9. Poster presented at follow up mixer meant to provide an overview of issues and our project, and to initiate conversation.

Follow-up family dockside event. We hosted "Fish Aren't Sticks: A family dockside event" on the Fish Harbor pier, next to the newly opened Tuna Harbor Dockside Market on 16 August 2014 (Fig. 10). This event presented project outcomes and offered four fun activities that educated kids and adults about local seafood species biology (2 different activities), food sustainability (food miles activity), and local marine life and art. This event also offered three kid-friendly seafood tastings (2 chefs made 3 dishes) including a cooking demonstration. This event was hosted in collaboration with: Tuna Harbor Dockside Market, Tijuana River National Estuarine Research Reserve, Alchemy Restaurant and Catering, Chef Jenn of Chef Jenn Cooks, Chef Cindy Quinonez of Scripps Mercy Hospital, Unified Port of San Diego, and Slow Food Urban San Diego. The tasting area hosted 277 people; we limited admission due to limited amount of food, but at least as many were turned away. There were a total of 485 visits to the activity area during the 3 hour period.

Public seminars. PI Talley presented background information on the issue and results of the study at two public venues: Tijuana River National Estuarine Research Reserve System Seminar Series (03/15/2014; 14 participants), and the San Diego Partners for Biodiversity Seminar Series (04/15/2014; 15 participants).

Blog Posts.

- Coverage of the topic: Our Ocean, California Sea Grant blog (03 May 2013): http://caseagrantnews.org/2013/05/03/revitalize-and-become-a-part-of-san-diegos-long-rich-coastal-culture/
- Blog post reporting on the lessons from the first day of the market, August 2014: http://caseagrantnews.org/2014/08/04/fish-market-debut/

Fig. 10 Poster advertising one of our follow-up events aimed at getting families down to the waterfront learning about local seafood species and the fishing community. The event was held in conjunction with the newly opened Tuna Harbor Dockside Market.

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DATA HANDLING AND AVAILABILITY

Raw data files are in MS Excel format and contain no personal information about participants. They will be submitted to CFR West after one year beyond the end date of this project (30 September 2014) to allow time for publication of results. The detailed results in this report will be posted and available for download within four weeks on the PI's website at California Sea Grant.

FINANCIAL REPORT

Changes to Matching funds. We lost the $250 of in-kind use of Driscoll's Wharf for one of the events upon the passing of Cathy Driscoll in June 2013. Our partners from the United Women of East Africa did not uphold our agreement made at the time the proposal was written. They chose to not provide the Amharic translation of surveys as in-kind match ($950), and they requested for more money for the Somalian translation, as well as money for the verbal Amharic translation. We felt strongly that the surveys be accessible to all participants so we agreed to their last minute changes in terms. Luckily, we found 2 University of San Diego students to volunteer at the event- one who is fluent in Somalian and the other in Amharic (they are included in the volunteer calculations below).

Despite these losses of match, the in-kind match provided by Adina's salary still covered the required match amount and, as outlined in "changes to the budget", we received a multitude of in-kind support.

