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Using Socioeconomic and Fisheries Involvement Indices to Understand Alaska Fishing Community Well-Being

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ABSTRACT

Over recent years, fisheries managers have been going through a paradigm shift to prioritize ecosystem-based management. With this comes an increasing need to better understand the impacts of fisheries management decisions on the social well-being and sustainability of fishing communities. This article summarizes research aimed at using secondary data to develop socioeconomic and fisheries involvement indices to measure objective fishing community well-being in Alaska. Data from more than 300 communities in Alaska were used to create a database of socioeconomic and fisheries involvement indices of objective well-being and adaptability for Alaska communities dependent on marine resources. Each index was developed using a principal components factor analysis to assess the relative position of each community compared to all other communities in Alaska. We find that creating performance measures, such as the indices presented here, provides a useful way to track the status of socioeconomic conditions and fisheries involvement by communities over time.

KEYWORDS

Alaska; community vulnerability; fishing community; fishing dependence; resilience; well-being

Introduction

Fishing communities exist within a larger coastal economy; however, in many places, fishing is central to community sustainability and is vital to the survival of the local economy. As such, it is widely recognized that perturbations in the availability of fisheries resources, such as regulatory changes, larger national and international economic forces (e.g., recessions, monetary exchange rates, fuel prices, credit availability), climate change, changes in stock abundance, ecosystem shifts, and environmental disasters, can cause significant disruptions in such communities both as a whole and to individual fishermen and their families (Colburn and Jepson 2012; Morzaria-Luna, Turk-Boyer, and Moreno-Baez 2014; Olson 2011; Pollnac et al. 2006). These disruptions often manifest in changes to community well-being (e.g., employment rates, occupational mobility and conflict) and fishermen's job satisfaction (e.g., participation structure, job stability, earned income) (Pollnac et al. 2006). Such disruptions often endure over time as communities figure out how to adapt to the change. The

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capacity of communities to adapt will affect the overall potential for a community to be negatively affected by a given change and ultimately how resilient it is to various perturbations.

In recent years, fisheries managers have been going through a paradigm shift to prioritize ecosystem-based management. With this comes an increasing need to better understand the impacts of fisheries management decisions on the social well-being and sustainability of fishing communities. The ability to better understand the ways in which communities are vulnerable to both changes in fishing activity and social factors independent of fishing is crucial to understanding how change will affect communities and coastal economies (Jepson and Colburn 2013). Furthermore, given the variety of risks communities face, it is important to understand how the different types of risk will likely impact the overall well-being of a community. Similarly, across communities, it is important to appreciate which indicators best predict resilience or vulnerability of a community to each type of risk is of interest. This will provide fishery managers a broader awareness of the threats each community faces and the ways in which their actions will likely affect each community.

Recognizing these issues, the use of quantitative indicators has been promoted widely and used in a variety of cases as a way to measure community vulnerability, resilience and well-being (e.g., Boyd and Charles 2006; Fraser et al. 2006; GSAFFI 2010; 2013; Jacob et al. 2010; Jepson and Jacob 2007; Morzaria-Luna, Turk-Boyer, and Moreno-Baez 2014; Pollnac et al. 2006). In recent years, social scientists working in the National Marine Fisheries Service's regional fisheries science centers have developed a methodology to respond to these analytical needs by creating indices for evaluating various aspects of fishing community vulnerability and resilience. The purpose of this paper is to adapt this methodology (Jacob et al. 2010, 2013; Jepson and Colburn 2013) to create Alaska-specific indices to measure community well-being in Alaska, where many of the people and fishing communities are in transition, coping with change on a daily basis with varying degrees of success. These indices are intended to provide policymakers with an objective and data-driven approach to analyzing the comparative vulnerability of fishing communities across Alaska to proposed fisheries management regulations.

The goal of these indices is to improve assessments of the social impacts of proposed fishery management plans and actions (e.g., Colburn and Jepson 2012; Jepson and Colburn 2013; Himes-Cornell and Kasperski 2015). These indices are intended to enhance the analytical objectivity of fisheries social impact assessments (SIAs), through analysis of adherence to various federal statutes, including the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the National Environmental Policy Act, among others, require agencies to examine the social and economic impacts of policies and regulations. National Standard 8 (NS8) of the MSA specifically states that communities need to be considered when changes in fishing regulations are made, requiring that we "take into account the importance of fishery resources to communities" in order to provide for communities' sustained participation in fisheries and to minimize adverse economic impacts on fishing communities. Creating social indices of well-being for fishing communities as documented here provides a pragmatic approach toward (1) meeting this mandate and (2) standardizing data and analysis for evaluation of the long-term effects of fisheries management actions and other significant changes. Given the often short time frame in which policy-based analyses are often conducted, an advantage to the approach presented here is that the majority of the data used to construct these indices are readily accessible secondary data and can be compiled quickly to create measures of social well-being. In addition, creating performance

measures in fisheries provides a useful way to track the status of important economic and social variables over time.

Following Colburn and Jepson (2012), we define resilience as "the capacity of a community to adapt to change and still maintain function without ceasing to exist" (Walker et al. 2004). In contrast, we define vulnerability as a combination of a community's exposure to change, dependence on resources that could be affected by that change, and capacity to adapt to that change (Adger 2006; Allison et al. 2009; Cinner et al. 2012; Gallopín 2006; Hovelsrud and Smit 2010; Kelly and Adger 2000; Smit and Wandel 2006; Turner et al. 2003). Finally, we define community well-being as the level of happiness, health, and prosperity of an individual, family or community (Pollnac et al. 2006). In addition, we adopt a framework of indices that characterize community well-being by focusing on three basic forms of vulnerability to change: exposure or sensitivity to a given change, dependence on resources that will be affected by that change, and a community's adaptive capacity to offset negative impacts of that change (Adger 2006; Allison et al. 2009; Cinner et al. 2012; Hovelsrud and Smit 2010; Kelly and Adger 2000; Smit and Wandel 2006; Turner et al. 2003).

The article is organized as follows. First, we illuminate the importance of fishing activities to Alaska communities and provide examples of vulnerabilities that Alaska communities experience that can affect their well-being. Second, we describe the methodological framework used to develop indices of community well-being. Third, we present the results of applying that framework to communities across Alaska. Finally, we discuss the application of these indices to understanding how communities across the state of Alaska may be affected by regulatory, economic, and environmental changes and what such changes might mean for them.

Background

Alaska's commercial, recreational, and subsistence fisheries and their supporting marine ecosystems play an essential role in the cultural, economic, and environmental well-being of nearly all Alaskans. Alaska's commercial fishing industry generated $4.2 billion in sales impacts, $1.8 billion in income impacts, $2.2 billion in value-added services, and 55,890 jobs in 2012. Furthermore, the commercial harvesting sector generated more economic impacts than any other sector in the state and ranks third among Alaskan industries in total economic value behind North Slope Oil and Gas and the Federal Government (NMFS 2013; Northern Economics 2009). Likewise over 90% of Alaska's rural residents rely on wild-caught subsistence foods for at least part, if not all, of the year (Wolfe 2004). Recreational fishing is also important to Alaska's economy, with approximately 4,800 jobs, $558 million in sales revenue, $214 million in earned wages, and $338 million in value-added services in 2009 (NMFS 2013).

Alaska differs from the rest of the United States because it has a wide variety of community typologies based on the resources harvested by local residents. Some communities are solely focused on one or two specific commercial or recreational fisheries. Others are solely focused on harvesting subsistence resources, including various fish species, marine invertebrates, waterfowl or marine mammals, or any combination thereof. Yet other communities participate in some combination of all three categories of fisheries throughout the year (Himes-Cornell et al. 2013). Unlike more economically diverse communities in the rest of the country, there are a large number of Alaska communities that only exist due to the

presence of fishing (Himes-Cornell et al. 2013; Lowe 2008). A key example of this is the City of Kodiak in the northwestern part of the Gulf of Alaska, where the majority of the local economy is dependent on the commercial fishing industry, from the fishermen themselves to their families, fisheries support businesses, the main grocery store (which supplies the fishing vessels with supplies), the U.S. Coast Guard base and many other local businesses (personal observation; Carothers 2008a; Himes-Cornell et al. 2013). Another feature of Alaska communities is the widespread dependence on subsistence resources, which in many communities is the only way local residents can survive through the harsh winters (Loring and Gerlach 2009; Lowe 2007; Martin, Killorin, and Colt 2008). The extensive reliance of communities on fishing allows for some synergies between communities that have the same fishing interests as well as fighting between communities with different interests or even within communities that have multiple interests.

Given that seafood and the marine environment are a central part of Alaska's economy and unique way of life (Loring, Gerlach, and Harrison 2013), it is crucial that policymakers can identify those areas of the state that might be adversely affected by future regulations and how community sustainability and well-being may change across the state. The well-being of Alaska communities can be greatly affected by a number of social and economic factors that can be impacted by external forces, including demographic shifts in population (e.g., changes in the number of transient residents, age structure, racial composition), environmental hazards (e.g., tsunamis, earthquakes, storms, flooding, volcanic eruptions), and changes in fisheries management (e.g., fleet consolidation, catch share programs, limited entry programs, annual catch limits), all of which can cause disruptions in communities (Carothers 2010; Langdon 1995; Loring and Gerlach 2009). The rapid and unprecedented nature of today's environmental and societal challenges creates special needs and many Alaskans are faced with the decision of whether to take short-term mitigative actions at the expense of long-term goals, such as health and sustainability.

Some noteworthy challenges that Alaska communities are facing include those associated with climate change, the lack of economic opportunities, and changes in fisheries management. Those communities being affected by climate change are being faced with increasing erosion risk, changes in resource distribution, changing seasons and changes in sea ice extent (Griffis and Howard 2013; Himes-Cornell and Kasperski 2014). Second, few economic opportunities are available for Alaskans to switch between fisheries, or even to an occupation that has nothing to do with fishing (Loring and Gerlach 2009). Given that many communities are centered around fishing, non-fishing occupations in these communities are frequently connected to the fishing industry—doctors treat fishermen, accountants and lawyers provide services to fishermen, crew food and supplies are bought at the grocery store, and restaurants and local stores rely on fishermen's families to spend money there (personal observation).With regard to fisheries-related economic opportunities, individuals within a community that lack wealth may be more likely to sell their fishing permits/vessels/quota shares and other means of economic opportunities because they lack the capital to draw on during poor fishing years. However, this limits their economic opportunities in the future as entry costs in most fisheries have increased substantially and once thriving fishery support businesses that provided jobs for non-fishermen may have closed in conjunction with the loss of community fishermen.

Overall, the cumulative long-term effects of economic downturns, changes in market forces, fisheries management (e.g., limited entry and catch share programs), and the

environment can have significant, yet difficult to anticipate impacts on local livelihoods (Koslow 1982; Langdon 1995; Loring et al. 2011). Such changes may end up favoring one region of the state over another, providing opportunities for growth in some communities and new challenges in others.

Methods and Data

We identified, collected, assembled, and analyzed a large database of demographic and commercial, recreational, and subsistence fisheries data for 347 communities throughout Alaska (see Table 1). To explore some of the issues mentioned above, we created 14 indices of community well-being along several different dimensions of well-being, similar to Jepson and Colburn (2013) and Colburn and Jepson (2012), but adapted to the context of Alaska communities. The main differences involve (1) not including indices of gentrification as this is

Table 1. Description and source of variables used.

