

DEDICATION

I am blessed with two families. The first family, one of genes and blood, has instilled in me confidence and the desire to learn. This dissertation is dedicated to my parents, Robert and Marilyn Dawson, and my sisters Cynthia Williams and Jennifer Moore.

My second family is one I have chosen. They are my friends and my beloved. They have been my constant source of support. They have been shoulders to cry on when things became overwhelming and partners in commiseration over muggy summers, the cultural wasteland of Blacksburg, and our inept Republican administration. More importantly they have been dance partners, fellow shoe-shoppers, drinking companions, editors, sounding boards, and classmates. This dissertation is dedicated to my best friend Jennifer Griffith, and Angela Becker-Dippman, Natalie Fousekis, Godfrey Gibbison, Erika McEntarfer, and Elizabeth Perry. They are my Family.

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CHAPTER 1. INTRODUCTION, PROBLEM STATEMENT AND OBJECTIVES

1.A. Introduction

Vertical integration¹ has been discussed in the economics literature since the turn of the last century. Debate has centered on what drives a firm to vertically integrate; why a firm will buy-out one of its suppliers or in some other way internalize the production of an intermediate good. Likewise, why would a firm want to absorb a firm to which it sells its goods? Since Coase's seminal "The Nature of the Firm" (1937), the answer has focused on two factors. Coase first put forward the idea that firms vertically integrate to reduce transaction costs, the cost of using the market. The transaction cost school of thought owes much of its recent resurgence in popularity to Williamson (1975, 1979, 1985), and Klein, Crawford, and Alchian (1978). Related to this is what Whinston (2003) refers to the property rights approach of Grossman and Hart (1986) and Hart and Moore (1990). The other factor driving vertical integration is that firms aim to foreclose market in order to gain market power.²

In commercial fisheries, there is one added dimension. Commercial fisheries are not always characterized by the private property rights structure that is assumed in standard

¹ Because different fields of economics use the terms vertical coordination and vertical integration differently, clarification of its use here is needed. In the non-agricultural industrial organization literature, vertical integration is generally used to describe any situation where upstream and downstream firms are engaged in any form of long-term cooperation or agreement. That cooperation can be outright ownership, a franchiser-franchisee relationship, or a contract to provide inputs on some regular basis. In the literature on agricultural industrial organization specifically, vertical coordination tends to be used most often to describe the overall concept of vertical organization, with out-right ownership noted separately as vertical integration. To avoid confusion, in this paper, vertical *integration* will be used to describe the merging of an upstream firm with another firm downstream, *contracting* will be used to mean the existence of a legally binding mutual obligation, and vertical *coordination* will refer to the overall concept of the vertical relationship.

² Market foreclosure particularly concerns antitrust authorities and has come up in several cases, including a proposed merger of Kinney Shoe Stores with Brown Shoes, and the *Standard Fashion* case of 1922 (see Tirole (1992), p. 194).

industrial organization models. Rather, they are either common property³ or open access⁴ resources. Since 1990, however, the U.S. has instituted a form of private property rights management in some of its fisheries.⁵ Typically this is accomplished by using individual transferable quotas (ITQs) that assign to a harvester the right to harvest a certain share of the total allowable catch (TAC) of a fishery.^{6 7} And like any private property the ITQs are transferable. Therefore if a harvester wishes to catch more fish than allowed by the quota he holds, he is able to (and must) buy ITQs from someone willing to sell. Harvesters might sell their quota for many reasons: sickness, equipment breakdown, or because they simply prefer the money payment to the right to fish.

Other methods of controlling harvest include non-transferable quota, gear restrictions, and fishing season limitations. These have been used around the world to varying degrees of success or failure (see Hannesson, 1991; Doeringer and Terkla, 1995; Ocean Studies Board, 1999). The ITQ system, however, is gaining in prominence, with over 40 different fisheries worldwide currently under this type of management (Casey et al, 1995). In Iceland, ITQs were first used in 1976 in their herring fishery and since 1990 all Icelandic commercial fisheries have been managed by a uniform individual transferable quota system (Arnason, 1993b). Likewise, New Zealand first used ITQs in 1986, and now 32 species's fisheries in New Zealand are managed with ITQ systems (Falloon, 1993). In the United States, four commercial fisheries are currently managed through some type of system of private property rights.

This management strategy seems to be successful from a purely economic point of view. There are studies that show fisheries worldwide have become more economically

³ Most U.S. fisheries can be described not simply as common property, but as what Santopietro and Shabman (1992) call a state farm. The government restricts who may use a state farm common property resource and how it may be used. Specifically, use is restricted to U.S. citizens (or fewer fishermen in the case of limited-entry license fisheries) and there are restrictions on the type of gear one may use and when one may fish.

⁴ An open access resource has no restrictions on who can use it or how they can use it.

⁵ Instituting private property rights in fisheries is also often referred to as "rationalizing" the fishery, or rationalization.

⁶ The annual total allowable catch for a fishery is based on an assessment of the stock of fish available, the species's rate of regeneration and other biological considerations.

⁷ In this paper, quota systems where rights are granted to the harvesting sector only will be analyzed.

efficient after the implementation of quota programs, yet little attention is paid to *how* they become more efficient (Arnason, 1993b; Falloon, 1993). Efficiency occurs because the fishing fleet shrinks, allowing each boat a greater catch. The exit of traditional independent fishermen leads to an increase in either horizontal or vertical integration, or even both.

Increased vertical integration is a result with which some fishermen, politicians, and others with an interest in fisheries are not happy. But there exists little literature analyzing vertical ties in commercial fishing. Only two papers address the question directly, and each focuses on a very specific aspect of the question. Lacking any empirical evidence, it is unclear how a conversion to private property rights contributes to the decision to vertically integrate. Therefore, the purpose of this research is to investigate vertical integration in commercial fisheries by incorporating both the traditional explanations of transaction costs and market foreclosure, and investigating the conversion of fisheries to private property.

1.B. Vertical Integration

Coase defined transaction costs as the deciding factor for a firm's expansion. The cost of using the market includes the costs incurred by collecting information, writing contracts, and policing and enforcing those contracts. Coase said that if a firm finds that it can internalize the production of one of its inputs at a lower cost than buying that input on the market (including transaction costs), the firm will vertically integrate that part of its production process.

In fisheries, as in many other industries, there are four primary factors that affect transaction costs. The first is uncertainty over the quality of the input. The greater the uncertainty over quality, the greater incentive a downstream firm has to internalize and better control the production of the input. The second is uncertainty about the availability of supply. If there is no substitute available for one particular input in the downstream firm's production process, integrating the production of that intermediate good can

alleviate fears that there will be insufficient supply. The upstream firm can be likewise concerned over whether or not they will have a buyer for their (intermediate) product. Therefore, advance contracting can guarantee a buyer for future production. A third concern is when either the downstream or upstream firm has a specific asset that has little or no value in its next best use. In the fisheries literature this is often referred to as capital malleability. In this case there is a possibility of hold-up by either party in the transaction. To illustrate using an example, for the upstream firm to hold-up the downstream firm simply means that it takes advantage of the fact that the downstream firm has no other way to earn revenue from its specific asset, so when bargaining, is able to capture more rent than it would otherwise be able to capture. Contracting to avoid hold-up can lead to higher transaction costs. Search costs are the final component of transaction costs. The longer one must search for a trading partner the higher are transaction costs.

When a firm decides to vertically integrate to reduce transaction costs, this increases efficiency in the market. On the other hand there is the case of market foreclosure, where a firm vertically integrates in order to gain monopoly power in one or even both markets.

The concern over market foreclosure is the worry that one downstream firm controls access to the entire supply of an input. Downstream foreclosure in a fishery would be one processing firm controlling all harvesting vessels or quota in a fishery. The degree to which a market can be foreclosed depends upon many things. Chief among these is the availability of substitutes for the input in question. The degree of substitutability depends on what form the final product will take. Pollock, as an example, is typically used in the production of fake crab. There are other species such as Pacific whiting and hake that can be used for the same purposes, although their landings are a fraction of pollock landings. Conversely, products going directly to consumers, such as lobster and salmon, have few if any substitutes. The impact of market for closure is that if one processor controls access to an input such a lobster, it has the ability to not supply other processors or will perhaps charge them higher prices. This would lead to a monopoly in the downstream market (Tirole, 1992).

1.C. Arguments Against Vertical Integration in Commercial Fisheries

The main concern of the opponents of vertical integration discussed here is not based on economics but is one of equity and social justice. Fishing, like farming, has been a family tradition for many families for hundreds of years in the United States. And while evidence suggests that vertical integration can make fisheries more efficient, some harvesters, processors, environmental groups, academics and fishery managers find the potential gains in efficiency to be outweighed by the costs.⁸ These costs include the loss of independent fishermen and disruption of coastal communities where many fishermen live because of lost revenue and availability of jobs.

Davis argues from a “social research” point of view (which he defines as including anthropology, sociology, ecology and other fields), that ITQs favor harvesters “commonly enmeshed in corporate, accumulation sector enterprises” as opposed to the traditionally independent, small-scale “livelihood” fishermen (1996, p. 105). Opposition to ITQ management also appears in popular media. Numerous articles cite the fear that ITQ management and any ensuing vertical integration will ruin what has traditionally been a way of life for many people for many generations; that the entrepreneurial spirit of family fishing will be lost (see Gifford (1996) and Berton (1994) as examples).

In testimony before the National Research Council’s Ocean Studies Board, James O’Malley, executive director of the East Coast Fisheries Federation, stated that, “the greatest danger in an ITQ system is that it will change the fisherman from an independent entrepreneur to a sharecropper, being paid a service fee to retrieve someone else’s ‘property’ from the ocean” (1998). Why does O’Malley think this will happen? This was explained by Walter Gorden, president of Mid-Atlantic Foods, Inc. a clam processor, in testimony before the U.S. House of Representatives’s Committee on Merchant Marines and Fisheries’s Sub-Committee on Fisheries Management in 1994. Gordon

⁸ It should be noted that, as with virtually all issues, there is not universal acceptance or rejection of ITQs. See for example, Baker, Cox and Emerson (1998) for a **statement of the pro-ITQ stance of the group Environmental Defense**, and Copes (1986) for an academic critique.

noted that multi-vessel owners have the option of consolidating their quota on fewer vessels, which will lead them to be more efficient and earn more profit. This additional profit could be used to buy even more quota. However, Gordon says,

Single vessel owners or those without sufficient amount of ITQ's to fish economically must either (a) sell out, (b) buy ITQ's with dollars from an outside source; or (c) form an arrangement to sell their catch to a processor with allocation and in return fish enough of the processor's ITQ's to become efficient.⁹

Gordon further opines that the fishery management plan (FMP) as written, “will lead to a few vertically integrated corporations controlling every aspect of the industry from harvesting through marketing” (1994). As will be discussed in more detail later, initial evidence suggests that there has been a substantial amount of vertical coordination in the SCOQ fishery since the implementation of the ITQ program.

Greenpeace also cites this social/equity argument in their fight against ITQs. While they concede that a move towards industrialization, in the form of increased vertical integration, might be the natural trend in some fisheries¹⁰, the problem with individual transferable quota is that ITQs “institutionalize a regime which excludes participants based above all on their financial means” (Greer, 1995, p. 4). This argument is tenuous given the relative cost of quota to the capital cost of fishing vessels.¹¹

⁹ To give the reader perspective, O'Malley (1998) says “in the case of surf clams, a bushel of clams sells for less than \$15. The ITQ, the right to catch that bushel year after year, goes for at least five times that, and before a recent market downturn, there were stories about \$100 offers with nobody willing to sell at that price.”

¹⁰ Unfortunately, Greenpeace does not explain what they mean by this statement that some fisheries may naturally trend towards vertical integration or how one can tell the difference.

¹¹ Commercial fishing vessels vary in price according to size, hull material, year built or rebuilt, and other specifications. According to Brent Paine of United Catcher Boats, a trawl vessel used for harvesting North Pacific pollock will typically cost a few million dollars (2000). According to the listing of vessels currently for sale at <http://www.shipsusa.com> to buy a 90' or greater loa steel-hulled trawler will cost at least \$145,000 (rebuild 1986) and upwards of nearly \$900,000 (newly built 2001). The two crabbers they have advertised are both listed at \$1.2 million. Alaskabroker.com has advertised a long-lining vessel (1988 build, 32' loa, aluminum) for sale at \$110,000 including 60,000 lbs of halibut quota. At the same time they are brokering sales of quota at a fraction of a cent per pound. Even if the quota costs 1 cent per pound, it would only be worth \$600 compared to the \$109,400 vessel.

Greenpeace and others seem to be implicitly arguing that we need to maintain what economists have termed a “worker satisfaction bonus” (WSB) in fisheries. This is the idea that fishermen receive a non-monetary benefit from being fishermen. Being one’s own boss at sea and pitting one’s self against the ocean and the fish are often cited as reasons for and benefits of being a fisherman (Smith, 1981). Therefore, when looking at the benefit a fisherman receives, it is not just the revenue from the fish he harvests and sells to the processor. There is also this WSB that must be accounted for. Greenpeace and other seem to imply that this bonus is lost if the fisherman sells out to a processor, even if that means still fishing, but doing so as someone else’s employee. Even signing a contract that specifies the behavior (species to target, date of delivery) of the fisherman can take away some of this bonus.¹²

One reason a processor might be induced to buy out harvesters and their ITQs is to earn a larger profit through market foreclosure. A firm that can control the availability of a necessary input can control the market for their final product. Jim O’Malley’s example to the Ocean Studies Board was a restaurant chain being able to control access to the supply of lobster. O’Malley expresses this as ITQs coming “under either the ownership...of those entities who can put a higher price on it by adding value, by marketing, or just by keeping it out of the hands of their competitors” (O’Malley, 1998).

Regulatory agencies and Congress have also asked about the link between management techniques and vertical integration and coordination. The Committee to Review Individual Fishing Quotas, which was part of the National Academy of Sciences’s Ocean Studies Board, was charged with investigating market structure and vertical integration (Tietenberg 1998, Ocean Studies Board 1999). As well, the North Pacific Fishery Management Council (NPFMC) has expressed concern over the “decline

¹² This argument also seems to imply that the fisherman is somehow not able to account for this loss of WSB when deciding upon a reservation price for his quota. This seems a tenuous conclusion—not to mention an insult to the fishermen.

in the number of independent boats” and “increased vertical integration.”¹³ The NPFMC admits that they do not know whether this is due to the management regime or is “more reflective of the overall dynamics of the fishing industry” (NPFMC 1998, Appendix II p. 37). Uncertainty over this and other perceived results of ITQ management led Congress to impose a moratorium on the institution of any more ITQ programs until October 2000. This moratorium was later extended to last until October 2002. In 2003, members of both the Senate and House of Representatives introduced bills to allow the implementation quota programs with some restrictions, S. 1106 and H.R. 2621.

If we are concerned with saving the independent fisherman, vertical integration is the critical issue to investigate. It may be that certain fisheries have a natural tendency towards vertical integration and ITQs merely better facilitate this, or it could be that ITQs allow for vertical coordination in fisheries where it might not otherwise occur. While Greenpeace, or fishermen, or processors, or even the government might speculate that ITQs cause or encourage vertical coordination, there is no empirical evidence to support this claim.

1.D. Problem Statement and Objectives of this Research

Given the preceding concerns over vertical coordination, the primary focus of this research is on how do transaction costs, the desire for market foreclosure, and changing the property rights structure affect vertical coordination in commercial fisheries? Specifically, this research will address the following three objectives:

- (i) determine what market conditions, incentives and industry characteristics will lead to changes in the level of vertical coordination in fisheries;
- (ii) analyze how changing the management regime and hence the property rights of the fishery changes the level of vertical integration and contracting; and,

¹³ The I/O3 Socioeconomic Impact Assessment was part of the analysis of the impacts of the proposed allocation of North Pacific pollock between the inshore and offshore sectors of that fishery for 1999.

- (iii) if there is an effect, develop possible conditions on the ITQ program framework that will limit vertical coordination.

The remainder of the dissertation is organized as follows. Chapter 2 is a brief history of commercial fishing and fisheries management in the U.S. and a more detailed description of the theory behind ITQs. Following this is a discussion of what factors may currently be increasing the level of vertical coordination in some fisheries. An explanation will be presented that reflects both economic theory and experiences in similar industries. Hypotheses are presented regarding the many reasons why the level of vertical coordination in a fishery may change.

Chapter 3 covers methodological issues, to include survey methods and analysis. Chapter 4 presents the results in five parts. The first three sections are case studies for individual fisheries. Each case study will be an attempt to provide a complete picture of the fishery and how certain variables have affected the level of vertical integration and contracting in that fishery. Finally, Chapter 5 will look at comparisons across the fisheries to see if there are trends, or if it is possible to generalize across fisheries; will offer policy recommendations; and conclude.

CHAPTER 2. HISTORY, LITERATURE, AND THEORY

2.A. A Brief History of Fishing and Fisheries Management in the United States

There is a long-standing tradition of commercial fishing in the United States. One of the original North American fisheries is the New England cod fishery. Cod was originally caught inshore with seines, a type of net, and hand lines. Around 1700 schooners started to fish offshore using long lines. In the mid-1800s this was replaced by long lining from dories, smaller boats that traveled with the schooners. The fish were gutted, split, and then salted, and, as early as the 17th century, were exported to England and Europe. Fisheries based in Europe were not open year round due to weather while the North American cod fishery, centered in Boston, had no such problem. Other east coast fisheries including halibut, mackerel, menhaden, and herring were fished as early as colonial times (U.S. Dept. of Commerce, 1996).

On the Pacific coast, salmon was one of the first fisheries to be exploited for commercial purposes. When British-American trading companies like the Hudson Bay Company came to the region they contracted to be supplied with fish by Native Americans fishing on the Fraser and Columbia rivers. Salmon was even cured and exported to England starting in 1823. However, most exports went to Hawai'i to serve as supply on whaling ships. Another large west coast fishery was the California sardine fishery. This fishery developed in 1915 to satisfy demand for animal feed, made from processed fishmeal and oil (Sahrhage and Lundbeck, 1992).

Around 1870 when New England halibut stocks declined, fishermen moved their effort offshore to the Grand Banks. One year later Congress created the Commission of Fish and Fisheries, the precursor to today's National Marine Fisheries Service. One of the jobs of the Fish Commission, as it was called then, was “studying and recommending solutions to an apparent decline in New England’s fishes” (Department of Commerce, 1996). Even a century ago it was clear that fish populations could be over-fished to the point of causing irreparable damage. Along with the Fish Commission’s biological

research work there were early attempts to manage how and where fishermen plied their trade in order to maintain fish stocks. In 1896, Congress, based on research work performed by the Fish Commission (to avoid confusion, hereafter only National Marine Fisheries Service or NMFS will be used), regulated Alaskan salmon fishing through the use of net restrictions, closed seasons and spawning escapement¹⁴ requirements. The 1906 Sponge Act, which regulated how sponges were harvested, was the first time the federal government asserted any control over a marine fishery. Other early attempts at fisheries management included the 1917 closure of California's San Francisco Bay-San Joaquin Delta for harvesting of white sturgeon for any reason other than subsistence fishing, and "Initiative 77" enacted in 1935 in Washington that, among other things, banned fixed fishing gear in state waters (Iversen, 1996). Restricting who can access the resource and how they may access the resource changes it from an open access resource to a common property resource. Today, most fisheries in the United States are common property resources.

These early efforts to manage harvest used techniques that are still commonly used today: gear restrictions and grounds closures. Another common management technique used in contemporary fisheries management is minimum requirements for the size of fish that may be kept. This restriction on catching younger fish is meant to help the stock regenerate. Limits on the total amount of fish that may be caught by the industry and limits on the seasons in which the resource can be harvested are also meant to help preserve the stock of resource. And limited entry programs where the number of licenses available for a fishery is restricted limit further entry into a fishery.

2.B. The Result of Open Access and Common Property Management in Fisheries

Even with the restrictions described above, fisheries exhibit problems that stem from the incentives caused by their open access property rights regime. Because no one owns the resource until it is caught, each vessel's harvest results in a loss in harvest (and profit) to all other vessels by taking away a portion of the TAC (Casey et al, 1995). This is often

¹⁴ An escapement requirement is simply a requirement that a net's mesh size be a certain minimum so that young fish can pass through.

referred to as the “rule of first possession” or “rule of capture.” The result is that this *common property* fishery has an inefficiently high level of capital investment just like an open access resource because of the focus on outputs rather than inputs (Ciriacy-Wantrup and Bishop, 1975). This is true both for the individual boats and for the fishery as a whole.¹⁵

Anderson explains this most completely in his 1986 *The Economics of Fisheries Management*, and the next few paragraphs follow from his analysis.^{16 17} In an open access fishery, society sees too much effort expended to catch fish. Crucial to this is what defines effort. Anderson defines effort as, “a measure of the number of boats (in some cases the number of traps, etc.), their catching power, their spatial distribution, the time spent fishing, the skill of the crew, etc.” (p. 19). Note that the number of vessels and size of vessels, both measures of capitalization, are a subset of effort. Quite often in public policy debates, the discussion is couched in terms of just over-capitalization. For instance, in the Ocean Studies Board’s *Sharing the Fish: Toward a National Policy on Individual Fishing Quotas* report to Congress (1999), while the differentiation between effort and capitalization is noted, attention is paid almost exclusively to the number of vessels in a fishery and the size of those vessels, over-capitalization. After all, if there are fewer vessels (of a constant size) active in a fishery that also means there are fewer fishermen active in the fishery.

Given this measure of effort we can define catch-per-unit-effort (CPUE). Ideally, society likes to see a high CPUE, meaning that some constant amount of fish is being harvested with the least amount of effort possible. As more vessels are added to a fishery¹⁸, with a constant catch, the CPUE drops. From society's point of view, a fishery is most efficient under a private property regime. To see the difference between the socially optimal outcome and the outcome under an open access regime the following

¹⁵ Limited entry license management does have the effect of limiting the size of the overall fleet though over-capitalization on the part of individuals is still a problem.

¹⁶ For the sake of brevity, the analysis presented here will omit Anderson’s derivation of a fishery’s total sustainable yield and start from the point of the long run total revenue and total cost curves.

¹⁷ Some may prefer Eggertsson (1990) who draws heavily on Cheung (1970).

¹⁸ Or as any aspect of effort is increased.

simple analysis can be used. Assume that there are many fishermen, none of who can influence price in the market, and any number of processors to whom the fishermen sell their catch.

Long run total revenue and total cost generated by the fishery are show in Figure 2-1. Total revenue is derived using the total sustainable yield curve of the fishery. Total sustainable yield is simply the amount of catch that can be harvested given different levels of effort and population size. Figure 2-1 assumes a given population and therefore every point on the total revenue (TR) curve is sustainable. Assuming an atomistic market results in simply scaling this sustainable yield curve by the price, hence the TR curve. Add to this a constant cost per unit of effort¹⁹ and the total cost and total revenue curves for the fishery are shown in Figure 2-1.