			All Institutions				
A. SALARIES AND WAGES			2013-14 Budget		ACTUAL		DIFF
INSTITUTIONS:	CFR	t-SH	CFR	Cost-Share	CFR	Cost-Share	
Theresa S Talley			5,357	250	7,759		
Adina Batnitzky				5,485		5,485	
TOTAL SALARIES AND WAGES			5,357	5,735	7,759	5,485	
B. FRINGE BENEFITS							
Theresa S Talley			1,709		1,898		
Adina Batnitzky							
TOTAL BENEFITS			1,709		1,898		
TOTAL SALARIES, WAGES, FRINGE BENEFITS (A+B)			7,066	5,735	8,964	5,485	1,898
C. PERMANENT EQUIPMENT							
Theresa S Talley							
Adina Batnitzky							
TOTAL EQUIPMENT							
D. EXPENDABLE SUPPLIES							
Theresa S Talley			9,616		7,860		
Adina Batnitzky			7,014		7,014		
TOTAL SUPPLIES			16,630		14,874		-1,756
E. TRAVEL							
Theresa S Talley			240		98		
Adina Batnitzky							
TOTAL DOMESTIC TRAVEL			240		98		-142
F. OTHER COSTS EXCLUDING TUITION REMISSION							
Theresa S Talley				950			
Adina Batnitzky							
TOTAL OTHER				950			
G. TUITION/REMISSION							
Theresa S Talley							
Adina Batnitzky							
TOTAL TUITION REMISSION							
H. SHIP TIME							
Theresa S Talley							
Adina Batnitzky							
TOTAL SHIP TIME							
I TOTAL DIRECT COSTS *(A THROUGH H)*			23,936	6,685	23,936	5,485	
J. INDIRECT COSTS							
Theresa S Talley							
Adina Batnitzky							
TOTAL INDIRECT COSTS							
K. SUBTOTAL PROJECT COSTS (Line H + Line I)			23,936	6,685	23,936	5,485	

Changes to budget.

We requested two rebudgets during this project. The first on 03 July 2013 to transfer $2000 from UC salary to USD salary for a student assistant, and the 2nd on 21 May 2014 to transfer $1532 from UC supplies to UC salary for student assistant. As reflected in the 2nd rebudget (and no cost extension), we spent $1898 more in salary, $1756 less in supplies and $142 less in travel (see budget table above). As justified in the rebudget and no cost extension request, we ended up with an outpouring of in-kind support from all partners, so we used the fund and the time extension to continue to contribute to our project goal of outreach event by hosting a family dockside event (Fish Aren't Sticks), and by developing webpages that host the informational materials developed throughout this project (fact sheets, fishery information). To accomplish these tasks, we requested that the remaining funds be used for funds for event supplies, printing outreach materials, and salary to hire a Lab Assistant I (Step 2) who helped a) coordinate and run the outreach event, b) finalize several informational sheets, c) create a set of 24 fishery trading cards, d) develop the project website, and e) run an information table at the Tuna Harbor Dockside Market for the first two months after opening.

In kind support from partners and our home institutions is as follows:

- The use of 3 vans from USD to transport East African Women to and from the event on 9/7.
- Volunteers from University of San Diego (6 students, ½ day)
- Volunteers from Mesa College Hospitality Program (4 students, full day)
- Volunteers from Slow Food Urban San Diego (4 people, full day)
- Donations of all produce used in the event from Specialty Produce
- Donations of all shellfish, sea urchin; and discounted price on fish ($4/lb instead of $5.50/lb) from the Tuna Harbor fishermen
- Donation of fish processing services by Ocean Harvest who filleted 30lb of black cod for one of the chefs.
- Donation of 12 lb of smoked assorted local fish for the event by Ocean Harvest.
- Donation and delivery of white seabass from Pacifico Aquaculture
- Chefs who demonstrated cooking and prepared samples for public tasting (10 chefs X ½ day)
- Volunteers from Hubbs Sea World Research Institute (2people X 6 hrs) hosting aquaculture information table.
- Volunteer from Tijuana River National Estuarine Research Reserve and one from UC Santa Barbara who hosted the shellfish information table. (2people X 6 hrs)
- Volunteer from UCSD Public Health who hosted the nutrition table (1 person X 3 hrs)
- Volunteer fishermen (project partner Pete Halmay) who hosted the fishing information table (1 person X 6 hrs)
- Volunteer fishermen who filled in last minute for a chef who had to cancel on us (2 good natured guys X 4 hrs)
- Volunteer from NOAA who hosted the fishery management information table (1 person X 5 hrs)
- Volunteer from California Sea Grant to take photos (1 person x 5 hrs)
- Volunteer from Mesa College Hospitality program to help plan and host the Fishermen's event (1 person X 6 hrs)
- The restaurant Fish Public donated chef time (sous chef 2 hrs, head chef 4 hrs) to prep and cook local seafood, donated wait staff time (4 hrs) to set up and host event, and donation of the use of venue for the follow up mixer.
- Volunteer board member from Slow Food Urban San Diego helped to coordinate and plan the follow up mixer (1 person X 3 hrs).
- Volunteers from Slow Food Urban San Diego who helped with Fish Aren't Sticks event (3 people X 4 hrs + 1 person X 6 hrs)
- Volunteer from CA State Parks who hosted the food sustainability activity at Fish Aren't Sticks event (1 person X 5 hrs)

