

# Fishing to live or living to fish: Job satisfaction and identity of west coast fishermen

Daniel S. Holland, Joshua K. Abbott, Karma E. Norman

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**Abstract** Fishing is a dangerous and financially risky way to make a living, but it attracts many participants that prefer it to higher paying and safer jobs. Based on a survey of over 1400 U.S. West Coast fishing vessel owners we use factor analysis and structural equation modeling to quantify distinct latent variables representing job satisfaction related to non-monetary versus monetary aspects of fishing and measures of identity and social capital associated with being a fisher. We show that these latent variables have distinct effects on (stated) fishery participation behavior and that higher non-monetary job satisfaction, social capital, and identity, are associated with a willingness to forgo higher income to be a fisher. Understanding how these factors affect and are affected by participation in fisheries could be important to increase benefits from fisheries and to ensure sustainability of management regimes that rely on indirect controls on effort to limit catch.

**Keywords** Factor analysis · Fisheries · Identity · Job satisfaction · Social capital · Well being

## INTRODUCTION

Fishing is often a difficult way to make a living. It is physically demanding and, in the US, has a fatality rate more than 30 times higher than the average across all occupations (Bureau of Labor Statistics 2011). In addition, fishers' incomes often swing widely from year-to-year creating substantial financial risk (Kasperski and Holland

2013). Nevertheless, fishing draws many participants who say they prefer it to higher paying jobs. Understanding the non-monetary motives for fishing as an occupation, and ties to fishing as way of life, can help fishery managers better understand fishers' decision-making and the benefits fishers and communities derive from fisheries. A failure to recognize and quantify non-monetary individual and social benefits may lead to the selection of policy and management actions that are suboptimal (Pollnac and Poggie 2006; Coulthard et al. 2011; Plagányi et al. 2013; Poe et al. 2014). Ignoring non-economic benefits and motivations for fishing may also bias predictions of participation based solely on expected profits. The tendency to reduce or drop out of fishing when profitability declines may be overestimated, thereby undermining management regimes that rely on indirect controls of effort (e.g., license limits, gear restrictions, trap limits, season length) to limit catch and ensure sustainability (Durrenberger 1997; Anderson 1980; Cinner et al. 2009; Crosson 2015).

Participation in commercial fisheries is motivated by a mix of economic, psychological, and social factors that extend well beyond the provisioning of income. It has long been argued that fishers garner non-monetary benefits from fishing (Anderson 1980) that may keep them from taking other better-paid work. This "satisfaction bonus" should arguably be considered an economic benefit similar to the consumer surplus derived from recreational fishing or other activities done for enjoyment. There is a longstanding literature showing that fishing attracts participants and contributes to their wellbeing in ways that differ from alternative occupations (e.g., Poggie and Gersuny 1974; Durrenberger 1997; Anderson 1980; Smith 1981; Hanna and Smith 1993). Subsequent studies across multiple regions have consistently identified non-monetary motivations as important determinants of job satisfaction for

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fishers, but also have shown that they can vary substantially across categories of fishers based on species, gear, vessel type, and commercial and recreations sectors (Apostle et al. 1985; Gatewood and McCay 1990; Binkely 1995; Pollnac and Poggie 2006; Pollnac et al. 1975, 2015). This variability has implications both for predicting participation behavior (e.g., entry and exit) and for understanding how management actions that change the nature of fishing (e.g., individual quotas replacing a derby) may affect the well-being of participants (Breslow et al. 2016; Hicks et al. 2016). Most of these studies find that fishers tend to prioritize characteristics of their occupation that satisfy needs related to self-actualization and esteem and, consequently, choose fishing over occupations with higher income and less physical risk. Within the set of job characteristics that have been categorized as self-actualization are some that pertain to personal tastes (e.g., working outdoors, being out on the water, challenge, adventure), and others that may be more molded by social norms in one's family, community and perhaps industry—including “identity as a fisherman” and “doing something worthwhile” (Gatewood and McCay 1990).

Akerlof and Kranton (2000, 2005) distinguish between tastes and identity, arguing that identity is a social creation associated with an individual's perceived membership in a group that brings with it the expectation of acting in accordance with associated social norms. They propose a general model of behavior that posits that people have identity-based payoffs for their actions and those of others that are important in understanding behavior. Actions that run counter to the social norms associated with one's sense of identity create disutility that can cause an individual to act in ways that differ from what they would choose based on their personal preferences alone. Akerlof and Kranton use their model to explain how identity may reinforce otherwise counterproductive or inefficient behavior. Identity tied to fishing may help to explain fishing participation choices that appear inconsistent with profit maximization. Understanding the role of identity and other non-monetary motivations for fishing participation decisions can help to create a structural bridge between the, often separate, analyses of social processes in fishing communities and economic modeling of participation behavior in fisheries.

Maintaining or investing in fishery-related social capital may also be an important determinant of fishery participation, particularly the resilience of fishers and their tendency to remain in the fishery after downturns in fish availability and fishery closures. Putnam (2000) describes social capital as the value of relationships, networks, and public participation. Dasgupta (2005) proposes a tighter and more easily measurable definition of social capital—namely “interpersonal networks.” Social capital may increase short-term individual and community resilience by

enhancing social networks for reciprocal aid that ultimately offset the challenges of uncertainty and exogenous shocks in fisheries-dependent contexts (Bodin and Crona 2009; Ramirez-Sanchez and Pinkerton 2009). Communities that are home to a relative abundance of fishers, fishing activities and fishing infrastructure are frequently centers for fisheries-oriented social capital (Jentoft 2000; Hall-Arber, et al. 2001; Grafton 2005), maintained through the communication, interaction, social networks, and sharing of food associated with fishing activities (Gatewood 1984; Orth 1987; Schumann and Macinko 2007). However, Dasgupta (2005) notes that social capital can have negative consequences in some cases leading to lower efficiency in deployment of capital (including human capital) and maladaptive behavior. Since the degree and type of interaction (e.g., information sharing, competition) can vary across fisheries, we might find differences in social capital across participants from different fisheries. We posit that fishery-related social capital and identity are often closely related. However, it is possible that some fishers will identify strongly as a fisher without having substantial fishery-related social capital and vice versa.