From here it is easy to determine the different outcomes under open access and private property. Under private property, the producer, or owner of the resource, equates marginal revenue and marginal cost in order to maximize profit. In Figure 2-1 this level of effort is shown at E*. When discussing natural resources this return to the resource is referred to as *scarcity rent*, or just *rent*, and this term will be used from here on (Anderson 1986, p. 37). Under a private property regime, rent is maximized.

¹⁹ Assuming increasing marginal costs leads to the same conclusion.

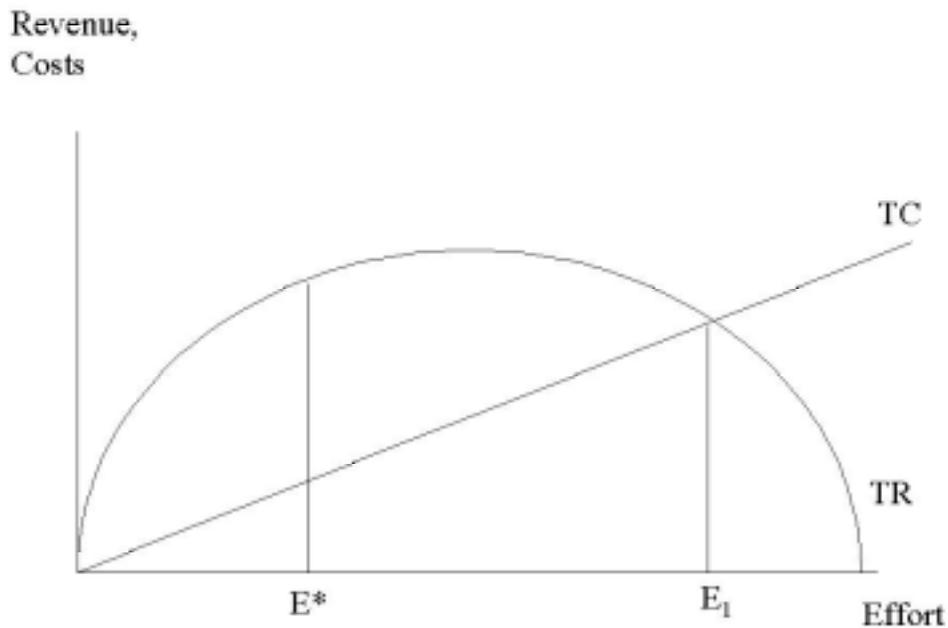


Figure 2-1 Open Access and Socially Optimal Levels of Effort in a Fishery

The difference under open access is due to the lack of barriers to entry. Any individual fisherman that can earn a profit will enter the fishery. This drives the fishery's profits to zero, i.e. effort equal to point E_1 . After all, when a new fisherman decides whether or not to enter a fishery, or an existing fisherman decides to increase effort, the individual only cares about the effect this action will have on his own profits. The analysis at the individual level is predicated on the change in averages not the marginal changes. As long as average revenue is greater than or equal to average cost, it is worthwhile for the individual to enter the fishery.

Since there is rent to be appropriated (profit to be had) for each individual fisherman up to the point where total cost is equal to total revenue, or average cost equals average revenue, fishermen will choose that level of effort, given by E_1 in Figure 2-1. Therefore, any time total cost is less than total revenue at some level of effort this will result in the

open access (E_1) level of effort being greater than the private property level of effort, and we see complete dissipation of rent in the fishery. If it is possible to increase the net return earned in the fishery, then open access is not optimal. Also notice that as long as the total cost curve intersects the total revenue curve along the downward sloping portion of the total revenue curve, the total catch associated with the OA level of effort could be caught with less effort, and hence at a lower cost (whether or not that level of effort is rent-maximizing), thereby increasing CPUE.

Over-utilization of the resource follows directly from this same argument.²⁰ Because there are no use or access restrictions and no one fisherman owns the resource, there is no incentive to leave in place any portion of the stock.²¹ If you do not catch the fish, your competitor will. Therefore, in order to earn some revenue from the resource, you will fish. We see this in the OA level of effort. Effort is increased until there is no profit left in the industry. Because this level of effort is always greater than the socially optimal level it is also always associated with a smaller stock or population of fish since the greater is the catch the smaller will be the population left over for regeneration. Hence we see the possibility for extinction under open access.

The third problem with an open access fishery is also a result of the fact that there is no specific allocation of rights to the resource itself. Because no one person owns the resource until it is harvested, fishermen have an incentive to obtain possession of the un-owned resource as quickly as possible. And this results in over-capitalization. The indirect effect of this is that the fishing fleet is able to catch an entire year's TAC in a shorter and shorter period of time. When this happens we have what is commonly called a "derby" fishery or a "race to fish." This has forced fisheries managers to shorten allowable fishing seasons. For example, in the surf clam and ocean quahog fishery the window had shrunk to only two weeks per year by the mid 1980's. Having such shortened seasons leads fishermen to fish no matter the weather conditions and as one

²⁰ This is clearly only the case in the absence of some restriction on total catch in the fishery that keeps the total catch at the biologically tenable level.

²¹ Even if the fishery were completely privately owned, an owner with the right preferences and discounting factor could easily drive a fishery to extinction as well.

might expect this has led to the deaths of many fishermen (see Gwinn, 1997). As a result, commercial fishing has one of the highest mortality rates of any occupation in the United States.

Other types of regulations are used as well, sometime overlapping one another. However, no matter the type of regulation used, the open access nature of a fishery still creates the incentive for over-capitalization and over-utilization of the resource (Boyce, 1992).

2.C. Individual Transferable Quotas

The use of individual transferable quotas in fisheries was spurred by the problems described above. This problem was brought to light most recently²² and famously in the economics literature by Gordon in his seminal 1954 paper “The Economics of a Common Property Resource: the Fishery”.²³ He argued that because of a fishery’s open access nature, there was an incentive for fishermen to expend too much effort catching fish and to over-exploit the resource. This comes from fact that no one owns the fish until they are caught; hence if you get to the fish faster and take more of the fish, you will increase your share of the un-owned resource rents and presumably earn more money. Christy (1973) was one of the first economists to suggest using quantitative property rights in fisheries, and the theory has grown in popularity since (cf. Moloney and Pearce 1979; Neher et al 1988; Hannesson 1991; OECD 1993; Anderson 1994; Grafton 1996; these are a *very* brief sampling of the literature on the subject).

Previous research shows that assigning private property rights to the fishery will eliminate the incentives to over-capitalize (Arnason, 1993b; Casey et al, 1995). Because the harvester is guaranteed a certain portion of the TAC, she need not worry about beating her competitor to the fish. The resource is there for her to take when it makes the most economic sense for her to do so. And she is free to make capital investments as it

²² Though it was Warming (1911) who first wrote about the common property problem.

²³ Note that what Gordon called a common property resource is now referred to as an open access resource. The distinction between the two is explained in the previous chapter.

best suits her own needs—there is no longer a need for bigger and faster boats in order to beat her competitor to the fishery. Because quotas are simply shares of the TAC, assuming no cheating, a portion of the stock is reserved each year for regeneration.

When a fishery is already over-capitalized, the imposition of private property rights does not just give an individual fisherman an incentive to no longer over-invest in fishing technology but it also gives some fishermen the incentive to leave the industry. Since not all fishermen face the same costs, those with lower costs are better able to compete. These fishermen are often referred to as *highliners*, and the return to fishing ability is often called *highliner rent*. To illustrate how increasing marginal costs and transferable quota can lead to a smaller fleet, consider the following example.²⁴ Suppose there are two fishermen, one high-cost, H, and one low cost, L. The high-cost fisherman faces a constant marginal cost of \$100 per pound, with zero fixed costs. The low-cost fisherman faces constant marginal cost of \$50, also with no fixed costs. Both face constant marginal revenue, $MR_H = MR_L = \$100$ per pound. Therefore if each has the right to harvest one pound of fish, H will just break even, while profit to L will be \$50. Since L can earn \$50 for each pound of fish she harvests but H will only break even, there is an opportunity for a trade. The minimum price that H will be willing to accept for his one-pound quota is zero dollars and L's maximum willingness to pay for an additional pound's worth of quota is \$50. Any trade made at a price greater than 0 and less than \$50 will make both parties better off.

Because ITQ management has been used in other countries for many years there is evidence that it can lead to increased efficiency, increased catch-per-unit-effort. In the Icelandic fisheries there has been a reduction in the amount of effort expended, and improvements in the quality of catch (Arnason, 1993b, 1996). New Zealand, likewise, has seen “reduced overcapitalization; greater industry freedom, flexibility, and responsibility; and improved industry efficiency, competitiveness, and profitability” in

²⁴ Anderson (1986, pp. 215-219) also gives an explicit (numerical) example of a scenario where trading ITQs benefits both parties to the trade and obviously results in less capitalization in the fishery.

the fisheries where ITQs have been used (Ocean Studies Board, 1999). Both cases are expanded upon in the next section.

2.D. Experiences with Individual Transferable Quota in Other Countries

Iceland and New Zealand are two countries where ITQs are used extensively. Other countries that use them are Australia, Italy, and Canada. With so much worldwide experience there should be some indication of whether or not ITQs are meeting the objectives of the managers and governments that instituted them.

To determine if quota management actually leads to the outcome theorized by Anderson and others, the pertinent issues to look at are levels of capitalization, the state of the fish stock, and the mortality rate within the fishery. In the Icelandic fisheries, Arnason (1993b) finds that, in the herring fishery, there was a “dramatic increase in efficiency” (p. 218). Arnason bases this conclusion on a decline in fishing effort and an increase in landings (i.e., more fish caught per unit of effort). After being closed from 1973 to 1976 due to declining stocks and fear of extinction, the fishery had still not recovered greatly and individual vessel quotas were very small. Quota was subsequently made transferable in 1979 and since then the stock has recovered and landings have tripled from what they were in 1977. Results are similar in the capelin fishery, though less dramatic, and the results from the demersal²⁵ fishery are inconclusive. Fleet size and aggregate effort have both increased (slightly), yet there is evidence of significant rents being generated (Arnason, 1993b).

In an analysis of the Australian southern bluefin tuna fishery, Geen and Nayar (1988) found that after the implementation of an ITQ system the number of vessels in the fishery fell by 70 percent due to high-cost fishermen selling their quota and leaving the industry. At the same time, the remaining vessels’ catch rates increased, signifying a decrease in costs. Profitability also grew sharply after fishermen were afforded the time to concentrate on larger fish for the Japanese sashimi market, where ex-vessel prices are

²⁵ Demersal is the general term for fish that live at the bottom of the sea.

higher. Finally, the authors state that “simulations of the fishery under alternative management regimes indicate that the amount of resource rent earned by the fleet would be less than 25% of the [sic] earned under ITQs for the same total catch...It can be concluded that the economic performance of the fishery has been substantially improved by the changeover to ITQs” (p. 382).²⁶ These studies tell us that, at least from this economic point of view, ITQ programs are effective at making fisheries more efficient.

2.E. A Review of Literature on Vertical Integration

There has been much time devoted to the study of vertical coordination, with the work being divided into two main areas. First is the transaction cost school of thought (attributable to Coase and Williamson) that believes vertical integration is a result of the sometimes-high cost of using the market. The other school of thought focuses on monopoly power in the development of vertical integration and contracting. That is, a firm integrates upstream in order to gain market power by controlling access to an input, market foreclosure.

Transaction costs

The study of transaction costs in vertical integration and contracting can trace its roots back to Coase’s (1937) seminal paper “The Nature of the Firm.” Coase’s main thesis was that a firm “suppress[es]...the price mechanism,” that is, a firm will integrate any part of its production process, as long as doing the work in-house is cheaper than purchasing the input or service on the market (p. 389). Transaction costs are usually defined as, (i) information costs—discovering prices, supply, demand, market participants, and other relevant market information; (ii) contracting costs—the cost of agreeing on quantity and price and writing it in a legally binding document; and, (iii) policing and enforcement costs—the cost of making sure that the contract is being followed and if it is not, the cost of having it followed or being compensated (Tirole 1992, p. 29).

²⁶ cf. Tierney, 2000.

Masten (1996) further describes the “critical dimensions that influence the relative efficiency of various” forms of vertical coordination as asset specificity, complexity and uncertainty, measurement costs, reputation, and the role of risk aversion. Asset specificity has been the focus of much of the empirical work in analyzing vertical integration (Tirole, 1992). Williamson (1975) was the first to bring the concept to the economics literature. Relationship-specific assets²⁷ are those assets that have limited use in situations other than for what they were designed. An example of this would be a fishing vessel specifically designed and equipped to harvest a particular species, where the method of harvest is not used in any other fishery. Because of the low value in its next best use, specific investments generate “appropriable quasi-rents” that are defined as the difference between the asset’s value in its intended use and its next best use (Masten 1996, p. 13). A supplier that knows the electricity generator is dependent upon their certain type of low-sulfur coal can appropriate these quasi-rents. Williamson (1985) saw this as a principal reason for specialized organizational structures such as contracting and integration.

Monteverde and Teece (1982) investigate how the transfer of specific knowledge to a supplier affects vertical integration. No matter the legal claim on the equipment used to make the input, if the downstream firm gives the upstream firm specialized knowledge, the supplier can use this position as a bargaining tool when a contract is to be renegotiated. The supplier and auto producer both know that if the producer wishes to find a new source of inputs they will be forced to find a new supplier (search costs), negotiate a new contract (contracting costs, which they are already facing), and will have to train the new supplier’s employees. This puts the original supplier in the position of being able to appropriate some quasi rents. Monteverde and Teece found that the more complex is an input, or the higher the cost of designing and engineering the input, the more likely that the part will be produced in-house.

²⁷ According to Williamson (1983), asset specificity can take on four forms: (i) physical asset specificity; (ii) site or location specificity; (iii) human-asset specificity; and, (iv) dedicated assets.

Masten (1984) looked at the complexity of the aerospace industry in a similar analysis. He finds that government administrators are hesitant to internalize transactions due to what government policies refer to as “substantial administrative burden,” yet when design and production are complex the process is, in fact, more likely to be integrated. This is a second example of the hold-up problem and how vertical coordination is used to avoid it. Certainly then, the hold-up problem is not confined to one type of industry but is possible in many types of industries.

Continuing in the transaction costs school, we move to the idea that hidden behavior or attributes of one or both parties to a contract can affect transaction costs. The so-called “principal-agent” literature seeks to explain behavior dealing with moral hazard (hidden action) and adverse selection (hidden attributes), and the contracts and other non-market arrangements that are used to account for them.²⁸ Quality issues come up in this literature in a number of different ways. Often a producer of a final product needs an input of a certain quality. In fisheries, processors may require a certain level of quality in the fish they purchase, and in the timing of deliveries to their plants. Even with integration, monitoring the level of effort that an employee invests towards maintaining quality is often not directly possible and any ex post indication of this effort is an imperfect measure.²⁹

One method to reduce the moral hazard problem is through franchising.³⁰ Lafontaine (1992) found that franchising was more common when there was an “incentive or monitoring problem downstream” (p. 281). The ability to monitor one’s employees is the key to Lafontaine’s result. If it is not possible to monitor the agent’s behavior then the principal does not want her own profit dependent upon that behavior. If monitoring is not possible (or is imperfect), then having the agent maximize his own profit (as opposed to

²⁸ The name principal-agent simply refers to the two parties in the transaction. A principal typically hires or contracts with an agent to perform a job.

²⁹ The uncertainty in fisheries comes from the fact that the quality of the fish may be due to the fish’s existence before being caught, or could be related to the amount of time that it sits on the vessel’s decks waiting to be packed on ice, the care taken in handling the fish, etc.

³⁰ Franchising is just the licensing of a name or trademark for retail uses. As an example, most McDonald’s restaurants are franchises and not actually owned by the McDonald’s Corporation.

earning a paycheck from the principal) will lead to higher profit for the principal. Otherwise, if the principal hires the agent as an employee, the agent has no incentive to work in the best interest of the principal—the paycheck comes as long as the agent shows up for work.

In a fishery if the processor's profit is dependent upon the fisherman's actions with respect to the quality of the fish delivered, then the important question is whether or not it is possible to cost-effectively monitor that behavior. In some fisheries, quality plays no role at all. For instance, if the fish is being processed into oil it only matters that the fish has not spoiled. However, quality is of great concern in markets where fish are sold fresh. Other behaviors that are difficult to monitor yet could affect a processor's profits are the captain's up-keep of the vessel itself, and effort expended in finding good fishing grounds.

Grossman and Hart's (1986) seminal paper on contracting, "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration" looks at how the distribution of residual rights in a contract shifts the incentives for opportunistic behavior. One result of their work is that an employer-employee relationship differs from a contractor-contractee relationship in the allocation of residual rights for control over assets. An employer-employee relationship is typically characterized by the fact that many details of the job to be carried out are left to the employer's discretion. Thus, the employer has many of the residual rights of control. In a contractor-contractee relationship, the job is specified in much greater detail, and the contractee typically has many of the residual rights of control (p. 717).

Grossman and Hart's main result is that there are limited ways to achieve the first best, surplus maximizing, outcome. For the non-integrated, contractual situation, both parties must be able to specify in the contract how each party makes "relationship specific investments" and what actions are taken after these investments. If firm 1 controls firm 2, the output from firm 2 must not depend on the actions taken by *either* firm, and if firm 2 controls firm 1, the output of firm 1 must not depend on either's

actions. It is only in these instances that we will see the first best outcome. When these conditions are not met the best that can be done is the second best optimum, or the best outcome from that set of feasible outcomes available to the two parties given the moral hazard problem.

To put this in terms of the fishery, let us assume there is concern over the quality of the fish delivered. If the processor and harvester contract, the only way to achieve a first best outcome is if all actions can be specified in the contract and monitored. Clearly this is not the case since it is nearly impossible to monitor the behavior of the fishing crew while at sea. On the other hand, if the processor controls the fishing operations, the quality of the fish delivered must not depend on either the processor's nor the fisherman's actions in order to achieve the first-best outcome. Clearly this is not possible, as many actions the fishing crew could take would affect the quality of the catch. This means that it is not possible to maximize surplus in the case of a fishery facing a moral hazard problem.

From both Grossman and Hart's theoretical analysis and Lafontaine's empirical analysis we can deduce that the captain will only act optimally if he is given the incentive to do so. That incentive comes in the form of profits, and so the contract offered by the processor is written such that what is optimal for the vessel captain/owner is also optimal for the processor. And even then we only see, at best, the second best optimum. Without being able to contractually specify all actions taken by both parties, and without perfect monitoring, the result is still the second-best optimum.

One non-contractual way to mitigate this problem is through reputation effect. In some industries, particularly in fishing, there is concern about reputation. Aside from any contractual obligations, fishermen must be concerned with their reputation in the industry. Terkla (1998) states that reputation is especially important in smaller fisheries where everyone knows everyone else. This would suggest in small markets that contracting or spot-markets may be the most efficient way to provide fishermen with the

best incentive to provide high quality inputs thus acting to maximizing the processor's profits as well.

Market Foreclosure

There are two main motivations put forth for market foreclosure. One is gaining monopoly control over an input to your production process and therefore control of the market for the final good in which you operate. Second is the idea of integrating so you no longer have to bargain over, or share, the rents generated in the fishery.

The desire to gain market control or in some way be able to control prices in the market in which you function is an easily understood motivation for vertical integration. Again, this brings to mind O'Malley's hypothesized story of a restaurant trying to buy as many lobster³¹ quota shares as possible so that they can be guaranteed a steady supply of lobster while their competitor restaurants cannot do the same.

Notice that this is dependent upon the fishery being under quota management. The ITQs create a barrier to entry that does not exist in an open access or common property fishery. In a non-ITQ fishery, the processor wishing to gain monopoly control over the resource must not only buy out every fishing vessel but must find a way to keep out new entrants. With ITQ management the processor does not even need to buy the fishing vessels, only all of the available quota shares.

Rent Capture

If there are rents to be distributed between harvester and processor, integration allows one party to eliminate the need to bargain and instead capture all of the rent. The first thing to notice is that integration does not eliminate all of the contracting costs. Under independence the processor contracted for delivery of input, under integration she must hire a crew. This is simply a different type of contracting cost.

³¹ This argument is based on the assumption that there are no substitutes for lobster. If there are substitutes available, of course, the argument will not hold.

Even in a monopsony market, processors must cede some rent to fishermen. And as the number of processors in the market increases, the amount of rent captured by the fishermen increases. If processors wish to keep all rent for themselves they might eliminate the seller with whom you must share the rent; vertically integrate their operations.

Two papers have specifically looked at the distribution of rent in fisheries under different management regimes. Casey et al (1995) found that in the British Columbia halibut fishery a larger share of rent was distributed to fishermen when the fishery is under private property management³² than when under common property management. This is attributed to the fact that there was a shift in the structure of the market. Under common property management, halibut was only caught a few days out of the year. In order to make halibut available during other times of the year, freezing facilities were required. The necessity of purchasing freezing facilities acted as a barrier to entry into the processing sector. The removal of this barrier led to more entry into the processing sector. This resulted in an increase in the ex-vessel price for halibut due to the increased competition between buyers (Love et al, 1995). The result is that (i) there is more rent to be had and (ii) because there are more processors competing for the attention of fewer fishermen, bargaining power has shifted in favor of those fishermen. In addition, because halibut is caught year-round under private property management, more is sold fresh, which receives a higher price than frozen halibut. This also helped increase the distribution of rents to the fishermen.

2.F. Vertical Integration in (non-fish) Agro-food Industries

Reviewing the literature on vertical coordination in the agro-food sector is appropriate for two reasons. First, commercial fishing exhibits many of the characteristics of an agro-food industry. There are many of the same concerns over input quality, asset specificity, and price and supply uncertainty in both industries. Also, the last ten to twenty years

³² The Canadian Pacific halibut fishery is managed under an Individual Vessel Quota program. This distinction in name is made because this program limits how quota can be bought and sold. This important distinction between programs will be addressed in Chapter 4.

have seen an increase in the level of vertical integration and coordination in poultry, hogs and other agro-food sectors that has spurred a number of empirical investigations into its cause. According to Sporleder (1994), between 1960 and 1980 farm production under contracting or out-right integration increased from 19 percent to 30.3 percent. Barkema, Drabenstott and Welch (1991) report that 22.5 percent of cattle were produced under some type of vertical coordination in 1990, up from 16.7 percent in 1960. Drabenstott (1994) also reports that vertical coordination has increased in the production of fresh vegetables (from 45% to 65%) and processed vegetables (from 75% to 95%). Barkema (1994) reports that contracting is commonplace in specialty grains, broiler, hog, and vegetable production.

The following four subsections will explore, in some detail, possible reasons for vertical coordination in the agro-food industries. These reasons include quality uncertainty, price uncertainty, asset specificity, and search costs.

