Smith Fellowship Application 2015: Research Plan
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Abstract

Managing the world's fish in ways that are both ecologically and socially sustainable is a major challenge for conservation. Community supported fishery (CSF) programs, in which consumers commit to purchasing fish directly from harvesters for a full season, have been proposed to promote ecologically sustainable fishing practices while also benefiting fishing communities. CSF programs are increasing in number nationally, and could have substantial effects on fisheries ecology and economic and social features of fishing communities, but their effects are not well understood. CSFs also provide an opportunity for the conservation movement to connect with the food security and food justice movements. I propose to evaluate ecological, economic, and social impacts of CSFs on a national and local scale. To evaluate the ecological and economic effects of CSFs, I will partner with a national network of CSFs and the National Marine Fisheries Service to assess the effects of CSF programs across the country on both fishing patterns and economic indicators. To evaluate the social impacts of CSF participation for harvesters and consumers, I will work with a new CSF in southern New Jersey to assess its role in building connections between NJ harvesters and Philadelphia consumers, and fisheries sustainability and food access issues. Together, these components will provide the first comprehensive study to assess ecological, economic, and social effects of CSFs, and will provide critical information for both policy on and implementation of CSFs in the future.

Background

Sustainable fisheries management is among the great conservation challenges of our time. Two-thirds of global fish stocks are considered overfished,[1] global fish catch has peaked,[2] and demand for fish continues to increase due to a growing human population and rising income levels.[3] We are struggling to find ways to manage fisheries that are both ecologically and socially sustainable. Many current management approaches, such as reducing total allowable catch or number of allowed fishing days, instituting spatial closures, or implementing rights-based systems such as catch shares, have effectively limited harvest. However, these policies have also often resulted in fleet consolidation and loss of owner-run fishing vessels, and face community opposition as a result.[4] Olaf Jensen, my PhD advisor (and Smith Fellow '08), likes to quip: if you like what has happened to US agriculture (i.e., large-scale consolidation and the demise of the small family farmer), you'll love what catch shares are doing to US fisheries. Long-term success in conservation requires that the human communities most affected – in this case, fishing communities – remain engaged with conservation strategies; we need innovative, win-win scenarios that promote sustainable fishing while also supporting small-scale harvesters.

Community-supported fishery (CSF) programs have the potential to promote fishing that is both ecologically and socially sustainable. This movement draws on the success of community supported agriculture (CSA) programs, in which consumers pay a sum directly to a harvester at the start of the

season in exchange for a series of weekly food shares.[5,6] This arrangement provides consumers with fresh food, and harvesters with guaranteed income and a guaranteed market for product. CSFs are growing in number: the first US CSF started in Port Clyde, Maine, in 2007,[7] and there are now at least 39 running nationwide (B Dubik, pers. comm.). Given this growing popularity, there is a critical need to understand the true ecological, economic, and social impacts of CSFs.

CSFs have the potential to increase the ecological sustainability of fishing in a number of ways: reducing fish discards, distributing fishing pressure to a wider variety of species, including more abundant species, and reducing overall fishing levels. Research suggests that CSFs increase sale of underutilized and/or bycatch species by creating small-scale markets for species that might otherwise be difficult to sell, incentivizing greater catch diversity.[8] Increased catch diversity has multiple conservation benefits: ecosystem modeling suggests that distributing exploitation across a wide range of species ("balanced harvesting") may both increase ecosystem stability and conserve biodiversity while also maximizing catch, compared with more traditional species-selective fishing.[9,10] Beyond increasing catch diversity, the guaranteed markets created by CSFs may also incentivize harvesters to specifically target more highly abundant fish stocks,[8] which is in itself a more sustainable fishing practice.