	Personal Disruption	
pct_unemp	% of residents that are unemployed	U.S. Census Bureau, 2010
pct_nodipl	% of residents without a high school diploma	U.S. Census Bureau, 2010
pct_pov	% residents in poverty	U.S. Census Bureau, 2010
pct_femsep	% of females aged 15 and over that are separated	U.S. Census Bureau, 2010
	Population Composition	
pct_white	% of population that self identifies as white	U.S. Census Bureau, 2010
pct_femhh	% of households with a female head of household	U.S. Census Bureau, 2010
pct_0_5_pop	% of population that is aged between 0 and 5 years old	U.S. Census Bureau, 2010
pct_spkeng	% of residents that speak English less than well	U.S. Census Bureau, 2010
	Poverty	
pct_assist	% of residents receiving cash public assistance	U.S. Census Bureau, 2010
pct_finpov	% Families in poverty	U.S. Census Bureau, 2010
pct_65pov	% of residents over age 65 in poverty	U.S. Census Bureau, 2010
pct_chldpov	% of residents under age 18 in poverty	U.S. Census Bureau, 2010
	Labor Force Structure	
pct_lf	% of residents in the labor force	U.S. Census Bureau, 2010
pct_femlf	% of female residents in the labor force	U.S. Census Bureau, 2010
pct_self	% of residents that are self employed	U.S. Census Bureau, 2010
pct_recss	% of residents on social security	U.S. Census Bureau, 2010
	Housing Disruption	
Pctchg_mort	% change in median mortgage cost (2000–2009)	U.S. Census Bureau, 2000, 2010
Pctchg_homeval	% change in median home values (2000–2009)	U.S. Census Bureau, 2000, 2010
Pctchg_ownercost	% of households with mortgage costs that exceed 35% of their household income	U.S. Census Bureau, 2000, 2010
	Status of Schools	
schools	Number of schools in a community	Alaska Department of Education, 2012
students	Number of students in a community	Alaska Department of Education, 2012

(*continued*)

Variable	Description	Source
	Housing Characteristics	
rent_cost	Median monthly rent	U.S. Census Bureau, 2010
mort_cost	Median monthly mortgage cost	U.S. Census Bureau, 2010
rooms	Median number of rooms in occupied units	U.S. Census Bureau, 2010
pct_mobile	% of housing units that are mobile homes	U.S. Census Bureau, 2010
	Commercial Processing Engagement	
port_val	Ex-vessel value of commercial catch landed in a community	ADF&G and CFEC, 2011
port_lbs	Pounds of commercial catch landed in a community	ADF&G and CFEC, 2011
processors	Number of processors located in a community	ADF&G, 2011d
	Commercial Harvesting Engagement	
res_val	Ex-vessel value of commercial catch from vessels owned by residents	ADF&G and CFEC, 2011
res_lbs	Pounds of commercial catch from vessels owned by residents	ADF&G and CFEC, 2011
permits	Number of CFEC permits held by residents	CFEC, 2011
vessels	Number of vessels owned by residents	CFEC, 2011
crew	Number of crew licenses held by residents	ADF&G, 2011a
	Commercial Processing Reliance	
port_val_pc	Ex-vessel value of commercial catch landed in a community per capita	ADF&G and CFEC, 2011
port_lbs_pc	Pounds of commercial catch landed in a community per capita	ADF&G and CFEC, 2011
processors_pc	Number of processors located in a community per capita	ADF&G, 2011d
	Commercial Harvesting Reliance	
res_val_pc	Ex-vessel value of commercial catch from vessels owned by residents per capita	ADF&G and CFEC, 2011
res_lbs_pc	Pounds of commercial catch from vessels owned by residents per capita	ADF&G and CFEC, 2011
permits_pc	Number of CFEC permits held by residents per capita	CFEC, 2011
vessels_pc	Number of vessels owned by residents per capita	CFEC, 2011
crew_pc	Number of crew licenses held by residents per capita	ADF&G, 2011a
	Recreational Fishing Engagement	
charter	Number of charter businesses located in a community	ADF&G, 2011c
sport_lic	Number of sportfishing licenses	ADF&G, 2011a
sport_bus	Number of sportfishing guide businesses	ADF&G, 2011b
sport_guide	Number of sportfishing guide licenses	ADF&G, 2011b
	Recreational Fishing Reliance	
charter_pc	Number of charter businesses located in a community per capita	ADF&G, 2011c
sport_lic_pc	Number of sportfishing licenses per capita	ADF&G, 2011a
sport_bus_pc	Number of sportfishing guide businesses per capita	ADF&G, 2011b
sport_guide_pc	Number of sportfishing guide licenses per capita	ADF&G, 2011b
	Subsistence Harvesting Involvement	
percent_hh_subs	Percentage of households involved in any subsistence activities	ADF&G, 2014
sub_harvest	Subsistence harvest in pounds	ADF&G, 2014
sub_harvest_pc	Subsistence harvest in pounds per capita	ADF&G, 2014

not a significant problem in Alaska communities, (2) including subsistence harvests that are of critical importance for many Alaska communities, and (3) including an assessment of the status of schools in a community as a measure of overall community viability. Using a similar methodology as Jepson and Colburn (2013) and Colburn and Jepson (2012) allows us to create a set of social and fisheries engagement and reliance indices for Alaska communities that are comparable to indices that have been calculated in other regions of the United States. In tandem, these regional indices will allow for a more objective inter- and intra-regional analysis of social impacts of fisheries management decisions across the United States. Ultimately, the focus of the present article is on the creation of social and fisheries-related indices for Alaska communities. A next step in this project will be to combine our efforts and undertake a national analysis of community vulnerability and well-being.

The 14 indices of community well-being can be broken down into two major groups, indices of socioeconomic well-being, and indices of fishing involvement. The seven socioeconomic indices of community well-being include: personal disruption, population composition, poverty, labor force structure, housing disruption, housing characteristics, and status of schools. The seven indices of fishing involvement include: commercial processing engagement, commercial processing reliance, commercial harvesting engagement, commercial harvesting reliance, recreational fishing engagement, recreational fishing reliance, and subsistence harvesting involvement. For the six commercial and recreational fishing involvement indices, reliance represents the per capita values of the variables included in the engagement indices. The reliance and engagement are assessing different aspects of fisheries involvement and provide different information, and therefore can be considered separately. By including the reliance indices in per capita terms, it allows smaller communities with small fishing fleets to still be represented as having a strong involvement in fishing if a large fraction of their population is involved in fishing. For example, if two communities rank highly in commercial harvesting and processing engagement, but one has a much larger population; the larger community will not rank highly in either type of reliance while the smaller community will rank highly in the reliance indices because a larger share of the population is involved in fishing activities.

We use mean values from 2005–2009 for all variables for each community to correspond with the U.S. Census Bureau's 2005–2009 American Community Survey (ACS), with the exception of the subsistence harvesting data.[1] We use the 2005–2009 ACS data as the basis for our analysis because it is the first year that such 5-year estimates are available and the 5-year estimates are the only estimates available for all communities in Alaska. This will enable us in future work to create a second data point from the 2010–2014 ACS data and conduct a comparison of community well-being over time. The number of communities included in each index varies based upon data availability for the variables included. See Table 1 for a complete list of variables included in each indicator and its source.

Each index of community well-being is created through a separate principal components factor analysis (PCFA) of factors that are thought to contribute to (or detract from) community well-being, with the exception of the status of schools index described below. PCFA is a variable reduction strategy that converts a large number of variables into a smaller set of components that are linearly independent from one another (Kim and Meuller 1978a; 1978b). Following Jepson and Colburn (2013), we begin with a single concept of community well-being and conduct an initial PCFA using the same variables from Jepson and Colburn for each concept of well-being. We then use an iterative process of including and removing

variables until we achieve a single factor solution for each PCFA, indicating that all variables included in that PCFA inform a single concept of community well-being.

Each index can then be interpreted as increasing or decreasing community well-being based on the signs of the factor loadings on each of the included variables. For all socioeconomic well-being indices, a higher index score reflects a lower level of well-being. A higher fisheries involvement index score represents a larger importance of a particular aspect of the fishing industry to the community. The quantitative indices of community socioeconomic well-being and fishing involvement for each of the indices are created using the regression method by summing the standardized coefficient score multiplied by the included variables (Smith et al. 2011). In several instances we retain variables that have factor loadings below |0.40| in our analysis because these variables were found to be important on the U.S. east coast by Jepson and Colburn (2013), thus maintaining comparability across regions. Similarly, the housing disruption index has a very low Armor's theta reliability coefficient but is included to allow for future cross-regional comparisons (Armor 1974).

The quantitative methods presented here represent one possible approach to assessing community vulnerability. However, there are limitations to undertaking such analyses. It is important to examine the appropriateness of the input variables selected for each index for every new geographical region or set of communities that are being assessed. One commonly accepted method for testing this is through a groundtruthing exercise, where in person qualitative assessments of the individual components of vulnerability being tested are compared against the results of the PCFA (Biedenweg et al. 2014; Blount et al. 2015; Jacob et al. 2010; Jepson and Jacob 2007; Marshall and Marshall 2007; Morzaria-Luna, Turk-Boyer, and Moreno-Baez 2013). This type of groundtruthing exercise will be undertaken in the next phase of the present research and will ultimately be used to better inform the indices presented here in the future. Despite these limitations, numerous researchers have determined that using principal components analysis, factor analysis and PCFA appears to provide a reasonable assessment of community vulnerability (Colburn and Jepson 2012; Himes-Cornell and Kasperski 2015; Jacob et al. 2010; 2013; Jepson and Colburn 2013; Jepson and Jacob 2007; Morzaria-Luna, Turk-Boyer, and Moreno-Baez 2014).

Results

Socioeconomic Well-Being Indices

The factor loadings for six of the seven community well-being indices (excluding the status of schools, which is a binary index) are included in Table 2 and the highest ranking communities for each of the indices are portrayed in Figures 1 and 2. The personal disruption index is intended to measure factors that can cause complications in resident's lives, thus increasing their social vulnerability. It includes the percentage of residents that are unemployed, the percentage of residents without a high school diploma, the percentage of residents in poverty, and the percentage of female residents aged 15 and older that are separated. Higher levels of well-being are associated with lower index scores by having lower unemployment rates, lower number of residents without a high school diploma, fewer residents in poverty, and fewer separated female residents. The personal disruption index explains 43% of the variance in the variables with a theta reliability coefficient of 0.56.

Table 2. Community socioeconomic well-being indices with factor loadings and total variance explained.

	Factor loading	Total variance explained	Number of communities
Personal Disruption			
% of residents that are unemployed	0.785	43%	312
% of residents without a high school diploma	0.664		
% residents in poverty	0.781		
% of female residents aged 15 and older separated	0.241		
Population Composition			
% of residents that are white	−0.865	52%	318
% of households with a female head of household	0.713		
% of residents below age 5	0.632		
% of residents that speak English less than well	0.654		
Poverty			
% of households with cash public assistance	0.731	58%	262
% Families in poverty	0.930		
% of residents over age 65 in poverty	0.319		
% of residents under age 18 in poverty	0.900		
Labor Force Structure[a]			
% of females over 16 that are employed	0.805	46%	311
% of residents over 16 that are in the labor force	0.890		
% of the labor force that is self-employed	0.178		
% of households receiving social security	−0.597		
Housing Characteristics[a]			
Median monthly gross rent	0.720	51%	176
Median monthly mortgage costs	0.837		
Median number of rooms per residence	0.707		
% of households lacking complete plumbing facilities	−0.757		
% of households heating with fuel oil, kerosene, etc.	−0.520		
Housing Disruption			
% change in median mortgage costs (2000–2010)	0.746	40%	198
% change in median home values (2000–2010)	0.635		
% of households in unaffordable housing (cost>35% HH income)	−0.483		

[a]Represents indices that were multiplied by -1 to maintain consistency of the orientation of the other indices such that a higher index score reflects a lower level of well-being.

The population composition index represents the demographic characteristics of a community that may make them more vulnerable. It includes the percentage of residents that are white, the percentage of households with a female head of household, the percentage of residents below age 5, and the percentage of residents who do not speak English well. Higher levels of well-being are associated with lower index scores by having a larger share of residents who are white, fewer female head of household, fewer dependents, and fewer residents who do not speak English well. The population composition index explains 52% of the variance in the variables with a theta reliability coefficient of 0.69.

