Empirical Evidence on the Economics of Stakeholder Opposition to Fishery Rationalization

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Abstract:

In common pool resource settings, the transition to institutional arrangements that improve the health of the resource and are economically beneficial are often met with resistance. An important example is the implementation of rights based management in fisheries, which has seen considerable political opposition despite its well-documented benefits of increased harvesting efficiency and fishery health. This paper explores the role of harvester location and landings history in determining this opposition. Using a novel data set of written and oral public comments from the Alaskan Halibut and Sablefish fisheries, harvester position is observed. Commenter information, such as name, address, and/or vessel name, is then linked to vessel ownership data and harvester performance. The initial allocation of quota, which is primarily done through grandfathering, and harvester location are predicted to be important determinants of opposition. Remote communities may see reduced landings while individuals with inconsistent participation history in the fisheries receive a relatively lower share of the initial allocation. Results show a harvester who misses a single year during the grandfathering period is 18-26% more likely to oppose rationalization. Harvesters located in remote communities are 30% more likely to oppose rationalization. Understanding the distributional issues that determine opposition may allow policymakers to better design politically feasible property-rights based resource management programs.
“There are still ocean cowboys around who feel this is the last frontier. They think that anybody should have a right to fish, no matter what it does to the resource and whether or not it makes good economic sense.” – Walter Pereya, Seattle Seafood Processor

I. Introduction

Many environmental and natural resources remain characterized by insecure property rights and open access conditions despite large potential gains from increased institutional control. One of the most extreme examples of inefficient resource use is in fisheries, where there are an estimated $50 billion in losses worldwide each year (Arnason, 2008). A 2004 study by the FAO (2009) finds that better management could alleviate losses by up to 50% of current fishery revenues (via Arnason, 2012). In the United States, many fisheries are managed under regulated open access conditions where rules restrict season length, gear type, and other methods of production. These types of rules have been characterized as “regulation by inefficiency” because they promote a “race to fish” wherein overcapitalization is combined with high-cost and dangerous fishing practices. There is compelling and increasing evidence that rationalization, the movement of a fishery to limited-entry Rights Based Management (RBM) such as Individual Transferable Quotas (ITQs), improves both the economic and ecological health of a fishery (Arnason 1997; Grafton 1996; Dewees 1998; Danielsson 2000; Clark 1980; Costello, Gaines, and Lynham 2008). Yet inefficient management persists.

The difficulties of transitioning out of an inefficient management regime are linked to the cost of the process by which a new institution is created and adopted

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2 The study by the World Bank and FAO (2009) found that in 2004 the global ocean fishery operated at a significant net economic loss financed in part by government subsidies.
(Libecap 1989; 1993). A large amount of political resistance can result in delays or even stop the management implementation and formation process. US fisheries are mandated by the Administrative Procedure Act to incorporate stakeholder input in the formation of fisheries management policies (Turner et al, 2005). It is apparent that political opposition has halted or delayed many rationalization programs in the United States. When Congress reauthorized the primary law governing fisheries management in US federal waters, the Magnuson-Stevens Act (MSA, 1976), in 1996, political pressure from the processing industry and other equity concerns led to the issuance of a 6-year moratorium on the creation of new ITQ programs (Guide to U.S. Environmental Policy). Prior to the MSA reauthorization, Alaskan Pollock harvesters attempted to rationalize, but political protests from processors halted any new or pending plans to change management regimes in a way that allocated rights to individual harvesters. In the formation of some of the earliest US ITQ programs, concern for small-scale fishermen and the takeover of fisheries by big business were cited as reasons for opposition. The concern has been publically acknowledged as a potential outcome from ITQs in congressional testimony. And public opposition to ITQ systems is not limited to the United States. The Icelandic Cod Quota

3The Administrative Procedure Act requires that all U.S. federal regulatory agencies “shall give interested persons an opportunity to participate in the rulemaking through submission of written data, views, or arguments with or without the opportunity for oral presentation” (Title 5 U.S. Code Section 553(c), 1988 edition). In Corrosion Proof Fittings v. Environmental Protection Agency (1991) the Supreme Court showed its willingness to require that public opinion be adequately consulted. (In this case, the court vacated proposed regulation because the Environmental Protection Agency prematurely ended public hearings and deprived the public of sufficient opportunity to “comment [on], analyse, and influence the [regulatory] proceedings”)

4Rolland Schmitten. Assistant Administrator for Fisheries at the National Marine Fisheries Service in answering questions in congressional testimony in 1994: “Do ITQs promote ‘big-business’ as large companies have resources to buy or lease a significant amount of shares? This could happen, as experienced with grocery stores, agriculture, and other such enterprises… To the extent that larger firms are relatively better capitalized, they may be able to obtain more shares relative to their needs for efficient operation than could smaller firms.”
system, implemented in 1983, resulted in sweeping concentration of the fleet and the
capital, implemented in 1983, resulted in sweeping concentration of the fleet and the
public naming the quota holders “Lords of the Sea” (Helgason, 1996). In Canada,
opposition to ITQs has been so strong that one parliamentary committee in Ottawa went
so far as to argue that evidence for New Zealand and Australia’s ITQ systems shouldn’t
be used to justify Canada’s use of ITQs (McTaggart et al. 2003).

This paper explores the economics of political resistance to ITQ adoption. In
changing the property right allocation from the status quo, some users may see net losses
even if the overall gains are large. Other users do not foresee future losses but instead see
opportunity to increase their share by holding out. These users may delay or prevent the
adoption of a welfare-enhancing institution (Matulich and Sever, 1999). While this has
been the case in the evolution of many ITQ programs in the United States and other
countries, there is limited understanding of the specific economic factors which
determine stakeholder opposition to rationalization.

Prior research show how ITQ design affects the distribution of benefits among
and within sectors (Matulich and Sever, 1999; Costello and Grainger, 2015; Costello,
2015). I test whether the distribution of benefits as predicted by economic theory explains
opposition using data from the adoption of the Alaskan Halibut and Sablefish ITQ
program. The adoption of the Alaskan Halibut and Sablefish ITQ in 1995 culminated
fourteen years of deliberations on limited entry. As such, the program development
process was noted as being “enormously complicated and controversial” with “extremely
painful” decisions deliberations (Pautzke and Oliver, 1997). In both fisheries, quota was
allocated based on historic catch. Given the same catch pre- and post-ITQ, a harvester is
expected to be better off under the ITQ regime. Therefore, the contentious part is the allocation of the total catch among private individuals. When a grandfathering scheme is used, allocation is contentious because individuals prefer the time period when their harvest levels were greatest (Granger and Parker 2013).