CSFs may also promote ecological sustainability as a result of revenue targeting on the part of harvesters. In economic target revenue theory, an economic actor aims for a pre-determined revenue value, rather than seeking to maximize revenue, as in conventional economic theory.[11] In some fisheries, harvesters have been shown to adjust trip length according to this target revenue model, staying out longer on bad fishing days to reach a revenue target, and coming in on good days once the target is reached.[12,13] In other fisheries, harvesters have been shown to follow a traditional, revenue-maximizing model, staying out longer on lucrative days than on bad ones.[14] If harvesters who follow a target revenue model receive higher prices for fish through a CSF (as described below), this model predicts that they will decrease trip length, thereby reducing overall fishing level. This scenario aligns economic and conservation goals and may result in harvesters being more willing to partner with conservation organizations, rather than opposing conservation measures and, for example, advocating for higher catch limits.

Along with these ecological benefits, CSFs provide three potential economic benefits for harvesters: they can reduce income volatility, decrease intermediate costs, and enable specialty marketing. The upfront payment from CSF consumers provides a buffer against vagaries of both market (inconsistent prices) and environment (inconsistent harvest). Moreover, marketing directly to consumers reserves the full retail price for the harvester, rather than diverting a portion to processors and retailers.[5,6,15] Marketing directly to consumers also allows specialty marketing (e.g., marketing fish as "local," "community," or "sustainable"), which may command higher prices.[5,16] While consumers are willing to pay more for fish labeled as sustainable,[17,18] such increases in retail price are not always passed on to harvesters.[19,20] CSFs

that market specialty product directly to consumers may allow harvesters to sell at higher prices and keep the difference. Research to date on effects of CSF on fish prices has been limited to only a few CSFs.[21,22]

The institutional characteristics of CSFs also have potential to expand the conservation movement beyond its traditional base. The US environmental movement has long struggled to engage meaningfully with domestic working class communities and communities of color, and scholars and activists contend that to maximize long-term conservation success, the conservation movement must align itself with justice issues that can engage diverse US communities.[23-25] Most CSFs to date have targeted affluent consumers (J Stoll, pers. comm.), but a CSF that connects harvesters with consumers from under-resourced communities not only facilitates an exchange of food product, but may also facilitate coalition-building in two directions: (1) allowing consumers who are not traditionally part of the conservation movement base to engage in conservation-oriented practices by helping to reshape the seafood market to support small-scale and low-impact fisheries, and (2) allowing harvesters to contribute to food security and food justice, thus aligning conservation with these broader issues. CSFs have been shown to have the potential to build social capital (defined as networks of relationships and access to resources and actions that result from those relationships)[26-28] both among harvesters, and between harvesters and consumers.[22] Research on social movements indicates that such social capital is a key ingredient for successful coalition building.[29-31] This specific potential for CSFs to build relationships and coalitions between harvesters and working-class consumers and consumers of color has not been previously investigated.

I propose a two-part, multidisciplinary approach to examine these ecological, economic, and social ramifications of CSFs (Fig 1). For the first part, I propose to work with LocalCatch.org (a North American network of CSFs) and the National Oceanic and Atmospheric Adminstration (NOAA) National Marine Fisheries Service (NMFS) to assess ecological and economic ramifications of CSFs across the US. For the second part, I propose to qualitatively evaluate the effect of a new CSF targeting low- and middle-income urban consumers of color on both harvester and consumer engagement in conservation and food access issues. This work would be the first comprehensive study of the ecological, economic, and social ramifications of CSF programs. It will provide critical information for both policy and implementation of CSFs in the future, as well as provide tools for the conservation movement to build coalitions outside its traditional base.