Commercial fisheries on the West Coast of the U.S. employ over 2800 vessel owners and an unknown, but much larger, number of crew who fish in a variety of fisheries managed by both federal and state agencies. Understanding what drives these fishers to enter, exit, and move between these fisheries is important to ensure that West Coast fisheries are managed sustainably and in a way that generates the greatest benefits for participants and coastal communities. Many of these fisheries have highly variable productivity and consequently exhibit large swings in effort, catch, and revenues. Some are subject to occasional and unpredictable closures, including Dungeness crab closures to protect consumers against toxic algal blooms and salmon closures to protect endangered wild salmon runs. Most West Coast fisheries are managed with indirect controls such as limits on licenses and gear deployment (e.g., pot limits for crab), but most also have substantial latent effort (unused or partially used licenses) that could be activated. Many fishers, particularly the more active ones, fish in multiple fisheries and may have some ability to transfer effort between them. Shifting effort in, out, and between fisheries impacts sustainability and the benefits derived from these fisheries, but the drivers of this behavior are not well understood. Information on gross earning of vessels is regularly collected, but managers know little about non-monetary motivations for participation, fisher related social capital and identity, or how fishers supplement income with other work that may influence whether and when they fish.

In 2017 we conducted a survey of over 2800 commercial fishing vessel owners that had marine commercial landings

in 2015 or 2016. Utilizing responses to a range of survey questions, we use factor analysis and structural equation modeling to identify and predict latent variables that measure job satisfaction, social capital, and identity for individual fishers and draw upon these predictions to test several hypotheses. We hypothesize (1a) that fishers with high job satisfaction related to non-monetary benefits from fishing (e.g., self-actualization and personal tastes for job characteristics such as working outdoors) will be more likely to continue fishing in less profitable conditions than fishers with lower non-monetary job satisfaction. In contrast, (1b) fishers with high job satisfaction tied to earnings and livelihood may be more likely to switch to another occupation or fishery when fishing becomes unprofitable. We hypothesize (2) that fishers that strongly identify as fishers or have high fishing social capital will also be less likely to leave fishing for other employment. We hypothesize (3) that it is possible to distinguish between personal tastes for fishing versus socially influenced identity and social capital as determinants of fishery participation. Fishers that have family or social ties in their fishing community (i.e., and consequently fishery-related social capital) may feel compelled to adopt socially-constructed behavioral norms consistent with this identity (Van Ginkel 2001). For example, they may continue fishing to provide employment for crew even when fishing is not profitable for the vessel. We hypothesize (4) that distinct fisheries and fishery gear types are associated with different levels of job satisfaction, identity, and social capital due to the characteristics of the fishing itself and to the social ties and communities associated with the fisheries. This may help explain differences in relative stickiness of entry-exit processes across fisheries.

Our study extends the existing literature in a number of ways. While there have been a number of surveys of fishers' job satisfaction (e.g., Apostle et al. 1985; Gatewood and McCay 1990; Pollnac and Poggie 1988, 2006), our sample is substantially larger than past surveys in terms of number of participants, geographic range, and diversity of fisheries. Extending beyond prior research, we collect and evaluate information about identity and social capital and explore how these relate to each other and to job satisfaction. Finally, by including questions about behavior and matching supplementary observations of actual participation to survey data, we are able to test behavioral hypotheses related to job satisfaction, social capital, and identity. Our analysis provides valuable insights into why participation decisions may appear to depart from economically rational behavior. It suggests that non-monetary motivations for fishing may keep people from exiting when profitability declines, which could lead managers to under predict fishing effort. Also, policies that maximize profits (e.g., by driving consolidation and forcing exit of less

efficient fishers) could reduce benefits even while increasing profits to the extent that these less efficient fishers were deriving non-monetary benefits (e.g., job satisfaction) from the fishery.