The poverty index represents the degree of poverty across several dimensions. It includes the percentage of families in poverty, the percentage of residents over age 65 in poverty, the percentage of residents under 18 in poverty, and the percentage of households receiving public cash assistance. Higher levels of well-being are associated with lower index scores by having fewer residents receiving cash public assistance and in each poverty grouping. The

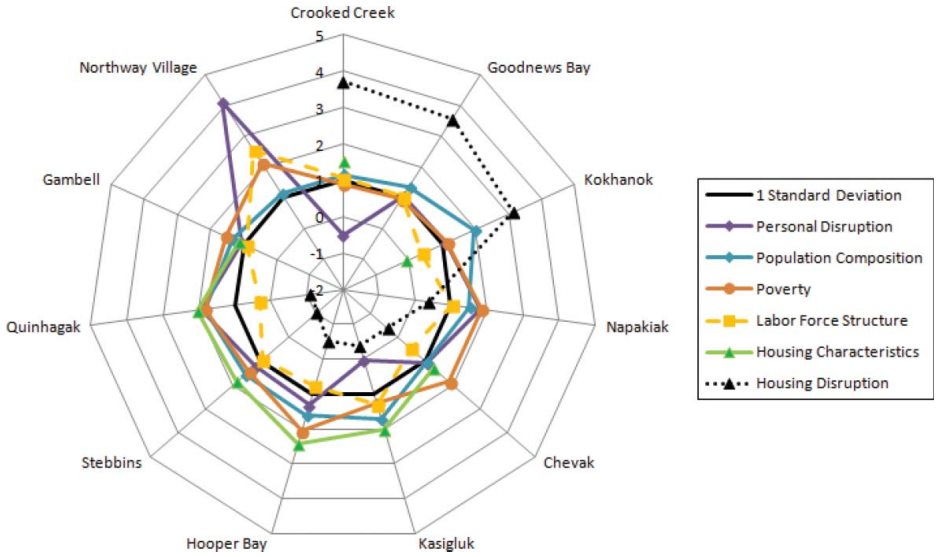

Figure 1. Community socioeconomic well-being indices for the top scoring communities.

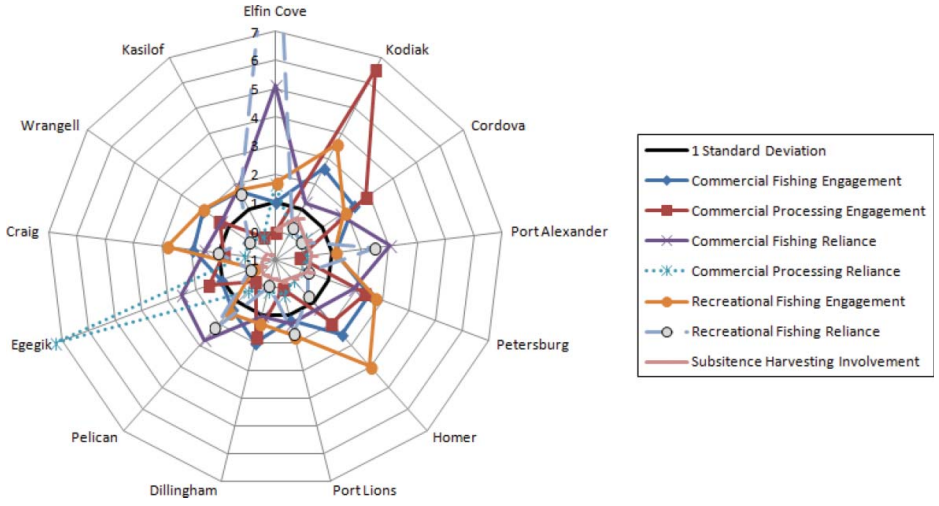

Figure 2. Fisheries involvement indices for the top scoring communities.

poverty index explains 58% of the variance in the variables with a theta reliability coefficient of 0.76.

The labor force structure index represents the strength and stability of the community's labor force. It includes the percentage of females over 16 that are employed, the percentage of residents over 16 that are in the labor force, the percentage of the labor force that is self-employed, and the percentage of households receiving social security. The index value is multiplied by –1 so that a higher index value reflects a lower level of well-being, consistent with all other indices. Therefore, a higher level of well-being is associated with more female employment, more residents in the labor force, a higher share of self-employed, and fewer

households receiving social security. The labor force structure index explains 46% of the variance in the variables with a theta reliability coefficient of 0.60.

The housing characteristics index represents the physical qualities, degree of permanence, and operating costs of the housing stock. Higher levels of well-being are associated with larger and more expensive homes while lower levels of well-being are associated with smaller, less expensive homes that may lack plumbing facilities and require deliveries of home heating oil. The index contains the median monthly gross rent, the median monthly mortgage costs, the median number of rooms per residence, the percentage of residences that lack complete plumbing facilities, and the percentage of residences that use home heating fuel. Similar to the labor force structure index, the housing characteristics index value is multiplied by –1 so that a higher index value reflects a lower level of well-being, consistent with all other indices. Therefore, a higher level of well-being is associated with higher rental and mortgage costs, larger homes, fewer households without plumbing and fewer homes relying on heating fuel. The housing characteristics index explains 51% of the variance in the variables with a theta reliability coefficient of 0.76.

The housing disruption index represents the degree of fluctuation in the housing market and the affordability of housing for community residents. It includes the percentage change in median mortgage costs from 2000 to 2010, the percentage change in median home values from 2000 to 2010, and the percentage of households that are in unaffordable housing, which is measured as whether the average estimated owner's monthly costs are greater than 35% of average household income. Higher levels of well-being are associated with lower index scores by having smaller changes in mortgage costs and home values, and surprisingly a larger share of residents living in unaffordable housing. The negative factor loading on the unaffordable housing variable is possibly related to communities with lower absolute monthly costs experiencing very large increases in costs between 2000 and 2010 while those communities with unaffordable housing are experiencing decreases in prices because people cannot afford to live there. The housing disruption index explains 40% of the variance in the variables with a theta reliability coefficient of 0.22.

The status of schools index represents overall community vulnerability given that in rural Alaska many communities have such low student enrollment that they are at risk of losing funding to keep their schools open or they have already lost their schools. It is commonly recognized that once a community loses its school, overall well-being and ability to persist as a community declines dramatically (Jollie 2009; Langlois 2013; Yardly 2009). When a school's average daily enrollment falls below 10 students, the school loses state funding and the students either enroll in another nearby school (if one exists), are sent to regional boarding schools, use online correspondence courses, or are home schooled (ADCRA 2009). We create this binary index to be equal to one if a community has fewer than 25 students enrolled. Of the 347 communities included in this study, there are 224 communities with schools, 59 of which have on average fewer than 25 students, including 7 communities that lost their schools during the time period of interest.

Commercial Fishing Involvement Indices

The factor loadings for the four commercial fishing involvement indices are included in Table 3. Commercial processing engagement represents the scale of the commercial fishing and processing industry in the community. The commercial processing engagement index

Table 3. Commercial fishing involvement indices with factor loadings and total variance explained.

	Factor loading	Total variance explained	Number of communities
Commercial Processing Engagement			
Commercial pounds landed in the community	0.919	73%	338
Commercial revenue landed in the community	0.982		
Number of registered buyers	0.623		
Commercial Processing Reliance			
Commercial pounds landed in the community per capita	0.972	94%	334
Commercial revenue landed in the community per capita	0.990		
Number of registered buyers per capita	0.950		
Commercial Harvesting Engagement[a]			
Commercial landings by vessels owned by residents	0.960	93%	338
Commercial revenue from vessels owned by residents	0.959		
Number of vessels owned by residents	0.973		
Number of CFEC permits held by residents	0.958		
Number of crew licenses held by residents	0.964		
Commercial Harvesting Reliance[a]			
Commercial landings by vessels owned by residents per capita	0.880	79%	334
Commercial revenue from vessels owned by residents per capita	0.886		
Number of vessels owned by residents per capita	0.881		
Number of CFEC permits held by residents per capita	0.898		
Number of crew licenses held by residents per capita	0.897		

[a]Reflects variables that have been converted to log base 10 values.

contains commercial pounds landed in the community, commercial revenue landed in the community, and the number of registered buyers and explains 73% of the variance in the variables with a theta reliability coefficient of 0.82. Commercial processing reliance represents the importance to the community of the commercial fishing and processing industry in terms of values per person and the commercial processing reliance index explains 94% of the variance in the variables with a theta reliability coefficient of 0.97.

Commercial harvesting engagement represents the number of fishermen and commercial fishing vessel owners in the community. The commercial harvesting engagement index contains the commercial landings by vessels owned by residents, commercial revenue by vessels owned by residents, the number of vessels owned by residents, the number of Commercial Fisheries Entry Commission (CFEC) permits held by residents, and the number of crew licenses held by residents and explains 93% of the variance in the variables with a theta reliability coefficient of 0.98. Commercial harvesting reliance represents the importance to the community of the fishermen and commercial fishing vessel owners in the community, and explains 79% of the variance in the variables with a theta reliability coefficient of 0.93.

Recreational Fishing Involvement Indices

The factor loadings for the two recreational fishing indices are included in Table 4. Recreational fishing engagement represents the scale of the charter and guide businesses in the community. The recreational fishing engagement index includes the number of charter businesses, the number of sportfishing licenses, the number of sportfishing guide businesses, and the number of sportfishing guide licenses. This index explains 77% of the variance in the variables with a theta reliability coefficient of 0.90. Recreational fishing reliance represents the

Table 4. Recreational fishing involvement indices with factor loadings and total variance explained.

	Factor loading	Total variance explained	Number of communities
Recreational Fishing Engagement			
Number of charter businesses	0.759	77%	338
Number of sportfishing licenses	0.809		
Number of sportfishing guide businesses	0.970		
Number of sportfishing guide licenses	0.962		
Recreational Fishing Reliance			
Number of charter businesses per capita	0.872	72%	334
Number of sportfishing licenses per capita	0.585		
Number of sportfishing guide businesses per capita	0.961		
Number of sportfishing guide licenses per capita	0.925		

importance of the charter and guide industry to the community in terms of value per person. The associated index explains 72% of the variance in the variables with a theta reliability of 0.87.

Subsistence Harvest Involvement Indices

The factor loadings for the subsistence harvesting involvement index are included in Table 5. Subsistence harvest involvement represents the scale, scope, and participation of subsistence harvesting that occurs in the community. All subsistence activities that are reported in the State of Alaska's Community Subsistence Information System (CSIS) database were utilized, including birds and eggs, salmon and non-salmon fishing, vegetation (berries), marine invertebrates, marine mammals, and land mammals (ADF&G 2014). The subsistence harvest involvement index includes the percentage of households involved in any subsistence activities, subsistence harvest in pounds, and subsistence harvest in pounds per capita and explains 49% of the variance in the variables with a theta reliability coefficient of 0.49.

Overall Community Scores

In order to assess community well-being across the indices, each community is given a score of 1 if they are +/– 1 standard deviation above the mean index score and a zero otherwise. A threshold for significance of 1 standard deviation was used in line with previous research using this methodology (Colburn and Jepson 2012; Cutter, Boruff and Shirley 2003; Jepson and Colburn 2013). Future groundtruthing of this methodology will assist in determining the appropriateness of this threshold. This dichotomized score is then summed across all socioeconomic well-being indices and then across all fishing involvement indices for each community. The communities with the highest total score for each set of indices are presented in Tables 6 and 7 where the final column represents a sum of all other columns. Of the 347 total communities included in socioeconomic well-being analysis, only Kokhanok has a total index score of 4 (out of 7 possible), 25 communities have a total index score of 3, 53 communities have a total index score of 2, 130 communities have a total index score of 1, and the other 138 communities have a total social index score of zero. The results for each socioeconomic well-being index for all communities are included in Appendix Table A1.