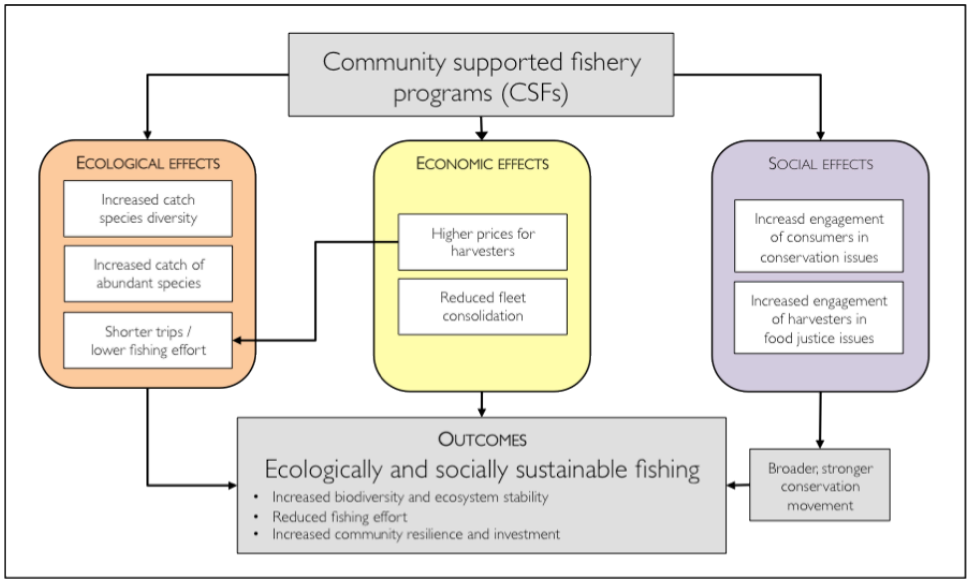

Fig 1: Conceptual diagram of some potential ecological, economic, and social effects of CSFs. White boxes indicate metrics studied in this project.

Statement of objectives

1. Measure effects of CSF programs on ecological indicators: diversity of catch species, stock status of catch species, and trip length.
2. Measure effects of CSF programs on economic indicators: prices received by and annual revenue of harvesters, and number of permits in a given port.
3. Determine effects of CSF participation on engagement of consumers and harvesters in conservation, sustainable fishing and food access issues.
4. Disseminate results of this work to CSF programs and organizations working on sustainable fishing and fishing communities nationwide.

In addition to presentations addressing (4), I anticipate that two manuscripts will emerge from this work: one combining work from (1) and (2), and another with the results of (3).

Approaches, methods, and anticipated results

Data

I will use quantitative data from three sources for this project:

1. I will work with LocalCatch.org, a national network of CSFs, to identify key data from 30-40 CSFs nationally, including: (a) IDs of vessels participating, and years of participation, (b) approximate percentage of catch sold through the CSF, and (c) fish species sold through the CSF and (d) prices received for fish species though the CSF over the time frame of each CSF. I expect that (a-c) will be available from many CSFs, while (d) will be available from only some CSFs.

2. The National Marine Fisheries Service (NMFS) and state agencies maintain databases of commercial fishing permits and collect data on every trip landed by commercial fishing vessels. These databases include species caught, species landed (brought to port) and sold at what price, total trip revenue, and landing location. I will work with these agencies to access vessel-level permit, catch, and sale data starting in 2002 (which is 5 years before the first CSF started). To protect harvester confidentiality, these fishing data must be aggregated to units of at least 3 vessels. Although some of my analyses will be conducted at the single vessel level, all results will be reported in aggregations such as overall CSF/non-CSF participation, port, and specific CSF participation. For individual CSFs that have fewer than 3 vessels, those results will be reported only in the context of port, or overall CSF participation.
3. Stock status is available through the RAM Legacy Stock Assessment Database[32] for many US stocks, and can otherwise be determined from publicly available stock assessments.

Part 1: Ecological ramifications of CSFs

- *Hypothesis 1*: CSFs increase catch diversity.
- *Hypothesis 2*: CSFs increase targeting of abundant fish species.
- *Hypothesis 3*: CSFs decrease trip length.
- *Hypothesis 4*: Given that many harvesters sell only a portion of their catch through a CSF (J Stoll, pers. comm.), I predict that the proportion of catch sold through a CSF will correlate with the above outcomes: i.e., vessels with higher CSF-quotients will exhibit proportionally greater catch diversity, more fishing of abundant species, and shorter trips.