Quality Uncertainty

Quality uncertainty in the agro-food sector can refer any number of characteristics affecting market value, including safety, nutrition value, and aesthetics. Processors expect growers to provide raw goods free of any defects that could be passed on to the final product and affect its safety. For instance, animals must be inoculated against certain diseases. Also, as people become more aware of their health, and demand products with less fat, processors need to know that growers can provide them with inputs that will meet this demand.

One executive from a large flour milling company ranked U.S. Food and Drug Administration (FDA) safety and nutrition standards as the number one criterion for measuring the quality of wheat (Hennessy, 1996). Clearly if safety and nutrition are so important in food processing, then processors have a need for information on how growers are maintaining the quality of produce and animals before they reach the processing plants.

When dealing with live animals in particular, testing for quality (both in safety and nutritional terms) is costly. Tested animals are no longer edible and testing is not a perfected science (Hennessy, 1996). Because of this, buying animals on a spot market can be costly to processors if input quality is highly variable.³³

To avoid this problem of quality uncertainty, it has become quite common for processors to contract with growers directly. Contracts can specify feed, pharmaceuticals, and other factors that affect final quality. Crop production is similar. Prior to planting, a contract can be drawn up to specify genetics and pesticide use. In the broiler industry vertical coordination is used to control production processes and use of genetic stock in order to better guarantee quality of inputs to the processing plant (Westgren, 1994).

Supply Uncertainty

Vertically integrating or contracting to avoid supply uncertainty, and hence input cost uncertainty, is a risk reduction strategy. This coordination gives the downstream firm (the processor or packer or what is sometimes called an integrator) the ability to better choose the levels of other inputs that are used alongside the uncertain one (Kinnucan and Nelson, 1993). Arrow (1975) also suggests that, even in a downstream industry that is initially competitive, such input supply uncertainty can lead to imperfect competition. In the case of the fishery this means that if there is input supply uncertainty on the part of the perfectly competitive processing sector it can lead to an imperfect market in the processing sector. This is due to the incentive for processors to integrate with more and more harvesters in order to forecast input costs more accurately. As there is more and more vertical coordination, control over the input can eventually end up in the hands of a limited number of firms thereby making the downstream industry less competitive.

Hennessy (1996) adds to this argument by pointing out that, for goods with futures markets, there is less need to coordinate because the futures market provides information

³³ These costs can be manifested in different ways. The scenario easiest to imagine would probably be a processor purchasing what turns out to be a low quality input, which may lead to lower profits.

on input costs. However, for goods with no futures markets, such as minor crops or geographic regions with variable production, contracts are often used to hedge against uncertainty. Finally, Frank and Henderson (1992) analyzed approximately 40 different agro-food industries ranging from meat packing to wet corn milling to malt beverages and found that supply (price) uncertainty plays a major role in motivating vertical coordination through non-market arrangements.

Asset Specificity

Asset specificity plays a large role in the vertical coordination decision in many sectors of the agro-food industry. In meatpacking there is evidence of investment in specific assets. In order to produce high quality pork (as measured by nutritional value), processors must invest in certain physical capital, as well as have employees trained to use the equipment (Sporleder, 1994). This investment is now dependent upon the supply of hogs of higher nutritional value—less fat, for instance. Again, the incentive is for processors to at least contract with growers for specific breeding and production techniques. In the extreme the integrator³⁴ will vertically integrate the growers' operations to guarantee the quality of supply.

Another case is seen in the poultry industry. According to Westgren, “the investment in specialized assets (poultry houses) is a difficult investment choice for growers who have no guarantee of a lasting vertical relationship with an integrator” (1994, p. 566). Hennessy adds that investment in specific production capital “presents the processor with the opportunity to extract economic rent from producers” (1996, p. 1036). This is the hold-up problem discussed above. The key here is that investment in new growing houses creates more possibility for profit for both the grower and the processor. However, if the grower cannot be guaranteed a return to their investment they will not make the investment; there is a fear of hold-up. Therefore before investing in new capital the grower will increase its level of vertical coordination with a processor. The processor

³⁴ This use of integrator should not be confused with the concept of vertically integrating that is being discussed. In this usage integrator is a commonly used name for a processor that takes hogs, poultry, etc. and processes the input into an intermediate or final product. Thus, a company such as Campbell's Soup (which will be discussed below) is an integrator.

will agree because they get the benefit of the new houses and (usually) control over some other aspects of how the poultry is grown. It is a simple trade-off that results in greater benefits for both parties.

Frank and Henderson (1992) find that along with price uncertainty, asset specificity is a prime motivator for vertical coordination in the agro-food industries investigated in their research. Frank and Henderson used investment in research and development (R & D) as a proxy for asset specificity. If a firm is considering whether or not to invest in R & D a prime consideration must be the return they expect to get from that investment. If there is a negative expected return they will not invest. The authors found that those companies that invested in R & D were more likely to be vertically coordinated to guarantee a return to their investment by avoiding the hold-up problem.

Search Costs

Every firm faces search costs no matter how small or large. They are a type of information cost. Any firm that must search for a trading partner faces search costs, whether they are a processor or producer/grower. A grower's search costs can be prohibitively high if they must transport their product (chickens, cattle, etc.) from processor to processor trying to find the most profitable deal available. However, societies have devised ways to avoid these costs. For thousands of years, communities have had organized market days when all ranchers and farmers brought their livestock and produce to town. Buyers knew what day the market would be open and came to town that day to buy. This was a very simple solution requiring no vertical integration or contracting. In the more recent past futures markets have developed where buyers and sellers come together to make arrangements for future delivery of produce and livestock.

Where markets like this exist, search costs are minimized. However, if such markets do not exist, both growers and processors face search costs. To avoid this, one can vertically coordinate. This will not eliminate the initial cost of searching for a trading partner but will eliminate any future search costs.

Based on the evidence in the agricultural industries, vertical coordinate can be thought of as a function of quality uncertainty, price uncertainty, asset specificity, and search costs. The level of vertical coordination can be thought of as a having independence at one extreme and outright integration at the other. The extreme case of no supply uncertainty, no asset specificity and zero transaction costs would, according to theory, result in independence between grower and processor. The other extreme of infinite search costs, complete uncertainty and absolute asset specificity would yield a result of complete vertical integration. Somewhere in between would probably yield different levels of vertical coordination chosen to maximize the actors' profits. The next section will outline the parallels between the non-fish agro-food industry and fisheries, as well as introduce some differences.

2.G. Literature on Vertical Integration in Fisheries

There are two papers that have done limited empirical analyses of vertical relationships in. Both deal with the issue of holdup. Gallick's 1984 analysis of the tuna fishery looks at how new technology changed what was a situation of no holdup to one of potential holdup. Koss's paper looked at investment in non-malleable capital by both harvesters and processors.

The tuna industry relied on exclusive delivery contracts from the 1950s until the late 1960s when new harvesting technology significantly changed the industry. Prior to the 1960s the tuna fishery used hook and line methods to harvest fish. Small capacity vessels made frequent trips between the fishing grounds and on shore processing plants. Harvesters and processors agreed to contracts that generally specified how tuna price was determined, any limits on quantity to be delivered, services provided by the processor, and exclusive delivery of catch to the processor (p. 206). Gallick notes that exclusive contracting was used to eliminate costs that would have been present in any sort of competitive auction system. Relying on auctions instead exclusive contracting would mean the catch would need to be sorted by harvesters and inspected by processors (redundant inspection). However, because price was determined at delivery, the use of

exclusive contracts made the tuna itself a specific asset—with its use limited to an exclusive processor. This created a potential holdup problem. Harvesters were required by contract to deliver to a particular processor, but that processor then had the power to extract rent or refuse delivery. However, since tuna harvesters were small and made frequent deliveries, and the marketing cost savings were large enough, it was never in the processors' best interests to try to capture this quasi-rent.

When new technology emerged in the 1960s, this situation changed. Hook and line vessels had an average capacity of 200 tons. New purse seine vessels built in the late 60s and early 70s averaged a carrying capacity of 1000 tons. With fewer deliveries and larger quantities of tuna per-delivery, the use of exclusive delivery contracts was no longer in the best interest of the harvesters because of the increased rent seeking incentives of the processors.

The change in technology led to changes in the type of vertical coordination between harvesters and processors. One change in coordination was through joint ownership. A processor that partly owns a harvesting vessel will be concerned with its revenue and will have a disincentive to engage in holdup. Mortgage guarantees were another new tool used to combat holdup. A processor that engaged in holdup would reduce the profitability of the harvesting sector and would end up using that rent to guarantee that the harvester's mortgage was paid. If the processor did not do this, his assets would then be subject to confiscation by the bank. Joint ownership and mortgage guarantees are, as Gallick points out, substitutes for one another to some degree.

Another significant change in contracting was empty boat determination of price. Thus, price was now determined before the vessel left for the fishing grounds. This reduces the ability of a processor to engage in holdup by taking away one of the processors tools.

The paper by Koss, "Self-Enforcing Transactions: Reciprocal Exposure in Fisheries" (1999), investigates how the investment in nonmalleable capital affects the decision to

vertically coordinate. In this respect it is much like Gallick's paper. However, where Gallick used a case study of one fishery, Koss used an econometric analysis of 726 vessels and 75 fish buyers in British Columbia, Canada. With this data set she analyzed four different fisheries, salmon, halibut, sablefish (black cod), and herring. These fisheries accounted for approximately 86% of the value of fish harvested in British Columbia for the year 1988. Her data also spanned five gear types: purse seine, gill net, troll, longline, and trap. These different gear types serves as her specific investment that she hypothesizes will affect vertical ties in the fisheries.

Koss is concerned with the problem of hold-up due to the investment in specific assets but extends the problem. Koss argues that the problem is actually two-sided because processors invest in specific assets as well. This results in a problem of *double moral hazard*. While fishermen can invest in particular harvesting technologies, processors can invest in canning facilities and related production line and distilling equipment which cannot be used for any food processing other than salmon. This is a specific investment that ties those processors with canning facilities to salmon fishermen who use gillnets and/or purse seines.³⁵ On the other hand, salmon fishermen that use troll lines have the opportunity to sell to any processor with cold-storage facilities. These salmon will be quickly transported for fresh sale. This is a fairly clear basis on which to hypothesize that specific investment will result in increased vertical coordination. The market for fresh salmon will be less vertically coordinated while the market for canned salmon will be more vertically coordinated.

Koss found that "transactions with canners are 26% less likely to be conducted on the spot market than transactions with processors or buyers without canning facilities" (p. 746).³⁶ Further, the probability that a vessel is partially owned or in some way financed

³⁵ Some species of salmon are most suitable for canning due to natural characteristics such as the high level of oil in pink and sockeye salmon. But salmon that are caught using gillnets and seines simply cannot be sold on the fresh market due visible bruising that occurs, and are therefore sent straight to canneries.

³⁶ To quote Koss (1999): "With a spot contract, buyers and sellers of fish seek one another after incurring seasonal investments (e.g., vessel maintenance, crew, processing facilities, etc.); there is no prior arrangement for exchange, nor is there an agreement the relationship will continue beyond this transaction" (p. 737). Koss also notes that this is equivalent to what Williamson called a "discrete transaction" (Williamson, 1975).

by a processor increases 16% if that processor owns a canning facility. This decreases the processor's chances of being held-up by the fishermen; by owning some stake in the vessel, the processor has the ability to dictate to whom the catch is delivered. Likewise, those fishermen who invest in what Koss describes as the most specific assets (seine and trap gear) "are more likely to require a credible commitment from a processor than are the other gear types" (p. 746). So a vessel owner is choosing whether or not to invest in trap gear or seine gear is more likely to require some financial investment by a processor than a vessel owner investing in other gear types. However, all gear types showed higher vertical coordination when compared with a *combination* of gear types (the least specific investment type).

2.H. Hypotheses on Vertical Coordination in Fisheries

The literature on vertical coordination in fisheries combined with the related research in the other agricultural industries creates a basis for hypothesizing on how vertical coordination is determined in fisheries. However, unlike other agro-food industries, fisheries has the added complication of differences in property rights under various management techniques. Additionally, if a farmer wants to grow more wheat or raise more hogs they need only buy the proper inputs—land, seed, and other inputs—as long as the inputs are available. The government will not stop him from planting and other farmers planting wheat does not reduce his ability to plant wheat. However, if a fisherman wants to catch more fish, this may not be possible. The TAC may have already been reached or the legal season may have ended and the regulatory agency closed the fishing grounds. These added problems will be dealt with in turn.

Like the previous section on the agro-food sector, this section presents five issues that can create incentives for vertical coordination of processors and harvesters. A simple hypothesis statement follows each motive.

Quality Uncertainty

When discussing quality concerns it is important to remember that in the agro-food industry the farmer or rancher is able to control some of the inputs into the production of their product. The farmer or rancher has some degree of control over breeding of livestock or genetics in plants, as well as pesticide use and feeding. In fisheries, this is not the case.³⁷ The fisherman has no control over breeding, genetics, disease or any other thing that can affect the fish before it is harvested. In this respect a fishery is much more of an extractive industry like mining.

Quality now revolves around the method of harvest, how the fish are handled after landing, and timeliness of delivery to the processing plant. And not all of these are of concern to all fisheries. While processors care very much whether a salmon is caught using a long line or gillnet they don't care how pollock or hake are caught. The difference is due to the final product market for the fish. Pollock and hake are destined to become either surimi, which is used in the production of fake crab products, or frozen fillets, and the general quality (within reason) of the input has no effect on the final product. Salmon, on the other hand, may be processed into other fresh products. Certain harvesting methods can cause damage to salmon and make it unsuitable for fresh markets. Likewise if the fish is being processed into fishmeal or oil, as long as the fish has not spoiled, it is fine. Thus, concern over quality is highest for fresh consumer products than for highly processed products.

The second important quality issue is the timing of delivery to the processor. For a species like pollock, delivery must be scheduled so that the vessels are not forced to wait very long to be off-loaded. Pollock must be processed within three days of being caught, therefore without an agreed upon delivery date and time, a vessel could conceivably end up waiting so long to be off-loaded that the catch spoils. Further, the processing plant cannot speed up their work in order to off-load vessels more quickly without reducing the quality of the final product. Overburdening the production line can cause workers to not take as much care as they should during handling and can cause problems with automated

³⁷ The case of fish farming is not considered here.

machinery. For species that require such processing, contracts can be used to specify delivery date, thereby reducing or eliminating the possibility of ill-timed deliveries.

A third quality issue is the effort exerted by harvesters to maintain the quality of their catch. This includes freezing the catch within the needed time and handling fresh fish carefully so as to cause no damage. Because processors are often not able to monitor harvester effort to maintain quality, the distribution of information is affected and can play a large part in the processor-harvester relationship (Doeringer and Terkla, 1995). There are, of course, exceptions to this. Most fish sold in a frozen ice block is assumed to be of low quality by both harvesters and processors. Therefore, there is no way for harvester behavior to affect the product in the eye of the processor. Also, display auctions allow the processor to view some fish prior to placing a bid, and in smaller fisheries reputation plays a role in monitoring a harvester's behavior. By being able to view the product before buying it, (i) the processor can see who offers the best fish and will learn to deal with those fishermen; and (ii) harvesters know that processors can do this and will change their behavior accordingly. However, there are also fisheries where these conditions do not hold. Oftentimes fish is sold by the boatload with no prior inspection. Some processors in some fisheries also buy from a large circle of suppliers where reputation is unknown (Terkla, 1998).

Full integration offers the processor the option of firing the crew of a boat that continually brings in low quality fish. With open market sales, or even contracting, a processor only has the option of firing, no longer doing business with, an entire supplier. The processor having the option of firing only the crew of a problem vessel can induce the workers to consider the processor's interests as well as their own (Hart and Moore, 1990).

Based on the above, the following hypotheses can be drawn.

Ceteris paribus,

- (i) a fishery where the final product is sold fresh is more likely to be vertically coordinated than one in which it is sold frozen;

- (ii) a fishery where the input has a limited time before it must be processed is more likely to be vertically coordinated than one where wait-time is not as important; and,
- (iii) due to reputation effects, fisheries with many processors and harvesters are more likely to be vertically coordinated than fisheries with few processors and harvesters.

Supply Uncertainty

Uncertainty over the availability of supply is becoming more of a concern for fish processors. Grocery stores and restaurants are willing to pay higher prices for a guaranteed stable supply of fish, and processors want to be able to contract to fulfill that demand. However, varying fish stocks and the possible desire of harvesters to sell to other processors can leave those processors who do business with grocers and restaurants in breach of contract (Terkla, 1998). Having control over boats, either by contract or by ownership, can guarantee the processor the supply necessary to write and carry out contracts with retailers.

Two characteristics add to the uncertainty of supply/input prices. One is that there are no futures markets for fish.³⁸ Aside from contracting with or buying harvesters, there is no real way to guarantee or be able to plan for future input prices. Secondly, due to biological fluctuations, annual total allowable catch and actual harvest can change from year to year. Vertical coordination can at least allow a processor to hedge against, though not eliminate, uncertain supply.

Based on the above, the following hypothesis can be drawn.

Ceteris paribus,

- (iv) a fishery with a history of variability in annual harvest is more likely to be vertically coordinated than one with a consistent annual harvest level.

³⁸ The lone exception to this seems to be the futures market for black tiger shrimp and white shrimp on the Minneapolis Grain Exchange.

Capital Malleability

Just like the agro-food industry, participants in fisheries must be concerned with investment in relationship-specific assets due to the possibility of hold-up. Some fishing vessels may not be easily modified to catch alternative fish species. In addition, certain fisheries require licenses be purchased before operating. In this case, even if the vessel can be converted easily, obtaining the required license may be very difficult if not impossible. Schellberg (1993) explains: “in the Pacific halibut industry, for example, vessels are designed for longlining, i.e. catching primarily halibut and black cod using lines placed on the sea bottom. Considerable expense is required to convert these boats for use in another fishery” (p. 245). So while there may be some degree of malleability for fishing vessels, clearly one cannot shift a 65 foot trawler from off-shore fishing to sport fishing, much less to dinner cruises. Again, referring back to Gallick (1984) there are appropriable quasi-rents in a fishing vessel. Koss (1999) arrived at the same conclusion in her analysis of the B.C. halibut fishery. However, she also notes that the relationship works in the opposite direction as well. Just as the fisherman can invest in relationship-specific harvesting assets, so too can the processor invest in relationship-specific processing capital. In both cases the asset owner has incentive to formalize ties.

Based on the above, the following hypotheses can be drawn.

Ceteris paribus,

- (v) a fishery that requires non-malleable harvesting or processing capital, whether physical or human, is more likely to be vertically coordinated than one that does not; and,
- (vi) if alternative fisheries require limited-entry licenses, it is more likely that the primary fishery will be vertically coordinated than if alternative fisheries do not require limited-entry licenses.

Search Costs

A harvester faces potentially very high search costs in the case of fresh fish spoiling if he does not reach agreement with a buyer soon after coming to port. This high search cost may induce him to accept an early offer in order to not lose their entire catch. To quote

Koss, "the intermediate market for raw fish is characterized by time and space considerations that create significant quasi-rents...between the fisher and the initial processor(s) approached to complete the exchange. This...is more pronounced the fewer the number of alternative potential buyers, the more perishable the catch, and *the more geographically dispersed the alternative buyers*" (1999, p. 741, emphasis added).

Love et al (1995) cite as some of the costs of searching for an alternative processor, "1) additional fuel, food, and vessel wear and tear; 2) ice for chilling and associated reduction in hold capacity for halibut catch; 3) need for additional handling of the halibut; 4) additional risks (particularly for small vessels with full holds) of encountering bad weather and rough seas; and, 5) risks of breakdowns at sea and potential loss of the catch" (p. 235). Because the processor knows that it is expensive for the harvester to search for another buyer it may offer a lower price than if it were easy to find another. Again, harvesters and/or processors may seek to avoid this through either prior contracting or by integration.

Based on the above, the following hypotheses can be drawn.

Ceteris paribus,

- (vii) markets for fresh fish will exhibit more vertical coordination than markets for frozen fish; and
- (viii) fisheries where processors are more geographically dispersed are more likely to be vertically coordinated than fisheries where processors are not dispersed.

Property Rights

Changes in fishery management form from common property to private property may create new incentives for vertical coordination. The two key issues are (i) the desire for monopoly control of the resource; and, (ii) the attempt to capture more of the available rent in the fishery. Based on the arguments made above, there are two clear reasons why processors have an incentive to increase their vertical coordination with harvesters when a fishery switches from common property management to ITQ management.

The first of these is that ITQs constitute a barrier to entry into the market. If there are no substitutes for this input and no substitute for the final good, a processor that controls the entire quota in a fishery will also control the processing sector of that fishery. They would have monopoly power in both sectors.

Rent distribution is the second motivator of vertical coordination. When a fishery is converted to private property, a processor may lose rent for a number of different reasons. One of these is that a fishery that required freezing capabilities at the processing level may no longer require that freezing capacity when converted to private property. This allows for easier entry into the processing sector by new competitors due to lower entry costs. Increased competition in the processing sector will lead to less rent being distributed to that sector. Additionally, the institution of ITQs has been shown to reduce fleet size. Decreased competition in the harvesting sector gives relatively more bargaining power to the fishermen that remain. Owning one's own harvesting vessels can help a processor retain rent by eliminating the bargaining process all together.

Based on this, the following hypotheses can be drawn.

Ceteris paribus,

- (ix) converting to a system of private property rights will encourage vertical coordination by processors who have extensive investment in processing capital; and,
- (x) under rights based management, the existence of close substitutes will make vertical integration less likely.

CHAPTER 3. METHODOLOGY

Case studies will be the method of analysis used to answer the research question. As is discussed below, case studies offer flexibility and the ability to capture qualitative aspects of decision-making that may not otherwise be captured.

There are two reasons for using case studies. The first reason concerns whether or not quantitative data would actually capture all of the issues at hand. As Wilber and Harrison (1988) state, “a thirst for power, a sense of independence, altruism, idle curiosity, custom, and habit may all be powerful motivations of economic behavior” (p. 72). For many people, fishing, just like farming, has a long-standing tradition of being an entrepreneurial, “I’m my own boss” way of life. When the question arises of whether or not to sell your boat and become an employee of a processor (or anyone else for that matter), the decision is not always simply one of whether your wages will be higher, or whether your job will be safer. Instead, it is a question inherently involving how you will feel about no longer owning your own boat, about taking orders from someone else, or even a perceived duty to carry on a family tradition. It is only through talking with industry participants that these issues can be addressed. As Rod Moore of the West Coast Seafood Processors’ Association stated, “you really just have to spend a lot of time talking to a lot of people in the seafood business” (1998).

However, one can argue that these non-monetary issues will still be accounted for within a person’s utility function. As long as fishermen and processors weigh these factors against monetary concerns when making a vertical coordination decision, the data will reflect those choices. Having quantitative data would allow for statistical hypothesis testing. This leads to the second reason for using case studies, the question of whether or not it is possible to collect the necessary data.

