Meeting National Standard 8: Ground-truthing Social Indicators of Fishing in South Atlantic Coastal Communities

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National Standard 8 and South Atlantic Fisheries

Based on field research in 21 South Atlantic coastal communities reaching from Wanchese, N.C., to Palm Beach Shores, Fla., this article compares data from direct observations and interviews in the communities to data from publicly available sources such as fisheries statistics and the U.S. census, providing baseline information for social impact assessments, fisheries management plans, and other policy initiatives. The study emerged from ongoing attempts to meet the mandate of National Standard 8 (50 CFR Ch. VI (01 Oct 10 Edition: §600.345:60): "Conservation and management measures shall…take into account the importance of fishery resources to fishing communities by utilizing economic and social data that are based upon the best scientific information available..."

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ABSTRACT—National Standard 8 of the reauthorized Magnuson-Stevens Fisheries Management Act mandates that fisheries managers consider a community's dependence on fisheries when crafting regulations. This article compares findings regarding dependence on commercial and recreational fisheries from direct observations and interviews in 21 U.S. South Atlantic communities to findings from publicly available data sources such as the U.S. census. The comparisons revealed that, in over 80% of the 21 ports examined, data developed from direct observations and interviews and those developed from publicly available data sources yielded similar results. Where there were large discrepancies between the two sets of findings, in most cases, the ports were located in large metropolitan areas where fishing constituted a small proportion of the economy. These findings indicate that the use of publicly available data sources is an efficient way for fisheries managers and others to meet the mandate of National Standard 8 in a timely fashion, yet they also suggest that rapid ethnographic procedures can aid in characterizing fishing communities that differ in terms of size, rural vs. urban settings, gentrification, resilience, and other features that could assist fishery managers in evaluating the impacts of fishing regulations.

While concern for fishing communities is secondary to the concern for rebuilding and maintaining healthy fishery resources, National Standard 8 (NS8) nevertheless demands that social and economic data be developed to address questions such as a community's dependence on or engagement with fishery resources, its ability for sustained participation in fisheries, and whether or not a Fishery Management Plan or policy initiative will adversely affect the community.

National Standard 8 defines a fishing community as "a community that is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew, and fish processors that are based in such communities. A fishing community is a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries-dependent services and industries (for example, boatyards, ice suppliers, tackle shops)" (50 CFR Ch. VI (1 Oct 10 Edition: §600.345:61).

The 21 fishing communities we profiled range from small, unincorporated communities like Wanchese and Sneads Ferry, N.C., to large metropolitan areas like Wilmington, N.C., Charleston, S.C., Savannah, Ga., or the heavily populated strip of south Florida coast around Palm Beach Shores. In addition to those just mentioned, the others were: Hatteras Village, Beaufort, Morehead City, Atlantic Beach, and Wrightsville Beach in North Carolina; Little River and Murrells Inlet in South Carolina; Brunswick, St. Simons Island, and St. Marys in Georgia; and Fernandina Beach, St. Augustine, Cape Canaveral, Sebastian, Ft. Pierce, and Palm Beach Shores in Florida (Fig. 1).

Methods

This research, conducted from August 2012 to June 2013, combined direct observations and interviews with the collection of secondary source data collection in the 21 ports. In each port, we visited fishing centers, fish packing facilities (commonly known as fish houses), recreational and commercial marinas, docks, fishing regulatory offices, seafood retail markets and restaurants, marine- or water-oriented museums, and other sites related to commercial and recreational fishing. At these sites we observed activities, took photographs, interviewed people both casually and in more depth about local recreational and commercial fishing, and completed inventories of marine-related businesses. We conducted web-based searches about each community, collecting data on fishing

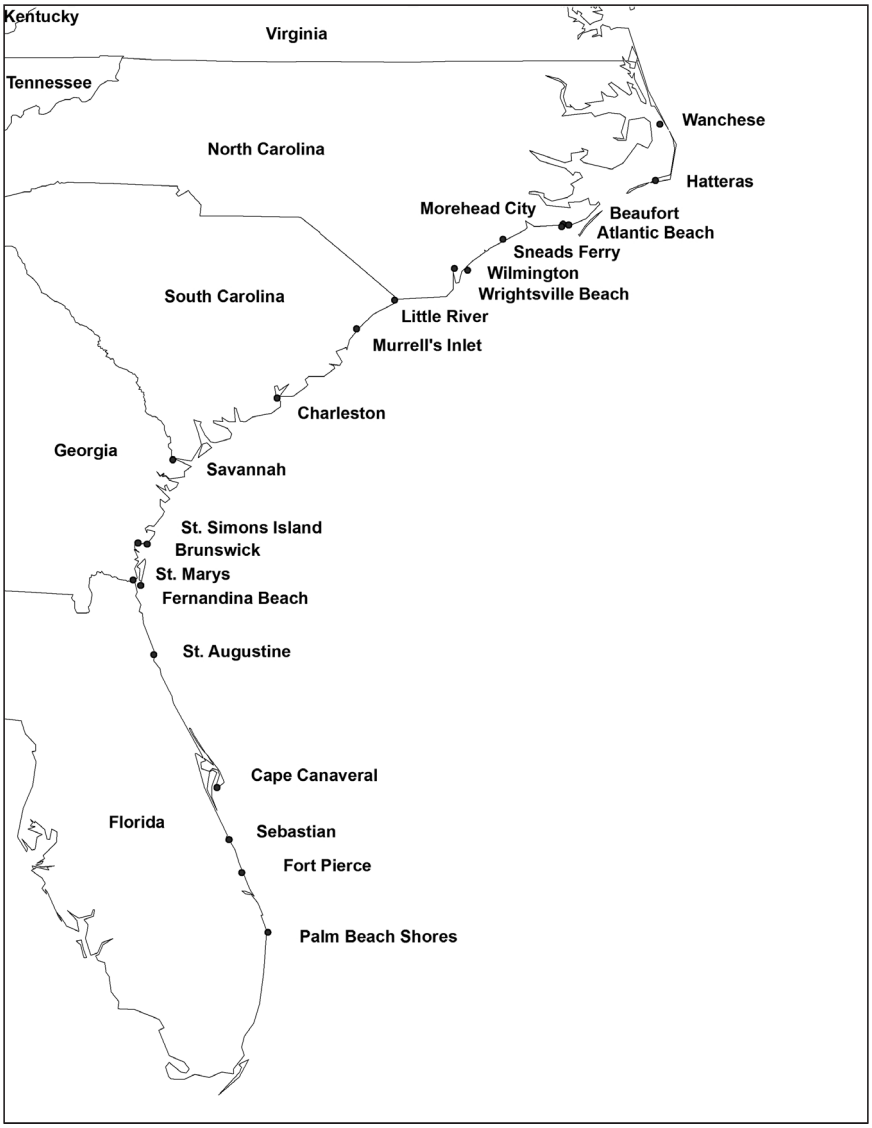

Figure 1.—U.S. South Atlantic communities in the study.

and seafood related businesses, demographics, and other public data. Finally, we collected or perused published and printed materials from local bookstores, archives, local libraries, and other repositories (Earll, 1887; Ballance, 1989; Cecelski, 2000; Beal and Prioli, 2002; Garrity-Blake and Nash, 2012).