Table 5. Subsistence harvest involvement index with factor loadings and total variance explained.

	Factor loading	Total variance explained	Number of communities
Subsistence Involvement			
% of households involved in any subsistence activities	.559	49%	243
Subsistence harvest in pounds	.688		
Subsistence harvest in pounds per capita	.835		

The results for the communities that score the highest in fishing involvement are presented in Table 7, where the final column represents a sum of all other columns. Of the 347 communities included in this analysis, only Elfin Cove and Kasilof have a total index score of 5 (out of 7 possible), 12 communities have a total index score of 4, 26 communities have a total index score of 3, 37 communities have a total index score of 2, 138 communities have a total index score of 1, and the other 132 communities have a total fishing involvement index

Table 6. Community socioeconomic well-being indices for a selection of Alaska communities.

Community	Personal disruption	Population composition	Poverty	Labor force structure	Housing characteristics	Housing disruption	Status of schools	Total social score
Chevak	1	1	1	0	1	0	0	4
Crooked Creek	0	1	0	1	1	1	0	4
Gambell	1	1	1	0	1	0	0	4
Goodnews Bay	1	1	0	1	0	1	0	4
Hooper Bay	1	1	1	0	1	0	0	4
Kasigluk	0	1	1	1	1	0	0	4
Kokhanok	1	1	1	0	0	1	0	4
Mentasta Lake	1	0	1	1	0	0	1	4
Napakiak	1	1	1	1	0	0	0	4
Northway Village	1	1	1	1	0	0	0	4
Platinum	1	0	1	1	0	0	1	4
Quinhagak	1	1	1	0	1	0	0	4
Stebbins	1	1	1	0	1	0	0	4
Takotna	1	1	0	1	0	0	1	4
Akiachak	0	1	1	0	1	0	0	3
Anvik	1	0	1	0	0	0	1	3
Central	1	0	0	1	0	0	1	3
Clark's Point	1	0	1	0	0	0	1	3
Eek	0	1	0	1	1	0	0	3
Grayling	1	1	0	1	0	0	0	3
Holy Cross	1	0	1	1	0	0	0	3
Karluk	1	1	0	0	0	0	1	3
Koyuk	1	1	1	0	0	0	0	3
Koyukuk	1	1	0	0	0	0	1	3
Kwethluk	0	1	0	1	1	0	0	3
Marshall	0	1	1	0	1	0	0	3
Nikolai	1	0	1	0	0	0	1	3
Northway	1	1	1	0	0	0	0	3
Oscarville	1	0	1	1	0	0	0	3
Pitkas Point	1	0	1	0	1	0	0	3
Savoonga	1	1	1	0	0	0	0	3
Sheldon Point (Nunam Iqua)	0	0	1	0	1	1	0	3
Shishmaref	0	1	1	0	1	0	0	3
Slana	0	0	1	1	0	0	1	3
Stevens Village	0	1	0	1	0	0	1	3
Tetlin	1	1	0	1	0	0	0	3
Tuluksak	1	1	1	0	0	0	0	3
Tuntutuliak	1	1	1	0	0	0	0	3

Table 7. Community fishing involvement indices for a selection of Alaska communities.

Community	Commercial processing engagement	Commercial harvesting engagement	Commercial processing reliance	Commercial harvesting reliance	Recreational engagement	Recreational reliance	Subsistence harvesting involvement	Total fishery score
Elfin Cove	0	1	1	1	1	1	0	5
Kasilof	0	1	0	1	1	1	1	5
Cordova	1	1	0	1	1	0	0	4
Craig	0	1	0	1	1	1	0	4
Dillingham	1	1	0	1	1	0	0	4
Egegik	1	1	1	1	0	0	0	4
Homer	1	1	0	1	1	0	0	4
Kodiak	1	1	0	1	1	0	0	4
Pelican	0	1	0	1	1	1	0	4
Petersburg	1	1	0	1	1	0	0	4
Port Alexander	0	1	0	1	1	1	0	4
Port Lions	0	1	0	1	1	1	0	4
Soldotna	0	1	0	0	1	1	1	4
Wrangell	1	1	0	1	1	0	0	4

score of zero. Results for the fishing involvement indices for all communities are presented are in Appendix Table A2. These results demonstrate the multitude of ways in which Alaska communities are involved in fisheries and how important fisheries are to these communities as 62% of communities are above one standard deviation from the mean for at least one fisheries involvement index.

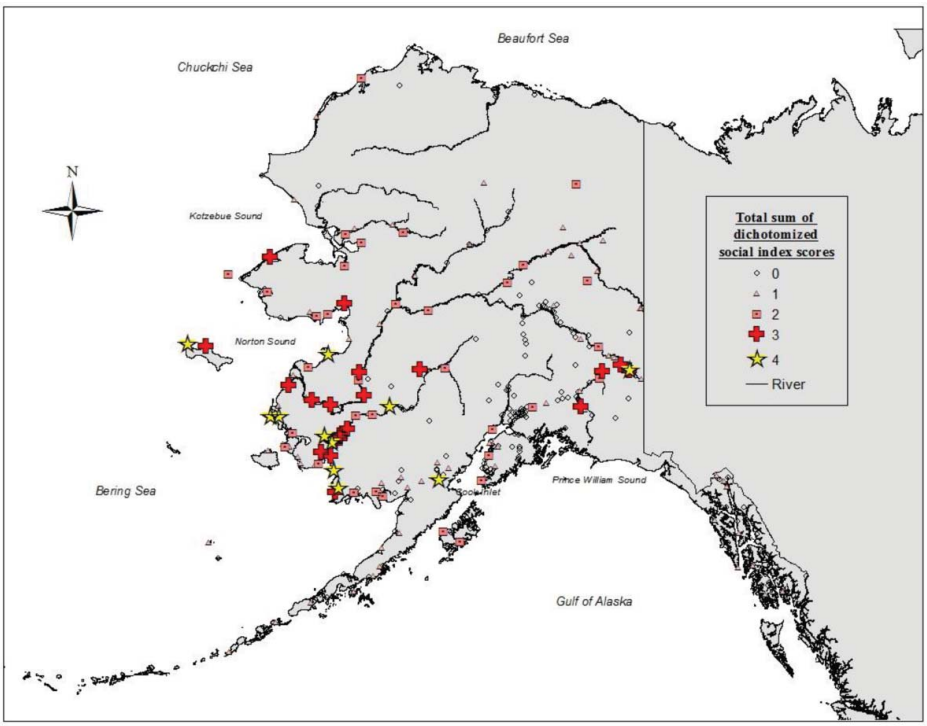

Figure 3. Total sum of dichotomized scores for all socioeconomic well-being indices for all communities.

The range of fisheries involvement and well-being in communities around the state is further illustrated in Figures 3 and 4. The communities that are most affected by the socioeconomic well-being indices are found in western Alaska where few economic opportunities exist. On the other hand, the majority of communities that are most affected by the fisheries involvement indices are located in southcentral and southeast Alaska, where there is heavy involvement by local residents in multiple fisheries and both on the harvesting and processing side.

The differences seen in these two figures can be further explored through an analysis of the relationship between the indices of socioeconomic well-being and how they correlate with the fishing involvement indices. Through a simple regression analysis, communities that have higher total fishing involvement scores have statistically significantly (at the 0.1% level) fewer high-scoring socioeconomic indices of well-being, which implies that communities with higher fishing involvement have a lower incidence of social problems. The relationship is stronger in magnitude and is still statistically significant at the 0.1% level if only communities that have total sum of dichotomized social or fishing involvement scores that is greater than zero are included (from 347 to 280 communities included in the regressions).[2] A natural conclusion from this finding is that the presence of fishing activity by residents appears to improve the overall socioeconomic well-being of Alaska communities. In fact, the importance of fishing to Alaska communities has been inextricably linked to the survival of many communities that are isolated and dependent on natural resources because they lack access to alternative local economic opportunities (Carothers 2008b; 2011; 2013; Carothers,

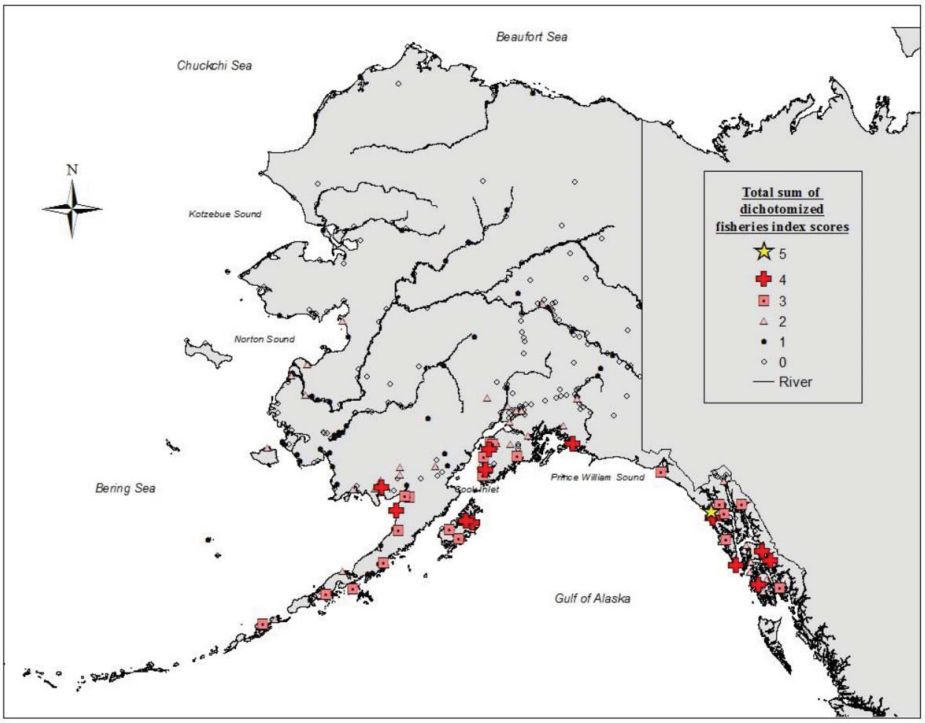

Figure 4. Total sum of dichotomized scores for all fishing involvement indices for all communities.

Lew, and Sepez 2010; Knapp 2011; Lowe 2008; Langdon 2008). In addition, many Alaska communities were founded based on access to fisheries resources. In these places, ultimately all facets of the community are tied to fishing activity in some way (e.g., supporting fishermen's families, local businesses that service fishermen) so that any decrease in fishing activity is likely to ultimately lead to the overall socioeconomic decline of the community.

Discussion

It is clear that community well-being is in many cases affected by multiple factors that interact with, or are directly or indirectly affected by, one another. In addition, the distinct characteristics of individual communities results in factors differentially affecting each community. To understand overall community vulnerability and well-being the relationships among such variables must be understood. In an attempt to uncover these relationships, Figures 1 and 2 show individual community index scores plotted for the top 20 scoring communities in the socioeconomic well-being and fishing involvement indices. The diversity of factors affecting individual communities is apparent from these figures. Specifically, there is no overlap between the top scoring communities in each set of indices, and each community appears to be affected most by a different combination and degree of factor scores for the indices.

For those communities most affected by the socioeconomic well-being indices, one can note that their common characteristics include having low populations and being remote. This is further compounded by the fact that data used for the housing characteristics and housing disruption indices were not available for some of these top scoring communities; however, these communities still remain in the top 20 due to high factor scores for the population disruption, population composition, and poverty indices. This is showcased in Gambell and Savoonga, the two communities on St. Lawrence Island at the southern end of the Bering Strait, where the populations have relatively high poverty rates and are heavily reliant on subsistence activities. Other variables leading to high factor scores for these communities include high percentages of the population that are Alaska Natives, a high percentage of children and a high percentage of the populations that do not speak English well. Another example is the community of Akutan, which lies on the Aleutian Island chain. This community scores high on the population composition, labor force structure, and status of schools indices, mainly due to the young, foreign and transient nature of the local population, approximately 90% of which is brought in from other countries by the local fish processing plant. Likely due to the high level of support provided to these transient residents by the processing plant, this community scores below one standard deviation for the poverty index.