This paper predicts opposition should occur in three groups: parties from remote communities, harvesters with high volatility in landings, and low volume fishermen. Opposition may be higher for those located in remote communities due to lack of market access, informational disparities, or general mistrust of government.\(^{5}\) Individuals with inconsistent participation history in a fishery may receive an initial quota lower than what was actually caught in any year in which they participated. The observed structure of post-ITQ fisheries confirms some of harvester concerns, for instance the Canadian Halibut fishery. Prior to rationalization, the fishery had been reduced to six fishing days per vessel from a 60-day season in 1982, even with a significantly larger overall harvest quota. When it was rationalized, efficiency increased but landings shifted and dropped as much as 12% in some ports as their freezing facilities became unnecessary, and the number of crew-members employed dropped by 32% (Casey et al., 1995).\(^{6}\)

To test these predictions, the Alaskan Halibut and Sablefish ITQ programs were selected because both programs were implemented simultaneously in 1995, and there is overlap in harvesters. I exploit differences in the locations and characteristics of harvesters to disentangle the underlying economics of opposition. A unique dataset is

\(^{5}\) The New York Times (1992) quotes a fisherman describing ITQs as “Un-American.”

\(^{6}\) Though number of crew dropped, individual crew shares increased on those vessels operating with fewer crew members
constructed by coding available public comments made regarding Alaskan Halibut and Sablefish ITQ adoption between 1987 and 1992. This time period captures the initial reaction to the rationalization proposals and is the time period where all major modifications were made to the ITQ/fishery management plan. The names of commentators are linked to individual characteristics, including location, vessel ownership and landings data. The combined data is used to statistically test the role of participation history and location in determining levels of support for ITQ implementation. Results show that being located in a remote location decreases likelihood of being supporting ITQs by about 30%. Both variation in annual landings and missed fishing years are inversely related to ITQ support, with attendance being a more powerful predictor of an individual’s position on ITQ adoption. Missing a year of fishing decreases the likelihood an individual supports ITQs by as much as 22% for halibut harvesters and up to 26% for sablefish harvesters.

Identifying and quantifying the underlying reasons certain harvesters, remote community members, and industry members may lose under ITQs can assist in the design of management institutions, reduce the amount of opposition and the length of time to implementation, and improve overall implementation efficiency. Understanding opposition allows management to be designed to achieve a variety of social goals. For instance, to achieve the most effective design incorporating benefits to fishing communities, rights can be allocated to fishing cooperatives or fishing ports, rather than to individual fishermen (Costello, 2014). The paper is organized as follows: section II provides background on ITQs and the role of public input in the formation of fisheries
management in the United States; section III provides a detailed breakdown of the
distribution of costs and benefits and develops testable predictions; section IV describes
the data and empirical design; section V provides the results of the statistical analysis;
concluding remarks follow.

II. Background

Changes Under Fishery Rationalization

The implementation of ITQs have been linked to stakeholder opposition
attributable to the redistribution of rents under the new regime (Matulich et al 1996). The
fisheries examined in this paper have transitioned from a regulated open access, or derby,
management system to an ITQ system. In a derby fishery with no vessel restrictions,
there are typically a large number of vessels operating. Vessels and gear are chosen to
maximize quantity harvested in a short time period. Without a limit on the number of
vessels permitted to enter, the fishery will attract new harvesters until all rents are
dissipated (Homans & Wilen, 2000). This implies that if the fleet is homogeneous, each
vessel’s total revenue will equal total cost, and the dockside price will be equal to the
average total cost of fishing. If the fleet is heterogeneous, inframarginal rents will accrue
to the higher-skilled fishermen (Costello & Grainger, 2015). Harvesters will fish
intensively over a short time period to race for a limited total allowable catch (TAC). In
extreme cases the entire TAC can be harvested in just a few days (Homans & Wilen,
2000).
When RBM is implemented, harvesters are allocated a certain percentage of the catch and are typically allowed to sell quota with limits on consolidation. In an ideal ITQ setting, fishermen no longer race for the catch, but aim to maximize the value of their quota and landings by controlling when and where they fish (Grafton et al. 2000). Under ITQ management without trading restrictions, quota sales result in a smaller, more efficient fleet as compared to regulated open access without entry restrictions (Reimer, Abbott, & Wilen, 2013). Vessel owners may oppose ITQs if they prefer alternative management techniques or believe they will fare better under status quo management. As Costello and Grainger (2015) point out, the inframarginal rent enjoyed by high skill resource users may, upon the transition to property rights, be capitalized into asset values and transferred to all permit owners. However, they also find that as long as the initial allocation is at least 30% of historic catch, all users will be better off. Guyader and Thebaud (2000) find that many harvesters have preferences for input regulations such as gear restrictions, which are perceived to give equal opportunity to all participants and award the most skillful.

Vessel owners displaying higher variation in annual landings or with a shorter history of participation in the fishery may have incentive to object to rationalization or delay rationalization until calculation of quota share reflects internal beliefs about future landings potential. In other words, a harvester may try to delay ITQ implementation if she thinks her skill is improving over time, and past harvest is not reflective of future potential. This may also be the case if exogenous shocks caused non-participation during the grandfathering period. This situation is analogous to the process of unitizing oil
fields. When unitizing an oil field, lease production is influenced by firm management policies for which the details are not publically available (Libecap & Wiggins, 1985). This leads to internal calculations of lease value that differ from value calculations that are made using publically available data. If a firm believes the estimated lease values calculated using public information are too low, or that delay will reveal new information leading to a larger allocation, the firm will object to unitization. In the case of the fishery, if a vessel owner believes historic landings data is not reflective of future earning potential, the vessel owner may object to rationalization if it is believed that delaying rationalization will result in realization of actual landings potential and hence greater gains from rationalization. Libecap and Wiggins (1985) also point out that a firm may resist joining if holding out will result in concession from other parties.