Interview Protocol

Based on these activities, we developed an informal interview protocol and interviewed up to 15 individuals per port, completing a total of 345 usable interviews with a range of individuals knowledgeable about a variety of topics related to their communities. Informants included commercial and recreational fishermen (including charter boat captains and mates), local realtors, seafood workers, local politicians, librarians, school teachers, and residents from a variety of other occupations. In all, those we interviewed spanned 63 occupations.

Interviewees in each community were not explicitly randomly sampled; they were selected because of their long-time knowledge of the community or direct involvement in recreational or commercial fisheries. However, in most cases, individuals were intercepted at fishing sites, lending some randomness to the sampling process. Interviewers were instructed to probe individuals about their knowledge of local fishing, or they selected people referred to them as people particularly knowledgeable about local fishing. These interviews were then post-coded for the qualitative and quantitative discussions below.[1]

Post-coding is a time-consuming process of teasing from the texts of the interviews similar information for comparative purposes. The result of this process is that percentage counts are presented for many variables and, in some cases, new variables are constructed from a number of comments made by those interviewed. For example, we asked the general question of how people characterized their community, which resulted in over 80 descriptors; of these we developed a "gentrification" variable that included descriptors such as "wealthy," "high cost of living," "high taxes," and so forth.

Informant Characteristics

The following series of tables presents information on the sample from all 21 ports.[2] Table 1 includes demographic characteristics about the

[1]In the social sciences, this is referred to as a judgment sample: a sample of individuals who represent a domain of knowledge (Babbie, 2010; Bernard, 2011). While they cannot be said to represent, statistically, the community in the same way a census or a random sample might, they can give us sound information about the trajectories of each community's fisheries data that, replicated across communities, can be compared to other community fisheries visited in the study. Sampling procedures of this kind are widely used in the cognitive social sciences, guided by a general logic that people most qualified to provide information about a specific domain, such as community fisheries, are those who are actively involved with that domain. A random sample even in a small community like Wanchese might well include residents who know little to nothing about fishing.

[2]This article is based on research conducted with the National Marine Fisheries Service. A two-volume report was produced under this contract: "Ground-truthing social indicators of fishing in North Carolina, South Carolina, Georgia, and east Florida fishing communities: volume I (comparing remote and direct observations) and

Table 1.—Selected output from all interviews (*n*=345).

Variable	Output
Gender	Males = 68%, Women = 32%
Age	Mean = 51.75 (sd=13.53) Range = 20–81
Years employed	Mean = 18.36 (sd=16.75) Range = 1–77
Has seen change in the community	Yes = 95% No=5%
Would advise a young person to move to this community?	Unqualified yes = 45.4%; No = 19.4%; Qualified yes = 35.2%[1]
Average score for "There is a strong community here."[2]	8.27 (sd=1.67)
Average score for "There is a strong commercial fishing community here."	5.57 (sd=3.15)
Average score for "There is a strong recreational fishing community here."	7.79 (sd=2.38)
Average score for "Community depends on fishing economically."	5.51 (sd=2.92)
Average score for the strength of the community's overall economic health.	6.16 (sd=2.29)
Average score for the strength of the community's commercial fisheries' economic health.	3.66 (sd=2.25)
Average score for the strength of the community's recreational fisheries' economic health.	5.70 (sd=2.65)

[1]For example, yes if the person had enough money.
[2]Figures are for NC, SC, and GA ports only.

interview respondents, as well as information on the health of the communities and their commercial and recreational fisheries. Each of the last six variables was based on a scale from 1 to 10, with 10 indicating very strong and 1 indicating very weak. We discuss these findings in more detail below.

Data in Table 1 confirm what many observers of commercial fisheries and many members of commercial fishing families perceive: that commercial fishing communities and their economic health are not as strong or healthy as are recreational fishing communities. They also suggest the people interviewed believe that the coastal communities of North Carolina, South Carolina, and Georgia—most of which are communities with a lengthy history of fishing—have strong senses of community in general; the average "community strength" score of 8.27 and a standard deviation of 1.6 indicates little variability. Indeed, the ways in which people talk about their communities suggest that they feel strong ties to them. This is also reflected in the fact that over 80% of those interviewed said that they would advise a young person to move to their community.

Comparative Analysis

In essence, this work directly compares data from publicly available sources to data from direct, on-the-ground field research to determine how accurately the publicly available source data compares in terms of developing social indicators that estimate six community features: 1) dependence on and engagement with commercial fishing, 2) dependence on and engagement with recreational fishing, 3) sustainability, 4) vulnerability, 5) resilience, and 6) gentrification. Specifically, we draw primarily on Jepson and Colburn (2013) and secondarily on Jacob et al. (2013; Jacob et al.[3]) for estimates from remote data sources.

Dependence on and Engagement with Commercial and Recreational Fishing

During both the open-ended interviewing phase of the research and the more guided interviews, we asked several pointed questions about communities' relationships with commercial and recreational fishing. These included the five questions asking community residents to rank the strength or health of their fishing community and fishing economy on a scale of 1 to 10, including the general statement that "This community depends on fishing economically." Second, we asked two open-ended questions on the principal threats facing recreational fishing and commercial fishing.

Table 2 draws on the ground-truthing data—or those data from direct observations and interviews in the 21 communities. Because the sample was not completely randomly selected, in addition to reporting means and standard deviations, we also performed chi-square tests that compared the ports by their economic dependence on fishing and found that the differences were statistically significant (x^2=47.402; df=20; p=0.001). The column entitled Mean is an average of the scores from the five previous columns, or, in other words, an index that incorporates all those data. We are not arguing that each item in the index should be given equal weight, only that each should be included in the index. We provide the data for each item in the index for the reader to make his or her own judgement about each item's relative weight.