Striking diversity is seen in the fishing-related indices affecting communities. Communities across Alaska vary in their dependence and reliance on commercial, recreational and subsistence fisheries. From Figure 2, it is notable that 13 of the 14 communities (Soldotna is the exception) were above one standard deviation from the mean for commercial harvesting engagement and reliance, only one was above one standard deviation for both commercial processing engagement and reliance (Egegik), and 7 communities (Elfin Cove, Kasilof, Craig, Pelican, Port Alexander, Port Lions, and Soldotna) were above one standard deviation for both recreational fishing engagement and reliance. The appearance of general types of communities is also apparent. For example, Unalaska, Kodiak, and Sitka all score highly for commercial processing engagement, indicative of the large amount of processing activities taking

place in these communities compared to the rest of the state. Kodiak and Sitka, as well as Ketchikan, Homer, and Juneau, score highest in recreational fishing engagement, where a substantial amount of recreational fishing occurs. There are several much smaller communities that score highly for recreational fishing reliance, where the percentage of local residents participating in recreational fishing is high. Finally, it is notable that Egegik and Ugashik score the highest by far for commercial processing reliance, as the population is almost entirely composed of processing workers specifically brought in to work at the processing plants.

Finally, the results of this analysis suggest that the concept of adaptation should be considered at the community level. The concept of adaptive capacity is extremely difficult to measure or assess given how multifaceted and complex it can be. It is possible that no one analysis will ever be able to fully assess adaptive capacity. Recognizing this, the indices presented here focus on a small suite of variables that we believe to be important in considering a community's capacity to adapt. However, a key consideration is that once identified as "vulnerable" by scoring highly on a number of our social well-being or fisheries involvement indices, how should communities respond or adapt to prevent negative impacts? Adaptation refers to coping mechanisms that humans employ in obtaining wants and needs, and in adjusting their lives to the surrounding, socio-natural environment (Bennett 1976; Adger, Arnell, and Tompkins 2005). People adapt to the extent they are able in ways that involve forethought and innovation; however, this can be limited by existing vulnerabilities and a lack of the necessary materials, supplies, information, and authority to respond to change (i.e., their adaptive capacity). An interesting aspect of adaptation is that they may be large-scale planned responses to change, but more often they represent the accumulation of multiple small-scale incremental changes and experiments made at the individual level (Irvine and Kaplan 2001).

To date, there have been numerous studies that have focused on creating a methodology for assessing community vulnerability and well-being (Colburn and Jepson 2012; Cutter et al. 2003; GSAFFI 2010 and 2013; Jacob et al. 2010; Jepson and Jacob 2007). The results of the work presented here can assist policymakers, community leaders, and others in making decisions that can improve overall well-being. We believe this is a critical next step in the refinement and application of these indices to policy decisions and other key strategies that communities use to plan for their future.

Conclusion

Community well-being, resilience, and vulnerability are typically assessed through time consuming and expensive qualitative methods (e.g., ethnographic fieldwork). However, there is a need to develop much quicker and more quantitative methods for assessing community well-being and potential impacts from fisheries management decisions. The methodology presented here follows work done in other regions of the United States, with the intent to create a standard set of quantitative indices that can be used for cross-regional and nationwide analysis, of fishing community well-being and vulnerability. In addition, the validity of the results can be tested through in-community groundtruthing and ethnographic fieldwork.

A key conclusion of the results presented here is that communities may be grouped or typed based on a set of common characteristics (e.g., significant processing capacity and involvement in recreational fishing or significant involvement in subsistence fishing and

high poverty rates), but they will still retain distinct characteristics that will not be identical across communities. Given this, no two communities will be equally affected by changes in any of the variables that are commonly used to measure community vulnerability or well-being. Therefore, although the indices presented here provide a useful quantitative tool to quickly assess which communities are going to be affected by a given perturbation, it is clear that the individual context of each community must be further taken into account and explored to understand exactly how those communities may be affected.

In recognition of the potential limitations of the indices we have presented here, the next step in this research project is to undertake a groundtruthing exercise that incorporates stakeholder feedback from representative communities throughout Alaska regarding the appropriateness and adequacy of these indices. Using this information, we will be able to adapt the current methodology and improve the indices based on community member input. Outcomes of this groundtruthing exercise are expected to include a richer understanding of livelihoods in the region and a better appreciation for how people plan for and respond to change. This will enable more objective inter- and intra-regional analysis of socioeconomic impacts associated with marine resource management, and ways that management agencies and policymakers can help coastal communities escape the trap of mitigation in favor of enacting responses to change that are effective and sustainable in the long term. In addition, we will be undertaking an exercise to assess the ability of the indices to predict and track change in community vulnerability relative to known perturbations from fisheries management. Both the groundtruthing and predictive accuracy exercises are expected to shed significant light on the ultimate usefulness of these indices.

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Notes

1. The subsistence data are gathered from the Alaska Department of Fish and Game, Subsistence Division's Community Subsistence Information System (CSIS) (ADF&G 2014). While subsistence surveys are conducted annually, not all communities are surveyed each year and some have not been surveyed since the late 1980s. Therefore, we use an average of the subsistence data over all years (1980–2011) where the community was surveyed by ADF&G. However, the majority of data come from the "representative year" surveys and these communities average only 1.27 representative years over this 32-year period, so most of the data come from a single year survey for each community. We are therefore constrained to assume that the subsistence activities have remained constant for these communities over this time period and can therefore be compared with our other community data from the 2005–2009 period. While there have certainly been changes in subsistence activities over this time frame, no other source of data is available to assess the validity of this assumption.
2. These regression results are also consistent across alternative limited dependent variable model specifications including truncated normal regression, Poisson regression, negative binomial

regression, and zero-inflated Poisson regression using the percentage of households in poverty to predict a positive total social index score. The estimated ordinary least squares coefficients for all communities are: total social = 0.94 –0.22*total fish ($R^2 = 0.05$, $n = 347$). The estimated ordinary least squares coefficients for communities with a positive total social or total fishing index values are: total social = 1.45 –0.45*total fish ($R^2 = 0.19$, $n = 280$).

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Appendix

Table A1. Community social indices for all included Alaska communities.

Community	Personal disruption	Population composition	Poverty	Labor force structure	Housing characteristics	Housing disruption	Status of schools	Total social score
Chevak	1	1	1	0	1	0	0	4
Crooked Creek	0	1	0	1	1	1	0	4
Gambell	1	1	1	0	1	0	0	4
Goodnews Bay	1	1	0	1	0	1	0	4
Hooper Bay	1	1	1	0	1	0	0	4
Kasigluk	0	1	1	1	1	0	0	4
Kokhanok	1	1	1	0	0	1	0	4
Mentasta Lake	1	0	1	1	0	0	1	4
Napakiak	1	1	1	1	0	0	0	4
Northway Village	1	1	1	1	0	0	0	4
Platinum	1	0	1	1	0	0	1	4
Quinhagak	1	1	1	0	1	0	0	4
Stebbins	1	1	1	0	1	0	0	4
Takotna	1	1	0	1	0	0	1	4
Akiachak	0	1	1	0	1	0	0	3
Anvik	1	0	1	0	0	0	1	3
Central	1	0	0	1	0	0	1	3
Clark's Point	1	0	1	0	0	0	1	3
Eek	0	1	0	1	1	0	0	3
Grayling	1	1	0	1	0	0	0	3
Holy Cross	1	0	1	1	0	0	0	3
Karluk	1	1	0	0	0	0	1	3
Koyuk	1	1	1	0	0	0	0	3
Koyukuk	1	1	0	0	0	0	1	3
Kwethluk	0	1	0	1	1	0	0	3
Marshall	0	1	1	0	1	0	0	3
Nikolai	1	0	1	0	0	0	1	3
Northway	1	1	1	0	0	0	0	3
Oscarville	1	0	1	1	0	0	0	3
Pitkas Point	1	0	1	0	1	0	0	3
Savoonga	1	1	1	0	0	0	0	3
Sheldon Point (Nunam Iqua)	0	0	1	0	1	1	0	3
Shishmaref	0	1	1	0	1	0	0	3
Slana	0	0	1	1	0	0	1	3
Stevens Village	0	1	0	1	0	0	1	3
Tetlin	1	1	0	1	0	0	0	3
Tuluksak	1	1	1	0	0	0	0	3
Tuntutuliak	1	1	1	0	0	0	0	3
Willow Creek	1	0	1	1	0	0	0	3
Akiak	0	1	1	0	0	0	0	2
Akutan	0	1	0	0	0	0	1	2
Arctic Village	1	0	1	0	0	0	0	2
Beaver	1	0	0	0	0	0	1	2
Buckland	0	1	0	0	1	0	0	2
Chalkyitsik	1	0	0	0	0	0	1	2
Chickaloon	0	0	0	1	0	1	0	2
Chuathbaluk	1	0	0	0	1	0	0	2
Circle	1	0	0	0	0	0	1	2
Clam Gulch	1	0	1	0	0	0	0	2
Diomede	1	0	1	0	0	0	0	2
Dot Lake Village	1	0	0	1	0	0	0	2
Eagle	0	0	0	1	0	0	1	2
Elim	1	0	1	0	0	0	0	2
False Pass	0	1	0	0	0	0	1	2

(*continued*)

Table A1. (*Continued*)

Community	Personal disruption	Population composition	Poverty	Labor force structure	Housing characteristics	Housing disruption	Status of schools	Total social score
Gakona	0	0	0	0	0	1	1	2
Golovin	0	1	0	0	1	0	0	2
Igiugig	0	1	0	0	0	0	1	2
Kongiganak	0	1	0	0	1	0	0	2
Kotlik	0	0	1	0	1	0	0	2
Levelock	0	0	0	1	0	0	1	2
Lower Kalskag	0	1	0	0	1	0	0	2
Manokotak	0	0	0	1	1	0	0	2
Nanwalek	1	0	0	0	0	1	0	2
Newtok	0	1	0	0	1	0	0	2
Nikolski	0	0	0	1	0	0	1	2
Noorvik	0	1	0	1	0	0	0	2
Nunapitchuk	0	1	0	0	1	0	0	2
Old Harbor	1	0	1	0	0	0	0	2
Pedro Bay	0	0	0	1	0	0	1	2
Pelican	0	0	0	1	0	0	1	2
Port Alexander	0	0	0	0	0	1	1	2
Port Graham	0	0	1	0	0	0	1	2
Port Protection	0	0	0	1	0	0	1	2
Rampart	1	0	0	1	0	0	0	2
Ruby	1	0	0	0	1	0	0	2
Selawik	1	0	0	1	0	0	0	2
Shungnak	1	1	0	0	0	0	0	2
Tanacross	1	0	0	0	0	0	1	2
Teller	0	1	0	0	1	0	0	2
Togiak	1	1	0	0	0	0	0	2
Toksook Bay	0	1	0	0	1	0	0	2
Tyonek	1	0	0	0	0	1	0	2
Wainwright	1	1	0	0	0	0	0	2
Adak	0	0	0	0	0	0	1	1
Akhiok	0	0	0	0	0	0	1	1
Alcan Border	0	0	0	1	0	0	0	1
Aleknagik	0	0	1	0	0	0	0	1
Allakaket	1	0	0	0	0	0	0	1
Ambler	1	0	0	0	0	0	0	1
Anaktuvuk Pass	0	1	0	0	0	0	0	1
Angoon	0	0	1	0	0	0	0	1
Aniak	0	0	0	0	0	1	0	1
Atka	0	0	0	0	0	0	1	1
Atmautluak	0	1	0	0	0	0	0	1
Birch Creek	0	0	0	1	0	0	0	1
Chefornak	0	1	0	0	0	0	0	1
Chenega	0	0	0	0	0	0	1	1
Chignik Lagoon	0	0	0	0	0	0	1	1
Chignik Lake	0	0	0	0	0	1	0	1
Chignik	0	0	0	0	0	0	1	1
Chiniak	0	0	0	0	0	0	1	1
Coffman Cove	0	0	0	0	0	0	1	1
Cold Bay	0	0	0	0	0	0	1	1
Cooper Landing	0	0	0	0	0	0	1	1
Deltana	0	0	0	0	0	1	0	1
Dot Lake	0	0	0	0	0	0	1	1
Eagle Village	1	0	0	0	0	0	0	1
Edna Bay	0	0	0	0	0	0	1	1
Egegik	0	0	0	0	0	0	1	1
Ekwok	0	0	0	0	0	0	1	1
Emmonak	0	0	0	0	1	0	0	1
Fort Yukon	0	0	0	0	0	1	0	1