**Community Incentives**

Community sentiment may also play a role in fisher opposition to RBM. Most economic analysis of fisheries management has assumed that individuals act as autonomous agents, maximizing profit under budget constraints (Guyader, & Thebaud, 2000). However, residents of coastal communities worry about the effect of fleet consolidation on non-harvesting employment and economic activity (Reimer, Abbott, Wilen, 2013 8, 16-19). Many small communities rely on the processing industry as a source of employment, and jobs created by fish landings also include cannery production, vessel equipment, supply and repair business, and other sectors of coastal economies.
RBM generates rents through the elimination of excess capital and consolidation of harvest to the most efficient vessels (Reimer, Abbott, Wilen (1-4)). Fleet consolidation causes losses in the total number of crew jobs, although the remaining jobs are more consistent and over a longer season (Abbott & Wilen, 2010). The Canadian Halibut fishery experienced a reduction in the number of crew employed on active vessels and a consolidation of the fleet after ITQs were implemented. These two effects resulted in a 32% decrease in employment (Abbott & Wilen, 2010).

Agents making decisions are often not individuals but groups of individual households. In the case of rural areas Alaskan fisheries, many locally run fishing operations were conducted as partnerships or kin groups (Koslow, 1986 via Carothers, 2010). Although an agent may gain utility from earnings, it has been suggested that there exist non-monetary sources of utility derived from community fishing operations. In interviews conducted by Carothers, harvesters cited fishing as the “lifeblood of their communities” connecting the old and the young.

Members of small communities participating in Alaskan fisheries may receive allocations of fishing rights in line or above historic harvest levels, but the concern for coastal communities persists, particularly those in remote rural areas. Carothers (2000) goes as far to say that ITQs “brought about a dramatic alienation of local fishing rights and place-based livelihoods.” If local harvesting operations hold such cultural significance, why would the permits be sold? Carothers argues that the “cyclical nature” of remote economies dependent on natural resources suffer short-term cash flow problems and consequently sell permits. In 2006, local residents of remote, rural areas
depended on the government for 71% of their personal income (Goldsmith, 2008). By holding high-valued capital assets such as fishing permits, residents would likely not qualify for government aid, which creates a perverse incentive to sell permits (Carothers, 2000). While an economist may be skeptical of these claims, there is an absence of alternative explanation that characterizes the incentives of individuals opposing RBM—a gap this paper seeks to fill.

**Fisheries Management and Public Input**

Public input plays an important role in the formation of US fishery regulation. In the United States, regional fishery management councils have considerable power in fishery management decisions. The methods used by fishery councils to make decisions and of solicit public comment provide the key data source for this paper and here this process is discussed in detail. The North Pacific Fishery Management Council (NPFMC), which regulates the Alaskan sablefish and halibut fisheries, consists of eleven voting members including seven private citizens—five from Alaska and two from Washington—appointed by the Secretary of Commerce from lists submitted by the Governors of Alaska and Washington. Council members appointed by governors may have electoral accountability if reappointment to the council is dependent upon public satisfaction with their performance, and this can result in council members voting for politically favorable or neutral policies.

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7 The council also includes four non-voting members representing the Pacific States Marine Fisheries Commission, the U.S. Fish and Wildlife Service, the U.S. Department of State, and the Coast Guard.
The fishery management council makes decisions under the authority of the Magnuson-Stevens Act (1976). The council is able to modify and create a fishery management plan (FMP) for fisheries within its jurisdiction. FMPs characterize the way a fishery is managed and changes to management (amendments) are considered by the council at each meeting. Resource agencies or the public can submit amendments to specific FMPs. As of 2014, the council has implemented five different fishery management plans including Bering Sea/Aleutian Islands Groundfish FMP, Gulf of Alaska Groundfish FMP, Bering Sea/Aleutian Islands King and Tanner Crab FMP, Alaska Scallop FMP, and Alaska Salmon FMP.

The council composition is designed so that all stakeholder groups are represented. Meetings are open to public comments—written, emailed and oral—and decisions are made by recorded vote in a public forum. After the council has voted, the final decision is sent for a second review to the Secretary of Commerce. The Secretary receives further public comment, and if approved, the Council makes the decision final. All rules and policies must conform to the Magnuson-Stevens Act, Endangered Species Act, Marine Mammal Protection Act, Regulatory Flexibility Act, the National Environmental Policy Act, executive orders, and other applicable law. The timeline for regulatory change can take over a year, with duration increasing if the regulation is complex or contentious. In the US, the “incubation” time period for ITQ policy has ranged anywhere from 1 year to 17 years (author’s calculations).

In the time period studied, the NPFMC met five times a year and received input from a variety of advisory groups including the science and statistical committee (SSC),
Advisory Panel (AP) and “plan teams.” The AP consists of 20 members representing user groups, recreational fishermen, environmentalists, and consumer groups. Council meetings were held exclusively in Anchorage, Alaska until the late 1990s. Presently, public council meetings typically take seven days and are held variously in Anchorage, in a fishing community in Alaska, and in either Portland or Seattle. Minutes are taken at each council meeting and are available through request.

The meeting structure is determined by an agenda that is posted by the council. The public may propose changes to regulations by testifying to the Advisory Panel or making a comment to the Council during the public comment period. At each meeting, the council members and staff receive a briefing book, which contains summaries of background information for each agenda item, reports and materials for each item, and written public comment. These comments are documented and can be obtained by request. Because having a letter recorded does not require meeting attendance, an individual can participate in the political process at nearly no cost.

In the late-1980s and early-1990s the NPFMC floated proposals for RBM for five fisheries under their jurisdiction: halibut (1989) and sablefish (1988); Bering Sea and Aleutian Island crab (1991); Pollock (1990); Non-Pollock Groundfish (1991); and Rockfish (1991). These proposals were opened to public comment and comments were solicited via meetings and letters until RBM adoption. The first RBM scheme was adopted in the halibut and sablefish in 1995. A Pollock program was adopted in 2005,
Non-Pollock groundfish adoption occurred in 2008, and Rockfish adoption took place in 2012.