Table 3 compares the ground-truthing data with data from publicly available sources developed by Jepson and Colburn (2013) and others in their work to meet the criteria of National Standard 8 in their preparation of fishery management plans and social impact assessments. Among other things, the new ranks show that a community highly economically dependent on commercial fishing, such as Hatteras Village, may be less highly ranked when both commercial and recreational fishing data are considered together. According to these data, Wanchese, N.C., emerges as the community most attached to fishing, with other important fishing locations being Charleston

volume II (community profiles). Report available from the Southeast Regional Office.

[3]Jacob, S., M. Jepson, C. Pomeroy, D. Mulkey, C. Adams, and S. Smith. 2002. Identifying fishing-dependent communities: development and confirmation of a protocol. (MARFIN) Rep. prep. for the NMFS Southeast Reg. Off. By Univ. Fla. Dep. Family, Youth, Community Serv., Gainesville, Fla., 214 p.

Table 2.—Fishing dependence and engagement by port, interview data.

Port	Dependence on fishing economically [Rank]	Commercial fishing community strength	Recreational fishing community strength	Commercial fishing economic health	Recreational fishing economic health	Mean	New Rank[1]
Wanchese	8.29 [1]	8.71	8.57	4.71	6.00	7.26	1
Hatteras Village	7.93 [2]	7.53	8.07	4.00	5.80	6.67	5
Beaufort	6.81 [3]	6.37	8.50	4.44	7.31	6.69	4
Morehead City	6.00 [6]	5.64	8.50	4.14	6.07	6.22	6
Atlantic Beach	5.13 [12]	4.00	7.00	3.73	5.87	5.15	16
Sneads Ferry	6.00 [6]	8.15	7.62	5.08	6.77	6.72	3
Wrightsville	3.33 [19]	2.40	6.53	2.60	5.67	4.11	21
Wilmington	5.67 [10]	5.40	7.27	4.60	6.07	5.80	9
Little River	6.40 [4]	6.40	7.33	3.33	4.27	5.55	12
Murrells Inlet	6.27 [5]	7.80	7.67	3.13	4.87	5.95	7
Charleston	6.00 [6]	6.87	8.60	5.27	6.93	6.73	2
Savannah	4.87 [13]	6.20	8.40	3.67	5.60	5.75	11
Brunswick	3.87 [17]	4.47	6.53	3.00	4.20	4.41	20
St. Simons	4.80 [15]	5.73	7.87	3.40	5.33	5.43	13
St. Marys	2.87 [20]	3.27	8.67	2.73	6.20	4.75	19
Fernandina	4.82 [14]	3.94	6.41	3.82	5.35	4.87	18
St. Augustine	5.24 [11]	4.57	7.62	2.81	5.29	5.11	17
Cape Canaveral	4.00 [16]	5.40	7.30	3.70	5.65	5.21	15
Sebastian	5.95 [7]	4.85	7.90	2.90	4.85	5.23	14
Ft. Pierce	5.87 [9]	5.54	8.29	3.25	6.00	5.79	10
Palm Beach	5.91 [8]	5.27	8.59	3.55	5.86	5.84	8
Totals	5.51	5.57	7.79	3.66	5.70	5.65	

[1]Rank based on the average of the five scores.

Table 3.—Fishing dependence and engagement by port, publicly available data.

Port	Dependence on fishing economically [Rank]	Commercial fishing reliance [Rank]	Recreational fishing reliance	Commercial fishing engaged	Recreational fishing engaged	Average Rank[1]
Wanchese	8.29 [1]	4.020 [1]	0.785	2.117	0.964	5
Hatteras2	n.d.	n.d.	n.d.	n.d.	n.d.	n.a.
Beaufort	6.81 [3]	1.109 [3]	2.511	2.419	2.133	8
Morehead City	6.00 [6]	-0.013 [9]	2.447	1.040	2.959	7
Atlantic Beach	5.13 [12]	0.300 [4]	4.476	0.265	4.155	7
Sneads Ferry	6.00 [6]	2.565 [2]	0.478	2.137	0.409	8
Wrightsville	3.33 [18]	-0.173 [14]	1.520	-0.061	1.472	9
Wilmington	5.67 [10]	-0.206 [16]	1.521	3.215	1.284	10
Little River	6.40 [4]	-0.077 [10]	0.226	0.375	0.489	8
Murrells Inlet	6.27 [5]	0.103 [6]	1.479	0.685	1.662	6
Charleston	6.00 [6]	-0.222 [15]	0.163	1.716	0.265	12
Savannah	4.87 [13]	-0.251 [20]	2.534	-0.045	3.515	14
Brunswick	3.87 [17]	0.004 [8]	2.749	1.313	2.368	12
St. Simons	4.80 [15]	-0.251 [19]	1.803	0.058	1.679	18
St. Marys	2.87 [19]	-0.224 [17]	1.372	0.381	1.206	19
Fernandina	4.82 [14]	-0.086 [11]	4.499	0.572	4.414	12
St. Augustine	5.24 [11]	0.084 [7]	7.153	1.769	7.013	8
Cape Canaveral	4.00 [16]	-0.137 [13]	2.892	0.455	3.380	13
Sebastian	5.95 [7]	-0.225 [18]	1.334	0.293	-0.284	9
Ft. Pierce	5.87 [9]	0.120 [5]	7.203	1.012	6.716	9
Palm Beach	5.91 [8]	-0.095 [12]	1.454	-0.099	1.160	13

[1]Measure developed based on remote data, combining recreational and commercial data.
[2]No remote data were collected for Hatteras Village, which ranked #2 based on the ground-truthing data.

(ranks 6 and 2), Sneads Ferry (ranks 6 and 3), Beaufort (ranks 3 and 4), and Hatteras Village (ranks 2 and 5).

Table 3 lists the above communities in terms of four indices of reliance and engagement, developed primarily by Michael Jepson, Steve Jacob, and a few other social scientists.[4] They are

1) The "Commercial Fishing Reliance Index," which includes the value of fish landings by population, number of commercial permits by population, number of dealers with landings by population, and percentage of population employed in agriculture, forestry, and fishing. Scores are either negative or positive based on whether or not they are less than or more than one standard deviation from the mean.
2) The "Recreational Fishing Reliance Index," which includes recreational charter boat fishing by population, private recreational fishing by population, and shore recreational fishing by population.
3) The "Commercial Fishing Engagement Index," which includes the total value of landings, total commercial permits, total number of dealers with landings, and the pounds of landings—all without reference to the size of the population.
4) The "Recreational Fishing Engagement Index," which includes recreational charter boat fishing pressure (i.e., fishing trips), private recreational fishing pressure, and shore recreational fishing pressure—again without reference to the size of the community's population.