(*continued*)

Table A1. (*Continued*)

Community	Personal disruption	Population composition	Poverty	Labor force structure	Housing characteristics	Housing disruption	Status of schools	Total social score
Fox River	0	0	0	1	0	0	0	1
Funny River	0	0	0	1	0	0	0	1
Glacier View	0	0	0	0	0	1	0	1
Hope	0	0	0	0	0	0	1	1
Hughes	0	0	0	0	0	0	1	1
Huslia	0	0	0	0	1	0	0	1
Hydaburg	0	0	0	1	0	0	0	1
Hyder	0	0	0	0	0	0	1	1
Kaltag	1	0	0	0	0	0	0	1
Kenny Lake	0	0	0	1	0	0	0	1
Kiana	0	0	1	0	0	0	0	1
Kipnuk	0	1	0	0	0	0	0	1
Kivalina	0	1	0	0	0	0	0	1
Kwigillingok	0	1	0	0	0	0	0	1
Larsen Bay	0	0	0	0	0	0	1	1
Lutak	1	0	0	0	0	0	0	1
Manley Hot Springs	0	0	0	0	0	0	1	1
Mekoryuk	0	0	0	0	1	0	0	1
Mosquito Lake	0	0	0	0	0	1	0	1
Mountain Village	0	1	0	0	0	0	0	1
Mud Bay	0	0	0	0	0	1	0	1
Napaskiak	0	0	0	1	0	0	0	1
Naukati Bay	0	0	0	0	0	0	1	1
Nelson Lagoon	0	0	0	0	0	0	1	1
New Allakaket	1	0	0	0	0	0	0	1
New Stuyahok	0	0	1	0	0	0	0	1
Nightmute	0	1	0	0	0	0	0	1
Nondalton	0	0	0	0	1	0	0	1
Perryville	0	0	1	0	0	0	0	1
Pilot Point	0	0	0	0	0	0	1	1
Pilot Station	0	0	1	0	0	0	0	1
Point Lay	0	1	0	0	0	0	0	1
Port Heiden	0	1	0	0	0	0	0	1
Red Devil	0	0	0	0	0	0	1	1
Salamatof	0	0	0	1	0	0	0	1
Sand Point	0	1	0	0	0	0	0	1
Saxman	1	0	0	0	0	0	0	1
Scammon Bay	0	0	0	0	1	0	0	1
Seldovia Village	0	0	0	0	0	1	0	1
Seldovia	0	0	0	1	0	0	0	1
Shageluk	0	0	0	0	0	0	1	1
Sleetmute	0	0	0	0	0	0	1	1
St. George	0	0	0	0	0	0	1	1
St. Mary's	0	1	0	0	0	0	0	1
St. Michael	0	1	0	0	0	0	0	1
St. Paul	0	1	0	0	0	0	0	1
Stony River	0	0	0	0	0	0	1	1
Tatitlek	0	0	0	0	0	0	1	1
Tenakee Springs	0	0	0	0	0	0	1	1
Tok	0	0	0	0	0	1	0	1
Trapper Creek	0	0	0	0	0	0	1	1
Tununak	0	0	0	0	1	0	0	1
Twin Hills	0	0	0	0	0	0	1	1
Two Rivers	0	0	0	0	0	1	0	1
Ugashik	0	0	0	1	0	0	0	1
Unalakleet	0	0	0	1	0	0	0	1
Upper Kalskag	0	0	1	0	0	0	0	1
Venetie	1	0	0	0	0	0	0	1

(*continued*)

Table A1. (*Continued*)

Community	Personal disruption	Population composition	Poverty	Labor force structure	Housing characteristics	Housing disruption	Status of schools	Total social score
Whale Pass	0	0	0	0	0	0	1	1
White Mountain	0	0	1	0	0	0	0	1
Alakanuk	0	0	0	0	0	0	0	0
Alatna	0	0	0	0	0	0	0	0
Aleneva	0	0	0	0	0	0	0	0
Alpine	0	0	0	0	0	0	0	0
Anchor Point	0	0	0	0	0	0	0	0
Anchorage	0	0	0	0	0	0	0	0
Anderson	0	0	0	0	0	0	0	0
Atqasuk	0	0	0	0	0	0	0	0
Attu Station	0	0	0	0	0	0	0	0
Barrow	0	0	0	0	0	0	0	0
Bear Creek	0	0	0	0	0	0	0	0
Beluga	0	0	0	0	0	0	0	0
Bethel	0	0	0	0	0	0	0	0
Bettles	0	0	0	0	0	0	0	0
Big Delta	0	0	0	0	0	0	0	0
Big Lake	0	0	0	0	0	0	0	0
Brevig Mission	0	0	0	0	0	0	0	0
Buffalo Soapstone	0	0	0	0	0	0	0	0
Butte	0	0	0	0	0	0	0	0
Cantwell	0	0	0	0	0	0	0	0
Chase	0	0	0	0	0	0	0	0
Chicken	0	0	0	0	0	0	0	0
Chisana	0	0	0	0	0	0	0	0
Chistochina	0	0	0	0	0	0	0	0
Chitina	0	0	0	0	0	0	0	0
Cohoe	0	0	0	0	0	0	0	0
Coldfoot	0	0	0	0	0	0	0	0
College	0	0	0	0	0	0	0	0
Copper Center	0	0	0	0	0	0	0	0
Copperville	0	0	0	0	0	0	0	0
Cordova	0	0	0	0	0	0	0	0
Covenant Life	0	0	0	0	0	0	0	0
Craig	0	0	0	0	0	0	0	0
Crown Point	0	0	0	0	0	0	0	0
Cube Cove	0	0	0	0	0	0	0	0
Deering	0	0	0	0	0	0	0	0
Delta Junction	0	0	0	0	0	0	0	0
Diamond Ridge	0	0	0	0	0	0	0	0
Dillingham	0	0	0	0	0	0	0	0
Dry Creek	0	0	0	0	0	0	0	0
Eielson AFB	0	0	0	0	0	0	0	0
Ekuk	0	0	0	0	0	0	0	0
Elfin Cove	0	0	0	0	0	0	0	0
Ester	0	0	0	0	0	0	0	0
Evansville	0	0	0	0	0	0	0	0
Excursion Inlet	0	0	0	0	0	0	0	0
Fairbanks	0	0	0	0	0	0	0	0
Farm Loop	0	0	0	0	0	0	0	0
Ferry	0	0	0	0	0	0	0	0
Fishhook	0	0	0	0	0	0	0	0
Flat	0	0	0	0	0	0	0	0
Fort Greely	0	0	0	0	0	0	0	0
Four Mile Road	0	0	0	0	0	0	0	0
Fox	0	0	0	0	0	0	0	0
Fritz Creek	0	0	0	0	0	0	0	0
Galena	0	0	0	0	0	0	0	0

(*continued*)

Table A1. (*Continued*)

Community	Personal disruption	Population composition	Poverty	Labor force structure	Housing characteristics	Housing disruption	Status of schools	Total social score
Game Creek	0	0	0	0	0	0	0	0
Gateway	0	0	0	0	0	0	0	0
Glennallen	0	0	0	0	0	0	0	0
Gulkana	0	0	0	0	0	0	0	0
Gustavus	0	0	0	0	0	0	0	0
Haines	0	0	0	0	0	0	0	0
Halibut Cove	0	0	0	0	0	0	0	0
Happy Valley	0	0	0	0	0	0	0	0
Harding-Birch Lakes	0	0	0	0	0	0	0	0
Healy	0	0	0	0	0	0	0	0
Healy Lake	0	0	0	0	0	0	0	0
Hobart Bay	0	0	0	0	0	0	0	0
Hollis	0	0	0	0	0	0	0	0
Homer	0	0	0	0	0	0	0	0
Hoonah	0	0	0	0	0	0	0	0
Houston	0	0	0	0	0	0	0	0
Iliamna	0	0	0	0	0	0	0	0
Ivanof Bay	0	0	0	0	0	0	0	0
Juneau	0	0	0	0	0	0	0	0
Kachemak	0	0	0	0	0	0	0	0
Kake	0	0	0	0	0	0	0	0
Kaktovik	0	0	0	0	0	0	0	0
Kalifornsky	0	0	0	0	0	0	0	0
Kasaan	0	0	0	0	0	0	0	0
Kasilof	0	0	0	0	0	0	0	0
Kenai	0	0	0	0	0	0	0	0
Ketchikan	0	0	0	0	0	0	0	0
King Cove	0	0	0	0	0	0	0	0
King Salmon	0	0	0	0	0	0	0	0
Klawock	0	0	0	0	0	0	0	0
Klukwan	0	0	0	0	0	0	0	0
Knik River	0	0	0	0	0	0	0	0
Knik-Fairview	0	0	0	0	0	0	0	0
Kobuk	0	0	0	0	0	0	0	0
Kodiak Station	0	0	0	0	0	0	0	0
Kodiak	0	0	0	0	0	0	0	0
Koliganek	0	0	0	0	0	0	0	0
Kotzebue	0	0	0	0	0	0	0	0
Kupreanof	0	0	0	0	0	0	0	0
Lake Louise	0	0	0	0	0	0	0	0
Lake Minchumina	0	0	0	0	0	0	0	0
Lakes	0	0	0	0	0	0	0	0
Lazy Mountain	0	0	0	0	0	0	0	0
Lime Village	0	0	0	0	0	0	0	0
Livengood	0	0	0	0	0	0	0	0
Lowell Point	0	0	0	0	0	0	0	0
McCarthy	0	0	0	0	0	0	0	0
McGrath	0	0	0	0	0	0	0	0
McKinley Park	0	0	0	0	0	0	0	0
Meadow Lakes	0	0	0	0	0	0	0	0
Mendeltna	0	0	0	0	0	0	0	0
Metlakatla	0	0	0	0	0	0	0	0
Minto	0	0	0	0	0	0	0	0
Moose Creek	0	0	0	0	0	0	0	0
Moose Pass	0	0	0	0	0	0	0	0
Naknek	0	0	0	0	0	0	0	0
Nelchina	0	0	0	0	0	0	0	0
Nenana	0	0	0	0	0	0	0	0

(*continued*)

Table A1. (*Continued*)