III. Predictive Framework

I build upon the earlier work on oil field unitization by Wiggins and Libecap (1985, 1987) and develop a simple, testable model of a harvester’s decision to oppose or support rationalization in a fishery setting. When deciding whether or not to support rationalization, the vessel owner maximizes the expected value of her quota with respect to the date rationalization begins, \( t_r \). The vessel owner will decide her position on ITQ implementation at time \( t_r \) by calculating the difference between expected earnings under ITQ and status quo. This present value of a vessel’s quota share will depend on the date rationalization is implemented. Let \( E[ PV^{ITQ} ] \) and \( E[ PV^{SQ} ] \) be harvester i’s expected present value of earnings under ITQ management and status quo management, respectively. If at any given date in the future, \( t_r \), the difference in vessel owner’s expected present value of income under ITQ management and status quo management is greater than zero, the vessel owner will be in favor of rationalization at this time. That is, a vessel owner favors rationalization at time \( t^* \) if and only if:

\[
E[ PV^{ITQ} (t^*) ] > E[ PV^{SQ} (t^*) ]
\]

Quota shares are based on public estimates of landings potential such that the share for firm i of the total allowable catch is:

\[
S_i = \frac{V_i}{\overline{V}}
\]
where $\overline{V}_i$ is the management body’s calculation of some average based on publicly available historical landings data. $V^* = \sum_i \overline{V}_i$ is the aggregate landings across vessels. Alternatively, $X^F_i$ is the expected share of future landings under status quo management.

The harvester’s expected value (income) under status quo vs ITQ management depends on the individual’s expected future landings (weight and value). I simplify away from an exact form of the profit function and instead define a monotonically increasing likelihood function $L(X^F_i - S_i)$. The probability a harvester opposes rationalization is increasing in the difference between their private value of expected future landings and historic average catch.\(^8\)

There are many reasons an individual’s private valuation of future landings may exceed actual average catch. Public comments indicate that individuals with higher volatility in catch oppose rationalization at higher rates. These harvesters may optimistically view historic catch by making excuses for low harvest years and believing good years more accurately represent skill. It is also anecdotally the case that individuals with higher volatility in catch claim to have had a shorter history of participation and believe they have yet to reach potential, i.e. learning is possible. This is consistent with economic theory. If a high year of catch is used to form the expected future catch, whether this belief is rational or not, for instance $X^F_i = \max_i X_i$, then the difference between this value and the allocated share will be greater for high volatility harvesters.

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\(^8\) Even if TAC or price changes under different management regimes, the likelihood of opposition is still increasing in this difference.
Three types of fishers may have high volatility: those with missed years, those that are new to the fishery, and those with less dependable skill whose catch is inconsistent. These fishers are expected to gain less or lose from ITQs, and hence have increased likelihood of opposing ITQs. These arguments lead to two testable predictions:

**Prediction 1:** *Vessel owners with higher annual variation in landings are more likely to oppose ITQs.*

**Prediction 2:** *Vessel owners with shorter history of participation in the fishery are more likely to oppose ITQs.*

New vessel owners can be expected to have higher volatility in landings due to low number of years of landings and inexperience, as well as fewer years of participation. As outlined in prediction 1, higher volatility results in higher levels of opposition. In fisheries distributing initial quota shares by grandfathering, harvesters who spent years not fishing, or just learning about the fishery, will rationally expect their future landings to increase. Prediction 2 is supported by Grainger and Costello (2014), who show analytically that new entrants are likely to oppose ITQs. Multi-species harvesters may also have high volatility in annual landings if the fishery is only utilized in years that other fisheries are unavailable.

Larger firms may be less sensitive to a lower, than their perceived $X_i^F$, quota allocation because they internalize more of the benefits of the more efficient institution (Wiggins and Libecap, 1987). Relative to a small operation, larger operations are expected to experience greater gains from ITQs through decreased coordination and
investment costs. Higher average landings may indicate greater investment in the resource and hence more stake in the long-term stability of the resource. The following prediction summarizes this argument:

*Prediction 3:* Opposition to ITQs will be decreasing in average quantity of fish landed.

In addition to harvester production characteristics, their location may be an important factor in their decision to support or oppose ITQs. There are three common justifications for why remote communities oppose ITQs, beyond factors related to quota allocation: (i) individuals from remote locations may anticipate reduced market access resulting from rationalization; (ii) the wellbeing of the individual’s community may be a consideration (Carothers, 2000); (iii) the “culture” of remote locations may be one that mistrusts government or resents government control (Karpoff, 1985). The processing of fresh fish requires access to major port towns as fish are highly perishable and need to be flown to their final destination using commercial passenger planes (Interview with Trident Seafood). Processors located in remote areas will not be able to access the fresh market, but will be required to compete with fresh fish processors for raw materials. Remote community members could easily anticipate a diversion of fish away from their ports, as most fishing communities were aware of the changes that occurred when the BC halibut fishery rationalized a few years prior. There, the season lengthened from 5 days to 8 months and the amount of product sold to the fresh market increased from 42% to 94% (Casey, 1992). For these reasons, the final proposition relates to remote harvesters:

*Prediction 4:* Remote harvesters are more likely to oppose ITQs
After testing for an overall effect for rural harvesters, specific explanations can be examined using other explanatory variables. The first explanation is tested in this paper by examining opposition among fishers who harvest species with a fresh market relative to those who do not. A test of the second explanation would look at which remote communities suffered local employment losses after ITQ implementation, but is beyond the scope of this paper, as is the third explanation, which is a more general assessment of culture in rural locations and would be difficult to test directly using available data.

IV. Empirical Design and Data

Data

Predictions are tested in the context of the Alaskan Halibut and Sablefish fisheries. Both fisheries proposed rationalization in 1987 and underwent the same political process to council approval in 1992. During the period from 1987 to 1992, individuals, companies, NGOs, and many other groups publically stated their position on ITQ adoption by written or oral communication. In this analysis, three sets of individuals owning vessels that harvest halibut and sablefish are considered: the entire sample which consists of halibut only harvesters and both sablefish and halibut harvesters; only individuals that harvest only both sablefish and halibut, and fishers harvesting exclusively halibut. The sample consists of 724 vessels, 500 of which harvest both halibut and sablefish and 202 that harvest only halibut.