These figures are simple to interpret: the higher the score, the more reliant or engaged the community is in commercial or recreational fishing. While indices are susceptible to fault at any point in their construction, they are helpful in attempts to measure complex phenomena that cannot be reduced to mere counts or modeling exercises. Due to the problems with indices, however, another way to consider these data is to group the ports with rankings close to one another, as we have done in Table 4.

Again, in Table 4 we see considerable overlap between the two rankings, yet the differences deserve explanation. Of the 21 ports the two ranking methods clearly show Wanchese as the most dependent (or reliant) on commercial fishing; they draw out other similarities as well. Beaufort ranks three in both lists, and the North Carolina communities north of Wrightsville Beach—all except Snead's Ferry in and around the Albemarle-Pamlico Estuarine System—rank in the top ten. The two ranking methods also derived similar ranks for Murrells Inlet, St. Marys, and Cape Canaveral.

[4]These indices were developed at a small conference held in 2008 at the Houston Area Research Center, organized by Steve Jacob (York College, York, Penn.), and Pricilla Weeks (Houston Area Research Council, Houston, Tex.), which the authors attended.

Only four or five places separated Snead's Ferry, Wrightsville Beach, St. Simons, St. Augustine, Fernandina, Ft. Pierce, and Palm Beach. By contrast, larger discrepancies between the remote data source and ground-truthing data were found with regard to Atlantic Beach (group 3 in the ground-truthing rankings, 1 in the remote), Wilmington (group 2 in the ground-truthing data, 4 in the remote), Charleston (high in group 2 in the ground-truthing rankings, low in group 3 in the remote), and Sebastian (group 2 in the ground-truthing, 4 in the remote).

While we found large discrepancies between the ground-truthing and remote data in 4 (19%) of 21 ports, 2 of them can be explained, in part, by their size. Remember that the commercial fishing resilience index is based largely on variables relative to population size. The three most heavily populated ports in the sample are Wilmington, Charleston, and Savannah—each of which contains over 200,000 residents, in the midst of which live relatively few fishing families.

In all three ports, the ground-truthing data collection targeted areas within the three metropolitan centers, where we learned substantial fishing activity took place (e.g. marinas, piers, around fish houses, at charter boat docks, etc.), and where local residents were more likely to view fishing as a key part of their local economy—even if not a major element in the larger metropolitan area. In Wilmington, for example, early on in the research we were steered toward Carolina Beach, a community that is part of the Wilmington metropolitan area yet known for its fishing charters. In this area of Wilmington, with at least ten fishing charters and a large head boat, fishing is clearly important, which accounts for Wilmington's higher rank in the ground-truthing data.

The rankings of fishing communities show the overall importance of fishing in North Carolina in particular, with five of the eight communities listed falling into the top six ranks. By contrast, none of Georgia's communities ranked highly, and Florida's and South Carolina's were mixed. The importance of fishing to North Carolina is understandable in light of its complex coastline, particularly the Albemarle-Pamlico Estuary (Fig. 2), which includes three sounds rich in blue crabs, *Callinectus sapidus*; mullet, *Mugil cephalus*; Atlantic croaker, *Micropangonias undulates*; spot, *Leiostomus xanthrus*; and other estuarine resources, the Outer Banks with their proximity to the Gulf Stream, and several inlets and ferry channels facilitating marine navigation.

Table 4.—Ports grouped by quartiles from most to least dependent on fishing.

Groups of Ports	Ground-Truthing Rank	Remote Rank
Group 1: Most Dependent	Wanchese	Wanchese
	Hatteras Village	Beaufort
	Beaufort	Atlantic Beach
	Little River	Snead's Ferry
	Murrells Inlet	Ft. Pierce
Group 2: 2nd Most Dependent	Morehead City/ Charleston/ Snead's Ferry[1]	Murrells Inlet
	Sebastian	St. Augustine
	Palm Beach	Brunswick
	Ft. Pierce	Morehead City
	Wilmington	Little River
Group 3: 3rd Most Dependent	St. Augustine	Fernandina
	Atlantic Beach	Palm Beach
	Savannah	Cape Canaveral
	Fernandina	Wrightsville Beach
	St. Simons	Charleston
Group 4: Least Dependent	Cape Canaveral	Wilmington
	Brunswick	St. Marys
	Wrightsville Beach	Sebastian
	St. Marys	St. Simons
		Savannah

[1]All three communities had the same rank.

Yet even in North Carolina, commercial fishing is in decline. The number of Standard Commercial Fishing Licenses (SCFL's) has fallen by around 1,000 over the past decade, from 6,632 in 2002 to 5,640 in 2012 (NCDMF, 2013). By contrast, recreational fishing licenses from 2007 to 2011 remained more or less stable, fluctuating from a low of over 411,000 to a high of nearly 470,000 (NCDMF, 2013). Charter Boat licenses also remained fairly stable from 2008, when 653 were issued, to 2011, when 650 were issued, although the number fell to 576 in 2012 (NCDMF, 2013).

Sustainability, Vulnerability, and Resilience

Sustainability is a concept that has received a great deal of attention in the scientific literature recently, spawning a National Science Foundation initiative known as Science, Education, and Engineering for Sustainability (www.nsf/sees/). That involved a wide variety of disciplines—from engineering and biology to economics and anthropology—and occupied people interested in a range of activities, from the conservation of natural resources to the development of products with longer lives and less problematic disposal profiles. While this has led to a number of different interpretations of what constitutes sustainability, in terms of fisheries and fishing communities, sustainability generally means the ability to maintain and reproduce fishing livelihoods and fishing activities without jeopardizing fishery resources.

Pauly et al. (2002), for example, described a sustainable fishery as one where "fish populations were naturally protected by having a large part of their distribution outside of the range of fishing operations." In the cases they discussed, this occurred where fish populations were exploited by small numbers of fishermen located in extreme climates, (e.g., the Arctic), or were "protected" because intervening factors, such as warfare, made the seas unsafe for fishing. Regulations on fishing, usually based on fisheries biology, have been developed to achieve