To test hypotheses 1-4, I propose an impact evaluation of these ecological effects of CSFs using a difference-in-differences (DD) analysis. This econometric approach assesses the effect of programs by comparing performance of participating individuals before and after program implementation with that of non-participating controls over the same time period. For each vessel participating in a CSF, I will identify matched control vessels that use the same gear(s) and land at the same and/or nearby ports and do not participate in a CSF. A DD analysis simultaneously controls for two important sets of confounders that could otherwise lead to mis-estimation of program impact. By comparing individuals to themselves before and after program implementation, this method controls for pre-existing characteristics that might make vessels that choose to participate in a CSF different from non-participating vessels. For example, harvesters participating in CSFs may be market-savvy individuals (B Dubik, personal communication), and that fact might lead to an overestimation of the impact of the CSF itself. By simultaneously comparing CSF vessels to non-participating vessels, this method controls for concurrent factors unrelated to CSF participation (e.g., changes in management, environment) that may result in changes in fishing patterns for all vessels, regardless of CSF participation.[33-35]

Using a DD analysis, I will model four annual vessel-level metrics to assess the ecological effects of CSFs: average catch species diversity, total number of catch species, the weighted ratio of assessed biomass over the biomass at maximum sustainable yield (B/B_{MSY}: a measure of stock healthiness)[1,8,32], and average trip length. I will model these metrics as a function first of whether the vessel participated in the CSF that year (binary), and then by the percentage of catch sold through a CSF (continuous: a "dose effect"), with fixed effects for individual vessel, state, specific CSF, number of years in CSF, and gear.[34] I will also assess for a threshold effect, i.e., if a vessel has to sell at least 25 or 50% of its catch through a CSF to see significant effects.

It is possible that CSFs may have effects even on vessels not participating in them. For example, if CSF vessels fish more mullet and less snapper, non-CSF vessels may fish more snapper in response, thus canceling out the ecological effect. To identify any such effect, I will conduct this analysis on a port scale as well as by individual vessel, aggregating metrics for participating and control vessels in a given port.

Part 2: Economic ramifications of CSFs

- *Hypothesis 4*: Mean price for CSF-sold fish is higher than that for comparable fish in the same region.
- *Hypothesis 5*: CSF vessels have similar or higher total annual revenue than non-CSF vessels.
- *Hypothesis 6*: Ports with CSFs demonstrate lower permit decreases than comparable ports.
- *Hypothesis 7*: As in Hypothesis 4, I predict that the above outcomes will be positively correlated with proportion of catch sold through a CSF.

I propose to assess the effects of CSFs on price received by harvesters in two ways.

(a) For each CSF that is able to provide price data by species over time, I will compare CSF prices with prices for each species from the same month from that county and adjacent counties. This approach will allow me to calculate a price premium generated by the CSF, and has been used in other studies as a measure of the value added by CSF participation.[22]

(b) I will use the DD analysis described above to model two price metrics: total annual revenue by vessel, and monthly price by species received. For annual revenue, I will use a similar model structure as above, modeling annual revenue first as a function of CSF participation and then by percentage catch sold through a CSF that year. For each species sold through a CSF, I will also model monthly price of that species as a function first of CSF participation and then by percentage catch sold through a CSF that year, with an effects structure similar to that described above. I will assess for a threshold effect in both of these model sets as described above.

To evaluate the effect of CSFs on permit count by port, I will again use a DD analysis. I will identify ports with CSFs, and then identify matched control ports (nearby, with similar gear and catch species). I will model annual permit count in each port as a function of whether the port had a CSF that year, with fixed effects for year, port and state.

Part 3: CSFs and cross-community engagement

- *Hypothesis 8*: Harvesters will demonstrate greater knowledge about and interest in consumer community and food access issues after CSF participation.
- *Hypothesis 9*: Consumers will demonstrate greater knowledge about and interest in harvester community and sustainable fishing issues after CSF participation.

