I. Final report title, author, organization, grant number, date

Long-Term Effects of Limiting Access to Alaska's Sablefish and Halibut Fisheries

by

Matthew D. Berman

Institute of Social and Economic Research
University of Alaska Anchorage
3211 Providence Drive
Anchorage, Alaska 99508

A report of the University of Alaska Anchorage, Institute of Social and Economic Research pursuant to National Oceanic and Atmospheric Administration grant number NA37FD0184

July 30, 1997

II. Abstract

The study analyzed potential long-term effects of the Alaska halibut and sablefish individual transferable quota (ITQ) program for the fishing fleet and coastal communities. The analysis focused on changes in the structure of the fleet, changes in fisheries markets, changes in fish processing and transportation, and regional shifts in the pattern of harvesting and processing activities. As a tool for projecting the combined effects of these major changes, two complementary models were developed: a fisheries impact model and a community impact model. Projections from these models for long-term scenarios of fish prices, total allowable catch by management area, and rate of intercommunity quota transfers show that some communities could see large changes as a result of the program. The projected gains and losses are sensitive to assumptions about prices processors can pay in each community, suggesting a role for further research on evolving processing and transportation costs.

III. Executive Summary

This study investigated the longer term impacts likely to result from imposition of ITQ management in the Alaska halibut and fixed gear sablefish fisheries. Two principal objectives were to (1) examine how the composition of these fisheries will change in response to imposition of an ITQ system, and (2) project how the evolving fishery will affect the economies of local coastal communities.

In 1995, the Pacific halibut and fixed gear sablefish (black cod) fisheries off Alaska began operating under an individual transferable quota (ITQ) program, ending years of derby-like fishing under an open access fishery regulated by brief time and area openings. With an annual harvest in each fishery generally ranging from 15 to 25 thousand metric tons annually by up to 3,000 boats (Knapp, 1997a, Berman and Leask, 1994), the Alaska program involved the largest ITQ program implemented to date. The change in fishery management regime will bring enormous changes not only in the character of these fisheries, but to the processing industry and communities that serve them. Exploring the long-term implications of the halibut and sablefish ITQ program for coastal communities may provide valuable insights as the NPFMC considers bringing the remaining fisheries off Alaska into ITQ programs, and as the National Marine Fisheries Service considers the efficacy of limited access management systems nationwide.

The study addressed these objectives by developing two complementary modeling approaches: a fisheries impact model and a community impact model. The fisheries impact model explores how the fishing fleet will evolve over time in response to an ITQ system, focusing on fleet size and characteristics, the pattern of landings by community, and profitability of different components of the fleet. The community impact model projects the effects on employment and income on Alaska coastal communities resulting from projected changes in fleets and harvests for communities currently or potentially landing sablefish or halibut.

A number of research papers were prepared to document results of the project. A survey of the Alaska longline fishing fleet was conducted to obtain baseline (pre-ITQ) economic and social data on captains and crew participation, earnings patterns, community of residence, expenditure patterns by type and location, and attitudes towards the ITQ program. Berman and Leask (1994), and Knapp (1996) report the results of the survey. Wholesale fish markets and processing margins, particularly for halibut, are expected to change substantially from the pre-ITQ era. Knapp (1997a) investigate changes in these two factors since they are among the most important factors driving projections from both models.

Berman (1997) develops and estimates a discrete-choice econometric model of fishing alternatives for the longline fleet that provides cost and profit functions for the fleet. Knapp (1997b) reports how business patterns and processing margins are likely to change in the processing industry with the shift from intense derby openings to an eight-month season and increase in fresh product. Berman and Knapp (1997) use the fisheries impact and community impact models to project long-term effects for 31 coastal communities and small regions in Alaska, British Columbia, and the U.S. Pacific Northwest based on a scenario for fish prices, total allowable catch by management area, and two

different rates of intercommunity quota transfers. The results show that some communities could see large changes as a result of the program. The projected gains and losses are sensitive to assumptions about prices processors can pay in each community, suggesting a role for further research on evolving processing and transportation costs.