- Volunteers from Ocean Discovery Institute, Scripps Institution of Oceanography, The Unified Port of San Diego and University of San Diego who helped with the Fish Aren't sticks event (3 people X 6 hrs + 2 people X 9 hrs).
- Volunteer Chefs (2) who donated time (3 hrs on site, ~3 hrs prep) and non- seafood food to provide cooking demonstration and wonderful seafood tastings.
- Donation of 15 lbs tuna, 7 lbs rockfish by Captain Dan and the crew of the F/V Plan B.
- Donation of fish (5 lb sheephead, 5 lb blackcod) by Tuna Harbor Dockside Market
- Donation of time and effort by the Fish Market Restaurant to process 80-90 lbs of whole fish for the Fish Arent Sticks event.

PROJECT MEDIA

- UCSD Coverage of Project Award: Our Ocean (California Sea Grant blog) and Shoreline Newsletter. May 2013: http://caseagrantnews.org/2013/04/30/ca-sea-grant-specialist-to-study-local-seafood/?utm_source=Shoreline+Newsletter+May+2013&utm_campaign=Shoreline+First+Issue+on+CC&utm_medium=archive
- USD Coverage of Project Award:
  - Inside USD. www.sandiego.edu/insideusd/?p=32776
  - USD Press Release: www.sandiego.edu/about/news_center/press_releases/?_focus=2335
- NPR Coverage of the 9/7 Dockside Seafood Event: www.kpbs.org/news/2013/sep/09/fishermen-researchers-gather-string-dockside-fish-/
- Sea Grant coverage of follow up event: http://caseagrantnews.org/2014/03/18/findings-from-san-diego-dockside-fishing-markets-feasibility-study-to-be-presented/
- Slow Food Urban San Diego's announcement of follow up event: www.slowfoodurbansandiego.org/2014/03/march-slow-sips/
- News story on dockside market permitting challenges: http://voiceofsandiego.org/2014/06/18/whats-stopping-fishermen-from-tackling-the-market-on-dry-land/
- Story written by journalism student about demand for and challenges to the market opening: http://jmsreports.org/2014/05/27/san-diegans-bait-hook-for-seafood-market/
- Press release about permitting & impending opening of 1st fishermen's market (10news & 6news cite our stats):
  - http://www.kpbs.org/news/2014/jul/16/open-air-fish-market-coming-san-diego-bay/
  - http://voiceofsandiego.org/2014/07/16/local-fishermen-land-the-big-one-a-dockside-market/
  - http://www.10news.com/news/new-open-air-fish-market-coming-to-downtown-san-diego-on-august-2?utm_source=facebook&utm_medium=referral&utm_campaign=fanpage
  - http://www.sandiego6.com/news/local/Open-air-fish-market-near-Seaport-Village-to-begin-Aug-2-267381111.html
  - http://caseagrantnews.org/2014/07/18/recipe-for-health/
- Press coverage of opening of market, July-August 2014
  - http://www.10news.com/news/open-air-fish-market-near-seaport-village-set-to-open
  - http://www.nbcsandiego.com/news/local/Open-Air-Fish-Market-San-Diego-Tuna-Harbor-Fresh-Catch-267440101.html
  - http://timesofsandiego.com/business/2014/08/01/san-diego-seaside-fish-market-set-open/

Photographs taken throughout this project by the PI and project partners are available upon request of the PIs. Only photos of the East African women and the children will not be shared as per request of the community.

Appendix 1.
Samples of the San Diego seafood informational materials developed during this project.