An observation is defined as a public comment recorded at a Council meeting or a letter addressed to council regarding IFQ implementation. The data consists of 2,918
comments made by 2,669 unique individuals via meeting participation or letter writing between the years of 1987 and 1992. Figure 1 shows the number and type of comment in the complete dataset. I focus on a subsample (N=511) of the commenters that owned the 724 vessels harvesting halibut, sablefish or both species during the qualifying period for initial quota allocation (1987-1990). The data sources utilized in this study include NPFMC meeting minutes, NPFMC newsletters, and Alaska Federal Vessel Registry. Table 1 describes the data sources. Column one, titled “Source,” provides the agency or source from which the data was obtained. Column two provides a description of the types of data obtained from the source, and column three provides details on the actual data used in this analysis. All public comments were obtained from NPFMC meeting minutes, meeting binders, or meeting transcripts. The public comments were gathered through correspondence with council staff or by visiting the NPFMC office in Anchorage and making copies of all meeting materials.

To the best of my knowledge, the data described above represents the entire population of comments for the period 1987 to 1992. Up to 70% of individuals harvesting sablefish and 30% harvesting halibut between 1987 and 1992 made a public comment (written or oral) pertaining to ITQ implementation. Figure 2 shows the number of vessels harvesting halibut and sablefish for the study period. An additional 2,118 individuals or companies not owning vessels harvesting halibut or sablefish participated in the political process, either by mail or by speaking at a meeting. Although the overall number of sablefish harvesters is smaller, a much larger percentage of sablefish harvesters choose to participate in the political process.
Variables describing support or opposition and harvester characteristics are listed in Table 2. A comment is coded to determine demographic characteristics and the stance of the commentor on IFQ implementation. For most observations, the individual clearly states whether she is in favor of the proposal. For observations in which the individual’s stance is not clear, the observation is coded as “uncertain.” Each observation consists of a date, name, affiliation, occupation, location, vessel ownership status, and the comment/opinion expressed. Observations recorded from letters do not always contain affiliation of the individual(s), but consist of date of comment, name, and whether or not the individual is in favor of ITQs.

To determine whether or not an individual owned a vessel, I searched the Alaskan State Vessel Registry for all participant names and vessel names provided in the comment. In this way the comment database is matched with the vessel registry database. If the individual owns one or more boats, all vessel information is recorded. Vessel and owner characteristics include vessel name, homeport, mailing address, ADFG (Alaska Department of Fish and Game) number, vessel length, gear, year, and ownership information.

Each vessel is assigned a unique ADFG number, which is consistent over time. Upon making a landing, the vessel operator is required to fill out a fish ticket form containing information on the location, weight, value, date, and species landed. For the years the individual owns the vessel, the vessel’s landings data are recorded from ADFG fish tickets. In this way, catch is matched to the vessel and then to the public comment. An individual’s catch and catch volatility is measured for each species (halibut and
sablefish) for the four years 1987-1990, which are years for which catch data is available and for which actual quota allocation was to be based at the time letters were written. To measure volatility, the coefficient of variation (CV) is used. The coefficient of variation is equal to the standard deviation divided by total landings. CV is used instead of standard deviation to control for increasing standard deviation as landings increase.

The participant’s address (either return address, stated address, or address from vessel registry) is used to classify whether the individual is from a remote location. Remoteness is defined by whether or not the individual lives within driving distance of a town with a direct flight to Seattle. If the town of residence or homeport does not have direct air access to Seattle or is not within driving distance of such access, it is classified as remote ($R_i = 1$). All towns with known location with air access are classified as non-remote ($R_i = 0$). All observations with unknown locations are dropped from the analysis.

Figure 3 provides a map of selected cities from the sample. Cities that are classified as non-remote are denoted by an airplane inside of a circle. The circles marking the cities are increasing in size with increasing opposition. There are four Alaskan ports with direct flights to Seattle that are classified as not remote: Sitka, Anchorage, Juneau, and Ketchikan. All cities located outside of the state of Alaska are classified as non-remote. The sample consists of commenters located in 79 different cities in 22 different states. Of the 287 out of state participants, 207 come from Washington, which has a large stake in the Alaskan seafood business. There are a total of 39 cities classified
as non-remote, implying flexibility in delivery location and access to fresh market.\textsuperscript{9} The remaining 40 cities located in Alaska are classified as remote.

\textit{Empirical Design}

The position of party i, $Y_i$, on the implementation of RBM is equal to one if individual i is in favor of IFQ implementation and zero if opposed. $Y_i$ is regressed on the characteristics of party i that are expected to affect his or her position on ITQs using three different regression specifications. All specifications are tested using a linear probability model.\textsuperscript{10} The right-hand side variables include: a dummy variable, $MissedYear_i^S$, which equals one if individual i was absent for one or more of the four qualifying fishing years for species S; the log of average annual landings for each species $LogLbs_i^S$; a dummy variable for “remoteness”, $R_i$, equal to zero if the individual is located near a major transportation hub or lives outside of Alaska and one otherwise; regressions including both fish include a dummy variable indicating whether or not individual i is a sablefish harvester, $S_i$, which equals one if the individual harvests sablefish and zero otherwise; and the coefficient of variation of annual landings of individual i for species S, $CV_i^S$. Three different specifications are used, which differ by whether or not they include CV and/or years of participation. Specification (1) includes both CV and missed years, specification (2) includes only CV, and specification (3) includes only missed years.

\textsuperscript{9} Of the 30 non-remote cities, 6 are located in Alaska. The remaining 24 are located in Washington, Oregon, and other parts of the US.

\textsuperscript{10} To test the generality of this model, specifications were also tested using a probit model, and those results are similar in sign and magnitude, although they are not included in the paper in the interest of space.
All variables are specific to individual or entity, denoted as subscript i, and species, denoted as superscript S. Species S is equal to either B (both) or H (halibut). If sablefish effects are overwhelmingly strong, smaller or more subtle halibut effects may be identified by examining only non-sablefish halibut harvesters. For this subsample of data, equations (1), (2), and (3) are run on halibut only harvesters, where all superscripts indicating species are set to H. A similar subsample is used to examine just the effect when S=B.