IV. Purpose

A. Problem to fishing industry addressed

In 1995, the Pacific halibut and fixed gear sablefish (black cod) fisheries off Alaska began operating under an individual transferable quota (ITQ) program, ending years of derby-like fishing under an open access fishery regulated by brief time and area openings. With an annual harvest in each fishery generally ranging from 20 to 30 thousand metric tons annually by up to 3,000 boats, the Alaska program involved the largest ITQ program implemented to date. The change in fishery management regime will bring enormous changes not only in the character of these fisheries, but to the processing industry and communities that serve them.

Pacific halibut stocks have been protected since 1923 under a treaty between the U.S. and Canada. The treaty organization -- the International Pacific Halibut Commission (IPHC) -- annually sets harvest targets by area and determines legal gear (hook and line gear only). The North Pacific Fishery Management Council (NPFMC) uses its authority under the Magnuson Act to set annual harvest quotas by gear for sablefish. Although sablefish may be legally caught with a variety of gear, the longline fishery predominates, and is the only gear type included in the present analysis. Recovery of depleted fish stocks is not an issue for Alaska halibut and sablefish ITQs, since stocks had historically been adequately protected by gear, area, and season restrictions. Instead, introduction of ITQs carries the potential for long-term shifts in allocation as participants trade their quota shares. These allocation changes could have significant effects on the composition of the fishing fleet, with consequent effects on fishing communities.

Shortly after passage of the Magnuson Act in 1976, the Canadian halibut fleet was excluded from Alaska waters, and the U.S. harvest doubled. The U.S. fleet grew even more, climbing from about 1,000 vessels in 1975 to over 3,000 vessels by the early 1980s, where it remained for over a decade. The IPHC continued to cap harvest levels by steadily reducing season lengths from several months to just one or two days annually in the most productive areas (Berman and Leask, 1994). Sablefish can be caught with the same boats and gear as halibut. However, they inhabit deeper waters than halibut, so the fishery is generally prosecuted farther from shore. The Magnuson Act essentially created the Alaska longline sablefish fishery. However, strengthening markets in Japan during the 1980s brought many new entrants into the fishery, causing the NPFMC to steadily reduce the season length for the main Gulf of Alaska longline fishery until it reached just ten days in 1993 (National Marine Fisheries Service, unpublished data). Market, regulatory, and safety problems associated with these short derby-style fisheries motivated the NPFMC to recommend an individual transferable quota (ITQ) program for both longline fisheries. The ITQ program was implemented in 1995.

The rise in participation in Alaska's open access halibut and sablefish fisheries accompanied the introduction of state limited entry programs for salmon and other small boat fisheries such as herring. Closing access to these important coastal fisheries undoubtedly caused a "domino" effect on the halibut and sablefish fisheries. As a result, the longline fisheries took an important position in the economies to Alaska's small coastal communities. In 1993, 38 percent of the halibut catch and 41 percent of the sablefish catch was off-loaded and processed in Alaska communities with less than 1,000 inhabit-

ants. About one-fourth of estimated 13,450 crew members working in the halibut fishery that year lived in small Alaska communities, while another 52 percent lived in larger Alaska communities. Of the estimated 3,000 sablefish crew, about one-sixth lived in small Alaska communities, and another 47% in larger Alaska communities (Berman and Leask, 1994). Many of these crew members have little alternative income earning opportunities besides commercial fishing.

The Magnuson Fishery Conservation and Management Act bestows upon the North Pacific Fishery Management Council the responsibility of finding the allocation of federal fishery resources off the coast of Alaska that results in the greatest net benefit to the nation. The Council focused most of its analysis of the program to the distribution of initial allocation of quota shares, and has not had the resources to explore the longer term implications of the new regime. However, Alaskan communities and communities in the Pacific Northwest remain vitally interested in the long term implications of management by ITQs especially as it relates to patterns of local economic income and employment. Exploring the long-term implications of the halibut and sablefish ITQ program for coastal communities may provide valuable insights as the NPFMC considers bringing the remaining Alaska offshore fisheries into ITQ programs, and as the National Marine Fisheries Service considers the efficacy of limited access management systems nationwide.