1. Why buy local handout (http://ca-sgep.ucsd.edu/sites/ca-sgep.ucsd.edu/files/advisors/tstalley/files/why_local_handout.pdf) and blog post (http://caseagrantnews.org/2013/05/03/revitalize-and-become-a-part-of-san-diegos-long-rich-coastal-culture/)

why buy local?

San Diego-sourced commercial seafood

With so many imported options, why buy San Diego seafood?

Environmentally responsible. Lower carbon footprints due to fewer food miles and less processing; Some of the strictest regulations in the world on catch limits and habitat protections; Bolstered stewardship of the natural resources providing our food.

Boosts our local economy. Imports are often cheap due to underpaid labor and a general lack of regulations overseas, and undervalued global transport. Buying local supports fair jobs all along our food supply chain. Although this may result in lower availability and higher prices of local products, we get consistently high marks for sustainability and quality.

Just, healthy and safe food. Locally sourced means fresher product, and we have some of the strictest health and safety regulations in the world ensuring the security of fresh, healthy seafood for our community and of the people who bring it to us.

Coastal identity. Buying local and direct strengthens relationships between San Diego's long line of seafood harvesters and our proud coastal community, which sustains our historic coastal heritage, highlights our identity, and heightens our culinary uniqueness.

Get to know San Diego's catch

San Diego seafood profiles
http://ca-sgep.ucsd.edu/seafoodprofiles

Discover California Commercial Fisheries
http://ca-sgep.ucsd.edu/DiscoverCAFisheries

San Diego Fishermen's Working Group
Search Facebook for this group

California Dept Fish & Wildlife
http://www.dfg.ca.gov/marine/regulations.asp#commercial

NOAA FishWatch
www.fishwatch.gov

Eating local supports the supply of environmentally-friendly, economically-smart, safe and healthy, socially-just seafood!

Sea Grant California

SCRIPPS Institution of Oceanography UC San Diego

Compiled by: T.S. Talley, California Sea Grant; tstalley@ucsd.edu

2. Sample species profile- Red sea urchin (13 species completed so far, each consist of four 8.5x11" pages. Available at: http://ca-sgep.ucsd.edu/seafoodprofiles)

red sea urchin

Strongylocentrotus franciscanus

BIOLOGY FACT SHEET

Photo: Kirt L. Onthank, wikipedia.com

San Diego seafood profiles

Taxonomic description

- An echinoderm, in the marine invertebrate group along with sea stars, brittle stars, and sea cucumbers.
- This largest species of sea urchin can grow to be 18 cm (7") diameter with spine lengths of 8 cm (3") [1].
- Recognizable by its dark red almost black body color and large spines.

Distribution

- Found on the west coast of North America as far south as the tip of Baja California, Mexico [2,3]

Life history

- Spawns year round and peaks June – November in San Diego [3].
- When eggs are fertilized they develop into free-swimming larvae for 6-8 weeks until they settle to the sea floor and become juveniles [1]
- Larval and juvenile growth rates depend on water temperature.
- Can live 200 years [4] but most don't

Habitat

- Lives from lower rocky intertidal to depths of 160 m (525 ft).
- Major food source is kelps, so is common in kelp forests
- In San Diego, main predators include spiny lobster & California sheephead [2]; north of Pt. Conception main predator is the sea otter.
- Sensitive to water temperature changes as well as low salinity.
- Sea urchin feeding removes giant kelp so it can structure the whole forest ecosystem.

References

[1]Red Sea Urchins, *Mesocentrotus franciscanus* ~ MarineBio.org." MarineBio Conservation Society. Web. July 8, 2013. <http://marinebio.org/species.asp?id=45>. Last update: 1/14/2013

[2]Tegner, M. J., P. K. Dayton. 1981. Population structure, recruitment & mortality of two sea urchins (*Strongylocentrotus franciscanus* and *S. purpuratus*) in a kelp forest. Mar Ecol Prog Ser 5: 255-268.