Community	Personal disruption	Population composition	Poverty	Labor force structure	Housing characteristics	Housing disruption	Status of schools	Total social score
Newhalen	0	0	0	0	0	0	0	0
Nikiski	0	0	0	0	0	0	0	0
Nikolaevsk	0	0	0	0	0	0	0	0
Ninilchik	0	0	0	0	0	0	0	0
Noatak	0	0	0	0	0	0	0	0
Nome	0	0	0	0	0	0	0	0
North Pole	0	0	0	0	0	0	0	0
Northway Junction	0	0	0	0	0	0	0	0
Nuiqsut	0	0	0	0	0	0	0	0
Nulato	0	0	0	0	0	0	0	0
Ouzinkie	0	0	0	0	0	0	0	0
Palmer	0	0	0	0	0	0	0	0
Paxson	0	0	0	0	0	0	0	0
Petersburg	0	0	0	0	0	0	0	0
Petersville	0	0	0	0	0	0	0	0
Pleasant Valley	0	0	0	0	0	0	0	0
Point Baker	0	0	0	0	0	0	0	0
Point Hope	0	0	0	0	0	0	0	0
Point MacKenzie	0	0	0	0	0	0	0	0
Pope-Vannoy Landing	0	0	0	0	0	0	0	0
Port Alsworth	0	0	0	0	0	0	0	0
Port Clarence	0	0	0	0	0	0	0	0
Port Lions	0	0	0	0	0	0	0	0
Portage Creek	0	0	0	0	0	0	0	0
Primrose	0	0	0	0	0	0	0	0
Prudhoe Bay	0	0	0	0	0	0	0	0
Red Dog Mine	0	0	0	0	0	0	0	0
Ridgeway	0	0	0	0	0	0	0	0
Russian Mission	0	0	0	0	0	0	0	0
Salcha	0	0	0	0	0	0	0	0
Seward	0	0	0	0	0	0	0	0
Shaktoolik	0	0	0	0	0	0	0	0
Silver Springs	0	0	0	0	0	0	0	0
Sitka	0	0	0	0	0	0	0	0
Skagway	0	0	0	0	0	0	0	0
Skwentna	0	0	0	0	0	0	0	0
Soldotna	0	0	0	0	0	0	0	0
South Naknek	0	0	0	0	0	0	0	0
Sterling	0	0	0	0	0	0	0	0
Sunrise	0	0	0	0	0	0	0	0
Susitna	0	0	0	0	0	0	0	0
Susitna North	0	0	0	0	0	0	0	0
Sutton-Alpine	0	0	0	0	0	0	0	0
Talkeetna	0	0	0	0	0	0	0	0
Tanaina	0	0	0	0	0	0	0	0
Tanana	0	0	0	0	0	0	0	0
Tazlina	0	0	0	0	0	0	0	0
Thorne Bay	0	0	0	0	0	0	0	0
Tolsona	0	0	0	0	0	0	0	0
Tonsina	0	0	0	0	0	0	0	0
Unalaska	0	0	0	0	0	0	0	0
Valdez	0	0	0	0	0	0	0	0
Wales	0	0	0	0	0	0	0	0
Wasilla	0	0	0	0	0	0	0	0
Whitestone Logging Camp	0	0	0	0	0	0	0	0
Whittier	0	0	0	0	0	0	0	0
Willow	0	0	0	0	0	0	0	0
Wiseman	0	0	0	0	0	0	0	0
Womens Bay	0	0	0	0	0	0	0	0
Wrangell	0	0	0	0	0	0	0	0
Yakutat	0	0	0	0	0	0	0	0

Table A2. Community fishing involvement indices for all included Alaska communities.

Community	Commercial processing engagement	Commercial harvesting engagement	Commercial processing reliance	Commercial harvesting reliance	Recreational engagement	Recreational reliance	Subsistence harvesting involvement	Total fishery score
Elfin Cove	0	1	1	1	1	1	0	5
Kasilof	0	1	0	1	1	1	1	5
Cordova	1	1	0	1	1	0	0	4
Craig	0	1	0	1	1	1	0	4
Dillingham	1	1	0	1	1	0	0	4
Egegik	1	1	1	1	0	0	0	4
Homer	1	1	0	1	1	0	0	4
Kodiak	1	1	0	1	1	0	0	4
Pelican	0	1	0	1	1	1	0	4
Petersburg	1	1	0	1	1	0	0	4
Port Alexander	0	1	0	1	1	1	0	4
Port Lions	0	1	0	1	1	1	0	4
Soldotna	0	1	0	0	1	1	1	4
Wrangell	1	1	0	1	1	0	0	4
Chignik	0	1	1	1	0	0	0	3
Clam Gulch	0	1	0	1	0	0	1	3
Fairbanks	0	1	0	0	1	0	1	3
Gustavus	0	1	0	0	1	1	0	3
Hoonah	0	1	0	1	1	0	0	3
Juneau	1	1	0	0	1	0	0	3
Kenai	1	1	0	0	1	0	0	3
Ketchikan	1	1	0	0	1	0	0	3
King Cove	1	1	0	1	0	0	0	3
King Salmon	0	1	0	0	1	1	0	3
Larsen Bay	0	0	0	1	1	1	0	3
Naknek	1	1	0	1	0	0	0	3
Ninilchik	0	1	0	0	1	1	0	3
Old Harbor	0	1	0	1	1	0	0	3
Palmer	0	1	0	0	1	0	1	3
Sand Point	1	1	0	1	0	0	0	3
Seldovia	0	1	0	1	1	0	0	3
Seward	1	1	0	0	1	0	0	3
Sitka	1	1	0	0	1	0	0	3
Skwentna	0	0	0	0	1	1	1	3
Sterling	0	1	0	0	1	0	1	3
Ugashik	0	0	1	1	0	0	1	3
Unalaska	1	1	1	0	0	0	0	3
Wasilla	0	1	0	0	1	0	1	3
Willow	0	1	0	0	1	0	1	3
Yakutat	0	1	0	1	1	0	0	3
Akutan	1	0	1	0	0	0	0	2
Alakanuk	0	1	0	0	0	0	1	2
Aleknagik	0	1	0	1	0	0	0	2
Anchor Point	0	1	0	0	1	0	0	2
Anchorage	0	1	0	0	1	0	0	2
Bethel	0	1	0	0	0	0	1	2
Chefornak	0	1	0	0	0	0	1	2
Chignik Lagoon	0	1	0	1	0	0	0	2
Cooper Landing	0	0	0	0	1	1	0	2
Copper Center	0	0	0	0	1	0	1	2
Delta Junction	0	1	0	0	0	0	1	2
Edna Bay	0	0	0	1	0	1	0	2
Excursion Inlet	0	0	1	0	0	0	1	2
Haines	0	1	0	0	1	0	0	2
Halibut Cove	0	0	0	1	0	0	1	2
Hydaburg	0	1	0	1	0	0	0	2
Iliamna	0	0	0	1	0	1	0	2
Kake	0	1	0	0	1	0	0	2

(*continued*)

Table A2. (*Continued*)

Community	Commercial processing engagement	Commercial harvesting engagement	Commercial processing reliance	Commercial harvesting reliance	Recreational engagement	Recreational reliance	Subsistence harvesting involvement	Total fishery score
Klawock	0	1	0	0	1	0	0	2
Koliganek	0	0	0	1	0	0	1	2
Kotlik	0	1	0	0	0	0	1	2
Manokotak	0	1	0	1	0	0	0	2
Mekoryuk	0	1	0	1	0	0	0	2
Mountain Village	0	1	0	0	0	0	1	2
Nelson Lagoon	0	1	0	1	0	0	0	2
New Stuyahok	0	1	0	0	0	0	1	2
Nikiski	0	1	0	0	0	0	1	2
North Pole	0	0	0	0	1	0	1	2
Ouzinkie	0	1	0	1	0	0	0	2
Point Baker	0	0	0	1	0	1	0	2
Prudhoe Bay	0	0	0	0	0	1	1	2
Shaktoolik	0	1	0	1	0	0	0	2
South Naknek	0	1	0	1	0	0	0	2
Thorne Bay	0	1	0	0	1	0	0	2
Togiak	0	1	0	1	0	0	0	2
Valdez	0	1	0	0	1	0	0	2
Whittier	0	0	0	0	1	1	0	2
Akhiok	0	0	0	1	0	0	0	1
Akiachak	0	1	0	0	0	0	0	1
Akiak	0	0	0	0	0	0	1	1
Alcan Border	0	0	0	0	0	0	1	1
Aleneva	0	0	0	0	0	0	1	1
Allakaket	0	0	0	0	0	0	1	1
Alpine	0	0	0	0	0	0	1	1
Angoon	0	0	0	0	1	0	0	1
Atmautluak	0	0	0	0	0	0	1	1
Attu Station	0	0	0	0	0	0	1	1
Bear Creek	0	0	0	0	0	0	1	1
Big Delta	0	0	0	0	0	0	1	1
Big Lake	0	0	0	0	0	0	1	1
Buffalo Soapstone	0	0	0	0	0	0	1	1
Butte	0	0	0	0	0	0	1	1
Chevak	0	0	0	0	0	0	1	1
Chicken	0	0	0	0	0	0	1	1
Chignik Lake	0	0	0	1	0	0	0	1
Clark's Point	0	0	0	1	0	0	0	1
Coffman Cove	0	0	0	0	1	0	0	1
Cohoe	0	0	0	0	0	0	1	1
Cold Bay	0	0	0	0	0	0	1	1
College	0	0	0	0	0	0	1	1
Copperville	0	0	0	0	0	0	1	1
Covenant Life	0	0	0	0	0	0	1	1
Crown Point	0	0	0	0	0	0	1	1
Cube Cove	0	0	0	0	0	0	1	1
Deltana	0	0	0	0	0	0	1	1
Diamond Ridge	0	0	0	0	0	0	1	1
Dot Lake Village	0	0	0	0	0	0	1	1
Eek	0	1	0	0	0	0	0	1
Eielson AFB	0	0	0	0	0	0	1	1
Ekuk	0	0	0	0	0	0	1	1
Emmonak	0	1	0	0	0	0	0	1
Ester	0	0	0	0	0	0	1	1
False Pass	0	0	0	1	0	0	0	1
Farm Loop	0	0	0	0	0	0	1	1
Ferry	0	0	0	0	0	0	1	1
Fishhook	0	0	0	0	0	0	1	1

(*continued*)

Table A2. (*Continued*)

Community	Commercial processing engagement	Commercial harvesting engagement	Commercial processing reliance	Commercial harvesting reliance	Recreational engagement	Recreational reliance	Subsistence harvesting involvement	Total fishery score
Flat	0	0	0	0	0	0	1	1
Fort Greely	0	0	0	0	0	0	1	1
Four Mile Road	0	0	0	0	0	0	1	1
Fox	0	0	0	0	0	0	1	1
Fox River	0	0	0	0	0	0	1	1
Funny River	0	0	0	0	0	0	1	1
Gateway	0	0	0	0	0	0	1	1
Glacier View	0	0	0	0	0	0	1	1
Goodnews Bay	0	1	0	0	0	0	0	1
Happy Valley	0	0	0	0	0	0	1	1
Harding-Birch Lakes	0	0	0	0	0	0	1	1
Hobart Bay	0	0	0	0	0	0	1	1
Houston	0	0	0	0	0	0	1	1
Hughes	0	0	0	0	0	0	1	1
Ivanof Bay	0	0	0	1	0	0	0	1
Kachemak	0	0	0	0	0	0	1	1
Kalifornsky	0	0	0	0	0	0	1	1
Kipnuk	0	1	0	0	0	0	0	1
Knik River	0	0	0	0	0	0	1	1
Knik-Fairview	0	0	0	0	0	0	1	1
Kongiganak	0	0	0	0	0	0	1	1
Kotzebue	0	0	0	0	0	0	1	1
Kupreanof	0	0	0	0	0	0	1	1
Kwethluk	0	0	0	0	0	0	1	1
Kwigillingok	0	0	0	0	0	0	1	1
Lake Minchumina	0	0	0	0	0	0	1	1
Lakes	0	0	0	0	0	0	1	1
Lazy Mountain	0	0	0	0	0	0	1	1
Levelock	0	0	0	1	0	0	0	1
Lime Village	0	0	0	0	0	0	1	1
Livengood	0	0	0	0	0	0	1	1
Lowell Point	0	0	0	0	0	0	1	1
Lutak	0	0	0	0	0	0	1	1
Marshall	0	0	0	0	0	0	1	1
Meadow Lakes	0	0	0	0	0	0	1	1
Mendeltna	0	0	0	0	0	0	1	1
Mentasta Lake	0	0	0	0	0	0	1	1
Metlakatla	0	1	0	0	0	0	0	1
Minto	0	0	0	0	0	0	1	1
Moose Creek	0	0	0	0	0	0	1	1
Moose Pass	0	0	0	0	0	0	1	1
Mosquito Lake	0	0	0	0	0	0	1	1
Mud Bay	0	0	0	0	0	0	1	1
Napakiak	0	0	0	0	0	0	1	1
Nelchina	0	0	0	0	0	0	1	1
New Allakaket	0	0	0	0	0	0	1	1
Nikolaevsk	0	1	0	0	0	0	0	1
Nikolai	0	0	0	0	0	0	1	1
Nome	0	1	0	0	0	0	0	1
Northway Junction	0	0	0	0	0	0	1	1
Oscarville	0	0	0	0	0	0	1	1
Pedro Bay	0	0	0	0	0	1	0	1
Perryville	0	0	0	1	0	0	0	1
Pilot Point	0	0	0	1	0	0	0	1
Pilot Station	0	1	0	0	0	0	0	1
Pitkas Point	0	0	0	0	0	0	1	1
Pleasant Valley	0	0	0	0	0	0	1	1
Point Hope	0	0	0	0	0	0	1	1