Little data are available on the business practices of commercial fishermen. In particular, defining vertical coordination is hard. While in some industries vertical ties

are limited to perhaps ownership versus one or two different types of contractual relationships, vertical coordination in fisheries can come in the form of out-right ownership, partial ownership, long-standing informal contracts, provision of supplies by the processor to the fisherman in exchange for right of first refusal, or other formal or informal ties. Further, the type of vertical coordination can vary not just between different fisheries, but they can vary within any one fishery. Because of this lack of data and particular problem of consistently defining a level of vertical coordination, using case studies is clearly the best choice.

The three fisheries that are investigated are described in detail below. In one fishery, very little data is needed because of its particular (restrictive) management regime. In another fishery, representatives for both fishermen and processors advised that individuals not be contacted. In the third there are too few data sources from which to build a large enough sample. In fact, this fishery has so few participants that much of the data collected by the federal government cannot be obtained due to privacy concerns.

The use of case studies

In using case studies one is not simply telling a descriptive story or gathering anecdotal evidence. Rather, the use of case studies requires a structured methodological process that ensures consistent treatment across all cases so that collection of the relevant data is as complete as possible (Bryman and Burgess, 1994). The goal is to tell as complete a story as possible about each case (each fishery) such that all pertinent variables are addressed, and patterns and surprising phenomena or inconsistencies can be identified. This must be done while keeping in mind that the analysis must proceed to the next step of comparing across cases. Only by comparing across cases can this research determine whether or not there are certain trends or characteristics that all of the fisheries examined share that allow rules or generalizations to be developed that allow for policy recommendation to be made. While designing the survey instrument and carrying out interviews the end must always be kept in mind.

3.A. The Fisheries

In deciding which fisheries to use as case studies, it is important to remember the basic research question: What affects vertical integration in commercial fisheries and how does changing the property rights structure of the fishery augment or detract from that effect? Thus, only U.S. fisheries that do use some form of private property rights are considered. The three fisheries used for this research are the South Atlantic wreckfish fishery, the Pacific halibut and sablefish fishery, and the North Pacific pollock fishery.

South Atlantic Wreckfish

The South Atlantic Fisheries Management Council (SAFMC) manages the wreckfish fishery through an ITQ program. This program was the second ITQ program instituted in the United States. Like the SCOQ program, the wreckfish program itself is very simple; quota is freely transferable. The wreckfish fishery is also small. In 1993 there were only 31 quota shareholders, 22 vessels with wreckfish permits and only 14 vessels actually reported landing wreckfish. Since then, landings have dropped to just over 100,000 pounds in the 1999 fishing season, and in 2001 only 2 fishermen made landings. The fishery is also relatively new, having only been fished commercially for the first time in the mid 1980s (Gauvin et al, 1994).

The impact of the ITQ program on the size of the fishery has probably been small. Prior to institution of the program there were 90 active vessels in the fishery; this number held steady for 2 more years and then quickly shrunk after, and theories on why this happened vary. There has been limited research regarding this fishery. Gauvin et al (1994) discussed some of the general implementation issues and whether or not the program was meeting its stated objectives (including a brief analysis of horizontal consolidation) while Brod and Shobe (1996) analyzed the ensuing demand for quota in the fishery. This latter paper exposes the importance of capital malleability in effecting vessel owners' vertical coordination decision. Some have speculated, however, that the reasons for the fishery's decline have nothing to do with management.

Pacific Halibut and Sablefish

The Pacific halibut and sablefish fishery is managed under a program of Individual Fishing Quotas (IFQ). This is distinct from ITQs, as discussed above, in that the program has specific restrictions on how quota may be traded. In this IFQ program there are restrictions on how much of the total amount of quota can be held by one person, quota is divided between different vessel size-classes with only limited trading allowed between classes, and second generation owners of quota must operate the vessels on which the quota is being fished. According to Jessica Gherrit of the NMFS's Alaska Regional office, these requirements were specifically designed to “institutionaliz[e] the business practices that were in place at the time [the program was implemented]” (2002). That is, the program was specifically designed to maintain the small-scale aspects of the fishery. However, some processing companies owned active vessels in the fishery prior to the IFQ program. Because they were in operation prior to the program they were grandfathered into the program and are able to avoid some of these restrictions, thereby allowing some degree of increased vertical coordination.

In terms of participation, this is by far the largest fishery analyzed for this research. There are many thousands of halibut and sablefish fishermen. Unlike the other species, halibut can also be sold by a variety of means. Some halibut is sold fresh at the dockside, some is sold to processors, some straight to restaurants. The halibut is also one of the oldest in terms of being managed by the government.

This program is managed through the North Pacific and Pacific Fishery Management Councils (NPFMC). Because both the species occur along the Pacific coast from Oregon to Alaska there is a large Canadian fishery as well. The Canadian fishery is managed through what they call Individual Vessel Quotas (IVQ), which works very similar to an ITQ program. The International Pacific Halibut Commission (IHPAC) oversees the halibut fishery jointly for the U.S. and Canada. It conducts research, estimates the allowable catch, and approves management measures for both countries. This has been true since 1923 when the U. S. and Canadian governments created the Commission. There is no similar body governing the international issue of sablefish.

North Pacific Pollock

The North Pacific pollock fishery is the most valuable U.S. fishery, with the value of landings totaling more than a quarter of a billion dollars annually. Harvest was managed through a combination of entry limitations, gear restrictions and seasonal restrictions, as determined by the NPFMC, in Anchorage, Alaska. Instituting an individual transferable quota system had been proposed but was not approved prior to Congress's 1996 moratorium.

The latest change to the management regime in this fishery is the institution of fishermen-processor cooperatives, instituted under the 2000 American Fisheries Act. Under this program, fishermen enter into a one-year cooperative agreement with other fishermen and one processor. Because of the way that the yearly total allowable catch (TAC) is allocated in this fishery, the end result is essentially a private property rights system.

This particular fishery could be considered midsize in terms of participation, with approximately 100 catcher vessels, fewer than 50 catcher-processor vessels, no more than 5 true motherships (vessels that process at sea but do not participate in harvesting), and less than 10 shore-based processors in any year. Ownership is not totally clear but according to Kent Lind of the NMFS Alaska Region office, "massive vertical integration exists in the Bering Sea pollock fishery in both the inshore and offshore sectors" (1998).³⁹

3.B. Survey Methods

To develop complete case studies a flexible survey that consisted of a combination of phone and in-person interviews was used. If a particular line of questioning needs further investigation, a written mailed survey does not allow the opportunity to explore that

³⁹ The "inshore" fishery consists of those vessels that deliver to shore-based processors while "offshore" refers to that part of the fishery where landings are delivered to at sea-processors or are processed by the harvester that actually caught the fish (a so-called catcher-processor vessel).

topic. Phone and personal interviews, on the other hand, allow the researcher to lead the questioning so that all pertinent questions are answered and so that any topic that deserves further discussion can be covered in more depth.

The first step in gaining entry into or an introduction to a fishery was to contact the regional NMFS office and Fishery Management Council. Talking with economists or other specialists gave an initial indication of such things as the size of the fishery, participants' willingness to talk to researchers, and also provided very important contact information for local fishermen's and processors' associations. Additionally, of course, the NMFS is a source of data on transfer of quota and participation in the fisheries.

It was important to contact local fishermen's and processors' associations before contacting individuals, to get an official stance on issues, to clear up uncertainties about the particular fishery (maybe quality uncertainty is a moot question for some fisheries), and to get a second opinion of the willingness of members to participate in survey work. Second, if the association felt that members would be willing to participate, the association could provide names and contact information as well as the appropriate times to try to contact potential interviewees. Being able to reference the association would also signal the legitimacy of the research; if their association was willing to participate then hopefully the fishermen might be more inclined to do so as well.

The design of an appropriate survey was specific to each fishery. The first step was to gather basic information on the fishery, including landings and price statistics, number of participants and other such information that help to give a basic picture of the fishery. From this basic data, a survey could be designed that incorporated a particular line of questioning or path that could be followed. This involved attempting to anticipate the answer or type of discussion a question might generate, then examining that both for its usefulness in further answering the research question, and how one should proceed with the next question or line of discussion. This process took place individually for processors and fishermen in each fishery.

Differences in the fisheries necessitated formulating slightly different surveys for individuals in each fishery as well. For processors, these surveys included such information as which species they processed aside from the target species, whether or not they owned any vessels, and, where applicable, how much quota they were allocated or purchased. For fishermen, analogous information was included.⁴⁰

Even though no one survey suited every fishery, it should be noted that each fishery still included questions that would elicit enough explanation to be able to answer the various hypotheses from the previous chapter. For example, each fisherman's survey included a direct question about the respondent's financial dependence on the fishery and whether or not he specifically targeted other species. Processors' surveys included questions regarding specification of contracts. This was meant to determine such things as how they dealt with quality uncertainty.

Once an appropriate survey was designed, the intent was to pre-test it on the fishermen's associations in each fishery. This is the third and perhaps most important reason for contacting these associations. This was meant to help determine whether questions would elicit the useful answers and to see what biases certain wording or ordering of questions may introduce into the responses. However, it was not possible to "pre-test" the survey. In the pollock fishery, the associations' responses were needed to replace the (non-existent) individual responses. Actually talking to individual fishermen and processors was not always possible. In the halibut fishery, there was no need to survey individual fishermen or processors. And in the wreckfish fishery, there are no fishermen's associations that explicitly deal with wreckfish.

3.C. Analysis

As discussed above, case studies entail more than just a descriptive story. In Fusfeld's "The Conceptual Framework of Modern Economics" he discusses the use of pattern models, drawing an analogy with a jigsaw puzzle (1980). In each case study, pieces are

⁴⁰ Samples of surveys for processors and fishermen for each fishery can be found in Appendix A.

collected and fitted together to form a picture of the fishery. These pictures are then pieces of a larger puzzle that show a picture of commercial marine fishing (within some limits). As Fusfeld points out, “there is a logical relationship between the parts and the formation of the whole” (p. 29). That is to say, pieces of the puzzle are not merely pretty pictures that tell a nice story. They have logical connections that, when joined, show the realities of how the fishery works, and ideally, causal relationships that lead to answering the research question.

The logical connections in a pattern model are not the same linear connections found or assumed in a formal model. In a formal model, one moves from cause A to effect B. This linear movement is by logical steps, premise to conclusion. Pattern models do not work in this linear fashion. Instead, the pattern model “moves by logical analysis from one element to another, backwards, sideways, up and down, until a general pattern or framework is brought together by logical connections” (Fusfeld 1980, p. 29). In this way, pattern modeling can be a useful complement to statistical analysis and is often used as such.

Unlike statistical analysis, however, the objective of the case study analysis is not formal hypothesis testing, but rather a description of the patterns of causation within the industry. Ideally this builds a basis upon which predictions can be made. Being able to make predictions about the behavior of a fishery then allows you to make policy recommendations.

There is a drawback in that the pattern model is always an open model. You cannot make perfectly accurate predictions about one fishery after analyzing a different one. There is always another “relevant variable or relationship” that can add to understanding the fishery (Fusfeld, p. 33). And the two fisheries will never be the same fishery no matter how slight the differences. But, the interweaving nature of the case study allows for analyzing feedback and other relationships that a formal model would otherwise omit.

The actual physical process of analyzing the case studies starts with basic information gathering. What does market data (landings, prices) tell us? Talking to the fisheries community follows this. Part of this is asking why. Why did you or would you sell your vessel to a processor; buy out a harvester? What motivates anyone to contract, and for how long? Do the reasons suggested by theory hold true? The key is to be able to work out the cause and effect relationship. In some cases the answer will be easy, “I could make the same or more money by leasing my quota than I could if I had fished it myself.” In other cases the answer will not be so simple.

To determine the cause and effect relationship at the level of the fishery, it is the accumulation of the individual cases that leads to results. Here it will be rare for one single factor to be the cause of action. Rather, the industrial structure of a fishery will change because of the interaction of different factors. Sometimes this interaction will be sequential and sometimes it will be concurrent.

CHAPTER 4. CASE STUDIES

Introduction

The following chapter presents the results of the three case studies. They are presented in the order that each fishery was converted to its system of private property rights: wreckfish, halibut and sablefish, and finally pacific halibut. Each case study presents a brief overview of the fishery's biology and existence as a commercially targeted species. That is followed by a discussion of the fishery both before and after the implementation of private property rights. The next section of each case study is, of course, a discussion of how the implementation of the new management regime has effected vertical coordination. And for those fisheries for which it is appropriate, there is a discussion of each variable that theory says will effect vertical coordination. The final section is a conclusion.

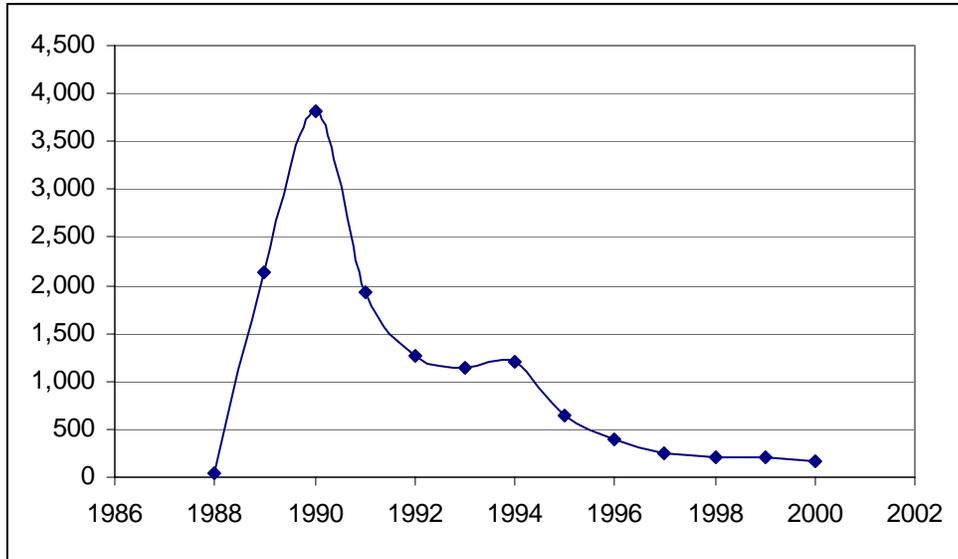
A fifth part, wherein each hypothesis is addressed, follows the case studies. From here any general rules or relationships that hold for commercial fisheries in general are presented.

4.A. South Atlantic Wreckfish

Overview/History of the Fishery

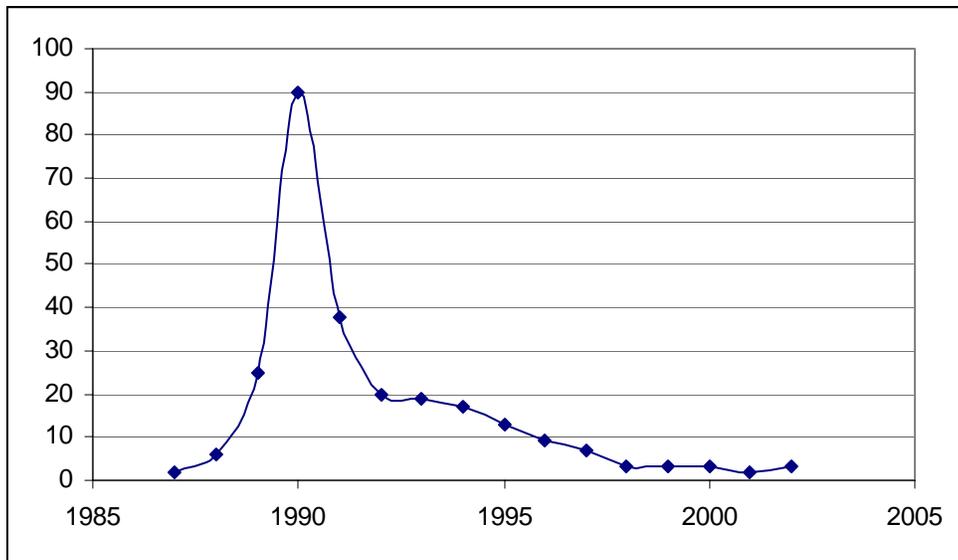
The wreckfish (*Polyprion americanus*; marketed in the United States as sea bass or red snapper) is a grouper species that occurs worldwide with fisheries on both sides of the Atlantic Ocean, as well as in the South Pacific. In the United States, the species is fished off the southeast coast in the Gulf Stream. Wreckfish grow to on average 47 kilograms and 2 meters in length, and have a life span as long as 30 years. Like other grouper species, wreckfish are sold to a niche market and are a substitute for snapper.

The fishery was first targeted in 1987; many years after most U.S. fisheries were first exploited. It was originally targeted as a substitute source of revenue for fishermen that had been targeting shrimp and other grouper and snapper species (Gauvin et al (1994), Brod and Shobe, (1996)). Wreckfish are harvested by catcher-vessels using a technique called “motor fishing” which is much like a vertical form of long lining (Gauvin et al, 1994). As shown in Figures 4-1 and 4-2, at the largest, the fishery was comprised of less than 40 vessels landing approximately 4 million pounds of wreckfish, while lately that has dropped to only a handful of vessels landing just over 100,000 pounds.



(source: NMFS)

Figure 4-1 Landings of Wreckfish (thousands of pounds)



(source: NMFS)

Figure 4-2 Vessels Landing Wreckfish

As is noted in the previous chapter, there has been limited research regarding this fishery. Gauvin et al (1994) and Brod and Shobe (1996) are the only two available research papers concerning the economics of this fishery, and neither analyzes the vertical structure of the fishery. The lack of research is probably due to the near non-existence of the fishery.

The South Atlantic Fisheries Management Council (SAFMC) manages the wreckfish fishery through an ITQ program. This program was the second ITQ program instituted in the United States. The wreckfish program itself is very simple. In this program, all participants own quota shares (QS) that specify what percentage of the yearly total allowable catch (TAC) the holder is due. When the TAC is determined for the season, coupons are distributed to each QS holder. Coupons come in two denominations, 100 pounds and 500 pounds. Upon landing his catch, a fisherman must hand over coupons equal to the amount of the catch. Shares are freely transferable, in whole or in part, while coupons may only be traded amongst QS holders.

The Fishery Prior to Quota Management

Prior to institution of the ITQ program in 1992, there were typical restrictions on fishing effort that are seen in most common property fisheries. Due to rapid growth in the fishery there was almost immediate concern over the health of the stock, and gear and seasonal restrictions were instituted. It was thought that this fishery would be a prime candidate for quota management (Gauvin et al, 1994). John Gauvin, former staff member of the SAFMC says that the fishery had become a classic derby fishery with fishermen “experiencing the adverse effects” of that (LobsterConservation.com). And the SAFMC cites excess capacity as justification for their ITQ proposal (1991). As well, there was little knowledge of the biology of the species since it had never been commercially targeted. The one thing that was known of the biology of the fish is that they are long-lived, meaning that they take many years to mature and grow and are therefore more prone to extinction from over fishing. There also were not very many actual participants in the fishery (relative to some other fisheries which numbered in the thousands), the fishery targeted just this particular species, and recreational fishermen did not target the

species (Iudicello et al, 1999). Thus, the wreckfish appeared ideal for quota management.

Although there were differences of opinion over the method used to determine initial allocations of quota shares, the SAFMC instituted the ITQ program in 1992 with the support of fishermen (Gauvin et al, 1994). According to Samuel Ray, a fisherman in this fishery, “the fishermen pushed for the process 100%” (LobsterConservation.com). When the quota program was started, the derby fishery ended.

The Fishery Since Quota Management

As shown in Figures 4-1 and 4-2, wreckfish landings and participation by fishermen have decreased dramatically since their peaks in 1990. Why fishermen stopped targeting wreckfish is not known for certain, but one very likely explanation put forward by Glen Ulrich, from the South Carolina Department of Natural Resources, is that fishermen simply found that targeting this species was far too expensive for the return (2001). Because the fishing grounds are far off-shore, fishermen have simply chosen to not target wreckfish, opting instead for shrimp, rockfish, and other species that they targeted in the past. As Ray states, “wreckfishing is very difficult; you are working in the middle of the Gulf Stream, the gear is expensive, and it just isn’t a fishery for everyone” (LobsterConservation.com).

Uncertainty over the biology of the species may also have played (and continue to play) a part in the decline of the fishery. As Sedberry et al state (1999) “mechanisms for maintaining gene flow and the patterns of recruitment are poorly understood” (p. 29). The wreckfish caught off the southeast coast of the U.S. are primarily adults. Juveniles are rarely caught in the U.S. and it is thought that the stock of wreckfish in the U.S. is recruited from the North Atlantic, off the coast of Portugal and the Azores (Sedberry et al, 1996). Because of this, the stock of U.S. fish may very well be affected by fishing in

other these other regions. For instance, pelagic⁴¹ juvenile wreckfish are frequently caught as by-catch in the nets of French tuna fishermen operating in the Bay of Biscay. Therefore, the U.S. stock of wreckfish may be greatly affected by foreign fishers. With this uncertainty regarding the biology of the species, biological stock estimates and, hence, the annual TAC, may be set too high, based on the false premise that foreign fisheries are well controlled and juveniles that would be recruited to the U.S. fishery are not being over-fished.

Since the introduction of ITQs in this fishery, the fishery decreased in size. The SAFMC estimated that if the size of the fishery were actually determined under a private property rights regime (rather than under a common property) the fishery would accommodate approximately 20 vessels (Gauvin et al, 1994). Given that there were 91 vessels fishing wreckfish in its last year of being a common property resources, one would have expected to see consolidation. According to Janet Miller of the NMFS, Southeast Regional Office (SERO), in 2002 there were only 25 QS holders. Of these 25 QS holders, she stated only 8 were potentially active in the fishery and only 3 vessels actually landed wreckfish.

Vertical Coordination in the Fishery

There is a question of what happens to the quota that is allocated for this fishery. Transfer data from NMFS show that most of it stays in the hands of the initial recipients, but is simply not fished. Because only a few hundred thousand pounds of the quota are used each year, over a million pounds of quota went unused. Prices for quota shares ranged from approximately \$9,000 to \$11,000 per 1% share in the first two years of the program (Brod and Shobe, 1996). Given that few allocation holders use their quota now, yet none sell either, if anyone is looking to buy wreckfish ITQ they would not need to look far.

⁴¹ Pelagic is the term used for fish that live in the open seas rather than in water adjacent to land. In this case, wreckfish have a pelagic juvenile stage, while the adults are demersal (living near the bottom of the ocean).

In the 11 years that the fishery has been under ITQ management, only half of those years saw any trading of quota shares at all, 1992 to 1995 and 1998. The trading during the first years of the program is the consolidation mentioned above. In fact, in 1992 approximately 27 percent of the available quota was transferred. In the next year that increased to about 30 percent and then it dropped off significantly in the following years. Less than one percent of the available quota was transferred in 1994, and 1995 saw about 3 percent being traded. The trading that did occur in 1998 (about 22% of the total shares) was due mostly to one transfer within a family. This transfer was for 13 percent of the total quota shares. By far the majority of all of the trades over the years were between individuals.