[3]Kato, S, S.C. Schroeter. 1985. Biology of the Red Sea Urchin, *Strongylocentrotus franciscanus*, and Its Fishery. California. Marine Fisheries Review 43: 1-20. http://spo.nmfs.noaa.gov/mfr473/mfr4731.pdf

[4] Ebert, T. 2003. Red sea urchins found to live up to 200 yrs. Science Daily www.sciencedaily.com/releases/2003/11/031106051646.htm

Did you know?

Among their spines, urchins have two other types of arms: suctioning tube feet and claw-like pedicellaria used to grab food, move and clean themselves. Look closely!

Sea Grant California | University of San Diego | UC San Diego

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Compiled by: J. Troyano & T.S. Talley, California Sea Grant; A. Batnitzky, Univ. of San Diego under a grant awarded from Collaborative Research Fisheries Research West

red sea urchin

Strongylocentrotus franciscanus

FISHERY FACT SHEET

Sea urchin fishing boat offloading at Driscoll's Wharf in San Diego Bay

Photo: Pete Halmay

San Diego seafood profiles

Seasonal availability

- In California, available year-round with reduced effort Mon-Thurs from April-Oct[1]

Managing authority

- California Department of Fish & Wildlife regulates the fishery
- California Sea Urchin Commission represents interests of California's sea urchin divers; operates under state law to ensure environmental, economic and social sustainability of the fishery.

Gear type

- Fishers use hookah lines for diving to depths of 12-33 m (40-110 ft)
- Collected by hand from crevices using a rake and placed in a collection basket
- In So. California, red sea urchins must have a minimum test diameter of 3.25" (8.2 cm)

Status of the fishery

- Little sustainability concern for local stocks at current level of exploitation & productivity
- Current efforts partner scientists & local fishers to expand monitoring & attain a "profitable, sustainable, locally managed fishery"[3]
- In 1987, after a 1970's State control effort that left ~75% of urchin population depleted in California[2], the industry initiated a moratorium on the fishery, including limited entry, seasonal closures & minimum size limits.
- Despite there being only 18 urchin divers in San Diego with an average age of over 50yr, no new dive permits can be issued at this time

Potential ecosystem impacts

- Minimal impacts when the management strategy considers: (a) amount of sea urchin relative to kelp biomass. E.g., the local fishery may limit population booms that form sea urchin barrens, areas where all of the kelp has been eaten. (b) the harvest of only high quality ("fat") sea urchins (≤50% of total), which leaves plenty behind to function in the ecosystem and "fatten up".
- In areas with limited rocky substrate, juvenile urchins may depend on the spines of larger, adult urchins for shelter [4] so high harvest rates may affect sea urchin recruitment in these conditions.

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[1] California Fisheries Fund . 2009. California Sea Urchin. California Fisheries Atlas .California Fisheries Fund. http://californiafisheriesfund.org/reso_atlas_urch.html

[2] Good, D. 2012. Fishing with the Urchin King Pete Halmay. San Diego Magazine. www.sandiegomagazine.com/San-Diego-Magazine/June-2012/The-Urchin-King/

[3] California Ocean Protection Council. Nov 2008. The San Diego Sea Urchin Project. www.opc.ca.gov/webmaster/ftp/project_pages/CA_Fisheries/SDWA_Final_Report_NoAppendices.pdf

[4] Nishizaki M.T., D.J. Ackerman. 2004. Juvenile-adult associations in sea urchins Strongylocentrotus franciscanus and S. droebachiensis: Is nutrition involved? Marine Ecology Progress Series 268: 93-103.

[5] Halmay, Pete. "San Diego Sea Urchin Fishery." Personal interview. 12 July 2013.

Did you know?