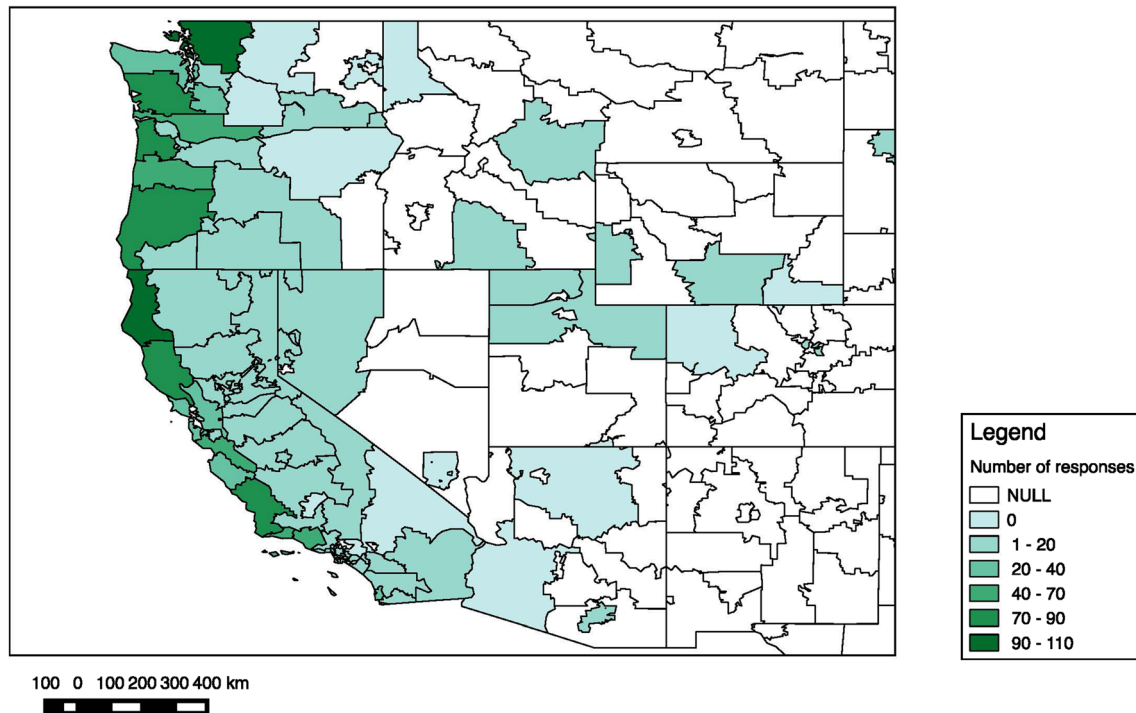
## DATA AND METHODS

We identified 2842 unique vessel owners with commercial fisheries landings in Washington, Oregon, and California during 2015 or 2016. We conducted a mail survey of all 2842 using the standard Dillman (1978) approach beginning with an advance postcard followed by an initial survey mailing, a follow-up postcard, and a second mailing to those who had not returned surveys. The survey was pre-tested (with approximately 10 survey completions and follow-up discussions) to ensure questions were understood. The pre-tests indicated the survey could be completed in less than 20 min. We included a \$5 bill in the envelope with the initial survey as well as a postage paid return envelope. We received 1437 completed surveys—over a 50% response rate. Pearson Chi square tests found no evidence of response bias based on several respondent characteristics including vessel length, horsepower, annual revenue, geographic area based on the first three digits of the zip code, or the number of individuals surveyed in 3-digit zip code areas. The survey instrument is included as an Online Appendix S1.

Respondents are mostly from coastal areas of Washington, Oregon, and California but some reside in interior areas and a few from interior states (Fig. 1). Around 25% of respondents reside in Washington, 17% in Oregon, and 55% in California. Our respondents had a mean age of 58 years, with more than 50% over 60 years of age. Perhaps unsurprisingly, given their age, over 64% of respondents live in households with two or fewer members. More than 73% of respondents have fished for over 20 years and over 96% still captain their own vessel at least occasionally (72% always, 17% mostly, 7% sometimes). Over 71% of respondents obtain more than half of household income from fishing; however, multiple income sources are the norm, with only 33% of households deriving all their income from fishing. Around 53% personally contribute non-fishing income to their household, and, for 29%, more than half of their personal contribution to household income is from non-fishing sources. Over 90% indicated they had health insurance.

We asked a number of questions designed to measure the strength of respondents' preference for fishing as an occupation and non-monetary motivations for fishing. Over 93% of respondents indicated that they prefer fishing to an alternative hypothetical job with the same pay. Less than 35% indicated they would switch to a non-fishing job even

### Number of Responses: Pacific NW



**Fig. 1** Number of responses by first 3 digit zip code areas

if it paid up to 50% more. Though more than half of these vessel owners are over 60 years old, 89% still captain their own vessel always or most of the time. 56% of respondents said they had sometimes fished in order to provide employment for crew when they thought profits earned might fail to cover vessel expenses.

We included a question on job satisfaction that assessed the level of satisfaction on a 5 point Likert scale with 14 potential attributes of commercial fishing (Table 1). The list of attributes was adapted from Pollnac and Poggie (2006) and other studies of fishery job satisfaction (e.g., Gatewood and McCay 1990). We also asked a number of questions intended to construct measures for fishery-related social capital and the strength of fishery-related identity (Table 2). Our approach to measuring social capital reflects Dasgupta’s (2005) definition, “interpersonal networks”, and draws from work by Holland et al. (2013) in New England fisheries and from survey-based methods of measuring social capital developed at the World Bank (Krishna and Shrader 2002; Grootaert et al. 2004). Social capital is sometimes measured by the number or density of social connections using a network approach, but eliciting data for such measures is expensive and time consuming for large samples. Our approach relies on responses to questions about the proportion of family and friends in fishing and length of personal and family history in fisheries. We use these to derive a measure of fishing

**Table 1** Factor loadings on job satisfaction questions using standard and polychoric factor analysis

Variable	Standard factor analysis		Polychoric factor analysis	
	Factor1	Factor2	Factor1	Factor2
Adventure of job	0.74	− 0.13	0.82	− 0.14
Challenge of job	0.73	− 0.05	0.81	− 0.06
Working outdoors	0.68	− 0.26	0.78	− 0.29
Camaraderie with crew	0.53	− 0.02	0.61	− 0.06
Being on the water	0.67	− 0.21	0.78	− 0.24
Competing with others	0.50	0.19	0.56	0.17
Doing something worthwhile	0.70	0.05	0.79	0.04
Producing healthy food	0.59	− 0.04	0.70	− 0.05
Pitting skill against nature	0.63	− 0.02	0.72	− 0.03
Being my own boss	0.63	− 0.17	0.75	− 0.10
Working my own schedule	0.61	− 0.10	0.72	− 0.02
Earnings from fishing	0.40	0.53	0.47	0.57
Predictability of earnings	0.34	0.61	0.37	0.66
Job safety	0.38	0.30	0.44	0.29
Eigenvalues	4.95	0.94	6.48	1.06
Cumulative variance	0.80	0.95	0.78	0.90

community oriented bonding social capital which is inward looking and tends to reinforce identities and homogeneous groups (Putnam 2000). In our case we consider bonding