To assess the effect of CSFs on connections between harvesters and consumers, I will employ a youth-based participatory research approach to evaluate a pilot CSF connecting New Jersey (NJ) harvesters to low- and middle-income families in Philadelphia. Participatory research involves community members in the research process, based on the idea that people being studied have expert knowledge about their own communities that can and should shape research questions and frame interpretations and results.[36,37] This study CSF is slated to start in the summer of 2016, and will connect harvesters landing at Barnegat Light, NJ (97% white, median income: $78,750), with consumers in South Philadelphia (57% white, 21% African-American, 16% Asian, median income: $37,587).[38,39] I am one of four people working to start this CSF. Using pre-existing relationships with schools in each place (see Personal Statement), I will recruit and train six students from Barnegat Light, and six from South Philadelphia. We will design, conduct, and analyze semi-structured pre- and post-interviews of CSF consumers and harvesters (target n = 10 for each group), focusing on cross-group understanding of and interest in challenges facing these two communities. I have a proven track record successfully training and working with parallel cohorts of students at these schools to conduct and analyze interviews, and publish the results.[40-44] (See Cover Letter and Personal Statement for more details.) Youth participation research has been shown to be transformative both for the youth, and the research outcomes.[45] Through this approach, the students – who are residents of the harvester and consumer communities themselves – will not only be studying the relationships between the communities, but will be directly engaging with each other, and the issues of sustainable fishing and food justice.

Research timeline

Phase		**Dates**	**Description**
Project prep		Mar – Aug 2016	Submit data requests, conduct pre-CSF interviews
Phase 1	Data assembly	Sep – Jan 2016	Build database and conduct post-CSF interviews
Phase 2	Fishing patterns and price analyses	Feb – Oct 2016	Analyze changes in fishing patterns and fish prices
Phase 3	Community engagement analysis	Nov 2016 – Mar 2017	Analyze community engagement data
Phase 4	Publication and results presentation	Apr – Aug 2017	Prepare analysis for publication; present results to community groups

Relevance to conservation science and practice

CSFs have the potential to transform the way fishing communities interact with not only the marine ecosystems that provide their livelihoods and also with fish consumers. Their potential conservation impacts range from immediate increases in sustainable fishing patterns, to long-term coalition building between conservationists, policy makers, fishing communities, and consumers.

A successful national strategy for sustainable fisheries management and marine conservation will not be a monolith; it will be a mix of top-down, bottom-up, legislated, mandated, and community-based solutions. As part of this mix, we need more on-the-ground solutions that work: programs that promote conservation – in the case of fisheries and marine resources, that means smart, strategic, and sustainable harvesting – while also promoting sustainable communities. While CSFs do not currently comprise a large percentage of the commercial fishing market, along with other direct-marketing strategies, they may represent an important and innovative component of an effective national strategy for sustainable fisheries management. Early research suggests that CSFs may be a win-win approach for sustainable fishing: they may promote fishing of more sustainable species, greater catch diversity, and lower fishing effort, while also increasing income and social capital in fishing communities. This project can provide timely, critical information on the impacts of CSFs, identifying opportunities for expansion and improvement in some areas, or informing us that our resources would be better directed elsewhere. With the help of my conservation sponsors, I will present the results of this work to current CSFs, and to organizations working toward conservation and sustainable fishing communities. These results will provide conservation practitioners with tools to talk specifically about the effects of their work with CSFs, as well as inform practitioners, policy makers, and funders considering promoting CSF implementation in the future.

The future of the US conservation movement is not just about conservation science. During my first summer of graduate field work, I saw a bumper sticker on the truck of a commercial fisherman that said: "NATIONAL MARINE FISHERIES SERVICE. DESTROYING FISHERMEN AND THEIR COMMUNITIES SINCE 1976." Central to our success is a campaign for hearts and minds, which is not only an obligation but also an opportunity to build relationships with two inspiring groups of allies. We must work with those who livelihoods depend directly on and whose histories are embedded in the resources we want to conserve. We must also reach out to the urban working-class communities of color that have been left out of so much of the conversation on conservation in this country – and who are particularly vulnerable to environmental decay – but who have mobilized powerful social movements in the last century. CSFs can be a tool to help us in this crucial work.

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