However, there are three exceptions that seem noteworthy. In all three cases a corporation bought into the fishery, having not been an original holder of wreckfish quota shares. However, no other information is available about these corporations. They may be nothing more than a legally incorporated fishing business (rather than a processor). Only one of the three even has a current listing in the phone book. The phone interview with this firm, a processor as it turns out, was fruitless, as no one currently working there had any recollection of why the firm would have purchased wreckfish quota shares in 1993. In fact, the only information that was gleaned from the short conversation was that this processor no longer deals with wreckfish and has not for many years even though it owns approximately ten percent of the quota shares (Anonymous, 2003a). This offers no insight into why a processor in the wreckfish fishery would have bought quota.

However, why a fisherman would sell his quota can be answered, in part, by considering that Brod and Shobe state explicitly that “this increase in fishing effort can be traced directly to a six-month closure of the near-shore shrimp fishery due to cold weather in December of 1989” (1996, p. 3). And as Gauvin et al remark, because many of the fishermen holding wreckfish quota are also licensed to catch snapper, grouper and shrimp, when those species have high ex-vessel prices, the opportunity cost of fishing for wreckfish is higher (1994). Because many fishermen got involved in the wreckfish fishery due to slumps in these other markets, it is likely that they sold their quota shares

and returned to their original fisheries. The general opinion in the fishery was that the method of allocation led to highliners receiving shares equal to less than what they were historically catching. Therefore it appears that transfers were taking place as high-cost fishermen were selling to low-cost fishermen.

It was difficult to verify the reasons for selling quota for several reasons. First, few people involved as a buyer or seller of wreckfish QS had current listings in the phone book and the listing that NMFS has in their database of transfers lists only a street address. The second problem is that the majority of the trades of QS were made a decade or longer ago. The nearest to completing an interview were two telephone conversations. One was with a former fisherman who sold his allocation of quota in 1992 and 1993. He clearly did not want to talk and would only say that he “left the fishery because [he] got too damn old” (Anonymous, 2003c). The second telephone conversation was with the wife of a former wreckfish quota holder who said that she thinks he sold his shares of quota because they were “not enough to make fishing worthwhile” (Anonymous, 2003b).⁴² Repeated attempts to talk with the fisherman himself were fruitless.

All other transfers of quota were either address changes or made by fishermen who were no longer listed in the phone directory. Because of this, phone interviews were limited to just these few instances.

Fishermen who target wreckfish also target other species in the area and have long standing relationships with the local processors. Because of these long-term relationships, there is no formal contracting or vertical coordination in this fishery. For the few fishermen still targeting wreckfish, their relationships with their processors have not changed. This is undoubtedly due to wreckfish being such a small share of their annual operations. And the quota recipients who choose to not fish their quota simply hold their quota and let it go unused rather than sell it to the processors (or anyone else for that matter).

⁴² This answer is not truly satisfying, though, since if a fisherman did want to purchase quota shares in this fishery, there are plenty of holders of quota who do not use them and presumably would be willing to sell.

Finally, because the wreckfish is a substitute for grouper (and other grouper substitutes) but is much smaller in size (only one-tenth the annual production of grouper), the potential for market foreclosure from purchasing QS is small. Unless a processor can control the quota for all of the other grouper and grouper substitute fisheries, which are not managed under quota programs, market foreclosure is not an issue.

Conclusion

It appears that the degree of vertical coordination in wreckfish has not changed since the implementation of the ITQ program. However, what role transaction costs and market foreclosure play in the wreckfish fishery is not clear.

Quality Uncertainty

The first three hypotheses presented in Chapter 2 all concern quality uncertainty. Wreckfish is processed both fresh and frozen, so quality can be an issue (NMFS SERO, 2003). Fishermen in this fishery have had long standing informal relationships with processors and when they started to harvest wreckfish, this type of vertical coordination did not change. Beyond this, however, there is not enough information available to evaluate the hypotheses.

Supply Uncertainty

With landings steadily increasing over the first few years wreckfish was targeted, it is hard to imagine that there was any uncertainty over the availability of supply. Neither processors nor fishermen seem to be dependent on this fishery, as most have left it and resumed their activities in other fisheries. Lack of activity, therefore, makes it impossible to determine how much supply uncertainty would lead to vertical coordination in this fishery.

Lack of dependence on any one particular fishery does offer a potential signal of a fishery that can be managed through the use of ITQs and not suffer from increased vertical coordination.

Asset Specificity

In this fishery, capital malleability appears to play a key role in determining the degree of vertical coordination. Fishermen can move easily between fisheries, with little or no issue of capital malleability. They are not financially dependent upon the wreckfish fishery for their livelihood and there are no legal barriers to overcome. They may have little objection to leave the fishery and simply sell their quota to the highest bidder. Hypothesis (v) states that, *ceteris paribus*, in fisheries that require nonmalleable capital (either harvesting or processing) there is more likely to be vertical integration. In this fishery, capital has a use in other fisheries. Since fishermen can move so easily between fisheries, they do not have an incentive to tie themselves to any one processor. This supports hypothesis (vi) which states that fisheries where there are significant barriers to entry into alternatives are more likely to be vertically coordinated. In this fishery, access to alternative fisheries is simple and vertical ties are limited to informal contracts.

Search Costs

This informal contracting also mitigates any problem of search costs. The wreckfish fishery is different from its substitutes in this regard. Since wreckfish is targeted so far from shore search costs could play a larger role. Home ports for the vessels, and hence the location of processors, are widely dispersed. They stretch(ed) from southern Florida to the middle of North Carolina, meaning they are not truly substitutes. A fisherman whose homeport is in southern Florida would certainly not deliver to a processor in North Carolina even if he was aware of a wreckfish processor there. The informal contracting that takes place in this and its related fisheries assures that one need not do that, and hypothesis (viii) is supported to some degree.

Wreckfish and the other snapper/grouper species are delivered and processed both fresh and frozen. Thus it is hard to draw any conclusion regarding hypothesis (vii).

Property Rights

Finally, changing the property rights structure in this fishery reduced over-capitalization but had no effect on vertical coordination. It would appear that at most what instituting this ITQ program did was offer fisherman an asset that they could sell when moving out of the fishery. Leaving the fishery didn't necessarily have anything to do with the ITQ program itself. Even though the wife of one fisherman claims he left the fishery because his allocation of QS was not large enough, since virtually no one is fishing their wreckfish quota, if it was in his best interest to continue targeting wreckfish, he undoubtedly could find someone from whom to buy more quota. Since there are many close substitutes for both fishermen and processors, yet there was no resulting increase in vertical coordination following the institution of the ITQ program, hypothesis (X) appears valid. Because of this exodus from the fishery and an inability to contact past or current wreckfish fishermen or processors, it is not possible to determine if there was any redistribution of rent after the ITQ program. However, because a shift in rent distribution seems to come from the creation of excess capacity in the processing sector and there are many, more plentiful, substitutes for wreckfish, it does not seem likely that there was any change in the distribution of rent.

Market Foreclosure

The other type of substitutability in this fishery is the substitutability between wreckfish and grouper and snapper species as a final product. Because they are substitutes there is no incentive for any one firm to try to gain market control in the wreckfish fishery. Supposing a processor does come to own all of the wreckfish QS, other processors can simply look to the (much larger) grouper and snapper fisheries for their inputs. Therefore, even if fishermen leave the wreckfish fishery for alternative fisheries and simply sell to their quota to the highest bidder, there is no necessary reason for processors to attempt to obtain all of the quota shares for wreckfish.

4.B. Pacific Halibut and Sablefish

Overview/History of the Fishery⁴³

Halibut (*Hippoglossus stenolepis*) is found along the continental shelf of the North Pacific Ocean from Santa Barbara, California to Nome, Alaska and in Asia from the Gulf of Anadyr to Hokkaido, Japan (IPHC, 1978). The largest concentrations, however, are found in the United States in the Gulf of Alaska (Best, 1981). Sablefish (*Anoplopoma fimbria*), also popularly known as black cod, are likewise found along the Mexican and United States coasts of the Pacific Ocean stretching all the way to the northeastern coast of Japan (Low et al, 1976). Also like halibut, sablefish are most abundant in the Gulf of Alaska.

Halibut grow quite large (upwards of 5 feet long and well over 100 pounds) and are targeted with hook-and-line longline gear. Sablefish on the other hand are about half this size and are targeted by trawl and fixed gear (pots). Landings of halibut peaked around the mid to late 80s at 80-85 million pounds, with recent years' landings being around 70 million pounds. Sablefish landings also peaked in the late 1980s at just over 100 million pounds, with recent years' landings just less than 50 million pounds. There are approximately 3800 unique quota share holders currently in this fishery, not all of whom actually land catch every year. Prior to IFQ implementation there were over 4500 vessels actually landing halibut and/or sablefish.

As with the other case studies, the next section will discuss the fishery prior to the implementation of its private property rights regime, in this case a system of individual fishing quota (IFQ), which will be followed by a section describing the changes in the fishery since implementation. The fourth section will discuss vertical coordination in the

⁴³ While halibut and sablefish are different species, they are managed under the same program. Licensing, determination of yearly TAC limits and other such management issues are dealt with separately for each species, of course, but general discussion in the literature is focused on the halibut fishery. In the following sections, at times a distinction will be drawn between the two species, while at other times the entire two-species fishery will be referred to as just the halibut fishery. The context will make this obvious.

fishery and what affect the IFQ program has had on that. Finally, the last section will have a short conclusion of this case study.

The Fishery Prior to Quota Management

The halibut and sablefish fisheries have very different histories prior to passage of the Magnuson-Stevens act in 1976 that declared a 200-mile exclusive economic zone off the U.S. coast. The U.S. and Canada have jointly managed the halibut fishery, through the International Pacific Halibut Commission (IPHC), since 1923. It was recognized early on that the halibut fishery was in danger of over-fishing, and the commission was created to head-off this problem. Primarily Japanese boats, on the other hand, targeted sablefish, with little participation by the U.S. fishing fleet. After the passage of Magnuson-Stevens Fisheries Conservation and Management Act in 1976 this started to change, and by the mid-1980s the fishery had come completely under the control of U.S. vessels.

Since the passage of Magnuson-Stevens the two fisheries have had similar experiences. In both cases fishing was restricted through the use of seasonal limitations, gear restrictions, and a yearly total allowable catch (TAC). This led to the fisheries becoming classic derby fisheries. In the halibut fishery this resulted in the fishing season being restricted to only 2 or 3 24-hour periods per year, and in the sablefish fishery, it was evidenced by a ten-fold increase in the number of vessels from the 1980s to the early 1990s. Clearly, there was a strong impression of over-capitalization.

Other problems in the fishery included safety, the economic stability of local communities, allocation conflicts, and gear conflicts (see Ocean Studies Board, 1999 and Love et al, 1995). More specifically, the Ocean Studies Board states that from 1977 to 1994 halibut catch in the central Gulf of Alaska tripled, while allowed fishing days dropped from 47 to just two or three. The West Yakutat sablefish fishery saw similar problems. From 1984 to 1994 the number of vessels increased from approximately 50 to nearly 200, prompting the NMFS to restrict allowed fishing days from more than 200 per year to just a few per year. As more evidence of the problem in this fishery, the IPHC estimated that in 1990 around 900 metric tons (approximately 3% of the commercial

catch) of halibut died due to lost gear. Gear is lost when fishing grounds become too crowded and when fishermen are too rushed.

The Canadian fishery faced similar problems, to the point where they instituted an individual vessel quota system for their fishery in 1991, four years before the U.S. program took effect.

The Fishery Since Quota Management

As is mentioned above, the halibut and sablefish IFQ program is slightly different from the ITQ programs discussed in the previous two sections. It is similar in that each harvester must hold quota shares (QS) that define their share of the yearly TAC. Based on a fisherman's QS allocation and the yearly TAC, the fisherman is allocated a certain number of allowances or coupons (the IFQ) that specify how many pounds of fish may be harvested.

There are two significant differences between the IFQ and ITQ programs. First, there are restrictions on the transferability of both QS and IFQ lbs. Halibut QS is divided into four different categories, A for catcher-processor vessels (CPs), B for catcher-vessels (CVs) less than 35' length overall (loa), C for CVs 35-60' loa, and D for vessels over 60' loa. In the sablefish program the division is the same except that there is no A category. Transfers are restricted by not allowing vessels in the C or D classes to buy QS from a smaller class-size vessel and A QS and IFQ pounds may only be traded within the A class. However, a B-class boat can purchase QS from a larger class-size. There is also a cap on how much QS any one individual or entity can hold, with the maximum for any species and fishing ground being one percent. There is also a maximum allowable amount of fishing that any one vessel can do in a year.

The second significant difference is that there is an owner-operator requirement for QS once it has been traded. The initial owner of QS need not be on the vessel using fishing the quota, but once the quota is traded any new owner must either captain the

vessel or be part of the crew. This is obviously different from the wreckfish fishery where it is possible to have an absentee quota owner that rents it to a fisherman for a fee.

After the implementation of the IFQ program some immediate effects were seen. One of the more drastic effects was the decline in the number of vessels active in the fisheries. In the halibut fishery, participation dropped from 3,450 vessels in 1994, the year prior to IFQ implementation, to 2,057 in the next year. By 1997, that number had dropped further to 1,925. Sablefish saw a similar decline. In 1994 there were 1,139 vessels, while in 1995 there were less than half that many; only 517. There has also been entry into the fishery. National Marine Fisheries Service data shows that 735 new participants joined the halibut and sablefish fisheries accounting for 11 percent of the halibut quota and 5 percent of the sablefish quota (Smith, 1998).

Season length has increased to eight months with four months off for the spawning season. This has led to fishery becoming primarily a fresh-fish market. The significance of this is that it means processors no longer face the large start-up cost of purchasing freezing capacity. Because of this, there has been a significant change in the processing sector, with both entry and exit. Lower entry costs has allowed brokers/reprocessors to enter the market, where they would not have been able to operate before. These brokers have “significant vertical linkages” with harvesters but these tend to be limited to agreements to deliver a certain amount of halibut to a certain dock on a given date. Price is agreed upon at delivery. Some harvesters have also expanded their operations to become processors, choosing to do some minimal processing on board and selling the catch at dockside (Matulich, 2002; Matulich, 2003).

Exit has been by processing firms that found it unprofitable to compete in this new market. Prior to IFQ management, the processing sector had invested in enough freezing capacity to handle 50 million pounds of halibut being delivered in 2 24-hour periods each year. Post-IFQ, with the season expanded to 240 days per year, most of that freezing capacity is excess to demand. During the 1992-1993 season there were 104 processors.

By 1999-2000 that number had decreased to 83. This change was actually comprised of exit by 83 processors and entry of 52 new processors (Matulich, 2002).

Vertical Coordination in the Fishery

Because the regulations governing transfer of quota in this fishery are so restrictive, the case study will be short. The following sections cover the general topics of out-right vertical integration, contracting, and auctions.

Vertical Integration

In this fishery, there is very limited opportunity for processors to purchase quota shares from fishermen. To determine how much quota has been sold to processors is difficult because there are many different classifications of potential buyers; and the potential buyers themselves chose these classifications when they applied for their license to purchase quota. They include Catcher-Processor (CP), Broker, Catcher-Seller (CS), Mothership (MS), Retail, Restaurant, Shoreplant, Tender and Other. While the classifications may seem self-explanatory, some elucidation is in order.

While one might normally think of a CP vessel as a vessel from which fish is caught and then processed and packaged on board (as is seen in the pollock fishery), in this fishery, if any processing at all is done on-board the vessel is classified as a CP. This includes something as common as head-and-gut processing. A Broker is a broker in quota, not fish. Catcher-Seller refers to those fishermen who sell their catch at the dockside to passers-by or at a market. They are typically small-scale fishermen. An MS is a vessel that does not harvest any of its on catch, but that takes catch from other vessels and then processes that catch on board. Retail is the classification for a retail store (as opposed to CS). Restaurant is surely self-explanatory, as is Shoreplant. A Tender is someone who unloads a CV (and pays for the catch) and then turns around and sells the catch to a shoreplant or some other buyer. Finally, the “other” classification is for anyone that feels they do not fit in any of these categories.

Because each of these "types" is legally able to buy quota, it was necessary to examine all sales/trades of quota since the inception of the program. Data was acquired from the Restricted Access Management (RAM) division of the NMFS Juneau office, which administers the program. These data were sorted by the type of buyer involved in each transaction. Since the point of this research is to evaluate the perceived problem of fishermen losing their independence to processors, it is necessary to evaluate each trade to see exactly what sort of buyer is involved in the trade.

It quickly became apparent that it was necessary to eliminate some trades from the data set. Because of the rather confusing classifications of registered buyers, two different data sets were created from the overall set of trades.

The first data set used a very broad definition of which buyers were processors. Any registered buyer listed as a CP, Shoreplant or Mothership for any year, no matter if other classifications were also chosen was identified as a processor. This likely represents an upper bound on the quota sales from fishermen to processors. Conversely, an alternative definition was used that classified a buyer as a processor only if the chosen definitions were CP, Mothership, or Shoreplant for all years in the data. Using this more conservative definition will likely yield a lower bound on the quota sales from fishermen to processors.

The resulting total QS traded and IFQ pounds traded are presented for every year starting in 1995 through 2001 in Tables 4-1 and 4-2. As is indicated, Table 4-1 shows data for halibut and 4-2 shows sablefish. The data are presented in columns defined by the upper bound and lower bound definitions of processor and the total amount traded in each year. In cases where the amount traded was positive, percentages of total are given in parentheses below.⁴⁴

⁴⁴ When there is a negative quantity of IFQ pounds traded, this means that someone has exceeded their yearly limit, but then sold their quota share. Because that overage must be accounted for, it is also transferred to the buyer and recorded as a negative amount of IFQ pounds traded.

Table 4-1 Trades of Halibut QS and IFQ Pounds From Fishermen to Processors

Year	Upper Bound		Lower Bound		Total Trades	
	QS (% of total)	IFQ	QS	IFQ	QS	IFQ
1995	1,102,322 (2.13%)	111,593 (2.23%)	778,712 (1.51%)	77,644 (1.55%)	51,631,624	5,005,620
1996	1,264,441 (2.49%)	115,580 (2.87%)	85,651 (0.17%)	3,582 (0.09%)	50,682,406	4,030,836
1997	643,238 (1.55%)	85,759 (1.70%)	399,164 (0.96%)	53,999 (1.07%)	41,577,898	5,030,977
1998	259,579 (1.13%)	39,669 (1.33%)	16,717 (0.07%)	2,947 (0.10%)	22,983,011	2,976,116
1999	434,101 (1.26%)	44,141 (1.01%)	103,681 (0.3%)	16,005 (0.37%)	34,378,552	4,369,592
2000	797,313 (2.94%)	40,052 (0.89%)	165,246 (0.61%)	0	27,101,269	4,490,090
2001	1,069,905 (3.73%)	132,773 (2.75%)	0	0	28,653,314	4,822,804

(source: NMFS)

Table 4-2 Trades of Sablefish QS and IFQ Pounds From Fishermen to Processors

Year	Upper Bound		Lower Bound		Total Trades	
	QS (% of total)	IFQ	QS	IFQ	QS	IFQ
1995	334,547 (0.85%)	60,003 (1.25%)	40,358 (0.10%)	5,704 (0.12%)	39,194,573	4,807,396
1996	626,114 (1.67%)	72,106 (2.24%)	357,780 (0.95%)	39,999 (1.24%)	37,527,645	3,225,432
1997	382,628 (0.86%)	16,392 (0.59%)	0 (0%)	0 (%)	44,434,119	2,781,767
1998	1,281,713 (4.21%)	100,398 (4.69%)	1,246,870 (4.09%)	96,610 (4.52%)	30,454,665	2,187,016
1999	0 (%)	0 (%)	0 (0%)	0 (0%)	40,360,312	2,825,882
2000	567,131 (2.85%)	47,652 (1.65%)	0 (0%)	0 (0%)	19,922,300	2,880,800
2001	424,855 (1.58%)	-131 (n/a)	0 (0%)	0 (0%)	26,938,962	2,746,492

(source: NMFS)

Table 4-1 shows that in the halibut fishery, between 1.5% and 4% of the QS was vertically integrated in any year. For IFQ pounds the percentages are even smaller. In the sablefish market, the trend was much the same with a maximum 4.2% of QS and a maximum of 4.7% of IFQ pounds being integrated.

What is interesting about this is that as processors consolidate QS and IFQ on their vessels they must eventually stop buying. Once those vessels already grandfathered into the program can no longer accommodate any more harvesting responsibility, the processor has no more incentive to buy QS or IFQ. The owner-operator clause of the program guarantees this. Even if the processor were to buy a new vessel, that new vessel

would not have been grandfathered into the program. Since holders of second-generation quota must be onboard the fishing vessel, there is no legal way to use the new boat's capacity. One way to view this is to think of it as a default cap on the level of vertical integration possible in the fishery.

Related to this is that one feature of the original regulation, the restriction on transfers between size classes, was changed in 1998 such that consolidation on smaller vessels is allowed. A smaller vessel fishing quota designated for a larger one is referred to as fishing down. This change came at the behest of harvesters. They asked, since the intent of the program is to maintain the small-scale characteristic of the fishery, why not let smaller vessels buy QS and IFQ from larger vessels? In terms of maintaining a small-scale fishing fleet, two advantages come from allowing fishing down but not allowing the opposite. The first is that not only will the smaller vessels remain, but this also allows for more small vessels to enter the fishery. Because processors tend to own larger vessels—so that quota can be consolidated on one vessel rather than being spread out over many smaller vessels—the transfer restrictions specifically encourages smaller-scale fishing.

Contracting

Conclusions regarding contracting stem from the overwhelming evidence that under the US IFQ and Canadian IVQ programs bargaining power has shifted from the processing sector to the harvesting sector. It is important to remember the enormous changes in the fishery pre- and post-IFQ in order to understand this shift in power. Prior to quota management the halibut fishery was a classic derby-style fishery with harvesters racing to catch fish within only 2 or 3 twenty-four hour periods. The fleet was so large and so effective at catching fish this was all the longer it took to harvest the entire year's allowable catch.

Since quota management began, however, the season has stretched to eight months (four months are set aside for spawning). And as the primary product shifted from frozen

to fresh halibut, wholesale prices rose 66%.⁴⁵ Prior to the IFQ program approximately 17 percent of halibut was processed fresh while post-IFQ that number has jumped to 59 percent. [Sablefish, however, is still processed frozen and shipped to Asia.] According to Matulich, even given the increase in the value of halibut, 100% of the benefit went to harvesters.⁴⁶ That fishermen benefit from this, rather than processors, shows that bargaining power must have shifted. And proof that this leads to greater bargaining power for the fishermen comes straight from the mouths of the processors.

In 2002 Congressional testimony Ralph Hoard of Icicle Seafoods, stated that while Icicle was in favor of rationalization of fisheries, they do have complaints about how the halibut program was structured. These complaints are related to their large investment in freezing capacity made in the late 1970s when the derby fishery developed. As the season grew shorter and shorter, additional freezer capacity was needed. As Hoard says, oftentimes there would be “3 to 4 million pounds of halibut waiting to be delivered” at once.