(*continued*)

Table A2. (*Continued*)

Community	Commercial processing engagement	Commercial harvesting engagement	Commercial processing reliance	Commercial harvesting reliance	Recreational engagement	Recreational reliance	Subsistence harvesting involvement	Total fishery score
Point Lay	0	0	0	0	0	0	1	1
Point MacKenzie	0	0	0	0	0	0	1	1
Pope-Vannoy Landing	0	0	0	0	0	0	1	1
Port Alsworth	0	0	0	0	0	1	0	1
Port Clarence	0	0	0	0	0	0	1	1
Port Heiden	0	0	0	1	0	0	0	1
Primrose	0	0	0	0	0	0	1	1
Quinhagak	0	1	0	0	0	0	0	1
Red Dog Mine	0	0	0	0	0	0	1	1
Ridgeway	0	0	0	0	0	0	1	1
Salamatof	0	0	0	0	0	0	1	1
Salcha	0	0	0	0	0	0	1	1
Scammon Bay	0	0	0	0	0	0	1	1
Seldovia Village	0	0	0	0	0	0	1	1
Sheldon Point (Nunam Iqua)	0	0	0	0	0	0	1	1
Shishmaref	0	0	0	0	0	0	1	1
Shungnak	0	0	0	0	0	0	1	1
Silver Springs	0	0	0	0	0	0	1	1
Slana	0	0	0	0	0	0	1	1
St. Mary's	0	1	0	0	0	0	0	1
St. Paul	0	1	0	0	0	0	0	1
Sunrise	0	0	0	0	0	0	1	1
Susitna	0	0	0	0	0	0	1	1
Susitna North	0	0	0	0	0	0	1	1
Sutton-Alpine	0	0	0	0	0	0	1	1
Takotna	0	0	0	0	0	0	1	1
Talkeetna	0	0	0	0	1	0	0	1
Tanaina	0	0	0	0	0	0	1	1
Tenakee Springs	0	0	0	1	0	0	0	1
Tok	0	0	0	0	0	0	1	1
Toksook Bay	0	1	0	0	0	0	0	1
Tolsona	0	0	0	0	0	0	1	1
Tuluksak	0	0	0	0	0	0	1	1
Tuntutuliak	0	0	0	0	0	0	1	1
Tununak	0	0	0	0	0	0	1	1
Two Rivers	0	0	0	0	0	0	1	1
Unalakleet	0	1	0	0	0	0	0	1
Wainwright	0	0	0	0	0	0	1	1
Willow Creek	0	0	0	0	0	0	1	1
Wiseman	0	0	0	0	0	0	1	1
Womens Bay	0	0	0	0	0	0	1	1
Adak	0	0	0	0	0	0	0	0
Alatna	0	0	0	0	0	0	0	0
Ambler	0	0	0	0	0	0	0	0
Anaktuvuk Pass	0	0	0	0	0	0	0	0
Anderson	0	0	0	0	0	0	0	0
Aniak	0	0	0	0	0	0	0	0
Anvik	0	0	0	0	0	0	0	0
Arctic Village	0	0	0	0	0	0	0	0
Atka	0	0	0	0	0	0	0	0
Atqasuk	0	0	0	0	0	0	0	0
Barrow	0	0	0	0	0	0	0	0
Beaver	0	0	0	0	0	0	0	0
Beluga	0	0	0	0	0	0	0	0
Bettles	0	0	0	0	0	0	0	0
Birch Creek	0	0	0	0	0	0	0	0
Brevig Mission	0	0	0	0	0	0	0	0
Buckland	0	0	0	0	0	0	0	0

(*continued*)

Table A2. (*Continued*)

Community	Commercial processing engagement	Commercial harvesting engagement	Commercial processing reliance	Commercial harvesting reliance	Recreational engagement	Recreational reliance	Subsistence harvesting involvement	Total fishery score
Cantwell	0	0	0	0	0	0	0	0
Central	0	0	0	0	0	0	0	0
Chalkyitsik	0	0	0	0	0	0	0	0
Chase	0	0	0	0	0	0	0	0
Chenega	0	0	0	0	0	0	0	0
Chickaloon	0	0	0	0	0	0	0	0
Chiniak	0	0	0	0	0	0	0	0
Chisana	0	0	0	0	0	0	0	0
Chistochina	0	0	0	0	0	0	0	0
Chitina	0	0	0	0	0	0	0	0
Chuathbaluk	0	0	0	0	0	0	0	0
Circle	0	0	0	0	0	0	0	0
Coldfoot	0	0	0	0	0	0	0	0
Crooked Creek	0	0	0	0	0	0	0	0
Deering	0	0	0	0	0	0	0	0
Diomede	0	0	0	0	0	0	0	0
Dot Lake	0	0	0	0	0	0	0	0
Dry Creek	0	0	0	0	0	0	0	0
Eagle Village	0	0	0	0	0	0	0	0
Eagle	0	0	0	0	0	0	0	0
Ekwok	0	0	0	0	0	0	0	0
Elim	0	0	0	0	0	0	0	0
Evansville	0	0	0	0	0	0	0	0
Fort Yukon	0	0	0	0	0	0	0	0
Fritz Creek	0	0	0	0	0	0	0	0
Gakona	0	0	0	0	0	0	0	0
Galena	0	0	0	0	0	0	0	0
Gambell	0	0	0	0	0	0	0	0
Game Creek	0	0	0	0	0	0	0	0
Glennallen	0	0	0	0	0	0	0	0
Golovin	0	0	0	0	0	0	0	0
Grayling	0	0	0	0	0	0	0	0
Gulkana	0	0	0	0	0	0	0	0
Healy	0	0	0	0	0	0	0	0
Healy Lake	0	0	0	0	0	0	0	0
Hollis	0	0	0	0	0	0	0	0
Holy Cross	0	0	0	0	0	0	0	0
Hooper Bay	0	0	0	0	0	0	0	0
Hope	0	0	0	0	0	0	0	0
Huslia	0	0	0	0	0	0	0	0
Hyder	0	0	0	0	0	0	0	0
Igiugig	0	0	0	0	0	0	0	0
Kaktovik	0	0	0	0	0	0	0	0
Kaltag	0	0	0	0	0	0	0	0
Karluk	0	0	0	0	0	0	0	0
Kasaan	0	0	0	0	0	0	0	0
Kasigluk	0	0	0	0	0	0	0	0
Kenny Lake	0	0	0	0	0	0	0	0
Kiana	0	0	0	0	0	0	0	0
Kivalina	0	0	0	0	0	0	0	0
Klukwan	0	0	0	0	0	0	0	0
Kobuk	0	0	0	0	0	0	0	0
Kodiak Station	0	0	0	0	0	0	0	0
Kokhanok	0	0	0	0	0	0	0	0
Koyuk	0	0	0	0	0	0	0	0
Koyukuk	0	0	0	0	0	0	0	0
Lake Louise	0	0	0	0	0	0	0	0
Lower Kalskag	0	0	0	0	0	0	0	0

(*continued*)

Table A2. (*Continued*)

Community	Commercial processing engagement	Commercial harvesting engagement	Commercial processing reliance	Commercial harvesting reliance	Recreational engagement	Recreational reliance	Subsistence harvesting involvement	Total fishery score
Manley Hot Springs	0	0	0	0	0	0	0	0
McCarthy	0	0	0	0	0	0	0	0
McGrath	0	0	0	0	0	0	0	0
McKinley Park	0	0	0	0	0	0	0	0
Nanwalek	0	0	0	0	0	0	0	0
Napaskiak	0	0	0	0	0	0	0	0
Naukati Bay	0	0	0	0	0	0	0	0
Nenana	0	0	0	0	0	0	0	0
Newhalen	0	0	0	0	0	0	0	0
Newtok	0	0	0	0	0	0	0	0
Nightmute	0	0	0	0	0	0	0	0
Nikolski	0	0	0	0	0	0	0	0
Noatak	0	0	0	0	0	0	0	0
Nondalton	0	0	0	0	0	0	0	0
Noorvik	0	0	0	0	0	0	0	0
Northway	0	0	0	0	0	0	0	0
Northway Village	0	0	0	0	0	0	0	0
Nuiqsut	0	0	0	0	0	0	0	0
Nulato	0	0	0	0	0	0	0	0
Nunapitchuk	0	0	0	0	0	0	0	0
Paxson	0	0	0	0	0	0	0	0
Petersville	0	0	0	0	0	0	0	0
Platinum	0	0	0	0	0	0	0	0
Port Graham	0	0	0	0	0	0	0	0
Port Protection	0	0	0	0	0	0	0	0
Portage Creek	0	0	0	0	0	0	0	0
Rampart	0	0	0	0	0	0	0	0
Red Devil	0	0	0	0	0	0	0	0
Ruby	0	0	0	0	0	0	0	0
Russian Mission	0	0	0	0	0	0	0	0
Savoonga	0	0	0	0	0	0	0	0
Saxman	0	0	0	0	0	0	0	0
Selawik	0	0	0	0	0	0	0	0
Shageluk	0	0	0	0	0	0	0	0
Skagway	0	0	0	0	0	0	0	0
Sleetmute	0	0	0	0	0	0	0	0
St. George	0	0	0	0	0	0	0	0
St. Michael	0	0	0	0	0	0	0	0
Stebbins	0	0	0	0	0	0	0	0
Stevens Village	0	0	0	0	0	0	0	0
Stony River	0	0	0	0	0	0	0	0
Tanacross	0	0	0	0	0	0	0	0
Tanana	0	0	0	0	0	0	0	0
Tatitlek	0	0	0	0	0	0	0	0
Tazlina	0	0	0	0	0	0	0	0
Teller	0	0	0	0	0	0	0	0
Tetlin	0	0	0	0	0	0	0	0
Tonsina	0	0	0	0	0	0	0	0
Trapper Creek	0	0	0	0	0	0	0	0
Twin Hills	0	0	0	0	0	0	0	0
Tyonek	0	0	0	0	0	0	0	0
Upper Kalskag	0	0	0	0	0	0	0	0
Venetie	0	0	0	0	0	0	0	0
Wales	0	0	0	0	0	0	0	0
Whale Pass	0	0	0	0	0	0	0	0
White Mountain	0	0	0	0	0	0	0	0
Whitestone Logging Camp	0	0	0	0	0	0	0	0