The California sea urchin fishery began in 1970 and most were exported to Japan until ca. 2000, when the Japanese economic bubble burst and sea urchins became popular in domestic markets

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Compiled by: A. Utter & T.S. Talley, California Sea Grant; A. Batnitzky, Univ. of San Diego under a grant awarded from Collaborative Research Fisheries Research West

red sea urchin

Strongylocentrotus franciscanus

NUTRITION FACT SHEET

Uni appetizer at Baci Ristorante, www.sandiegobaci.com; Photo: Kristen Goodrich

San Diego seafood profiles

Edible portions

- The gonads of both male and female red urchins are a culinary delicacy, known as either "roe,""uni" or "ricci del mar."
- Gonad quality is ranked on the size, color, texture, taste, and firmness [1]

Description of meat

- Roe, or uni, has smooth, buttery texture with a sweet, complex taste

Culinary uses

- Local sea urchin is mostly available live or fresh.
- Cleaning and cracking the test (the shell) is manageable. Instructions can be found in multiple online resources (e.g., [4])
- Sea urchin can prepared many ways: Freshly cracked & eaten from the test, as sushi, like caviar on pasta, rice, seafood, crackers & cheese, as a flavor enhancer in soups, custards, and pasta dishes[2]

Nutritional information

Sea urchin raw (3.5 oz) [2,3]

Nutrition Facts

Serving Size 3 pcs of sushi (100g)

Amount Per Serving	
Calories 120	Calories from Fat 43.2
	% Daily Values*
Total Fat 4.8g	7%
Saturated Fat 0.63g	3%
Cholesterol 290mg	97%
Sodium 220mg	9%
Total Carbohydrate 3.3g	1%
Dietary Fiber 0g	0%
Sugars 0g	
Protein 16g	
Vitamin A -	Vitamin C -
Calcium -	Iron -

* Percent Daily Values are based on a 2000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Omega 3 fatty acids 1.83 grams

Zinc 17.00 ppm

Toxicity report

- No known toxins

Seasonal availability

- Year round

References

[1] Leet, W.S., C.M. Dewees, R. Klingbeil, E.J.Larson, eds. 2001. California's Living Marine Resources: A Status Report. California Dept of Fish and Wildlife. www.dfg.ca.gov/marine/status/status2001.asp.

[2] Fat Secret: All Things Food and Diet. 2013. Uni (sea urchin). www.fatsecret.com/diary.aspx?pa=fjrd&rid=1948231

[3] Pacific Urchin Harvesters Association. 2013. Sea Urchin Nutritional Information. http://puha.org/assets/sea-urchin-nutritional-information.asp>.

[4] Taste with the eyes. 2013. www.tastewiththeeyes.com/2013/03/do-you-know-how-to-clean-a-sea-urchin/.

Did you know?

Fishermen can predict the quality of sea urchins by "reading the bottom", or assessing habitat conditions such as food supply, water movement, replenishment of sea urchins.

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red sea urchin

Strongylocentrotus franciscanus

CULINARY INFO SHEET

STEP 1: CLEAN

Tools:

- Rubber Gloves
- Cutting Board
- Kitchen Shears
- Spoon

Photo Credit: tastewiththeeyes.com [1]

Method:

1. POSITION Using gloves, place the sea urchin on a cutting board with the hole facing you.
2. OPEN Insert kitchen shears into the hole and cut in a shallow circle large enough to fit your spoon.
3. SEPARATE Drain the liquid and organs from the hole.
4. COLLECT Use a spoon to remove the roe (uni) intact.
5. CLEAN Gently rinse the uni under cold water, then drain.

San Diego seafood profiles

STEP 2: PREPARE

Appetizer | Uni Bruschetta

Adapted from Pacific Urchin Harvesters Association [2]

Ingredients (serves 4):

- 1/4 yellow onion, minced
- 1/2 tbsp. dry sherry*

**Non-alcoholic substitution:* orange juice

- 1/2 tbsp. fresh lemon juice
- 1/2 tbsp. cilantro, chopped
- 1 tbsp. extra virgin olive oil
- 2 sea urchin (~10 pieces of uni)
- Pinch of salt and pepper
- 12 slices of baguette

Photo Credit: Flickr | iheartyummy.blogspot.com [3]

Method:

1. In a bowl, combine the minced onion, sherry, lemon juice, cilantro, & 1 tbsp. of olive oil.
2. Gently toss the uni in the mixture, adding salt & pepper to taste.
3. While mixture is marinating, brush the bread slices with remaining olive oil and grill over medium heat until both sides are golden.
4. Slice the toast, top with uni mixture and serve.