This same end was realized in the sablefish fishery when it became a US-only fishery. Concerned that the US processing sector could not handle the entire catch, in 1984, the NPFMC decided that the US harvesting and processing sectors had until September to catch and process the entire year’s TAC, or the remainder would revert to the foreign fleet of CVs, CPs and MSs. This led to massive investment in processing capacity by Icicle and others. No matter the path taken, however, the result is the same. With rationalization, Hoard says, “The quality of fish being delivered is far superior to the pre-IFQ fishery. The added value of the catch in the market is a lot higher. Unfortunately, *100% of that value has gone to the harvesting sector*” (emphasis added). He continues, “Our profit margin on halibut and sablefish during the first 6 years of the IFQ program is \$20,000,000 less than it was the 6 years previous to the program.”

⁴⁵ According to Matulich (2002, pp. 37-39) the “average wholesale price for traditional processed halibut” in 1992-1993 was \$1.82/lbs. Of this, \$1.11/lb was due to ex-vessel cost. In 1999-2000 this increased to \$3.01/lb, and \$2.29/lb being ex-vessel cost. For custom processing in 2000, average wholesale price was \$3.07/lb. and \$2.23/lb was ex-vessel cost.

⁴⁶ Matulich surveyed more than half of the halibut and sablefish processors to obtain cost data. This was augmented by confidential data from the Alaska Department of Fish and Game.

Supporting this is Knapp's 1997 "Initial Effects of the Alaska Halibut IFQ Program: Survey Comments of Alaskan Fishermen." This survey of 300 fishermen elicited the following comments (among others) regarding prices in the market: "Better quality product—better price;" "Price is usually higher. The halibut derby flooded the market and quality was down. We can now compete with Canadians for fresh fish market throughout season;" and, "Seems to be more competitive among buyers for product— translates into higher price for product" (p. 247). This last comment is particularly telling. Now that the larger market for fresh halibut can be exploited, processors must compete more intensely among themselves. This leads to more bargaining power for the harvesters and thus higher prices.

Fifty-two new processors or broker/reprocessors entered the halibut market after the implementation of the IFQ program. Matulich (2003) describes these broker/reprocessor as being "analogous to an auctioneer...maximiz[ing] revenue to the quota holder by leveraging excess capacity among processors, given wholesale demand at any particular point in time." While brokers do have vertical ties to harvesters, they are limited to specifying quantity, date of delivery, and location of delivery. Regarding other entry into the processing sector, actual entry by primary processors was minimal and some of the entry of new processors was actually harvesters becoming processors themselves (Matulich, 2003).

The British Columbia halibut fishery has seen the same result since the 1991 introduction of individual vessel quota (IVQ) management.⁴⁷ Casey et al (1995) report that in the BC fishery ex-vessel prices have increased. The authors explicitly point out that in the BC fishery there has been entry by smaller, more specialized, processors. Because there is no longer the need for massive freezing capacity, entry costs are much lower. This entry into the processing sector has brought on more competition for the input. This is interesting to contrast with Love et al's (1995) pre-IFQ result that "season

⁴⁷ The Canadian halibut IVQ program runs much like the US IFQ program. The difference is that quota are actually associated with a particular vessel, restricting transfer to a great degree.

duration and processor market power exertion at the vessel level is evident” in the Pacific halibut fishery (p. 250). This led to rent being captured by the processing sector during derby-style fishing. Since the rationalization of these fisheries, however, that distribution of rent has shifted to the harvesting sector.

Whether or not there has been a change in the level of vertical coordination can be answered in two parts. Prior to IFQ management, harvesters and processors necessarily had some vertical ties. Due to the enormous quantity of fish being delivered in a short period of time, processors required a delivery schedule that allowed the plant to be run at peak efficiency. Matulich states that even though it was possible for a harvester to deliver to a different processor, “capacity restrictions tended to result in the formation of “traditional” delivery patterns” (2003). Since IFQ management, however, harvesters are freer to move amongst processors due to the excess demand for fish. Therefore, vertical ties have weakened. The second indicator of a change in vertical coordination is the emergence of the new Auction Block service.

Auctions

One further development in the processing sector that deserves discussion is the development of a new auction system for fresh halibut. The Auction Block, as it is called, was developed after the institution of the IFQ system. It takes advantage of the combination of fresh product and the ports along the Alaskan road system. A fee is charged for the auction service and, if harvesters desire, boats can be off-loaded, the harvest packed on ice, and trucks loaded for a further fee.

An auction is, of course, the antithesis of vertical coordination. While the Auction Block is not extensive since few ports are actually located along the road system, one result of the IFQ program has been the development of an institution where there are no vertical ties.

Conclusion

The Pacific halibut and sablefish fishery management program illustrates a property rights management regime that is specifically designed to allow very little vertical integration or horizontal consolidation by any one owner. It is a prime example of how one might want to design a program if they are concerned that vertical integration will increase under quota management and they want to avoid that.

The chief tool used to avoid vertical integration is the owner-operator requirement imbedded in second-generation quota shares and the inability to transfer QS and IFQ pounds from smaller vessels to larger vessels. This begs the question of what would have happened in this fishery if, instead of IFQ management, freely transferable ITQs were used. Since bargaining power and rent have shifted to the harvesters, and processors had invested heavily in processing and freezing capacity, one can certainly hypothesize that if they were able to purchase more quota they would do so. Like Koss's description of the BC fisheries and Gallick's description of the tuna fishery, the desire to vertically integrate seems to hinge most heavily on the problem of asset specificity.

Quality Uncertainty

Quality seems to be less of a concern, as the halibut fishery has become primarily a fresh fish market. Overall quality is higher and this is reflected in higher ex-vessel prices and higher retail prices. Sablefish, on the other hand, has remained a frozen product. Hypothesis (i) suggests that a fresh fishery would exhibit more vertical coordination than a frozen one. Since some fishermen have become "processors themselves" one could argue that vertical integration has increased. On the other hand, the development of the Auction Block is a move in the opposite direction. However, neither of these changes were motivated by a concern over quality *per se*. Rather, the change in structure is due to the change in the form of the final product.

For fishermen who have become processors as well, selling their catch on the dock after some on-board processing, there is no moral hazard issue. The processor and the harvester are one and the same and so the question of moral hazard is moot. The auction

mechanism, on the other hand, provides the incentive for a fisherman to maintain quality. If he does not, then presumably his catch will receive a lower price. If he wishes to earn more profit then he must improve the quality of his delivery.

The conditions discussed in hypothesis (ii), likewise, have seen a change. There is no less concern over processing the fish within a certain time limit, but the entry of new processors has alleviated any potential problem.

In smaller fisheries where participants know one another, reputation can play a role in controlling effort to maintain quality. The halibut and sablefish fishery has many thousands of participants, which according to hypothesis (iii) would lead it to be more vertically coordinated. The size of the fleet has shrunk while the number of processors increased. The Auction Block, as discussed above, does provide one market segment where reputation can have an effect.

Supply Uncertainty

Clearly processors worry that they will have enough input to be able to economically operate the freezing capacity they purchased in the 1970s and 80s. Presumably, processors have two choices of what to do with their excess freezing capacity. One option would be to keep it and use it for some other purpose and the other option is to sell the equipment.

Neither one of these seems to be a viable option for several reasons. First, freezing capacity is a “lumpy” good that cannot be sold off in parts. If the processor needs to retain any part of the freezing capacity (for other fisheries, say) then they must keep all of the freezing capacity. The other explanation is that there is simply no one that wishes to purchase used freezing equipment (or freezing equipment at all). Certainly none of the new entrants into the processing sector have need for this equipment—that is the reason they entered in the first place. And given that the freezing capacity is typically located in Alaska, potential buyers are limited. This puts the processors in the position of having debt to pay, yet seeing their ability to capture rent decline. This does not validate nor

refute hypothesis (iv), but it might provide a guideline for designing future quota programs, as can be seen in the North Pacific Bering Sea/Aleutian Islands crab fishery rationalization plan currently being considered by the NPFMC.

Asset Specificity

Strictly speaking, asset specificity is not an issue in this fishery. Both harvesting and processing capital *can* be used in other fisheries. However, it is the reality of shifting one's vessel from harvesting halibut or sablefish to some other fishery that leads to specificity. Typically, alternative fisheries require licenses that are not available. Hypothesis (vi) states that in a situation like this we should expect to see more vertical coordination. The reality of shifting freezing and processing capacity to another use is discussed above. When the fishing season extended and halibut were processed fresh rather than frozen, much of this processing capacity became excess to demand. This created a specific asset and hypothesis (v) posits that this should lead to more vertical coordination. In both cases, like in the cases of the other hypotheses, it is not possible to test this supposition.

Search Costs

Oddly, as the halibut fishery converted to fresh processing, the desire of fishermen to vertically coordinate undoubtedly decreased as bargaining power shifted to them. This directly contradicts hypothesis (vii). Hypothesis (viii) is difficult to evaluate given the influx of new processors into the market.

Property Rights

When the fishery converted to quota management and fishermen could choose when to fish, the fishing season extended to eight months and processing changed to primarily fresh-fish. The excess capacity this created in the processing sector has led bargaining power to shift to the harvesting sector. It is clear that processors would have preferred a different outcome and it is justifiable to think that if they were able, they would vertically coordinate. However, the program does not allow for that. Hypothesis (ix) states that if rent shifts it is more likely that there will be increased vertical coordination, and this

appears to be true. This restriction on vertical coordination also makes it hard to evaluate hypothesis (x). Halibut has few substitutes while sablefish (black cod) is a substitute for pollock and hake. If not for the restrictive program this would afford the opportunity to compare the effect of this difference on vertical coordination. But since processors are restricted in their purchase of quota, this is not possible.

Market Foreclosure

Market foreclosure is simply not an option in this fishery for two reasons. The first is that the structure of the IFQ program does not allow for that level of consolidation of quota. At most, one individual can hold one percent of any species's quota in any given fishing area. Second, the fishery is too large; no one processor has the capacity to process all of the halibut and sablefish landed annually.

4.C. North Pacific Pollock

Overview/History of The Fishery

The North Pacific walleye pollock (*Theragra chalcogramma*) is a groundfish⁴⁸, harvested in the Gulf of Alaska (GoA) and the Bering Sea/Aleutian Islands (BSAI) areas of the North Pacific Ocean. It is used primarily in the production of surimi, a paste-like product that is used to make a number of different consumer products, such as imitation crab. If not used for surimi, pollock is processed into fillets (i.e. McDonald's Filet O' Fish) or fishmeal. Pollock generally live up to 10 years and are found throughout the water column from the surface down to 500 meters. Pollock is fished primarily by trawl with a minor amount being taken as long line by-catch.⁴⁹ Vessels in the industry include catcher-vessels (CV), catcher/processor (CP) vessels, motherships (MS), and shore-based processing plants.

The North Pacific pollock fishery does not fit the stereotypical image of an owner-operator fishery for several reasons. First, due to the size of this fishery and its distance from shore, even small catcher-vessels cost millions of dollars. The owners of the vessels seldom captain them themselves, preferring to stay on shore running the day-to-day operations of their businesses (Paine, 2000). Second, due to weather conditions, the North Pacific fisheries are some of the most dangerous in the world.

Prior to enactment of the Magnuson-Stevens Act in 1976, Japanese, Russian, and some Korean vessels exploited the pollock fishery. When the fishery came under U.S. jurisdiction a total allowable foreign fishing (TAFF) level was established each year. As might be expected, the TAFF was significantly lower than the foreign vessels' historical harvest levels. In order to circumvent this, joint ventures between Japanese and American firms were formed. This allowed, for instance a Japanese processor to guarantee itself access to the resource by at least partly owning a company that was

⁴⁸ Groundfish, also known as demersal fish, are those species of fish that live primarily near the seafloor.

⁴⁹ Trawling is a method of fishing utilizing a bag-shaped net; long-lining involves using a long cable (usually several miles long) with hooks attached to harvest fish.

registered as being American. Because of this, the TAFF was not actually binding on the foreign participants.

At the same time, Alaskan fishermen were ignoring the pollock fishery due to their activity in the salmon, halibut, and red king crab fisheries. When the king crab fishery collapsed, Alaskan fishermen became more interested in the pollock fishery. At this point the Jones and Nicholson Acts were passed. Both had the effect of requiring that at least 51 percent of a vessel be owned by a U.S. entity (individual or corporation). There are no ownership requirements on shore-based processors, who are almost completely controlled by the Japanese.

There was a proposal in the mid 1990s to institute an ITQ system for this fishery. Due to the moratorium on ITQ implementation, however, this did not occur. The latest legal action to significantly affect the fishery is the American Fisheries Act, enacted in October of 1998. The act affects all vessels and processors operating in the Bering Sea-Aleutian Islands pollock fishery. The most important provision of the act is the creation of processor-affiliated cooperatives. The legal structure of these co-ops has changed the property rights system in this fishery from common property to de facto private property.

The Fishery Prior to Coop Management

For management purposes, the fishery is split into two sectors, the offshore and inshore sectors. The offshore sector is comprised of catcher-vessels, catcher/processor vessels and motherships that operate exclusively at sea. There is no delivery of fish to shore-based processing plants. Catcher-vessels that do deliver to shore-based processors and those processing plants comprise the inshore sector. According to the NPFMC there are eight inshore processing plants, 21 catcher processors, three motherships, and 112 catcher-vessels eligible to participate in the BSAI fishery (2002). The BSAI portion of the fishery has both inshore and offshore sectors, while in the GoA fishery there is only an inshore sector.

The BSAI pollock fishery has always been managed by restrictions on entry, restrictions on gear use, season limitations, and an annual total allowable catch. Further, the season is split into two seasons, the A, or roe, season and the B, or non-roe, season. The total allowable catch is split between the inshore and offshore sectors.⁵⁰ Vessels must also have permits and there are various restrictions on size of vessels and annual production.

These regulations led to the typical derby fishery (Matulich et al, 2001). As Table 3 shows, season length decreased significantly. The Bering Sea inshore B season hit a peak of 113 open days in 1992 but was only open for 49 days just the next year. Most of the sectors, areas, and seasons had their longest openings in either 1992 or 1993 and saw allowed fishing days decrease from then on. The Aleutian Islands offshore B season was closed for most years.

Table 4-3 Number of Open Days in the Bering Sea/Aleutian Islands Pollock Fishery, 1991 - 1998

Sector	Area	Season	1991	1992	1993	1994	1995	1996	1997	1998
Inshore	BS	A	53	46	63	41	40	42	30	37
		B	95	113	49	50	39	47	45	58
	AI	A	0	86	79	57	69	50	44	52
		B	0	11	54	54	0	1	0	0
Offshore	BS	A	0	46	33	29	26	31	25	25
		B	0	57	38	40	36	47	31.5	49
	AI	A	0	86	70	40	44	36	33	28
		B	0	37	0	44	0	0	0	0

(source: NMFS)

⁵⁰ In 2002, 10% of the TAC was automatically allocated to the community development quota (CDQ) program and an incidental catch allowance (ICA) was taken from the remainder. This leaves the directed fishing allowance (DFA), of which 50% was allocated to the inshore sector, 40% to the offshore CP sector and 10% to the offshore MS sector (Wilén and Richardson, 2003).

The proposal in 1995 to institute an ITQ program in this fishery would have been supported by many of the fishermen, and at least one processor felt that conversion to an ITQ system was guaranteed (Fraser, 1998; Paine, 2000). However, provisions of the AFA allowing for cooperative agreements between fishermen and processors have delayed further any implementation of an ITQ program and many in the industry are happy to work within the co-op programs rather than fight for an ITQ program (Paine, 2000; Richardson, 2000).

The Fishery Since Coop Management

The cooperative program works like the many cooperatives that are common in agricultural markets. In this case, a fisherman and a processor agree to a contract that must specify

1. A list of parties to the contract;
2. A list of all vessels and processors that will harvest and process pollock harvested under the cooperative; and,
3. The amount or percentage of pollock allocated to each party to the contract. (North Pacific Fishery Management Council 2002, p. 39).

Once in a co-op agreement, the fisherman is tied to that processor for the season and cannot move to another processor-cooperative until the season is over.

The allocation of the annual TAC is what makes this co-op program essentially a private property rights scheme. First there is a division of the TAC between the inshore and offshore sectors. Then there is a division of these allocations amongst each processor cooperative. Finally, within each cooperative, harvesters are assigned a certain portion of the co-op's allocation. In the end, each harvester is guaranteed a certain percentage of the overall annual TAC. Hence this co-op program is very much like the quota programs used in the fisheries discussed above.

According to the NPFMC, since implementation of the co-op program, the pollock fishing season has extended and the race to fish has lessened. Safety has also increased

in the fishery, with fishermen stating that they no longer feel the need to fish in bad weather. The Council notes that increased safety has “made it easier to recruit Western Alaskan residents to work onboard the at-sea vessels...this has helped to provide acceptable jobs for the residents of communities with limited employment opportunities” (2002, p. 8).

Vertical Coordination in the Fishery

Vertical Integration

The motivations for vertical integration in this fishery seem to be fairly clear. Both the processing and harvesting sectors are motivated by sheer financial dependence on the fishery. Both Brent Paine from the harvesting sector and Joe Plescha from the processing sector have made clear their respective positions that if the pollock fishery were to shut down they would no longer have a livelihood.

Joe Plescha of Trident Seafood says that their \$150 million processing plant in Akutan is dependent on the pollock harvest. It is possible to use the plant to process other species such as crab and cod (which they do), but these last only a few days of the year and the remainder of the year the plant needs pollock. That said, however, Plescha also noted that Trident owned boats before it owned any processing plants and that their current need for a guaranteed supply is due to this particular plant which started operation in 1990, many years prior to the AFA co-op program (Plescha, 2001).

While Trident feels that they need to own vessels to help guarantee that supply, and feels that AFA has only compounded this problem for them, Icicle Seafoods feels no such apprehension. They have worked with the same fleet of CVs for many years. This fleet includes both CVs owned by Icicle and independent fishermen, and Litesole say they “work well together” and that the relationship they have is “good for everyone” (Litesole, 2001).

Table 4-4 shows the dependence the processing sector has on this pollock fishery. As well as the inshore processors, data is presented for motherships and both fillet CPs and surimi CPs. Fillet CPs exhibit the least dependence on pollock, undoubtedly due to their ease of movement to other, substitute, groundfish fisheries such as cod. However, even this sector shows increased dependence over the years for which data is available.

Table 4-4 Contribution of Species Groups to Processors' Total Annual Wholesale Value, by Processor Type

Class	Year	Pollock	Groundfish	Shellfish	Salmon	Hake
Fillet CP	1991	49%	51%	0%	0%	0%
	1994	58	41	0	1	0
	1996	74	26	0	0	0
Surimi CP	1991	90	5	0	0	5
	1994	88	4	0	1	7
	1996	85	3	0	4	7
Mothership	1991	85	0	0	0	15
	1994	88	4	0	1	7
	1996	87	1	0	0	12
Inshore	1991	54	20	24	0	0
	1994	67	9	20	3	0
	1996	65	17	16	0	0

(source: North Pacific Fisheries Management Council, 1998)

Table 4-5 Contribution of Species to Catcher-Vessels' Annual Ex-Vessel Value

Size Class	Year	Pollock	Groundfish	Halibut	Shellfish	Hake
Less than 125' loa	1991	54%	30%	2%	10%	3%
	1994	71	19	1	8	2
	1996	70	21	1	2	6
125' to 155' loa	1991	62	33	0	5	0
	1994	91	7	0	1	0
	1996	95	5	0	0	0
Greater than 155' loa	1991	70	21	0	8	0
	1994	86	7	0	7	0
	1996	88	11	0	1	1

(source: NPFMC, 1998)

Table 4-6 Contribution of Species to Catcher-Vessels' Annual Ex-Vessel Value as Percent of Total Groundfish

	Species	1990	1992	1994	1996	1998
AFA Qualified with Crab Endorsement	Pollock	62%	92%	87%	82%	85%
	Pacific cod	35	5	11	16	14
	Flatfish	1	1	2	1	0
	ARSO ¹	2	1	1	1	1
AFA-Qualified without Crab Endorsement	Pollock	74	88	87	81	84
	Pacific cod	24	9	10	14	14
	Flatfish	2	2	2	2	1
	ARSO	0	1	2	3	1

(source: NPFMC, 2001)

Notes: 1. ARSO – Atka mackerel, all rockfish species, sablefish, and other groundfish

Brent Paine states outright that, without the pollock fishery, his members would not be fishing (2000). As Table 4-5 shows, in 1996 the harvesting sector depended on the pollock fishery for no less than 70 percent of its annual ex-vessel value, with the middle size-class of vessels depending on it for 95%. Table 4-6 shows similar data for those harvesting vessels that are now qualified for the AFA co-op program. In most years prior to the AFA program they depended on this fishery for more than 80% of their annual ex-vessel value. These data clearly support Paine's opinion on dependence.

Brent Paine explained the simple reasons that a harvester would sell his vessel to a processor. Paine stated that it is very common for his members to sell an interest in their vessels in exchange for an assumption of debt by the processors. His members who do this simply wish to no longer deal with a monthly mortgage payment and are happy to trade that debt for exclusive dealing. The other reason vessels are sold to processors is that processors have access to the capital needed to purchase these expensive vessels. When a fisherman decides to retire, there is typically only one possible buyer. In fact, Paine could only remember one instance when a fisherman bought a vessel, and this was a purchase by a son from his father (2000).

Prior to AFA one additional reason for owning catcher-vessels (not for contracting, however) was to establish a catch history for the processor. This was clearly the case when Tyson Foods, bought the Arctic Alaska Fisheries Corporation in 1992. Arctic Alaska owned a floating processor as well as a fleet of catcher-processors and catcher-vessels. Tyson paid over \$200 million not just for the physical capital but also for Arctic Alaska's catch history. Because the catch history is tied to the vessels and not the owner it transferred to Tyson in the sale. In an interview with a trade journal, John Tyson indicated that the decision to buy out Arctic Alaska was to gain a foothold in the fishery in anticipation of a change in management systems to one based on individual quotas (Freeman, 1993).

Contracting

The incentives to contract are essentially the same as those for vertical integration. Perhaps the primary motivation for contracting with CVs, however, is to better schedule deliveries in order to keep processing plants running at peak efficiency. Having deliveries arrive at inopportune times can lead to spoiling of fish in the vessels' holds. It can also cause problems on the processing line ranging from workers having to rush to do their jobs to workers not getting enough sleep to automated machinery not being able to keep pace with inputs. All lead to a lower quality final product. According to Terry Litesole of Icycle Seafoods (2001), they do not need to worry overly much about scheduling, but they do schedule to make the operations run more smoothly. Litesole also feels that a bigger processor like Trident, on the other hand, does need to worry since they have about half of the season's catch coming to one or another of their plants.