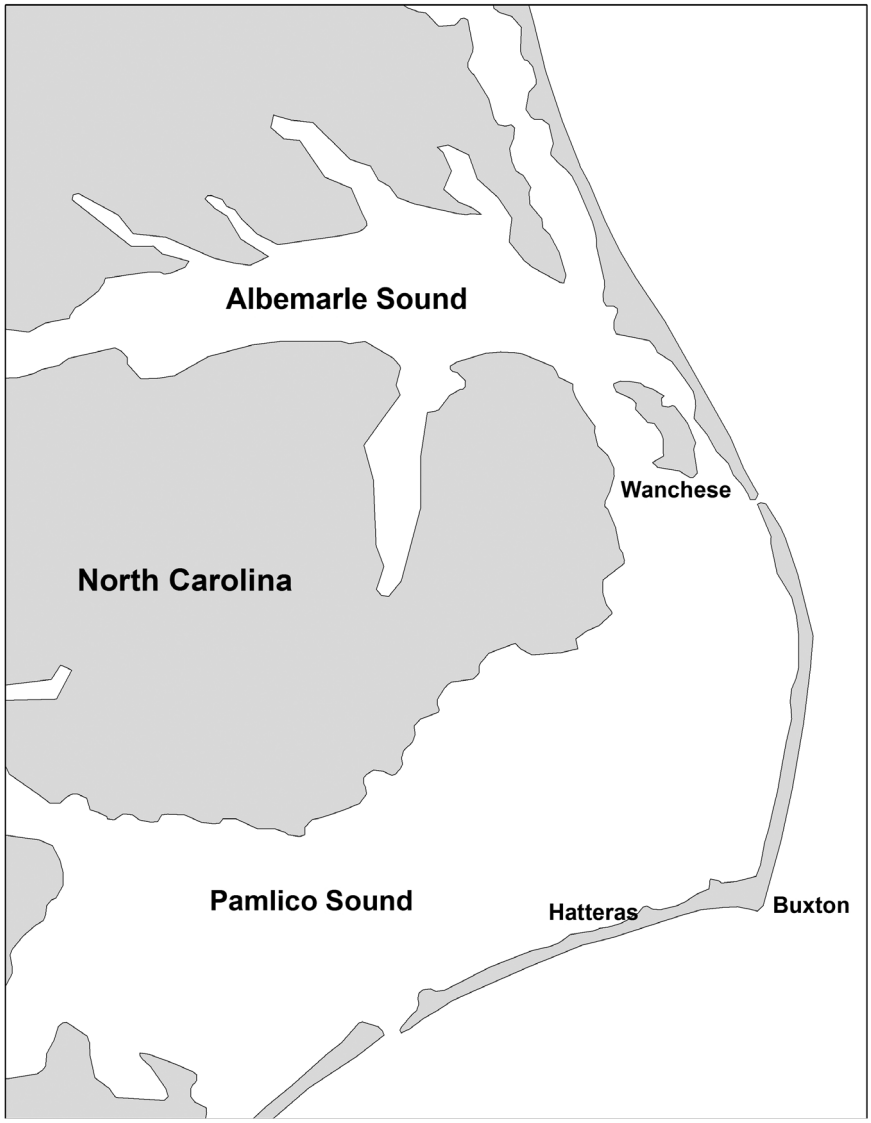

Figure 2.—Albemarle-Pamlico Estuarine System.

maximum sustainable yields—in other words, to achieve sustainability in fisheries. Among the more popular current measures to protect fish stocks are habitat-based management alternatives such as Marine Protected Areas and measures to protect nursery grounds and other environments conducive to fish stock health.

In terms of fishing communities, sustainability involves more than protecting fish, however many fish stocks are critical to a fishing community maintaining its identity and its heritage. Sustaining fishing livelihoods involves continued access to dock space, market infrastructure such as fish houses, and the ability to target species that can bring ex-vessel prices high enough to cover expenses and remunerate labor.

The focus on sustainability is often coupled with a consideration of what makes resources or communities vulnerable to threats to sustainability or resilient against such threats (Cutter et al., 2003). Thus, in relation to sustainability, vulnerability and resilience are opposites, and the three concepts are most effectively discussed together. In this research, we asked people in each port what factors threatened their communities. We listed above what they considered the principal threats to commercial and recreational fisheries, but we also asked them what factors would make their communities vulnerable to decline.

Table 5.—Vulnerability type.

Type of Vulnerability	Percent
Loss of Use	44.5
Development Problems	20.0
Economic Issues	35.5

From this, we identified several factors that, according to residents, increased their community's vulnerability. Across all 345 interviews, we elicited 38 sources of vulnerability, including fishing regulations, fuel prices, pollution, rampant development, and the loss of various kinds of infrastructure (e.g. fishing piers) or natural resources (e.g., water channels due to lack of dredging). Once we had this list, we grouped them by more general principles into three groups: 1) Loss of Use (e.g., closing fishing piers, reduced dredging, more regulations on fishing, a reduction in activities for tourists, beach erosion, etc.); 2) Development Problems (e.g., growth not sustainable, too many tourists, new people moving in, old residents leaving, etc.); and 3) Economic Issues (e.g., increased fuel prices, job losses, higher taxes, etc.) (Table 5). Overall, Loss of Use was perceived as the most common source of vulnerability, followed by economic issues, and finally development problems.

Based on these groups, we ran frequency counts on a port-by-port basis to determine how each community was liable to be influenced by each category of vulnerability. We also attempted to see how different sources of vulnerability were associated with significant changes taking place in the communities and how vulnerability was related to fishing dependence.

Table 6 shows how these types of vulnerability are distributed across ports, and these data give some indication of the absolute vulnerability of

Table 6.—Vulnerability by port. Numbers in parentheses refer to sources of vulnerability.

Port (N sources)	Loss of Use	Development	Economics
Wanchese (19)	74%	0%	26%
Hatteras (31)[1]	45%	19%	36%
Beaufort (25)	48%	16%	36%
Morehead (13)	23%	31%	46%
Atlantic (24)	46%	12%	42%
Sneads Ferry (20)	30%	30%	40%
Wrightsville (28)	32%	14%	54%
Wilmington (26)	58%	19%	23%
Little River (23)	48%	13%	39%
Murrels Inlet (18)	61%	11%	28%
Charleston (18)	28%	28%	44%
Savannah (11)	36%	54%	10%
Brunswick (21)	33%	29%	38%
St. Simon (18)	50%	50%	0%
St. Mary (13)	15%	30%	55%
Fernandina (25)	40%	16%	44%
St. Augustine (33)	42%	6%	52%
Cape Canaveral (29)	48%	10%	42%
Sebastian (27)	55%	15%	30%
Ft. Pierce (31)	48%	13%	39%
Palm Beach (34)	38%	35%	27%

[1]Boldface type indicates those communities having 25 or more sources of vulnerability.

Table 7.—Vulnerability by dependence on fishing.