Entrée | Uni Pasta

Adapted from Pacific Urchin Harvesters Association [2]

Ingredients (serves 4):

- 2 tbsp. extra virgin olive oil
- 1-2 cloves of garlic, crushed
- Pinch of chili pepper
- 3/4 lb. spaghetti or linguine
- 1 sea urchin
- Pinch of salt
- 2 tbsp. parsley, minced

Photo Credit: Flickr | Casa dell'Albero [4]

Method:

1. In a pot, bring water to a boil.
2. Heat olive oil in a pan and sauté garlic with chili pepper until light golden color.
3. Place pasta in pot and cook according to package directions.
4. As pasta is cooking, mix uni with garlic mixture and sauté for 7-8 minutes, adding salt to taste.
5. Drain the pasta and mix well with uni-garlic mixture.
6. Sprinkle with parsley and serve immediately.

SERVING SUGGESTIONS:

Uni is best eaten raw, sautéed, or baked.

OTHER RECIPE IDEAS:

With soy sauce/lemon over rice; ceviche; risotto; mousse; chowder.

Many dishes may be served using the urchin shell as a bowl.

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References

[1] Lynn, Lori Taste With the Eyes. Available: www.tastewiththeeyes.com/2013/03/do-you-know-how-to-clean-a-sea-urchin/

[2] PUHA. Pacific Urchin Harvesters Association. Available: www.puha.org/assets/sea-urchin-recipes.asp

[3] iheartyummy. Available: iheartyummy.blogspot.com/2013/03/sea-urchin-bruschetta-uni-toast.html

[4] Casa dell' Albero. Available: www.flickr.com/photos/casadellalbero/

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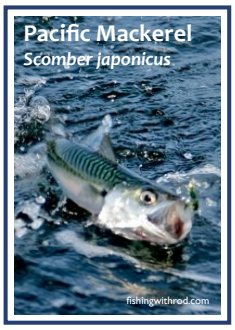
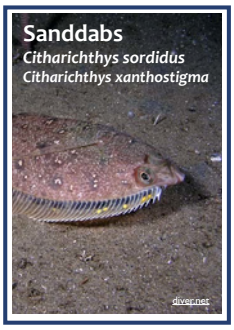
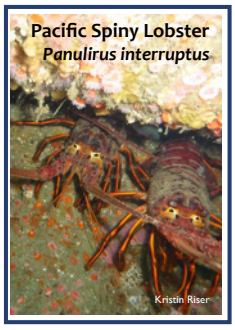
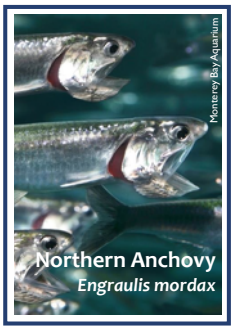
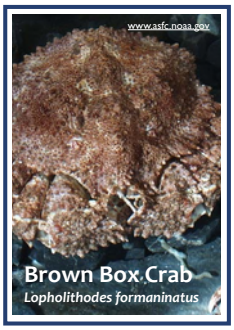
3. Local seafood trading cards with photo of a locally landed species on the front and web site resources on the back. Three pages of eight trading cards (24 species) have been completed. Hard copies are handed out at events and meetings.











4. Know your catch signs. Modeled after the Know California Commercial Fisheries materials developed by California Sea Grant's C. Pomeroy, C. Culver and colleagues. Used in education activities (local seafood fishing game) and posted on magnetic boards during outreach events. 34 cards (species) have been completed.

5. Summary for market stakeholders. This sample was prepared for the East African women; there are two more- one for the general public and a 3 page summary for marketers.