Contracting has not truly changed. Prior to the AFA processors dealt with the same harvesters year to year with informal contracts based more on the many years they had worked together than on any legally binding agreement. Now under the AFA program, this has been formalized.

Ownership

How much of the fishery is actually vertically coordinated is difficult to determine. Table 4-7 summarizes the data on outright ownership as it was known in 1996.⁵¹ Of the 47 total processing plants or CVs in the BSAI fishery, 11 (42.3%) owned their own catcher boats. The NPFMC notes that since 1994 it has become more common for processors to either directly own catcher-vessels or have some functional control over them. According to NMFS, of the 69 inshore catcher-vessels, 18 (26 percent) were owned outright by processors. Processors owned eleven of the 22 vessels that operated both inshore and offshore; processors owned 2 of the 27 offshore-only catcher vessels. That is

⁵¹ Please note that this information may not be 100 percent correct, as many vessels are owned by corporations that may or may not actually be owned by a processing plant or by the owner of a processing plant. According to the data source, after initially finding ownership information, those vessel owners were then asked to verify ownership.

an overall ownership rate of 26.3 percent; processors owned 31 of the 118 catcher-vessels.

Table 4-7 Catcher-Vessel Ownership, 1996

Processor Type	Number	Number Owning Catcher Vessels	Percent Owning Catcher Vessels	Number of CVs Owned	Percent of CV Fleet
Mothership	3	1	33.33%	2	1.69%
Catcher-Processor	38	22	57.89	11	9.32
Inshore Plant	7	5	71.43	25	21.19
Total	48	28	58.33	38	32.20

(source: NPFMC, 1998)

The one mothership listed as owning vessels is actually owned by a cooperative of catcher-vessel owners who purchased the MS after already owning their fishing vessels. Again, no specific reason for this ownership structure was given but the advantage it affords the CV owners vis-à-vis bargaining seems as likely an answer as any. Owning your own processing facility saves the time and money of bargaining altogether, though it does add the extra time, cost and worry of running an additional operation.

Outright ownership of catcher-vessels by catcher-processors is not common. Table 9 show in 1996 that 11 CVs were owned by 22 CPs. These numbers are a bit misleading, however. Fifteen of the 22 CPs are at least partially owned by one company, and another company wholly owns another 5. The former only owned one CV while the latter, Tyson Foods, owned six which they “shared” with Tyson’s inshore processing plant. While ownership is rare, contracting with CVs is standard practice for catcher-processors.

The reasons for working with a catcher-vessel are fairly basic. The primary reason is that CPs have a greater capacity for processing than they do for harvesting. In order to keep the processing activities running at peak efficiency it is necessary to accept deliveries from CVs. It is also useful to have CVs “scout” the waters for fish, especially in the B season when fish are more dispersed. Third, CVs can serve as runners between the processing vessel and port, ferrying supplies or workers in order to allow the CP to stay on the fishing ground.

As to the question of why fishermen invested in CPs rather than CVs and/or processing plants, one needs to look back to the 1980s. According to Ed Richardson of the At-Sea Processors Association (2000), in the 1980s there were a glut of 150+ LOA vessels available in Alaska. These vessels had previously been used in conjunction with the Alaskan oil fields but were no longer needed. At the same time the Norwegian government was trying to revive its shipbuilding industry and was offering deep discounts (10 to 20 percent off) for having work done in Norwegian shipyards. Also at the same time, on board processing technology had advanced far enough that it simply made sense to start processing fish on-board rather than deliver to the on-shore processors. The result was that a new technology was available that made it economical to convert what were 150’ vessels used for the oil fields into 300’ vessels that are able to fish for pollock far off-shore and process that catch while at sea. All the while because the ships maintained their U.S. made hulls, they were still legal for U.S. fisheries. And in 2002 there were 19 CPs in the fleet (see also Anonymous, 1994).

Conclusion

Clearly, the private property-style management regime used in the pollock fishery cannot be the direct cause of vertical integration in this fishery. This fishery was fairly vertically coordinated prior to the co-op program being instituted and that has not changed. Even if processors do feel the need to invest in CVs, as Plescha states, nothing says you necessarily can. There is no sense of market power that processors could use to induce fishermen to sell their operations. And if the fishermen do sell, Paine tells us, it is usually

due to the simple desire to retire, or reduce debt. This was true pre-AFA and is still true now.

It should also be noted that the NPFMC views this change in structure as quite possibly being an inevitable outcome of “a maturing pollock fishery” (NPFMC 1998, Appendix 2 p. 66). Paine says that economies of scale are “the name of the game” in the pollock fishery. The management regime has not changed that. And based on Dave Fraser’s (1999) comment that owning a catcher-vessel simply for harvesting is becoming less and less profitable, we could be seeing nothing more than simple scale effects taking hold of the fishery. Unfortunately, there is no research estimating the degree of scale economies in this fishery.

Regarding contracting, there is also no firm data available. Prior to AFA, vertical relationships took many forms including assumption of debt, provision of supplies, and slip space in exchange for exclusive dealing. Comments from those working in the fishery show that what was unofficial contracting, that is, agreements based on long-standing relationships, are simply formalized by the co-op agreements under the requirements of the AFA.

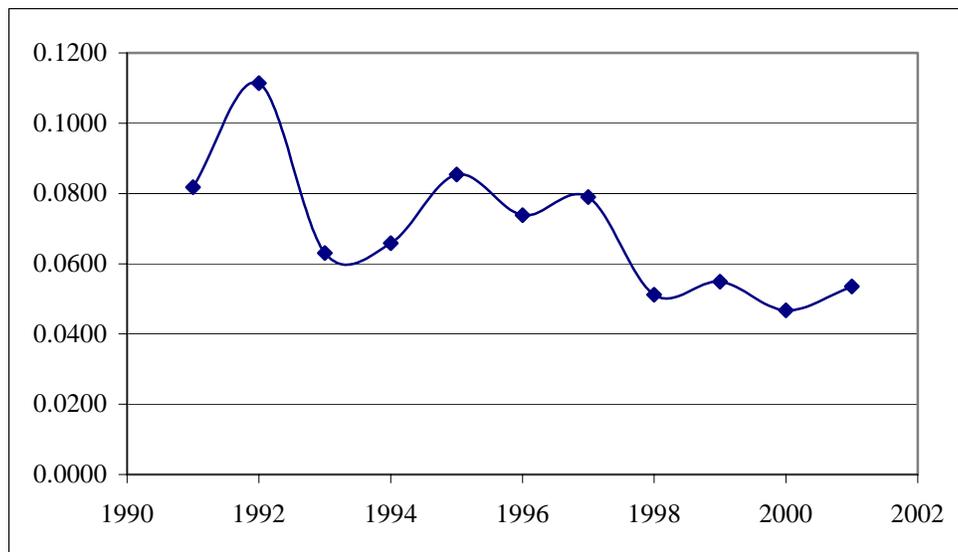
Quality Uncertainty

Pollock is highly processed yet also exhibits a high level of vertical coordination. This seems to contradict hypothesis (i) that says that fisheries with fresh final products will exhibit higher vertical coordination than others. Hypothesis (ii), on the other hand, is clearly supported in this fishery. Quality of pollock catch can be affected both by the length of time that the catch stays in the hold of a ship or in the nets, and also by the amount of fish in the processing line. In the former case, the quality of raw fish is affected to the point of the catch spoiling; pollock must be processed within three days of being caught. In the latter case, it is the final product that is affected. If the processing line is overloaded it can result in less care in handling by humans and mistakes made by automated machinery. Because of this, processors especially want to have control over delivery times. Hypothesis (iii) is not truly addressed here. Since timing of delivery is

the primary concern vis-à-vis quality, reputation plays an uncertain role in the workings of this fishery.

Price and Quantity Uncertainty

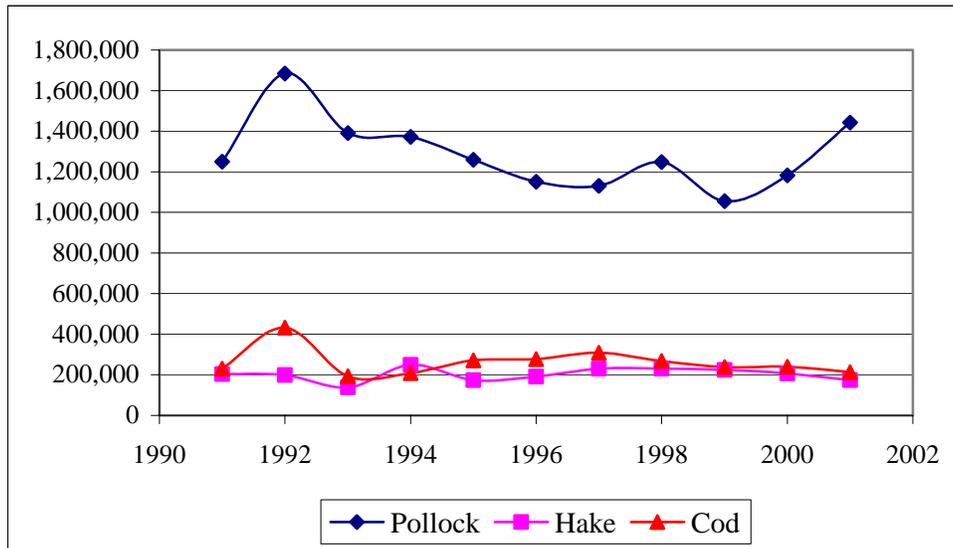
Prior to the implementation of the AFA processor co-op program, a marketing cooperative negotiated prices on behalf of the harvesting sector. Since passage of the AFA, prices are determined on an individual basis within each processing co-op. From the period 1991-2001, the real⁵² ex-vessel price of pollock has varied from a low of roughly 4.5 cents per pound to a high of approximately 11 cents per pound (as shown in Figure 4-2). Not all price changes are negatively correlated with changes in landings. For reasons other than availability/supply, in some years both catch and price have increased, and, of course, in some years both have dropped (for the limited data that is available, price and landings changes show a correlation of 0.39). Therefore, other variables must be found to explain changes in prices



(source: NMFS)

Figure 4-3 Real Ex-Vessel Price (\$/lb) for Pollock, 1991 - 2001

⁵² Real prices were calculated using a base year of 1990.



(source: NMFS)

Figure 4-4 Landings of Pollock, Hake, and Cod, 1991 - 2001

One factor in determining ex-vessel prices is the availability and price of substitutes. There are two species that substitute for pollock: hake (also called pacific whiting) and cod. However, at their highest levels, hake landings are only 21 percent of pollock landings and cod only 27 percent of pollock landings (see Figure 4-3). Demand for the final product, of which pollock is an input, is another factor that could affect the price of pollock. Because most of the pollock harvested goes into production of products that are exported to Japan, information on demand is not widely available. The Japanese control this data fairly closely; because pollock is imported in such large quantities demand data in this market is considered virtually a matter of national security. There has been only one study analyzing Japanese demand for Alaskan pollock, and it was published in 1983 (Crutchfield). Clearly this paper is too old to be of any use here. A related factor that can affect pollock prices is production costs at the processors. Again, there is no cost data available for processors so this line of reasoning cannot be taken far.

Even though catch varies little in this fishery,⁵³ prices have changed by more than 40% from one year to the next. All sectors of the fishery care very much about this variability. This is due to their financial dependence on the fishery. While the vessels used to catch pollock can easily be used to catch hake, cod, or many other species of fish (trawling is a very common way to catch fish), due to regulation, these fisheries are virtually inaccessible. The substitute fisheries in which these vessels would operate are all controlled through limited-entry license programs. Without the license in-hand a fisherman may not fish the pacific whiting fishery, for instance, and regulations restrict the number of licenses available. In order to obtain a license, a fisherman must buy it from a license holder (i.e. that fisherman must leave the fishery). Tables 4-5 and 4-6 show this dependence, and Paine's comments are plain.

The case for processing plants is the same. In 1991, dependence was very low at only 54 percent. Since then, however, dependence has increased to 67 percent in 1994 and 65 percent in 1996 (see Table 4-4). The two other major species-types processed are other ground fish and shellfish (mostly crab). Motherships' operational dependence on pollock has historically been among the highest of the four processor-types. Pollock has contributed between 85 and 88 percent, with hake accounting for the next largest share (7-15%) and other groundfish and salmon making up the rest. The NPFMC also notes that if an MS were to leave the fishery, "it does not appear likely that it would return to the fishery with new operators" (NPFMC, 1998, Appendix 2 p. 88). Finally, catcher-processors face much the same situation. While their dependence on pollock is smaller, pollock is still the largest contributor to their annual wholesale value.

Asset Specificity

Catcher vessels, CPs, MSs, and inshore processing plants can be used in fisheries other than the pollock fishery. Catcher vessels can use their trawl gear to catch many different species; trawling is very common. Inshore plants can and do process pollock, salmon, other groundfish, and shellfish. In fact, many of the inshore plants were originally built

⁵³ It is very important to remember that total landings (or quantity) remains stable because of biological reasons and, hence the total available catch (maximum production, as it were) is mandated by law.

to process crab. Some CPs have generated as much as half of their annual wholesale value from species other than pollock (NPFMC, 1998). In this strict sense, none of the sectors of this fishery suffer from asset specificity. Therefore, hypothesis (v) seems to be contradicted. On the one hand, the vessels and plants in this fishery are not specific to this fishery, yet there is a high level of vertical coordination. Hypothesis (vi) is probably more important, however. Because it is difficult, if not impossible, to legally move to other fisheries, there is incentive to vertically coordinate. Most alternative fisheries require a limited-entry license, thus the vessels and at-sea processors are dependent on this fishery.

Search Costs

The original concern or motivation for looking at the variable was that length of search could affect the quality of fish. That is, a CV owner or captain may have been forced into a less than ideal contract or sale in order to get something for his catch rather than letting it go bad. The history of contracting in this fishery leaves this concern unjustified. Prior to AFA, fishermen and processors traditionally had unofficial contracts for delivery. Processors and fishermen have long-standing relationships and for many years have worked together without explicit contracting (Plesha 2001; Reed 2001). And since the AFA co-op program has just formalized the contracts, this is no real change to the vertical structure of the market.

The fact that this fishery is not a fresh-fish market yet has a high level of vertical coordination seems to refute hypothesis (vii). However, the spirit of the hypothesis appears to be supported. That is, since pollock only have three days to be processed (even when frozen), fishermen must have a guaranteed buyer. Hypothesis (viii) is also not supported, even in spirit. In this fishery, processors are located all over the Aleutian Islands and in the Bering Sea. And while there is a high level of vertical coordination, it clearly is not linked to this geographical dispersion of plants.

Property Rights

There has been no change in bargaining power that might shift rents and no change in the form of the product to be processed like was seen in the halibut fishery. Because of this, there is no way to judge hypothesis (ix). However, there are substitutes available for pollock even though their landings are such a small percent of pollock landings. The fact that the availability of substitutes is minimal lends support to hypothesis (x) which says that a fishery for which there are no (or few, in this case) substitutes, will exhibit a higher degree of vertical coordination than one for which there are many substitutes (such as wreckfish).

CHAPTER 5. CONCLUSION

5.A. Analyzing the Hypotheses

Each hypothesis from Chapter 2 will be discussed in light of the three case studies just presented. Results drawn are limited, of course, because there are only three fisheries appropriate for the analysis. Therefore there exists little or no variability in the different characteristics of the fisheries that may affect vertical coordination. Nonetheless, some lessons can be taken from these case studies.

Quality Uncertainty

Quality is an issue in all but a few fisheries. Chapter 2 presented three hypotheses related to quality uncertainty and two of the fisheries analyzed above offer some insight into each. When the halibut fishery was converted to an IFQ program the fishery also converted from a primarily frozen fish industry to a primarily fresh fish industry. According to hypothesis (i) that means that there should have been a concurrent increase in vertical integration. To the degree that it was possible this did happen and can be seen in the small amount of QS and IFQ pounds that were purchased by processors. However, since the regulations governing this program were specifically written to avoid vertical integration it has not happened on a large scale. It appears that a shift in bargaining power can mitigate this effect. That is, even though processors might prefer to integrate, or in some way better control quality of fish, moving away from a frozen fish industry allowed more entry into the processing sector, thereby increasing the bargaining power of harvesters. This increase in bargaining power allows the fishermen to maintain their status as independent fishermen, rather than feeling any need to sell their operation to a processor.

Pollock is a good example of a fishery where the quality of the catch matters very much and the industry developed a way to deal with the problem. In this case, the need to process fish within three days of being caught and the need to not overburden the

processing equipment and workers led the industry to use informal contracting to establish delivery schedules. For this fishery, at least, hypothesis (ii) holds true and a fishery where there is a limited amount of time in which to process catch is highly vertically integrated. However, this only holds for the informal contracting that was occurring pre-AFA. It does not explain outright vertical integration. Brent Paine thinks that outright vertical integration is due to scale economies that processors wish to exploit. Again, there is no estimate of the degree of scale economies, but some of the desire to vertically integrate is undoubtedly due to a need to guarantee a supply of input. This is driven by financial dependence on the fishery and hence an issue of asset specificity again.

What role reputation plays in these fisheries is not clear. Terkla states that reputation does have an affect in smaller fisheries where the harvesters and processors all know one another. Wreckfish would have been an ideal fishery for such an analysis since harvesters and processors tend to be concentrated in certain geographical areas. However, as is explained in that case study, actually contacting participants in the fishery was difficult and so no analysis of this hypothesis is offered.

Supply Uncertainty

While there is some degree of certainty regarding the availability of any one species, it is not perfect. The National Marine Fisheries Service announces the TAC for a fishery before the fishing season opens, which does allow some degree of planning. However, the annual TAC varies from year to year. Because the TAC is based on biological conditions, many things can affect it; more than the fish stock affects regeneration and recruitment. Levels of pollution, the condition of the species's habitat, and activity of predator species all affect a year's total allowable catch.

For the three fisheries analyzed here, the annual TAC is set high enough that there does not seem to be any concern over dwindling supplies for the industry *as a whole*. In the wreckfish fishery, for instance, approximately one tenth of the TAC was landed in 2001, while halibut and sablefish were both caught to their limits. However, in the North

Pacific pollock fishery there have been complaints that NMFS is setting the TAC unjustifiably low. If the TAC were raised significantly, this would alleviate some of the pressure that processors feel about assuring they have enough catch for their plants. However, this dissertation is not the place to discuss either the validity of biological assessments or the political economy of the management system.

Asset Specificity

Asset specificity seems to play the largest role in the decision to vertically integrate. And it affects both fishermen and processors. Processors in the west coast fisheries have made large investments in freezing and processing capacity that is either not suitable for or not easily converted to other uses. Fishermen, likewise, cannot easily convert their vessels for uses in other fisheries not because it is physically difficult, but because it is legally difficult. Therefore hypothesis (v), which states that for fisheries that require non-malleable harvesting or processing capital, there is more likely to be vertical integration, is supported by the experiences in two of the fisheries.

The odd twist here, however, is that it was the conversion to an IFQ program that made the halibut processing equipment specific, by making it excess to demand. Massive processing capacity that was required for the derby fishery pre-IFQ, is no longer needed now that the fish is delivered fresh and almost year-round. So while the processing capital is not necessarily “required” anymore, it is, nonetheless, existent. For pollock there is a similar situation of processing capacity being as abundant as it is because of the size of pollock landings. If that supply is lost, at least one processor said they would be in dire financial straights (Plescha, 2001).

Most often, a fisherman is dependent upon a certain fishery because they have a license to fish in that fishery and they are not able, by law, to move into another, or because a large share of their annual revenue comes from one particular fishery. As fisheries are managed by more and more restrictive means (limited license entry programs and quota programs), it becomes harder and harder for a fisherman to simply target a different species. While both limited entry licenses and quota are traded, the

capital needed to purchase a license or quota may simply be beyond the means of a fisherman. On the other hand, a large processing company may have access to capital that the fisherman does not. Hypothesis (vi) holds in the case of the pollock fishery and the halibut and sablefish fishery. In both cases, fishermen are heavily dependent on this particular fishery and movement to other fisheries is restricted.

Wreckfish, on the other hand, might present just the opposite conclusion. Because fishermen were not dependent upon the wreckfish fishery, they could leave at will and fish in another snapper or grouper fishery or the shrimp fishery. Had the fishery kept up its level of harvest and if there was an active market for buying and selling quota shares and coupons, it is conceivable that fishermen might have kept their shares even while targeting other species. However, since there has been little to no demand for wreckfish (quota shares, coupons, or the fish itself), when fishermen did leave the fishery, quota might have simply been sold to the highest bidder. Again, inability to actually contact participants in this fishery makes it impossible to know what actually happened. But if this is the case and processors have the best access to capital, then it could result in increased vertical integration. It will be particularly interesting to see what happens in this fishery if there is a drop in the price of the substitute target fisheries and the wreckfish fishery sees increased activity.

Search Costs

Every fishery has developed ways to lessen search costs. Some use auctions or open markets where many buyers and sellers come together at pre-arranged times, while others use non-market techniques like contracting. Unfortunately, none of the fisheries discussed here offer much insight into hypotheses (vii) and (viii). In the pollock fishery for instance, the industry has always been vertically integrated to some degree and fishermen have never fished without a delivery agreement with a processor. This is due, in part, to quality concerns, but it is also certainly due to search cost concerns.

Finding an actual processor in this fishery is not an issue. After all, the participants in this fishery have been operating for many years and are familiar with one another. In this

case, the cost of searching would be the probability of a spoiled catch. Whether one wishes to call this a search cost or a quality concern almost seems to be a matter of semantics. One can add to the mix that neither the fisherman nor the processor truly wants to see the catch spoil. The processor, due to financial dependence on the fishery, needs the catch to be delivered on time. Yet this is as asset specificity above.

This is an example of how using case studies does not offer a linear cause-and-effect relationship.

Property Rights

The two hypotheses concerning property rights posited in Chapter 2 are:

Ceteris paribus,

- (ix) based on the expectation that rent will shift towards harvesters, converting to a system of private property rights will encourage vertical coordination by processors; and,
- (x) if there are no close substitutes for the species harvested in the fishery, converting to a system of private property rights will encourage vertical integration compared to a fishery for which there are substitutes.

For the first hypothesis, maintaining the *ceteris paribus* assumption is difficult. For instance, the imposition of the quota program in the halibut fishery directly led to longer seasons, which directly led to much of the freezing and processing capacity becoming excess to supply, thereby putting the processors in the position of having a specific asset. For the second hypothesis this is not a concern, but there are two different ways that species can be substitutes for one another: as a target for fishermen, or as a final good for consumers.

The hypotheses aside, however, it seems clear that the three case studies presented can be used to develop a general guideline for whether or not converting a fishery to private property rights will lead to increased vertical coordination.

5.B. Appropriateness of Quota Management

What does seem clear is that there are instances where management through completely freely transferable quota (ITQ) is preferable or appropriate, and other instances where it is not. Two situations present themselves as being amenable to management through ITQs.