**Table 2** Factor loadings on social capital and identity questions using standard and polychoric factor analysis

Variable	Factor analysis		Polychoric factor analysis	
	Factor1	Factor2	Factor1	Factor2
Being a fisherman is important	0.65	– 0.29	0.76	– 0.31
Continuing a family tradition of fishing important	0.67	0.09	0.76	0.05
My fishing community is important	0.80	– 0.31	0.85	– 0.35
Continuing a community tradition of fishing important	0.80	– 0.28	0.85	– 0.32
Fishing is a respected occupation where I live	0.51	– 0.18	0.57	– 0.24
Total number of years fished	0.20	0.22	0.28	0.32
Immediate family in fishing industry	0.33	0.59	0.40	0.61
Extended family in fishing industry	0.35	0.60	0.43	0.63
Proportion of acquaintances in fishing industry	0.33	0.15	0.40	0.11
Generations of fishing in family	0.38	0.53	0.44	0.58
Gives seafood to friends and family	0.13	0.00	0.17	– 0.04
Eigenvalues	2.95	1.35	3.73	1.60
Cumulative variance	0.76	1.12	0.71	1.01

social capital relating to the number and strength of connections with other members of a fishing community (Holland et al. 2013) which is consistent with definition of social capital proposed by Dasgupta (2005). We also included several questions about the importance of fishing and the fishing community to the respondent to measure the strength of fishery-related identity. We would expect social capital and identity to be related for many fishers, but social capital relates to relationships with people centered around fishing, while identity is a subjective internal value concept relating to personal values. Identity is likely to be influenced by social ties and social norms within the fishing community and may reflect the individual's subjective valuation of the importance of their social capital. However, an individual with a strong fishing-related identity need not necessarily have extensive relationships in the fishing community and vice versa.

Following previous studies of job satisfaction in fisheries, we conduct an exploratory factor analysis of the job satisfaction questions in an attempt to aggregate them into a smaller number of latent variables reflecting distinct dimensions of job satisfaction. We also use exploratory factor analysis to provide an initial indication of which variables to select to provide measures of fishery-related social capital and identity. All statistical analysis is performed with STATA™ MP Version 15.1. Because the job satisfaction data are responses to Likert scale questions which provide only ordinal rankings, a standard factor analysis, which assumes data are cardinal and normally distributed (e.g., Apostle et al. 1985; Gatewood and McCay 1990; Pollnac and Poggie 1988, 2006) could yield biased or inaccurate results (Holgado-Tello et al. 2010). Therefore, we also conduct a polychoric factor analysis. Polychoric

factor analysis treats the response variables ordinally, effectively running an ordered logit or probit regression to determine the relative spacing of the variables to convert them into cardinal variables before determining factor loadings. Polychoric correlation analysis has been shown to provide more robust and accurate estimates of correlation for ordinal data such as Likert scale questions (Holgado-Tello et al. 2010).

Drawing upon insights from the exploratory factor analysis, we then use STATA's structural equation modeling package to conduct a confirmatory factor analysis (CFA) to estimate and predict latent variables that best represent distinct aspects of job satisfaction (defined as Job Quality and Livelihood aspects) and fishery-related social capital and identity. Final models are estimated with STATA's Generalized Structural Equation package (GSEM) to allow for correct error structure of the ordinally scaled variables. GSEM also allows us to estimate the different latent variables simultaneously, allow for correlation between them, and test whether that improves model fit. We rely upon a combination of Lagrange multiplier tests for the statistical significance of the constrained parameters, Cronbach's alpha tests of index reliability, and log likelihood comparisons of alternative nested specifications to determine which observed variables to include in the estimation of latent variables. Predicted latent variables of job satisfaction, social capital, and identity based on the estimated factor loadings are calculated and then normalized by the standard deviation of each so that the scaling of the variables is comparable.

We then evaluated whether the latent variables for the two components of job satisfaction, social capital, and identity were significant predictors of responses to



questions that may indicate fishers are less likely to substitute non-fishing employment for fishing when profitability in the fishery declines or closures occur (hypotheses 1–3). We use either binary logit or OLS regressions (depending on whether the response variables were ordinal or cardinal). These regressions included responses to the following survey questions:

- Q1. Whether, given the choice between fishing and an alternative job for which they are qualified, they would prefer fishing or the alternative job if the expected pay for both was the same (binary logit);
- Q2. Assuming they preferred fishing in the previous question, how much more (in percentage terms) the other job would have to pay for them to prefer it over fishing (OLS regression)<sup>1</sup>;
- Q3. Whether respondents had ever continued fishing in order to provide employment for crew when they thought the profits earned by the vessel might fail to cover expenses (binary logit);
- Q4. Whether the individual had worked in a job or business other than commercial fishing in response to a fishery closure (binary logit).

Finally, to test hypothesis 4, we evaluate how scores for the normalized indicators representing social capital and identity, and the two components of job satisfaction vary across fishery participation patterns using a series of simple OLS regression with the latent variables as dependent variables and shares of fishing revenue coming from different state-fishery combinations as explanatory variables. These revenue shares are calculated from vessel-specific landings records (fish tickets). Although we use regressions to examine the relationship between fishery participation and social capital, fishing identity and job satisfaction, we are not attempting to develop a predictive model for these measures or positing that participation in a particular fishery causes them. Instead, we use the regressions to explore how social capital, identity, and job satisfaction scores are associated with fisheries participation patterns (similar to an ANOVA analysis). Share of revenue from a particular fishery serves as a proxy for relative importance of that fishery to each individual in terms of income and presumably participation. Revenue shares are based on the proportion of total fishing revenue from 2015 and 2016 associated with different coarsely defined fisheries (Dungeness crab, salmon, albacore, groundfish, and “other”) in either Washington, California, or Oregon. Revenue shares for these state-fishery combinations add up to 1.0 for each

<sup>1</sup> This question allowed fishers to choose from 5 ascending ranges of pay increase for the outside employment (1–10% more, 11–25% more, 26–50% more, 50–100% more, >100% more) as well as an option to say “they would never choose another job.”

participant. About half of the respondents only participated meaningfully (> \$1000 in revenue) in one fishery so their revenue share for that fishery is 100%. Around a quarter participated in two fisheries and another quarter in three or more fisheries. However, more than three-quarters of respondents got 75% or more of their revenue from one fishery.