Prediction 1, vessel owners with higher annual variation in landings are more likely to oppose ITQs, is tested by examining the coefficient on CV, \( \pi \), which is expected to be negative if higher variation in annual landings leads to increased likelihood of opposition. Prediction 2, regarding participation and support for ITQs by harvesters who missed a year or more of participation, is tested by including the coefficient on Missed Year, \( \psi \), and is expected to be negative if missing a qualifying year decreases the likelihood of support by individual i. Prediction 3, that support for ITQs will be increasing in size of operation is tested by including the coefficient on LogLbs, \( \Omega \), and is expected to be positive if higher landings contribute to increased probability of being in favor of ITQs. Including the variable LogLbs in the regression
helps to isolate the effect of CV by controlling for the size of operations (e.g. if larger operations inherently have higher CV). By using the log of annual landings, the distribution of landed weight more closely resembles a normal distribution.\textsuperscript{11} Prediction 4 is tested by examining the coefficient on remoteness, $\gamma$, and is expected to be negative—being from a remote location decreases the likelihood an individual supports ITQs.

\textbf{V. Results}

For the vessel owners who commented on rationalization, Table 3 provides the conditional means of each variable used in the analysis and also the count and percentage of commentators in each category. The sample consists of 511 unique vessel owners, 288 harvesting exclusively halibut, 12 harvesting exclusively sablefish, and 211 that harvest both species. Overall, 384 (77\%) vessel owners opposed ITQs and 127 (23\%) were in favor. Comparing the summary statistics of average landings, value, coefficient of variation, and years of participation of those in favor and opposed to ITQs provides a preview of regression results. The conditional means are consistent with predictions: sablefish harvesters in favor of rationalization have on average one extra year of participation history (~3.2 years) than those opposed (2.2 years). The average CV in annual sablefish landings of supporters is only 60\% (CV=0.88) of the average CV of non-supporters (CV=1.46). The comparison of summary statistics for halibut harvesters supporting and opposing ITQs are analogous to those of sablefish harvesters, but less

\footnote{\textsuperscript{11} See Figure A1 in appendix for the raw and transformed distribution of landed weight for halibut and sablefish harvesters}
striking. The average years of participation for halibut ITQ supporters and halibut ITQ opponents are 3.5 years and 3.0 years, respectively. Also in line with predictions, average landings and average log landings of both species are higher for supporters than opponents. A preliminary examination of landed weight and position can be seen in figure 4, which reveals higher average landings for ITQ supporters than ITQ opponents for both halibut and sablefish harvesters.

Several statistical specifications are used to test the paper’s predictions. There are two variables included in all regressions that serve as both controls and tests of predictions: remoteness and log of landed weight. The variable log of landed weight is used to control for fundamental differences in level of support that depend on size of operation. A dummy variable for remoteness is included in all equations to control for any differences between individuals located in remote communities versus those located near a major transportation hub. Statistical analysis is run on three different partitions of the data—the entire sample of halibut and sablefish harvesters (N=511), harvesters fishing exclusively halibut (N=247), and harvesters that fish both species (N=291). Because both species were rationalized simultaneously, it could be that a harvester’s preference for ITQ adoption is determined by the expected payoff in one of the fisheries. The specifications run on all harvesters include a dummy for those that harvest sablefish.

The first three of the nine regressions are performed on the entire sample and are found in Table 4. Regressions 4–6 are performed on halibut only harvesters, and regressions 7–9 are performed on harvesters that harvest both halibut and sablefish and these results are shown in Table 5. Prediction 1, vessel owners with higher annual
variation in landings are more likely to oppose ITQs, is tested by including CV for each species in six of the nine regression equations. In line with predictions, the probability of approving ITQs is decreasing in CV. In other words, harvesters with higher volatility are more likely to be opposed to ITQs. The first specification includes both CV and a missing year dummy variable for each species. The second specification includes coefficient of variation and the third specification includes a dummy variable for missing a year. Including CV and the “absent dummy” helps isolate the effect of higher volatility that isn’t caused by skipping years. All regressions include a dummy variable for remoteness to test prediction four. Consistent with predictions, the coefficient on remoteness is consistently negative and statistically significant at the 1% level for all specifications. The magnitude of the coefficient is consistent across all specifications, indicating that a harvester in a remote community is 23-36% more likely to oppose ITQs. The rest of this section examines coefficient results for CV, absent year, average landings, and remote location.

**Coefficient of Variation**

Prediction 1, Vessel owners with higher annual variation in landings are more likely to oppose ITQs, is tested by including CV for each species in all regression equations. The inclusion of CV controls for differences in support resulting from variation in annual landings, which is included in regressions 1, 2, 4, 6, 7, and 9 (equations one and two). The coefficient on CV is consistently negative for sablefish, and significant at the 1% level in regressions 2 and 9, and at the 10% level in 7. The coefficient on halibut CV is negative when halibut only fishers are included in the
regression, and significant when the sample is restricted to halibut only harvesters. In regressions 5 and 6 where halibut only harvesters are excluded, the coefficient on halibut CV becomes insignificant and near zero—harvesters of both species are less sensitive to halibut CV. In line with predictions, the probability of approving ITQs is decreasing in CV. Overall, the support of sablefish harvesters is more sensitive to changes in CV than the support of halibut harvesters. For halibut-only harvesters, a one-unit increase in CV will decrease the likelihood an agent is in favor of RBM by roughly 9%. For sablefish this is 6-14% depending on the specification.

Summary statistics of average halibut landings suggest halibut harvesters that also harvest sablefish are fundamentally different from those harvest exclusively halibut. The halibut harvesters that also harvest sablefish have much higher average halibut landings than those that harvest exclusively halibut—44,703 lbs/year for the both group compared to average landings of 12,059 lbs/year. The average halibut CV for exclusively halibut harvesters and halibut and sablefish harvesters are 1.15 and 0.77, respectively. The level of support from harvesters that harvest both halibut and sablefish is 38.1%, which is over 2.5 times as large as the level of support from exclusively halibut harvesters (14.7%).

**Participation History**

Prediction 2, vessel owners with shorter history of participation in the fishery are more likely to oppose ITQs, is tested in regressions 1, 3, 4, 5, 7, and 8 (although sablefish harvesters are not included in regressions 5 and 6). The coefficient on non-participation is negative for both Halibut and Sablefish, indicating being absent from the fishery for a
year decreases the probability of being in favor of ITQs. The coefficient on this dummy variable is only significant for sablefish when harvesters of both species are included in the sample. When sablefish harvesters are dropped from the sample, missing a year in the halibut fishery becomes significant at the 10% level. This implies that for halibut only harvesters, missing one of the four years of participation history decreases the likelihood of supporting ITQs by 21%. Missing a year of sablefish participation decreases the likelihood of supporting ITQs by anywhere from 18-26%.