The first would be the simple case of a fishery that is highly vertically coordinated prior to the institution of the program. This, of course, is an uninteresting case. In this case, antitrust law mitigates any concern about market foreclosure. The second would be a fishery where (i) fishermen are not dependent upon the targeted species specifically for their income; and (ii) everyone involved in the fishery has equal access to capital (for the purchase of both quota and vessels).

Notice that, as an example, the North Pacific pollock fishery fits in the first category of being highly vertically coordinated prior to rationalization. The South Atlantic wreckfish seems to fit in the latter category, as the fishermen there were not dependent on wreckfish for their income. In order to avoid market foreclosure, it is also important that the species being managed have substitutes available, as is the case with both pollock and wreckfish.

In the case where there is a genuine and well-founded concern about an increase in coordination it is possible to design a quota program that avoids the problem. The IFQ program instituted for Pacific halibut and sablefish (and the one recently proposed for BSAI crab) is an example of just such a program that was designed specifically to maintain the “small-scale” nature of the fishery. This program is described in much more detail in the previous chapter, but there are one or two points worth reiterating. To be noted are the specific provisions that eliminate the possibility of any significant increase in vertical coordination. First is that quota assigned specifically to one of the catcher-vessel categories can be “fished down”, that is a smaller vessel can use quota assigned to

a larger vessel, but not vice-versa. This encourages the small-scale nature of the fishery. The second provision is the owner-operator restriction that goes into effect when the quota is transferred.

5.C. Policy Recommendations

There are two bills currently in Congress that seek to define rules for instituting any new quota programs, S.1106, the “Fishing Quota Bill of 2003,” and H.R. 2621, the “Fishing Quota Standards Act of 2003.” Both specifically require the consideration of local communities’ social and economic status when any new quota program is developed. Both bills address the concern through the initial allocation, with S. 1106 stating that any allocation of quota shares “shall provide for the fair and equitable initial allocation of quota share and in such allocation...shall consider allocating a portion of the annual harvest to entry-level fishermen, small vessel owners, skippers, crew members, and fishing communities.” The language in the House bill is not as strong, but specifically addresses the need to allow new entry. Both mandate limits on how much quota any one individual can hold, with H.R. 2621 going so far as to specify one percent of the TAC except in certain circumstances. Finally, the Senate bill allows the designation of up to 25% of any fees collected from the fishery for aiding “entry level fishermen” and “fishermen who fish from small vessels” in buying quota. The House bill, however, forbids using fees for anything except administration of the program.

Given the stated aim of these bills to “minimize, to the maximum extent practicable, negative social and economic impacts of the system on local coastal communities,” (H.R. 2621)⁵⁴ both bills are well designed. Clearly, experience gained from the existing quota programs has shaped the mandates of these bills. Much like the halibut IFQ program, both bills suggest restrictions on who can own quota, how much can be owned, and how it can be transferred. Also like the halibut program, both bills emphasize the need for entry-level fishermen and crewmembers to be able to buy into the program.

⁵⁴ Of the nine objectives that any fishing quota program must meet according to the Fishing Quota Standards Act of 2003, this is the only one to address socio-economic issues. The others primarily address the technical operations of such a program.

Many economists will respond to limitations on the transferability of quota with the charge that this decreases the efficiency of the program. However, while the free transferability of quota may lead to the first-best outcome in the short-run, the same might not be true for the long run.

A concern of those opposed to freely transferable quota rights is the possibility of quota leaving local coastal communities where there are few opportunities for alternative employment. In fishing communities with no other industry, fewer jobs in fishing translates into fewer jobs at all. In Alaska, for instance, the concern is that if quota is made fully transferable it will be consolidated on larger factory vessels that are based in Seattle. These vessels hire their crews in Seattle, process their catch on board, and return to Seattle along with the profit earned in the fishery. Alaska is left with fewer jobs and a lower tax base, hence Senator Ted Stevens's (R-AK) support for the quota moratorium of 1996. Maintaining an owner-operator provision, as both of these bills do, can lessen or even avoid this.

Ensuring that crewmembers either are allocated quota or are able to buy quota also helps to maintain employment in local fishing communities. The halibut IFQ program includes a method for determining who qualifies as a legitimate buyer of quota. This allows crewmembers that were not original allocation recipients to buy into the program. The bills currently in Congress specifically address entry by new *entry-level* fishermen, with the Senate bill going so far as to allow subsidization of this with fees collected from other fishermen in the program for the administration of the program.

There is little question that such provisions as described above will maintain some degree of over-capitalization in the fishery. However, the alternative is a situation where societal welfare may not be maximized in the long run. The cost of welfare provision, retraining, and education for displaced fisheries workers subtracts from the benefits generated by quota going to its "highest and best" use. Restricting the transferability of

quota, allowing crewmembers to hold shares, and encouraging small vessel fleets can help to alleviate this problem.

5.D. Conclusion

Evidence seems to indicate that whether or not the institution of private property rights leads to greater vertical concentration in a commercial fishery depends completely upon the characteristics of the individual fishery. There is no one rule to describe every fishery. However, there is really little evidence to derive a solid conclusion, as each fishery had a quite different experience from the others. The one conclusion that can clearly be drawn is not a great surprise. And that is that a one-size-fits-all regulation such as the moratorium on quota programs passed by Congress in 1996 is far from efficient. Because of the great disparities in market structure, scale economies, and other aspects of commercial fisheries around the U.S., it is not efficient to impose one regulation on all fisheries. Each fishery will respond slightly differently in reaction to the management regime put in place. So, while it is clear that there are fisheries one would not want to fully rationalize, there are still others for which this style of management would be best.

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APPENDIX A. EXAMPLE SURVEYS

Wreckfish Fisherman's Survey

Name: _____

Date: _____

Fishery: WRECKFISH

Permission to quote by name? Yes or No

Initial QS allocation: _____(percent of TAC)

Selling/Purchasing activity:

Basics of the fishery:

- first targeted late 1980s
- ITQ program instituted 1992
- Landings have dropped significantly to the point where there is virtually no fishery left

1. NMFS and Council actions/responsiveness. How do they think the regional council listens to their concerns? As an example, it was congress that passed the moratorium on ITQs not NMFS. What about TAC or gear restrictions, etc.? Is that indicative of how government listens?

2. Demographic type questions:

- How long have you been fishing?
- How long in this fishery?
- Is this fishery their primary source of income?
- If no, is there a different fishery or is the primary source of income outside fishing?

3. Relationship with Processors.

- Do you contract with processors?
- If yes, what does the contract usually specify (ex-vessel price, quantity, quality, provision of ice or fuel, etc)?
- If not, why not?

4. Has a processor ever offered to buy your boat from you? Why didn't you accept the offer?

5. Variables that affect vertical integration and contracting. How do these affect decision to contract or potentially sell vessel and/or QS?
 - Quality Uncertainty
Do the processors you deliver to demand a certain level of quality of the fish, or is that an issue at all?

 - Ex-Vessel Price and Supply Uncertainty
Is the ex-vessel price you are going to receive an issue?
pre-ITQ: big changes
post-ITQ: upwards of -46% (all decreases)

Is your QS big enough or do you need to buy and/or lease additional QS? I.e. why the purchases/leases—a matter of survival or just to make more money?

- Asset Specificity
Is your vessel specific to this fishery/fish or can you easily move between fisheries?

- Search Costs
Is this an issue in your fishery, or does everyone pretty much know where everyone else is? Buyers and sellers know each other well?

Pre and Post ITQ changes? How were your answers from above affected by the switch to the ITQ program?

THEIR IDEAS:

6. These variables might not be things that you think of at all. If they are not, what are your concerns when considering whether or not to contract with a processor?

7. What would induce you to sell your boat and become an employee of a processor?

8. Thank you for your time. If I have any further questions may I contact you again? Is there a time that works best?

Wreckfish Processor's Survey

Name: _____

Date: _____

Fishery: WRECKFISH

Permission to quote by name? Yes or No

Selling/Purchasing activity:

Basics of the fishery:

- first targeted late 1980s
- ITQ program instituted 1992
- Landings have dropped significantly to the point where there is virtually no fishery left

1. NMFS and Council actions/responsiveness. How do they think the regional council listens to their concerns? As an example, it was congress that passed the moratorium on ITQs not NMFS. What about TAC or gear restrictions, etc.? Is that indicative of how government listens?

2. Demographic type questions:

- How long have you been in the fisheries business?
- How long in this fishery?
- Is this fishery their primary source of income?
- If no, is there a different fishery or is the primary source of income outside fishing?

3. Relationship with Harvesters.

- Do you harvest yourself? Do you own vessels? (If yes, go to section 5 right away.)
- Do you contract with harvesters?
- If yes, what does the contract usually specify (ex-vessel price, quantity, quality, provision of ice or fuel, etc)?
- If not, why not?

4. Have you ever attempted to buy a vessel or quota but were unsuccessful?

5. Variables that affect vertical integration and contracting. How do these affect decision to contract or potentially sell vessel and/or QS?
 - Quality Uncertainty
Do you demand a certain level of quality of the fish, or is that an issue at all? If so, how do you guarantee the quality?

 - Ex-Vessel Price and Supply Uncertainty
Is the ex-vessel price you are going to pay an issue?

Is the availability of the species a concern?
pre-ITQ: big changes in landings
post-ITQ: upwards of -46% change in landings (all decreases)

 - Asset Specificity
Is your processing plant specific to this fishery/fish or can you easily process other species?

 - Search Costs
Is this an issue in your fishery, or does everyone pretty much know where everyone else is? Buyers and sellers know each other well?

Pre and Post ITQ changes? How were your answers from above affected by the switch to the ITQ program?

THEIR IDEAS:

6. These variables might not be things that you think of at all. If they are not, what are your concerns when considering whether or not to contract with a harvester?

7. What would induce you to buy a boat and/or quota?

8. Thank you for your time. If I have any further questions may I contact you again? Is there a time that works best?

Halibut Fisherman's Survey

Name: _____

Date: _____

Fishery: HALIBUT

Permission to quote by name? Yes or No

Initial QS allocation: _____(percent of TAC)

Selling/Purchasing activity:

Basics of the fishery:

- IFQ program instituted 1995
- Restrictions on transfers

1. NMFS and Council actions/responsiveness. How do they think the regional council listens to their concerns? As an example, it was congress that passed the moratorium on ITQs not NMFS. What about TAC or gear restrictions, etc.? Is that indicative of how government listens? Council did change IFQ transfer restrictions at behest of fishermen.

2. Demographic type questions:

- How long have you been fishing?
- How long in this fishery?
- Is this fishery their primary source of income?
- If no, is there a different fishery or is the primary source of income outside fishing?

3. Relationship with Processors.

- Do you contract with processors?
- If yes, what does the contract usually specify (ex-vessel price, quantity, quality, provision of ice or fuel, etc)?
- If not, why not?

4. Has a processor ever offered to buy your boat from you? Why didn't you accept the offer?

5. Variables that affect vertical integration and contracting. How do these affect decision to contract or potentially sell vessel and/or QS?

➤ Quality Uncertainty

Do the processors you deliver to demand a certain level of quality of the fish, or is that an issue at all? Change since IFQ!

➤ Ex-Vessel Price and Supply Uncertainty

Is the ex-vessel price you are going to receive an issue?

pre-IFQ (1988 – 1994): less than 10% absolute any one year

post-IFQ (1995 – 2001): two big years -22%/+39% others less than 10%.

Is your QS big enough or do you need to buy and/or lease additional QS? I.e. why the purchases/leases—a matter of survival or just to make more money?

➤ Asset Specificity

Is your vessel specific to this fishery/fish or can you easily move between fisheries?

➤ Search Costs

Is this an issue in your fishery, or does everyone pretty much know where everyone else is? Buyers and sellers know each other well?

Pre and Post IFQ changes? How were your answers from above affected by the switch to the ITQ program?

THEIR IDEAS:

6. These variables might not be things that you think of at all. If they are not, what are your concerns when considering whether or not to contract with a processor?

7. Generally speaking, happy with the program? Is it a success or failure? Changes that you would suggest?

8. Thank you for your time. If I have any further questions may I contact you again? Is there a time that works best?

Halibut Processor's Survey

Name: _____

Date: _____

Fishery: WRECKFISH

Permission to quote by name? Yes or No

Selling/Purchasing activity:

Basics of the fishery:

- IFQ program instituted 1995
- Restrictions on transfers

1. NMFS and Council actions/responsiveness. How do they think the regional council listens to their concerns? As an example, it was congress that passed the moratorium on ITQs not NMFS. What about TAC or gear restrictions, etc.? Is that indicative of how government listens?

2. Demographic type questions:

- How long have you been in the fisheries business?
- How long in this fishery?
- Is this fishery their primary source of income?
- If no, is there a different fishery or is the primary source of income outside fishing?

3. Relationship with Harvesters.

- Do you harvest yourself? Do you own vessels? (If yes, go to section 5 right away.)
- Do you contract with harvesters?
- If yes, what does the contract usually specify (ex-vessel price, quantity, quality, provision of ice or fuel, etc)?
- If not, why not?

4. Have you ever attempted to buy a vessel or quota but were unsuccessful?

5. Variables that affect vertical integration and contracting. How do these affect decision to contract or potentially sell vessel and/or QS?

➤ Quality Uncertainty

Do you demand a certain level of quality of the fish, or is that an issue at all? If so, how do you guarantee the quality?

➤ Ex-Vessel Price and Supply Uncertainty

Is the ex-vessel price you are going to pay an issue?

Is the availability of the species a concern?

pre-IFQ (1988 – 1994): less than 10% absolute any one year

post-IFQ (1995 – 2001): two big years -22%/+39% others less than 10%.

➤ Asset Specificity

Is your processing plant specific to this fishery/fish or can you process other species?

➤ Search Costs

Is this an issue in your fishery, or does everyone pretty much know where everyone else is? Buyers and sellers know each other well?

Pre and Post IFQ changes? How were your answers from above affected by the switch to the ITQ program?

THEIR IDEAS:

6. These variables might not be things that you think of at all. If they are not, what are your concerns when considering whether or not to contract with a harvester?

7. What role has the switch to a fresh market played for you?

8. Thank you for your time. If I have any further questions may I contact you again? Is there a time that works best?

Pollock Fisherman's Survey

Name: _____

Date: _____

Fishery: POLLOCK

Permission to quote by name? Yes or No

Basics of the fishery:

- common property management until AFA co-op program
- Largest fishery in the US (\$ terms).

1. NMFS and Council actions/responsiveness. How do they think the regional council listens to their concerns? As an example, it was congress that passed the moratorium on ITQs not NMFS. What about TAC or gear restrictions, etc.? Is that indicative of how government listens?

2. Demographic type questions:

- How long have you been fishing?
- How long in this fishery?
- Is this fishery their primary source of income?
- If no, is there a different fishery or is the primary source of income outside fishing?

3. Relationship with Processors.

- Do you contract with processors?
- If yes, what does the contract usually specify (ex-vessel price, quantity, quality, provision of ice or fuel, etc)?
- If not, why not?

4. Has a processor ever offered to buy your boat from you? Why didn't you accept the offer?

5. Variables that affect vertical integration and contracting. How do these affect decision to contract or potentially sell vessel?

➤ Quality Uncertainty

Do the processors you deliver to demand a certain level of quality of the fish, or is that an issue at all?

➤ Ex-Vessel Price and Supply Uncertainty

Is the ex-vessel price you are going to receive an issue?

Are you worried about access to fish and ability to earn enough money? Post AFA—is allocation within co-op large enough?

➤ Asset Specificity

Is your vessel specific to this fishery/fish or can you easily move between fisheries? Physically, speaking? In terms of licenses?

➤ Search Costs

Is this an issue in your fishery, or does everyone pretty much know where everyone else is? Buyers and sellers know each other well?

Pre and Post ITQ changes? How were your answers from above affected by the switch to the AFA co-op program?

THEIR IDEAS:

6. These variables might not be things that you think of at all. If they are not, what are your concerns when considering whether or not to contract with a processor?

7. What would induce you to sell your boat and become an employee of a processor? Or sell at all?

8. Thank you for your time. If I have any further questions may I contact you again? Is there a time that works best?

Pollock Processor's Survey

Name: _____

Date: _____

Fishery: POLLOCK

Permission to quote by name? Yes or No

Basics of the fishery:

- common property management until AFA co-op program
- Largest fishery in the US (\$ terms).

1. NMFS and Council actions/responsiveness. How do they think the regional council listens to their concerns? As an example, it was congress that passed the moratorium on ITQs not NMFS. What about TAC or gear restrictions, etc.? Is that indicative of how government listens?

2. Demographic type questions:

- How long have you been in the fisheries business?
- How long in this fishery?
- Is this fishery their primary source of income?
- If no, is there a different fishery or is the primary source of income outside fishing?

3. Relationship with Harvesters.

- Do you harvest yourself? Do you own vessels? (If yes, go to section 5 right away.)
- Do you contract with harvesters?
- If yes, what does the contract usually specify (ex-vessel price, quantity, quality, provision of ice or fuel, etc)?
- If not, why not?

4. Have you ever attempted to buy a vessel or quota but were unsuccessful?

5. Variables that affect vertical integration and contracting. How do these affect decision to contract or potentially sell vessel and/or QS?

- **Quality Uncertainty**
Do you demand a certain level of quality of the fish, or is that an issue at all? If so, how do you guarantee the quality?

- **Ex-Vessel Price and Supply Uncertainty**
Is the ex-vessel price you are going to pay an issue?

Are you worried about access to fish and ability to earn enough money? Post AFA—is allocation within sector large enough? (Would you buy more vessels if possible?)

- **Asset Specificity**
Is your processing plant specific to this fishery/fish or can you process other species?

- **Search Costs**
Is this an issue in your fishery, or does everyone pretty much know where everyone else is? Buyers and sellers know each other well?

Pre and Post AFA changes? How were your answers from above affected by the switch to the ITQ program?

THEIR IDEAS:

6. These variables might not be things that you think of at all. If they are not, what are your concerns when considering whether or not to contract with a harvester?

7. What makes you want to buy harvesting vessels?

8. Thank you for your time. If I have any further questions may I contact you again? Is there a time that works best?

APPENDIX B. SELECTED BIOGRAPHIES

Dave Fraser – Dave Fraser started his fishing career as a deckhand on the F/V Hercules in 1971. He has since owned and operated fishing vessels in the groundfish, salmon, and halibut fisheries. Mr. Fraser also worked in various capacities for the Pacific and North Pacific Fishery Management Councils and is currently the president of High Seas Catchers' Cooperative.

Ralph Hoard/Icicle Seafoods, Inc. – Ralph Hoard is the Executive Vice President of Icicle Seafoods, Inc. Icicle was originally formed in 1965 when a group of fishermen and their employees purchased a canning facility in Petersburg, Alaska. Icicle has since grown into one of the largest seafood processors in the Pacific and North Pacific.

Terry Litesole/Icicle Seafoods – Terry Litesole is the head of public and government relations at Icicle Seafoods.

Lobsterconservation.com – Lobsterconservation.com is a website funded by the Pew Charitable Trusts through the Pew Fellows Program in Marine Conservation. The website is administered by Dick Allen, a veteran of more than 30 years of commercial fishing on the east coast.

Rod Moore – Rod Moore sits on the Pacific Fishery Management Council's Groundfish Advisory Subpanel and is the Executive Director of the West Coast Seafood Processors Association. The WCSPA represents seafood processors from Washington, Oregon, and California which process the majority of Pacific groundfish, Dungeness crab, and pink shrimp landed in those states.

James O'Malley/East Coast Fisheries Federation – James O'Malley is a former member of the New England Fishery Management Council and is currently the Executive Director of the East Coast Fisheries Federation (ECFF). The ECFF represents a variety of fishermen along the mid-Atlantic coast and is active in the debate over quota management.

Brent Paine/United Catcher Boats – Brent Paine is a former biologist for the North Pacific Fishery Management Council and current Executive Director of United Catcher Boats. United Catcher Boats represents 63 catcher-vessels accounting for 85% of all pollock and Pacific cod caught in the Bering Sea, Aleutian Islands, and Western Gulf of Alaska not caught by vessels that also process on board.

Joe Plescha/Trident Seafoods, Inc. – Joe Plescha is general counsel at Trident Seafoods. Trident Seafoods is active in many fisheries and describes themselves as a “vertically integrated harvester, processor, and marketer of seafood from Alaska, the Pacific Northwest, and around the world” (<http://www.tridentseafoods.com>).

Samuel Ray – Samuel Ray has been fishing for more than 30 years, and has been active in the wreckfish fishery since it started in 1987 (<http://www.lobsterconservation.com>).

Glenn Reed/Pacific Seafood Processors Association – Glenn Reed is the Executive Director of the Pacific Seafood Processors Association. The PSPA represents 16 seafood processors in Unalaska-Dutch Harbor, Alaska that operate primarily in the pollock fishery.

Ed Richardson, Ph.D./At-sea Processors Association – Ed Richardson is resource economist with the At-sea Processors Association. At-sea Processors Association represents catcher-processor vessels that operate primarily in the groundfish fisheries of the Bering Sea. There are seven member companies owning a total of 19 CPs.

Robert Dawson

Bob Dawson had lived on three continents by the time he moved with his family to Olympia, Washington in the beautiful pacific-northwest United States, at the age of seven. This early exposure to the jet-set lifestyle fueled his desire to travel and live abroad. And this is just what he has done. In the early 1990s Mr. Dawson competed in his first Paris-Dakar rally race, failing to finish the infamous race only due to an unfortunate incident with a camel. Shortly after this Mr. Dawson took up residence in Monte Carlo, becoming a personal counselor to Prince Albert in all matters of art restoration, masonry, ostrich-feather arranging, and macramé, a seemingly odd, yet very important position in the small principality of Monaco. He only stayed at that post for one year because of a poorly received rendition of the ages-old prank phone call “Do you have Prince Albert in a can?”

Moving to Monte Carlo proved to be fortuitous in many ways. It was there that Mr. Dawson recorded the famous "dueling cellos" suite with Yo Yo Ma, and it was also in Monte Carlo that Mr. Dawson met his soon-to-be wife, the supermodel Shalom Harlow. Meeting Ms. Harlow proved fortuitous not just for Mr. Dawson's romantic life, but also for his professional life. For it was Ms. Harlow, over a late night dinner at the Ritz in Paris, who reminded Mr. Dawson of his academic career. Mr. Dawson received his B.A. in Economics from the University of Washington in 1993 and his M.S. in Resource Economics from the University of New Hampshire in 1996, but had yet to complete his Ph.D. in Economics at Virginia Polytechnic Institute and State University. With her encouragement and support—indeed, it was a condition of her accepting his proposal for marriage—Mr. Dawson has now rejoined the academic community that he so loves and can be found at Washington College in Chestertown, Maryland, where he is Assistant Professor of Economics and Environmental Studies. It is here that he sits high on a hill, his white robes billowing in the breeze, passing his knowledge to the reverent, shaven-headed, monk-like students at the bucolic Eastern Shore campus. It is a wonder that he has had enough time to do so much in his short 31 years.