In addition to the state-fishery revenue shares in the regressions, we include the Shannon Index (SI) calculated using fishery revenue shares as a measure of fishery diversification. The SI for vessel  $j$  is calculated as  $SI_j = -\sum_i [p_{ij} * \ln(p_{ij})]$  where  $p_{ij}$  are the proportions of annual revenue from each fishery  $i$  for vessel  $j$  as defined by Kasperski and Holland (2013). We use the average SI for each vessel rather than the most current year value as it better reflects the long-term diversification of the vessel rather than simply the fishing choice made in a particular year. Diversification of fishery income across multiple fisheries has been shown to be correlated with lower year-to-year variation in revenue (Kasperski and Holland 2013; Holland et al. 2017) which we might expect to impact job satisfaction, particularly the livelihood measure. We might also expect fishers that are diversified to have broader social networks and perhaps more intense ties to fishing since diversification is correlated with fishing a greater proportion of the year and would likely bring individuals into contact with a larger and more diverse set of other fishers.

## RESULTS

### Exploratory factor analysis

With both standard and polychoric factor analyses we identify 2–3 distinct factors from the job satisfaction question (Table 1). The first factor, which explains close to 80% of the variance in the data, has strong loadings on most non-monetary characteristics of fishing. We refer to this factor as “job quality.” A second factor, explaining almost 15% of the variance has strong loadings on earnings, predictability of earnings, and job safety. We refer to this as a “livelihood” job satisfaction indicator. A third factor (not shown) has strong loadings on “being my own boss” and on “working my own schedule” but the eigenvalues for this factor are only 0.60 and 0.67 respectively for standard and polychoric factors analysis and these variables also have strong loadings on the first factor. Notably, loadings from the standard factor analysis and polychoric analysis are qualitatively similar for all three factors.

A factor analysis of questions related to social capital and identity reveals two distinct factors (Table 2). The first

factor explains 76% (71%) of the variance for the standard (polychoric) factor analysis. It loads heavily on the first five questions in Table 2 which asked about the importance to the individual of fishing and fishing community and also a question about whether fishing is considered a respected occupation where they live. These questions were included in the survey as a means of measuring fishery-related identity. The second factor, which explains 35% and 30% of variance respectively for the two models, loads heavily on personal and family involvement in fishing – potential indicators of fishery-related social capital. Again, loadings are qualitatively similar for the standard and polychoric factor analysis.

### Confirmatory factor analysis and structural equation modeling

The CFA analysis suggest that two distinct factors, estimated jointly to allow for correlation between them, best explain the latent job satisfaction variable in the data (loadings shown in Table 3). We took a similar approach to the questions proposed to measure social capital and identity. Based on the exploratory factor analysis, we anticipated that the first five questions in Table 2 would provide measure of identity and the remaining questions in Table 2 would provide a measure of social capital. Our analyses confirm that the first five questions did fit well together as a distinct latent variable, but that the proportion of acquaintances in the fishing industry should also be included in this metric of fishing identity (see Table 4 for factor loadings). The Lagrange multiplier Cronbach's alpha tests suggest that this variable should also be included in estimating the social capital latent variable along with the questions related to personal and family involvement in fisheries shown in Table 4. However, the question about importance of sharing seafood with family and friends was dropped from the social capital index due to a lack of significance in the structural equation model.

Figure 2 presents distributions of the standardized indicators from the structural equation model. All four indicators have extensive variability about the mean. Social capital has a positive skew, with a significant minority possessing much higher measures of social capital than the median fisher. All four indicators, while clearly distinct, are positively correlated. Fishing social capital and identity are fairly tightly linked ( $\rho = .374$ ), but there is a high degree of variability (and perhaps bi-modality) in the distribution of identity at low to average levels of the social capital index. The two metrics for job satisfaction, job quality and livelihood, have stronger correlation ( $\rho = .58$ ), showing that job satisfaction tends to agree along monetary and non-monetary dimensions. Interestingly, the job satisfaction metrics are only weakly correlated with social capital—