**Average Landings**

To test prediction 3, that opposition to ITQs will be decreasing in average quantity of fish landed, the variable log landed weight of sablefish and halibut is included in all regressions. For all halibut regressions, the coefficient is negative but insignificant for all regressions except number four, which is performed on halibut only harvesters and includes both halibut CV and a dummy variable for absent year. For all sablefish regressions, the coefficient is positive but insignificant. Including a variable for total pounds of halibut and/or sablefish alternatively tests this prediction and yields similar but more significant results. The positive coefficients on sablefish log of landed pounds are consistent with prediction 3, but given the insignificance of the sablefish coefficient and the sign of the halibut coefficient, the effect of size of operation on level of support for ITQs is inconclusive. The results do imply that when accounting for all other types of variation across harvesters (location and CV), total landings play a less important role in determining position.
Remote Location

The coefficient on remoteness is consistent and significant (1% level) across all regressions. Being located in a remote location decreases the likelihood an individual will support ITQ implementation by about 30%, as seen across the first row in regression tables one and two. Because sablefish does not have a fresh market, we expect to see the effect of remoteness to be stronger for halibut only harvesters. This is not the case. Although the coefficient on remoteness is significant at the 1% level, it is roughly 8 to 10% greater when sablefish is included. This results may indicate that remote individuals are choosing whether or not to support ITQs for reasons other than access to fresh markets.

VI. Conclusions

This paper uses previous literature and a novel data set to examine the determinants of support for property rights based management in fisheries. Higher opposition is related to users whose expected utility decreases under RBM: remote communities and harvesters with high volatility in catch, especially those fishing species subject to less forgiving initial allocation schemes. Results suggest that being from a remote community increases the likelihood of opposing rationalization by about 30%. This result is consistent with predictions, but is not readily apparent when only the monetary gains associated with ITQs are considered. Remote communities are allocated quota in the same manner as non-remote communities and have the option to sell the quota if the opportunity cost of fishing becomes too high. Although the gains of secure
property rights and the ability to sell these rights fall to these individuals, losses may still occur if landings shift to other ports (Casey et al., 1995). Many small communities have few alternative employment options, and finding new employment may require re-location (FAO, 2012). There may also be an anti-government sentiment present in remote communities resulting in opposition to government interventions of all kinds (Brennan, 2009). In the rules that were eventually adopted, Halibut and Sablefish IFQ was allocated to community development quota (CDQ) in remote areas and included consolidation caps intended to mitigate the impacts on communities. Based on this work, these CDQs could also be viewed as a side payment to lessen opposition from remote locations.

Initial quota allocation is based on the historic average catch of a given vessel. A harvester that does not fish for one or more of the quota qualifying years will be allocated an amount of quota less than her catch in any participating year. Further, the difference between high year catch and average catch will be greatest amongst harvesters with highest volatility. The expected result is that increasing volatility in landings increases the probability an individual will be opposed. The statistical tests demonstrate this result for both sablefish and halibut. Increasing catch volatility decreases the probability a harvester will be in favor of ITQs to a much larger extent in the sablefish fishery than in the halibut fishery. The present sample of comments stops after 1991. After 1991, the council modified the halibut and sablefish ITQ design to allow for dropping of the lowest one or two years from the qualifying period when calculating initial quota allocation. When ITQs were finally implemented, halibut quota was grandfathered based on the best
4 of 6 years and Sablefish permits were based on best 5 of 6 years. Additional analysis shows that landings volatility and absent years are indeed less relevant in determining support for ITQs after management designed changed.

My results suggest that in fisheries with high volatility in landings opposition to ITQs may be reduced by allocating quota in a more flexible manner. Allowing individuals to drop the lowest year’s catch when calculating average historic catch for allocation proved useful in achieving consensus for the Halibut ITQ framework. The overwhelming amount of resistance from small communities is likely indicative of political-cultural factors, and this resistance remains even after controlling for opposition related to quota allocation. In fisheries with a large amount of opposition from specific groups (e.g. small Alaskan communities), constructing side-payments may increase support for rights based management. More importantly, understanding the perceived and actual losses, monetary and otherwise, associated with transitioning to RBM is necessary in constructing side-payments, identifying potential opponents and political obstacles, and designing natural resource management that is both politically and logistically feasible.
VII. References


Matulich and Sever. (1999). “Reconsidering the initial allocation of ITQs: The search for a pareto-safe allocation between fishing and processing sectors.” Land economics. 75(2) 203-219


Research Council's Committee to Review Individual Fishing Quotas. Anchorage, Alaska. (Document revised October 8, 1997)


## Tables

### Table 1: Data Description (Years 1987-1992)

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
<th>Details</th>
<th>Managing Agency</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPFMC Meeting Minutes</td>
<td>Minutes of council meetings covering agenda items (proposed changes to management).</td>
<td>Name, location, agency, comment, date</td>
<td>NPFMC</td>
</tr>
<tr>
<td>NPFMC Newsletters</td>
<td>Quarterly newsletter to inform public of changes to FMPS and agenda items for upcoming meetings. Includes upcoming events, forums, and fishery news.</td>
<td>Proposed/Implemented changes to FMP</td>
<td>NPFMC</td>
</tr>
<tr>
<td>ADFG Fish Tickets</td>
<td>Log of all landings made in the state of Alaska.</td>
<td>ADFG number, species landed, weight, value, port, year and month of landings</td>
<td>ADFG</td>
</tr>
<tr>
<td>Alaska State Vessel Registry</td>
<td>Listings of vessels licensed by the state of Alaska to participate in commercial fishing activities.</td>
<td>ADFG number, ownership information (name, address, phone), vessel characteristics, years of ownership, home-port</td>
<td>CFEC</td>
</tr>
</tbody>
</table>