San Diego Seafood

Market Study

A summary for the East African community

Spring 2014

Introduction

As with most urban centers, there is a desire in San Diego for healthier diets and lifestyles, and maintenance of cultural heritage. These needs can be partially met with more access to local fresh, healthy seafood yet there is little to no connection between San Diego's mid-city and the fishing community.

As part of a project to identify the barriers limiting local seafood sourced in our waters from reaching our plates, we held a seafood tasting event at Tuna Harbor on 9/7/2013 for a group of East African Women with the assistance of the United Women of East Africa. Chefs, fishermen, aquaculturists, nutritionists and scientists introduced all aspects of local species, and participants provided information about eating and shopping habits, what they would like to see offered in local seafood sales, and thoughts about sustainability.

A summary of project results is presented here including evidence of a demand for San Diego seafood bought directly from producers, barriers to buying local, and suggestions for overcoming barriers.

Project scientists
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Synopsis

1. There is demand for local seafood, especially fish and some 'new' species given the chance to try them.
2. Inconvenience in accessing and preparing seafood, expense, health concerns, and unfamiliarity with local seafood limit local seafood consumption in this community
3. Addressing barriers will require a combination of outreach & communication, cultural sensitivity and increased accessibility within neighborhoods.

Demand exists

Top 5 motivations for buying local are healthy and fresh protein, knowing source of food, saving money, reducing food miles, access to cooking demonstrations.

Fish preferred. Of the locally landed species, participants most preferred yellowtail (preference rating of 4.2/5) bluefin tuna (3.8), sablefish (3.5), and swordfish (3.25). Over half of participants said, however, that they would eat white seabass, rock crab and red ogo seaweed again now that they'd tried it.

Amounts wanted. 31% of people said they'd buy 4-6 lbs, 23% said 2-4 lbs and 46% said 2 lbs or less of seafood per visit. Most said they'd buy for 3-4 people (40%) or 5 or more people (36%). 75% said they'd buy 2 or more species, and that they currently buy seafood monthly or more frequently.

Willingness to pay. Over 1/3 said they'd pay 20% or more for local seafood, 20% would pay 10-20% more and 15% would pay 5-10% more.

Barriers to buying local

Why don't people buy more fish? The main reasons given are that seafood is too expensive (agreement rating of 4.2/5), is not in stores commonly frequented (4.3), is messy (3.3), is not usually appealing (3.1), and may contain contaminants (3.0).

Food habits don't match local supply. The most commonly purchased seafoods are imported to Southern California and include fresh or frozen salmon (39% of responses), canned tuna (23%), tilapia (14%), catfish/swai (8%), and fresh or frozen tuna (8%) (see shopping cart).

Inability to travel. 70% of people said they'd travel less than 15 min for local seafood, and only 8% said they'd go every week or two.

Uncertain about "sustainable seafood." 81% didn't provide an answer when asked what sustainable seafood meant to them. Of the responses received, human health (seafood safety and nutrition) was included in 9% of answers, and aspects of food justice (access, affordability and variety) were included in 6% of answers. This indicates that common messages about responsibly sourced seafood (environmental and fishery protections, economic and social stability of seafood producers) are not reaching this demographic group; and the concerns of this group are not being met by seafood marketing and education groups.

Overcoming barriers

Raise public awareness about the value of buying San Diego seafood (responsibly sourced, supports the local economy) and the safety of local seafood can address several barriers, including the lack of familiarity with local species, health and toxicity concerns, and uncertainty about sustainability.

Cultural based outreach. Consideration of culture in determining and delivering outreach messages will help this community to maintain their culture and make messages more meaningful. For example, cooking demonstrations or classes can feature traditional spices and ingredients with local ingredients.

Encourage grassroots solutions. Create bottom-up pressure for a diversity of local seafood species. Encourage adventurousness: take an outing to the docks, and try new seafoods. Even a little of a diversity of seafood is healthy for you, the environment and the economy.

Neighborhood seafood. Increasing availability of seafood in neighborhoods and in frequented markets will improve access and increase interest in local seafood and support of the fishing community.