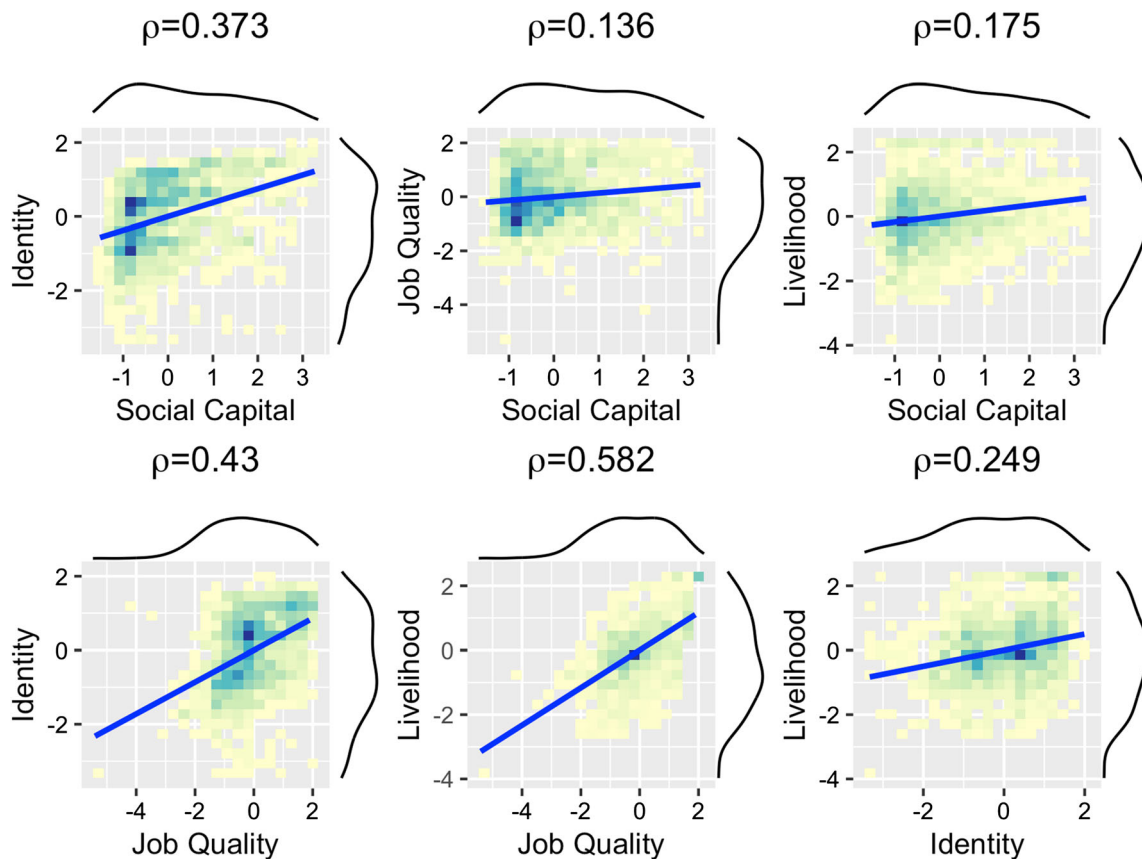
**Table 3** Latent variable loadings for job satisfaction from confirmatory factor analysis

Variable	Loading
Job quality satisfaction	
Adventure of job	1.00
Challenge of job	0.96
Working outdoors	0.95
Camaraderie with crew	0.47
Being on the water	0.84
Competing with others	0.41
Doing something worthwhile	0.76
Producing healthy food	0.64
Pitting skill against nature	0.64
Being my own boss	0.73
Working my own schedule	0.62
Livelihood job satisfaction	
Earnings from fishing	1.00
Predictability of earnings	0.94
Job safety	0.40

**Table 4** Latent variable loadings for social capital and identity from confirmatory factor analysis

Variable	Loading
Identity	
Being a fisherman is important	1.00
Continuing a family tradition of fishing important	0.65
My fishing community is important	1.83
Continuing a community tradition of fishing important	1.80
Fishing is a respected occupation where I live	0.52
Proportion of acquaintances in fishing industry	0.23
Social capital	
Total number of years fished	2.09
Immediate family in fishing industry	2.60
Extended family in fishing industry	3.48
Proportion of acquaintances in fishing industry	1.00
Generations of fishing in family	2.26

perhaps not surprisingly since social capital is largely a stock measure reflecting past investments in fishing and fishing relationships, including family relationships within fishing families. However, identity is more highly correlated with job quality ( $\rho = .43$ ) and livelihood satisfaction ( $\rho = .25$ ).



**Fig. 2** Joint distributions of predicted indicators of identity, social capital, job quality, and livelihood ( $N = 1443$ ). Darker colors indicate areas of greater concentration. The margins of each panel present the marginal density of each variable

### Impacts of social capital, identity and job satisfaction on stated behavioral responses

Over 93% of respondents indicated that they would prefer fishing over another occupation with equal pay (Q1). Of this subsample, over 32% indicated that they would “never choose another job.” A binary logit model with the dependent variable taking a value of 1 for respondents who indicated they would never choose a job other than fishing (Q2) suggests that this response is associated with both higher social capital scores and job quality scores (Table 5). In other words, individuals with high levels of social capital and non-monetary job satisfaction are resistant to exiting fishing for outside employment, regardless of the pay, which is consistent with Hypotheses 1a and 2. An alternative explanation is that this response may indicate the individual simply rejected the compensatory scenario in the question—refusing to consider the tradeoffs entirely. Interestingly, fishing-related identity is not significant in this model.

For those that responded to Q2 that they would consider a non-fishing job with higher pay we evaluate responses using

an OLS specification with the dependent variable coded to the bottom of the range of the pay increase. Choices included: 1–10%, 11–25%, 26–50%, 51–100%, > 100%.<sup>2</sup> Of those who responded they would choose another job only if it had higher pay, 22% indicated it would have to pay greater than 100% more, 35% in the 50–100% range, 31% in the 26–50% range, 9% in the 11–25% range, and 2% in the 1–10% range. A positive coefficient in this regression (Table 5) indicates that a higher value of the explanatory variable (e.g., identity) increases the percentage increase in pay required to take an alternative job. Consistent with hypothesis 1a and 2, the percentage increase required to take a non-fishing job increases significantly with higher scores for identity and job quality, but, consistent with hypotheses 1b, decreases with a higher livelihood job satisfaction score.

<sup>2</sup> We also estimated an ordered logit model. Qualitative results in terms of significance and sign are unchanged. However, we prefer the OLS model for its simplicity of interpretation.