Vulnerability type/ fishing dependence	Low fishing dependence	High fishing dependence
Loss of use	38%	51%
Development	24%	16%
Economic issues	38%	33%

Chi-square = 6.314; df=2; p=0.043

the fishing communities in our sample, in that the higher numbers of sources indicate increased vulnerability, as well as the types of vulnerability likely to threaten each community. The data indicate that ten communities (noted in bold in Table 6) have 25 or more sources of vulnerability, including Hatteras Village, Beaufort, Wrightsville Beach, Wilmington, Cape Canaveral, St. Augustine, Sebastian, Fernandina, Ft. Pierce, and Palm Beach. None of the South Carolina or Georgia communities were in this group, while all of the Florida communities were in this group.

In addition to presenting the raw data on types of vulnerability each community experiences, we grouped communities by high and low fishing dependence (above 5.95 on the dependence scale = high; below 5.95 = low) and ran cross-tabulations on vulnerability type. This showed that communities that were highly dependent on fishing were significantly more likely to be vulnerable to "loss of use" sources of vulnerability than communities less dependent on fishing (Table 7). This may be, in part, because the "loss of use" category included increased regulations on fishing activities, which usually translates into reduced use of fisheries stocks or other natural resources. By contrast, residents in low fishing dependence communities believe them to be more vulnerable to development pressures than those in high fishing dependence communities, perhaps because gentrification has advanced further in those communities already.

One final measure of vulnerability comes from the information on how the communities have changed in the past 5–10 years. As noted, all the communities we studied had experienced changes in this time period, and the types of changes mentioned coincided with many of the developments that residents associated with vulnerability. Overall, the most common changes noted were population growth (cited by 38% of those interviewed), economic decline (14%), less fishing due to increased fishing regulations (13%), and more of a focus on tourism and retirees (11%).

To create a measure of vulnerability from these data, we grouped responses into one of two categories: negative for commercial fishing (e.g., loss of working waterfront) and positive for commercial fishing (e.g., increased demand for local seafood). After running frequency counts on the responses, we grouped them into either negative for recreational fishing (e.g., loss of a fishing pier) or positive for recreational fishing (e.g., increase in charter boats). The results of these statistical exercises are given in Table 8.

In line with other findings presented above, these figures clearly demonstrate that sources of vulnerability to commercial fisheries are far more common than sources of vulnerability to recreational fisheries. In every port, changes that have been positive to commercial fishing are far smaller than those that have been negative. By contrast, in several ports, developments that have been positive to recreational fishing outweigh those that have been negative. The cross-tabulation in Table 9 shows that significantly more positive than negative changes in the ports in our study have affected recreational fishing than have affected commercial fishing, with 93% of the changes negatively affecting commercial fishing, compared to 42% of the changes negatively affecting recreational fishing. Negative changes affect both, however, in 41% of the cases, while only 6% are positive for both.

In the face of such vulnerability, what can we say about community resilience and sustainability? Again, to examine how resilient fishing communities may be, we turned to the list of community characteristics to develop

Table 8.—Vulnerability by port.[1]

	Commercial Vulnerability		Recreational Vulnerability	
Port	Neg	Pos	Neg	Pos
Wanchese	14	0	9	5
Hatteras	13	1	7	7
Beaufort	13	3	3	13
Morehead	12	2	3	11
Atlantic	14	0	8	6
Sneads Ferry	13	0	2	11
Wrightsville	12	3	7	8
Wilmington	10	5	4	11
Little River	12	2	10	4
Murrels Inlet	15	0	6	9
Charleston	14	0	3	11
Savannah	13	2	4	11
Brunswick	13	1	6	8
St. Simon	13	0	1	12
St. Mary	19	1	7	7
Cape Canaveral	19	1	12	8
St. Augustine	19	1	10	10
Sebastian	18	1	7	12
Fernandina	15	1	5	11
Ft. Pierce	20	1	14	7
Palm Beach	21	0	11	10

[1]Numbers refer to sources of vulnerability.

Table 9.—The quality of changes in the community for commercial and recreational fishing.

Quality of change	Positive for recreational	Negative for recreational	Totals
Positive for commercial	20 (6%)	5 (1%)	25 (7%)
Negative for commercial	172 (52%)	134 (41%)	306 (93%)
Totals	192 (58%)	139 (42%)	331 (100%)

Chi-square = 5.370; df =1; p=0.02

an index of resilience, presented in Table 10, assuming that in those communities that residents describe with terms such as "close-knit," "hardworking," "family-oriented," and other similar terms will be more resilient than those that tend not to be so described. The characteristics we selected for this index are generally those associated with strong inventories of social capital—or the social networks and memberships in community institutions that allow people to marshal their resources toward solving challenges to their communities (Griffith, 1999; West and Garrity-Blake, 2003; Griffith et al., 2007). Because of the importance of group membership in the formation and deployment of social capital, and the importance of identity in group membership, we also included in this index characteristics such as "religious," "unique language," and "rural."

Based on the data in Table 10, the most resilient communities tend to be smaller and more rural than those that are less resilient, although not in all cases. While the communities of Charleston and Savannah are the least resilient, according to this measure, Wilmington's resilience score is relatively high. On the one hand, this finding calls into question a measure of resilience based on social capital characteristics, in that the larger communities may be more resilient generally to things such as weather events, economic decline, etc. because they have more diversified economies, more resources, more people, and so forth to deal with such challenges.

On the other hand, we may consider this measure as indicative of the resilience of fishing communities rather than communities in general. Larger communities such as Charleston and Savannah may be able to withstand the loss of commercial fishing and even recreational fishing exactly because they are large, diversified economies. This may also explain why the Sneads Ferry's fishing community is considered not very resilient by this measure, in that the presence of nearby Camp Lejeune (a U.S. Marine Corps base) may be enough to absorb most of those displaced from fishing.

The loss of fishing to places like Wanchese, Hatteras Village, and even St. Marys, by contrast, could deliver a devastating blow to their local economies, proportionately far more damaging than the loss of fishing from large economic centers. Because of this, residents in these ports may be more likely to view themselves as the kind of people who "hunker down" in the face of a challenge and come together as a community to deal with it.

This is, in fact, exactly what happened in Wanchese and Hatteras Village in the wake of two major storm events, Hurricane Irene and Superstorm Sandy. Although these events flooded the communities and damaged homes, instead of abandoning the communities their residents repaired, raised their houses, and stayed. Further, the residents of Wanchese have united around the issue of the dredging of Oregon Inlet—a U.S. Army Corps of Engineers' activity that is essential to allowing large vessels access to Wanchese fish houses (Davis, 2012).

It may also be the case, however, that the items we selected for the index were more commonly mentioned by those living in smaller communities, and hence the index is biased toward finding smaller communities more resilient. Yet having participated in the interviews in both large and small ports, we did not find that descriptors such as "close-knit" were confined to smaller communities; this may be due to people's ideas of community as being more narrowly conceived there than a metropolitan area.