### Table 2: Variables Description

<table>
<thead>
<tr>
<th>Variable</th>
<th>Description</th>
<th>Calculation</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sablefish</td>
<td>Dummy variable for whether or not entity harvests sablefish between 1987 and 1990.</td>
<td>Sablefish=1 if total weight landed between 1987 and 1990 &gt;0; =0 otherwise</td>
<td>CFEC Fish Ticket Data; AK Vessel Registry</td>
</tr>
<tr>
<td>Remote</td>
<td>Dummy variable for whether or not entity’s mailing address is located in a remote community.</td>
<td>Remote=1 if city of residence is classified as remote (1); =0 otherwise</td>
<td>Based on criteria described in text</td>
</tr>
<tr>
<td>Absent Year</td>
<td>Dummy variable indicating whether or not an individual missed one or more years of fishing between 1987 and 1990.</td>
<td>Absent=1 if total years fishing species s is less than 4; =0 otherwise (perfect attendance)</td>
<td>CFEC Fish Ticket Data; AK Vessel Registry</td>
</tr>
<tr>
<td>CV</td>
<td>Variable measuring coefficient of variation in catch for each species over time period 1987-1990</td>
<td>=SD Annual Landings/ Average Landed Weight</td>
<td>CFEC Fish Ticket Data</td>
</tr>
<tr>
<td>Log Lbs.</td>
<td>Measure of the log of the average landed weight by species over years 1987-1990.</td>
<td>= log(Average Lbs.)</td>
<td>CFEC Fish Ticket Data (See Above)</td>
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Table 3: Conditional Means of Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sablefish In Favor</th>
<th>Sablefish Opposed</th>
<th>Halibut In Favor</th>
<th>Halibut Opposed</th>
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<tr>
<td>Years of Participation</td>
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<td>2.21</td>
<td>3.52</td>
<td>3.02</td>
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<td>Log Annual Landings (Lbs)</td>
<td>3.98</td>
<td>3.27</td>
<td>4.33</td>
<td>4.82</td>
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<tr>
<td>Coefficient of Variation</td>
<td>0.88</td>
<td>1.46</td>
<td>0.76</td>
<td>1.07</td>
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<tr>
<td>Average Pounds</td>
<td>14,4912</td>
<td>32,790</td>
<td>38,756</td>
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<tr>
<td>Average Value</td>
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<td>$27,631</td>
<td>$58,295</td>
<td>$31,526</td>
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<tr>
<td>Remote</td>
<td>31.00%</td>
<td>73.00%</td>
<td>33.87%</td>
<td>79.20%</td>
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<tr>
<td>Total Observations (Percent)</td>
<td>39.0%</td>
<td>61.0%</td>
<td>25.1%</td>
<td>75.2%</td>
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Table 4: Linear Probability Model of All Harvesters

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<th>(2)</th>
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<td>All</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>Remote</td>
<td>-0.294**</td>
<td>-0.310**</td>
</tr>
<tr>
<td></td>
<td>(0.107)</td>
<td>(0.109)</td>
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<tr>
<td>Sablefish Harvester</td>
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<tr>
<td></td>
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<td>(0.134)</td>
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<tr>
<td>Absent: Sablefish</td>
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<td>-0.214*</td>
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<td>Absent: Halibut</td>
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<td>-0.103</td>
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<td>(0.0536)</td>
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<tr>
<td>Log Pounds: Sablefish</td>
<td>0.0221</td>
<td>0.0283</td>
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<td></td>
<td>(0.0150)</td>
<td>(0.0145)</td>
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<tr>
<td>Log Pounds: Halibut</td>
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<tr>
<td></td>
<td>(0.00880)</td>
<td>(0.0101)</td>
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<tr>
<td>CV: Sablefish</td>
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<td>-0.104***</td>
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<tr>
<td></td>
<td>(0.0335)</td>
<td>(0.0297)</td>
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<tr>
<td>CV: Halibut</td>
<td>-0.0225</td>
<td>-0.0348</td>
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<tr>
<td></td>
<td>(0.0222)</td>
<td>(0.0221)</td>
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<tr>
<td>Observations</td>
<td>538</td>
<td>538</td>
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<tr>
<td>R-squared</td>
<td>0.308</td>
<td>0.287</td>
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Cluster robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05
Table 5: Linear Probability Model of Halibut Only and Both Only Harvesters

<table>
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<tr>
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<th>(7)</th>
<th>(8)</th>
<th>(9)</th>
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<td>Remote</td>
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<td>-0.231*</td>
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<td></td>
<td>(0.0882)</td>
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<td>(0.0901)</td>
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<tr>
<td>Absent: Sablefish</td>
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<td>-0.212*</td>
<td>-0.259**</td>
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<td>(0.0836)</td>
<td>(0.0777)</td>
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<td>Absent: Halibut</td>
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<td>Log Pounds: Sablefish</td>
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<td></td>
<td>(0.0145)</td>
<td>(0.0164)</td>
<td>(0.0147)</td>
</tr>
<tr>
<td>Log Pounds: Halibut</td>
<td>-0.0229**</td>
<td>-0.0135</td>
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<tr>
<td></td>
<td>(0.00787)</td>
<td>(0.00728)</td>
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<td>(0.0130)</td>
<td>(0.0135)</td>
<td>(0.0116)</td>
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<td>CV: Halibut</td>
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<td>(0.0268)</td>
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<td>(0.0322)</td>
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<td>(0.0387)</td>
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<td>CV: Sablefish</td>
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<td></td>
<td></td>
<td>-0.102*</td>
<td></td>
<td>-0.144***</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td>(0.0401)</td>
<td></td>
<td>(0.0321)</td>
</tr>
<tr>
<td>Observations</td>
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<td>247</td>
<td>247</td>
<td>291</td>
<td>291</td>
<td>291</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.165</td>
<td>0.157</td>
<td>0.123</td>
<td>0.318</td>
<td>0.308</td>
<td>0.296</td>
</tr>
</tbody>
</table>

Cluster robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Figures

Figure 1: Public Comment Method

![Chart showing Public Comment Method]

Figure 2: Vessels in the Sablefish and Halibut Fisheries

![Chart showing Number of Vessels in Sablefish and Halibut Fisheries]

Years: 1987-1992
Figure 3: Geographic distribution of select remote and non-remote cities.
Figure 4: Average Landed Weight by Harvester

![Average Pounds Landed](image)

Figure A1: Distribution of Landed Weight

![Distribution of Average Halibut Landings (Lbs.)](image)

![Distribution of Average Halibut Landings (Log Lbs.)](image)

![Distribution of Average Sablefish Landings (Lbs.)](image)

![Distribution of Average Sablefish Landings (Log Lbs.)](image)