**Table 5** Regressions of job satisfaction and social capital—identity on indicators of reluctance to stop fishing. The social capital, identity, job quality, and livelihood indices are scaled to have a standard deviation of one

Dependent (LHS) variable	Model type	Explanatory (RHS) variables			
		Social capital	Identity	Job quality	Livelihood
Would never choose another job over fishing (Q2)	Binary logit	0.162**	0.098	0.185**	0.040
How much % more would another job have to pay for you to prefer it over fishing (Q2)?	OLS	0.914	2.680**	4.922***	– 3.444**
Continued fishing to provide employment for crew when expected profits might not cover expenses (Q3)	Binary logit	0.264***	0.168***	0.116	– 0.026
Worked in job or business other than commercial fishing in response to closure (Q4)	Binary logit	– 0.220***	– 0.149*	0.522***	– 0.501***

\*10% significance level; \*\*5% significance level; \*\*\*1% significance level

Job quality has a stronger impact on this response than identity. Recall that the social capital, identity and two job satisfaction indices are scaled to have equal means and variance so the size of the coefficients indicates the relative strength of those variables in predicting the dependent variable. Social capital is not a significant predictor—perhaps not surprisingly since social capital is an accumulated state that may not be predictive of the attachment to fishing (i.e., the “reservation price” for leaving fishing aside), apart from the valuation of this social capital as reflected in identity. However, high social capital scores are associated with the higher probability of an individual responding that they would never consider a non-fishing job, regardless of pay.

56% of respondents indicated they have fished under potentially unprofitable conditions to employ crewmembers (Q3). The binary logit model yields a positive coefficient on social capital, identity, and job satisfaction, indicating a higher probability of fishing to employ crew (Table 5). Consistent with hypotheses 3, we find that higher social capital and identity scores significantly increase the probability of fishing to employ crew, but the job satisfaction variables have no significant effect. Social capital has a stronger impact on this response than identity.

The question about response to closure (Q4) is evaluated with a binary logit specification with the dependent variable taking a value of one if the individual indicated they worked in a non-fishery job in response to a closure (31% of respondents) and zero otherwise. A positive coefficient indicates that variable increases the probability of working in another job. The results suggest that individuals with higher social capital and identity scores and higher livelihood job satisfaction scores were less likely to take a non-fishing job in response to a fishery closure (Table 5). Surprisingly, those with higher job quality scores were more likely to do so.

### Variation in job satisfaction, social capital, and identity by fishery and state

Table 6 shows results of four separate regressions with job satisfaction, social capital and identity as dependent variables for the four regressions, and shares of fishing revenue coming from different state-fishery combinations and diversification (SI) as explanatory variables for all four regressions. These regressions provide a test of hypothesis 4. Note that the coefficients of the regressions are arranged vertically in columns in Table 6. Social capital is weakly predicted by fishery revenue shares ( $R^2 = 0.16$ ), but significant differences are nonetheless evident for some state-fishery combinations. In these regressions the proportion of revenue coming from California salmon is excluded from the regression (to avoid perfect collinearity since shares must sum to one) and is thus absorbed into the constant. For the social capital regression, the constant is negative and significant, with none of the other revenue share variables being negative and significant relative to it. This suggests social capital is significantly lower for participants in the California salmon fishery relative to others. The estimates suggest that social capital is positively correlated with greater participation in Washington and Oregon salmon fisheries, as well as Dungeness crab fisheries in all three states. The significant positive coefficient on the diversification measure with the SI suggests that social capital is also higher among more diversified fishers, regardless of fishery choice.

Identity scores are very weakly predicted by fishery revenue shares ( $R^2 = 0.04$ ), but there are a few fisheries with significantly different identity scores (Table 6). Participation in Dungeness crab in Washington is associated with a significantly higher identity score, whereas participation in albacore in Washington or Oregon and groundfish in Washington is correlated with weaker fishing identity.

**Table 6** Coefficients from Regressions of Social Capital, Identity, Job Satisfaction (Job Quality, Livelihood) on Proportions of Fishery Revenue from Fisheries in Different States and Diversification. Note that tables show vertical vectors of coefficients for regressions with Social Capital, Identity, Job Quality, and Livelihood as the dependent variables. These dependent variables are scaled to have a standard deviation of one

Explanatory variable	Dependent variables				% household income fishing
	Social capital	Identity	Job quality	Livelihood	
% revenue crab WA	1.43***	0.38***	0.01	0.82***	44.73***
% revenue crab OR	0.51**	0.03	0.27	0.77***	33.21***
% revenue crab CA	0.30**	− 0.15	− 0.09	0.49***	33.42***
% revenue albacore WA	0.20	− 0.39**	− 0.34*	0.36**	33.76***
% revenue albacore OR	− 0.17	− 0.56***	− 0.08	0.70***	7.61
% revenue albacore CA	0.29	2.27	1.74	− 0.56	77.64
% revenue Salmon WA	0.79***	0.08	0.15	0.49***	21.98***
% revenue Salmon OR	0.79***	0.15	0.03	0.29**	13.91***
% revenue groundfish WA	0.37	− 0.09	0.06	0.63**	21.31**
% revenue groundfish OR	0.10	− 0.35**	0.03	0.20	5.37
% revenue groundfish CA	0.05	− 0.16	− 0.06	0.51***	5.67
% revenue other WA	0.40**	− 0.44**	− 0.15	0.66***	35.33***
% revenue other OR	0.82**	0.08	− 0.35	0.70**	54.75***
% revenue other CA	0.23**	− 0.13	0.15	0.61***	19.97***
Diversification	0.31***	0.14	0.09	0.25***	21.60***
Constant (% rev Salmon_CA)	− 0.50***	0.01	− 0.05	− 0.56***	36.85***
R-square	0.16	0.04	0.18	0.05	0.17

\*10% significance level; \*\*5% significance level; \*\*\*1% significance level

Fishery diversification and strength of fishing identity have no significant relationship with identity.

Job quality appears to have almost no systematic covariation with fishery participation ( $R^2 = 0.01$ ), indicating that many other factors likely impact job satisfaction, or perhaps that it is largely idiosyncratic (Table 6). Only albacore in Washington has a significantly lower job quality score than in other fisheries. Fishery revenue shares are also only weakly correlated with the livelihood job satisfaction measure ( $R^2 = 0.05$ ), but there are several significant differences across state-fishery combinations (Table 6). Higher revenue shares from Dungeness crab in all three states, albacore and salmon in Washington and Oregon, and groundfish in Washington and California, are all associated with significantly higher livelihood job satisfaction relative to California salmon. Higher diversification is also positively correlated with livelihood job satisfaction.