Considering the above data on vulnerability and reliability, the sustainability of fishing in these ports is highly variable. Overall, currently, the data suggest that recreational fisheries are less vulnerable than commercial fisheries to loss of use or development, but this does not automatically mean that recreational fisheries are more sustainable than commercial fisheries in the long term. Recreational fisheries—particularly charter and head boats—are particularly sensitive to changes in tourist economies, fuel prices, and access to fish stocks, making them more highly vulnerable to reduced discretionary spending among consumers.

Many of these ports, particularly in Florida and South Carolina, have invested heavily in promoting tourism and related service-oriented economic sectors—sectors rarely lauded for producing high-income jobs and discretionary income—and whether or not growth of this nature is sustainable is a question that goes well beyond the question of whether or not recreational fisheries are. Recreational fisheries that are tied to such development models may not be any more sustainable than the development models themselves.

Regarding the sustainability of commercial fisheries, one of the reasons that communities like Wanchese and Hatteras Village may have scored highly on the resilience index is that they are both bringing a number of people together to promote community-based fisheries, although based on slightly different models. Wanchese,

Table 10.—Resilience by port.

Port	Resilience score	Rank
Wanchese	21	1
Hatteras	18	3
Beaufort	12	9
Morehead City	10	10
Atlantic Beach	17	4
Sneads Ferry	13	8
Wrightsville	13	8
Wilmington	17	4
Little River	13	8
Murrells Inlet	10	10
Charleston	8	12
Savannah	4	13
Brunswick	9	11
St. Simons	12	9
St. Marys	20	2
Fernandina	9	11
St. Augustine	14	7
Cape Canaveral	21	1
Sebastian	16	5
Ft. Pierce	13	8
Palm Beach	15	6
Average	13.6	

the more traditional model of the large fish house organizing fleets, and Hatteras Village, the somewhat newer model of promoting somewhat more independent, small-scale fisheries developing local markets for seafood.

Across North Carolina, these efforts have been supplemented by the development of local catch groups (Outer Banks Catch, Ocracoke Fresh, Carteret Catch, Brunswick Catch, and NC Catch[5]) that promote local seafood in local restaurants by creating connections between consumers and commercial fishing families. Whether fish-house organized or more independent, both types of fisheries are firmly embedded in the identities and cultural heritage of their respective communities. Because of this, they are more likely to recruit new members to their fisheries and are more likely to nimbly adapt to regulatory, physical, and natural environments.

Already some fish houses in Wanchese, for example, have scaled back the sizes of their vessels due to the problems of keeping Oregon Inlet open, giving them access to a number of in-shore, near-shore, and off-shore fishing grounds. It is perhaps because of these kinds of adaptations that Jepson and Colburn (2013:15) did not find Wanchese to be particularly highly socially vulnerable.

Gentrification

Along with imported seafood, the expansion of fishing regulations, and rising fuel costs, gentrification—or economic development oriented toward wealthier residents—ranks high among threats to commercial fishing today (Colburn and Jepson, 2012). As noted earlier, gentrification usually results in rising property and rental values, higher taxes, increased insurance costs with more expensive risk pools, and decreased access to fishery resources as marinas change from commercial to leisure uses and slip space cost rises. Additional problems arising from gentrification for commercial fishing can be pressures to change the aesthetics of coastal landscapes away from working waterfronts and toward boardwalks, shops, restaurants, etc., resulting in the loss of marine support businesses (e.g., marine railways), fish houses, fueling docks, etc. Finally, gentrification can lead to crowding on waterways, organized attempts by private and public interests to curtail fishing activities when they interfere with recreational activities, and other user-based conflicts.

Gentrification has become a major problem for commercial fisheries in the South Atlantic region, with the region's mild climates and attractive local natural resources attracting many people who have little to no appreciation of the heritage value of working waterfronts or commercial fisheries (Colburn and Jepson, 2012). While efforts have been underway recently to educate people about the heritage and other values of commercial fishing, equally vocal and often more powerful groups have been lobbying against commercial fishing. As recently as July 2013, the North Carolina Marine Fisheries Commission entertained discussion of a petition to close all in-shore waters of North Carolina to shrimp trawling by designating them nursery grounds (Spencer, 2013). While the petition was rejected, it demonstrated the political will of well-organized groups to erecting barriers to commercial fishing in the name of conservation.

As with previous indices, we developed an index of gentrification based on the ways that people we interviewed described their communities. The index was composed of 12 items in the list of characteristics used to describe the communities, including: rapid population growth, heavy traffic, high taxes, high cost of living, a "trendy" scene, and lots of tourism, rich people, second home owners, retirees, natural resource amenities, and golf. We also ranked ports by percentage of people earning $200,000 per year or higher—one of the remote data source methods of estimating gentrification (Table 11).

Again, these figures are in line with our observations, interviews, and general knowledge of these communities. All of the Florida communities, where gentrification is furthest advanced, score above the average of 10.47, while the smaller, more remote communities of Wanchese, Hatteras, and Sneads Ferry all score below the average. In Sneads Ferry and Wanchese, gentrification has been deliberately prevented by repeated organized opposition to community incorporation, which would extend water and sewer services to the coast. There seems to be some agreement, as well, between data from the on-the-ground interviews and some of the data that Jepson and Colburn (2013) used in their study.

One need only to drive through the coastal areas of Florida's coastal communities to see the continued effort to create a "new" waterfront. This is a waterfront, as expressed by interviewees, which caters not to the local population but to visitors and tourists. In fact, in many of the Florida coastal communities visited during the field research, the development of new second homes and condominiums for people from outside the community was commonplace even in what many consider to be a "down" economy. When realtors were asked if they could categorize or identify who the majority of the buyers are, the most common response was "people coming in from out of town either retiring or looking for a second home." The other common response was that people were taking advantage of the low housing costs and buying properties to rent as a part of a supplemental income, but that even many of these people are from "somewhere else."

For the sake of comparison, we took one variable from the data provided in the remote database—percentage of households with incomes of over $200,000 per year—and ranked the communities from most to least gentrified based on this one variable. The comparisons show that the rankings from the two measures are quite similar. The least gentrified port is Wan-

[5]Mention of trade names or commercial firms does not imply endorsement by the National Marine Fisheries Service, NOAA

Table 11.—Gentrification by port.