## CONCLUSIONS

Using factor analysis and structural equation modeling on survey responses of a large sample of US West Coast fishers we quantify monetary and non-monetary measures of job satisfaction, fishing-related social capital, and

identity at the individual level. Like previous studies (Apostle et al. 1985; Gatewood and McCay 1990; Binkely 1995; Pollnac and Poggie 2006; Pollnac et al. 2015) we find distinct latent variables representing job satisfaction related to job quality (e.g., self-actualization and esthetic factors such as being outdoors) vs. monetary aspects of the job (e.g., level and variability of income). We also find that measures of identity and social capital, though correlated, can be statistically differentiated, have different behavioral implications, and vary depending on the fisheries individuals participate (though only weakly). In future work we plan to explore how fishery-related identity and social capital are formed and change at the community level and whether individual level measures are tied to community level measures of engagement and reliance on fisheries.

The two components of job satisfaction we measured appear to have different implications for behavioral responses. A high job satisfaction score for the job quality index correlates with more stickiness in fishery participation in the face of lower profitability, supporting hypotheses 1a and 2, while high job satisfaction related to livelihood suggests more willingness to move to other occupations when they are more lucrative, consistent with hypothesis 1b. Response to a fishery closure (as opposed to just a reduction in profitability) may be different, however. Fishers with stronger social capital and identity related to

fishing, or higher job satisfaction related to livelihood were less likely to move to a non-fishing occupation, moving instead to another fishery or not working at all. However, fishers with a higher job quality score were more likely to take a non-fishing job. While this seems possibly inconsistent with hypotheses 1a and 1b, it may relate more to whether the individual had other fishing alternatives available to them during the closure. Social capital and identity related to fishing also appear to have distinct impacts on participation behavior, from each other and from job satisfaction. Strength of fishing identity is correlated with the pay premium individuals would require to take work other than fishing while social capital is not; however, higher social capital increases the odds that someone states they would never take a job other than fishing. Both social capital and identity significantly increase the probability the individual would continue fishing to employ crew while neither type of job satisfaction does. While these effects of social capital and identity may be positive in the sense of preserving and supporting fishing communities, they could also be maladaptive to the extent that human capital is not redeployed to potentially more productive activities.

As with previous studies (Gatewood and McCay 1990; Pollnac and Poggie 2006), we find differences in job satisfaction, as well as identity and social capital across fisheries. These could have some implications for understanding how fishers will respond to changes in profitability and regulations in these fisheries. For example, higher average social capital scores for Washington and Oregon salmon and crab fishers suggest effort in these fisheries may be less responsive to changes in profitability than some others. Albacore fishers on the other hand appear to have weaker identification with being a fisher which might result in less stickiness in participation in response to changes in profitability. The reasons for this finding are unknown, but may relate to the particular status of albacore fishing as an open access fishery in a region largely governed under limited access regimes. Ultimately, the individual variability in social capital, identity, and job satisfaction are poorly explained by fishery participation patterns, raising intriguing research questions about the drivers of this heterogeneity.

Fishing is more than just a source of income to many fishers. It is a source of enjoyment and fulfillment that other available jobs apparently cannot match for most fishers. It is a way of life and an important part of social identity to many. How fisheries impact the wellbeing of participants and coastal communities is influenced by factors aside from how much fish can be harvested and the profits the fishery generates. Wellbeing is impacted by how management decisions are made (e.g., inclusiveness and fairness) and how access is regulated and rationed (Breslow

et al. 2016; Hicks et al. 2016). It is well established that recreational fishing contributes to welfare of participants, and these benefits are often quantified with non-market techniques (Johnston et al. 2006). Our results suggest that similar benefits may accrue to some commercial fishers, over and above the income they derive from fishing. In order to manage fisheries effectively, to maximize the benefits they provide and ensure sustainability, it is important to understand how non-monetary benefits and motivations as well as profitability are impacted by management approaches and actions, and by exogenous events. Indicators of job satisfaction, identity and social capital measured with surveys can be a useful way to measure and track non-monetary benefits, but primary data collection has generally been infrequent and ad-hoc. The growing acceptance of the importance of social and cultural, as well as economic, considerations in evaluating fishery management obliges more regular data collection that can provide a more holistic picture of how human wellbeing is impacted by marine resource management.

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## AUTHOR BIOGRAPHIES

**Daniel S. Holland** (✉) is a Senior Scientist with NOAA, Northwest Fisheries Science Center. His research interests include natural resource economics, fishery management, and couple natural human systems modeling.

*Address:* Conservation Biology Division, Northwest Fisheries Science Center, NOAA, National Marine Fisheries Service, 2725 Montlake Blvd. E., Seattle, WA 98112, USA.  
e-mail: dan.holland@noaa.gov

**Joshua K. Abbott** is an Associate Professor in the School of Sustainability at Arizona State University. His research interests are natural resource and environmental economics, econometrics, fishery management, modeling of economic-ecological systems, and valuation of ecosystem services.

*Address:* School of Sustainability, Arizona State University, 800 S. Cady Mall, Tempe, AZ 85287, USA.  
e-mail: Joshua.K.Abbott@asu.edu

**Karma E. Norman** is a Social Scientist with NOAA, Northwest Fisheries Science Center. His research interests include environmental anthropology, methodologies for identifying and measuring cultural interactions within integrated marine ecosystems, and assessment of fishing community vulnerability.

*Address:* Conservation Biology Division, Northwest Fisheries Science Center, NOAA, National Marine Fisheries Service, 2725 Montlake Blvd. E., Seattle, WA 98112, USA.  
e-mail: Karma.Norman@noaa.gov