Port	Gentrification score	Rank	$200K inc. %	2nd Rank
Wanchese	3	11	0	16
Hatteras	5	10	n.d.	n.d.
Beaufort	13	4	4.2	6
Morehead City	12	5	1.4	14
Atlantic Beach	12	5	2.1	10
Sneads Ferry	8	9	3.2	9
Wrightsville	14	3	23.7	1
Wilmington	9	8	3.6	7
Little River	5	10	1.7	12
Murrells Inlet	10	7	4.8	5
Charleston	11	6	5.2	4
Savannah	11	6	1.5	13
Brunswick	10	7	1.7	12
St. Simons	13	4	11.8	2
St. Marys	5	10	1.2	15
Fernandina	12	5	4.8	5
St. Augustine	11	6	3.3	8
Cape Canaveral	11	6	1.9	11
Sebastian	12	5	1.2	15
Ft. Pierce	15	2	1.4	14
Palm Beach	18	1	8.4	3
Average	10.47			

chese, and Palm Beach ranked as one of the most, with only two places between the two rankings. Wrightsville Beach, number one in the $200K ranking, is number 3 in the ground-truthing ranking. Murrells Inlet, Little River, St. Augustine, St. Simons, Charleston, Fernandina, Beaufort, and Wilmington were close as well.

With the exception of Palm Beach, however, the Florida communities do not seem so highly gentrified in the second ranking as they emerge in the first. Of course, this is only one variable and not an index. It may also not be the best variable to use in a place like Florida, where many people may not report their income because their homes there are second homes, or where many of the retired have low annual incomes but are actually quite wealthy due to savings, stock portfolios, and the like.

Conclusion

Based on the comparative analysis above, the relationship between the ground-truthed data and the indices developed from publicly available databases correspond to one another—roughly in some cases, more precisely in others—with the former more appropriate to representing the fisheries embedded in large metropolitan centers and the latter most suited to fisheries based in smaller communities. This variation derives from both the ways that social indicators were developed and the nature of South Atlantic fishing communities. Using U.S. census and other databases not explicitly developed to track fisheries runs the risk of including data in the indices that have nothing to do with commercial or recreational fishing. In the occupational data, for example, fishing is counted together with agriculture and forestry, seafood processing workers with light manufacturing workers, and marine suppliers with service workers. Such groupings make it difficult to gauge the true proportion of a working population that fisheries employ, particularly in large metropolitan centers with diversified economies.

A further complicating factor is that many South Atlantic fishing communities are dispersed rather than concentrated, with fishing families' households tucked into neighborhoods with others engaged in other occupations unrelated to fishing. This has occurred, in part, due to gentrification and its influence on property values and taxes, access to waterfront, the growth of leisure uses of the coast that privilege recreational fishing over commercial fishing, and so forth. The dispersal of commercial fishing families across multiple neighborhoods that often results from these processes makes it difficult to rely on census data at the zip code level to estimate fishing dependence and engagement (Jacob et al.[3]). Finding themselves isolated from occupational communities has been the fate of working people around the world. With mill towns largely artifacts, occupational communities have been restricted primarily to occupations dependent on specific local natural resources: fishing, farming, forestry, mining, gathering (e.g., mushrooms, palmetto seeds, and medicinal plants), etc. For this reason, many of the studies of community dependence have been done in regions where reliance on natural resources has a long history (Donahue and Haynes, 2002).

Fishery dependent communities are somewhat different than, say, forestry-dependent or farming-dependent communities, however, in that fishery resources may be more difficult to manage than either forests or agricultural resources. This is due to several of the intrinsic characteristics of fisheries, including their status as common property resources, their susceptibility to developments beyond the control of those who rely on them or those who manage them (e.g., destruction of wetlands or weather-related events), their entanglement in multiple policy issues—from environmental concerns about sea turtles to user conflicts to regulations governing catch shares and marine protected areas—and the vulnerability of slow-maturing species to overfishing (e.g., members of the snapper-grouper complex).

The history of South Atlantic fisheries has produced a diversity of people, firms, families, and communities involved in utilizing fisheries and marine resources. Thus they are utilized by recreational fishermen as a kind of leisure activity, by fishermen who rely on them as a stable source of food, by aquariums for aesthetically pleasing exhibits, and by the highly diverse commercial fishing families and fishing fleets up and down the South Atlantic coast: fleets with hired captains and crews fishing for fish houses who are paid wages; fleets with captains and crews who fish for shares; individ-

ual family fishermen who fish alone or with one or two other family members, sharing the catch; small-scale, community-based fishing families; professional, for-hire charter boat fleets and party boats; etc. These different types of fishing operations are also differentiated by whether they are part-time, seasonal, full-time, or year-round; by whether or not they handle their own seafood marketing; by their relationships to fishery management, etc.

This diversity of social relations makes it difficult to disentangle fishing from the multiple personal and institutional networks in which they operate. This may be one of the reasons that remote data sources fall short of capturing conditions on the ground in some fishing communities; clearly, both the ground-truthing and the remote analysis have advantages and drawbacks, with the former suffering from small sample sizes and the latter from a lack of direct observations that might aid with the interpretation of the data. The above comparative analysis, however, demonstrated that the publicly available data sources and the ground-truthing came to similar conclusions in over two-thirds of the ports studied. Hence, the analysis recommends a hybrid approach, combining both low-cost, rapid assessment using secondary sources with focused interviewing and rapid ethnographic assessment procedures (REAP).

These techniques, moreover, could take advantage of the connections that span regions among different segments of the fisheries and different communities can assist in monitoring changes in fishing communities. We noted earlier that seafood promotion campaigns known as "Catch" programs have brought together fishing families with others interested in preserving community-based fisheries; these, in turn, have spawned Community Supported Fisheries (CSF). In CSF, consumers purchase shares in fishing operations and receive fresh fish regularly, increasing connections between community-based fisheries and the wider public while also exposing consumers to a wider range of seafood than they would normally experience. Here we mention such programs for their potential to serve as windows into fishing communities.

CSF and Catch programs are not alone in stimulating interregional connections. Other examples are seafood alliances and initiatives to promote heritage (e.g., www.saltwaterconnections.org) and protect the privilege of access to marine resources. In these settings are often individuals familiar with multiple fisheries who could easily characterize the problems and challenges that fishing families and communities face. They could, that is, relate developments that influence dependence, engagement, vulnerability, resilience, and sustainability. Such individuals could be recruited much in the same way that, now, NMFS recruits fishermen to observe fishing practices or to monitor marine resources. Once recruited, such individuals could be trained in REAP and assist in the monitoring of fishing communities, creating a cadre of citizen social scientists who could provide information to NMFS on a regular basis. Through such an effort, the mandate of National Standard 8 could be met more fully with timely information.

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