B. Objectives of the project

The goal of the proposed study was to investigate the longer term impacts on the fishing fleet and communities likely to result from imposition of ITQ management in the Alaska halibut and fixed gear sablefish fisheries. The study had two primary objectives:

1. Examine how and at what rate the composition of these fisheries will change in response to imposition of an ITQ system; and

2. Project how the evolving fishery will affect the economies of local coastal communities.

As a means to accomplish these objectives, the study would build a fisheries impact model to address the first objective, and an integrated community impact model to address the second objective. These two models would be used together to analyze potential longer term impacts of the shift to ITQ management.

V. Approach

A. Work performed

The study addressed these objectives by developing two complementary modeling approaches: a fisheries impact model and a community impact model. The fisheries impact model is an activity-analysis model that explores how the longline fishing fleet will evolve over time in response under an ITQ system. It focuses on potential changes in fleet size and characteristics, and the pattern of halibut and sablefish landings by community, as driven by changing profitability of alternative fishing activities. The community impact model projects regional income from fishing and fish processing in 31 ports (or groups of ports in a small geographic area), based on scenarios of landings by port projected by the fleet model. Both models require a wide variety of assumptions about prices, harvest and production costs, and residency of fishery workers.

In order to execute such a comprehensive modeling program, we undertook a number of closely related preliminary studies. The results of these intermediate steps constitute valuable research products in themselves. The four complementary studies may be summarized as follows:

1. A survey of the Alaska longline fishing fleet was conducted to obtain baseline (pre-ITQ) economic and social data on captains and crew participation, earnings patterns, community of residence, expenditure patterns by type and location, and attitudes towards the ITQ program. Berman and Leask (1994) describe the survey and its context. The results of the survey are discussed in Berman and Leask (1994), and in Knapp (1996).

2. An analysis was conducted of changes in halibut markets due to ITQs, with particular focus on the effects of increased availability of fresh halibut (Knapp, 1997a). The study estimated modest long-term gains in halibut ex-vessel prices for Alaska ports, with modest declines for Canadian ports.

3. A discrete-choice econometric model of costs and profitability of the longline fishing fleet was developed and estimated. (Berman, 1997) describes the model and uses the results to estimate the role of the net economic benefits of the halibut and sablefish fisheries for specific fishing communities.

4. An analysis was conducted of short-term changing employment and income patterns with the shift from intense derby openings to an eight-month season in 1995 and 1996. (Knapp (1997b) contains this analysis, and also estimates the associated increase in fresh product for five major halibut and sablefish ports.

These four preliminary studies contain the basic methods and assumptions used to construct and simulate the fisheries impact and community impact models. Berman and Knapp (1997) review these methods and assumptions, constructs scenarios for projecting long-run fishery and community impacts, and discusses results of model projections for

the fishing fleet and the 31 ports and small regions. Both market conditions and fish stocks have changed for halibut and sablefish since the ITQ program began. In order to isolate the effects of ITQs from these other changes, the paper uses 1993 market and total allowable catch (TAC) as a base. That year was selected as a base year because the most complete information, including the detailed survey results, was available for that fishing season.

Three sets of projections were prepared: a 1993 baseline projection, and two long-run projections based on differing rates of intercommunity quota transfers. The baseline scenario simulates the community impact and fishery impact models with the 1993 ex vessel prices by community and with the fishery constrained by the time are area openings and trip limits actually imposed in 1993. In the two long run scenarios, halibut prices are adjusted to reflect an estimate of what they would have been in 1993 had the ITQ fishery been in effect at that time (see Knapp, 1997a), sablefish prices remain at 1993 levels, and the fishery is constrained by harvest quotas (assumed equal to 1993 TACs). For the first long-run scenario -- really an intermediate case -- the fishing fleet home ported in each of the 31 ports and small regions may increase its quota share holdings in each vessel class by 20 percent over the initial allocation in 1995. In the second long-run scenario, the fleet in each region may increase its quota share in each vessel class by 100 percent.

B. Project management

Dr. Matthew Berman headed up the project as principal investigator, with Dr. Gunnar Knapp serving as coprincipal investigator. Dr. Berman assumed primary responsibility for modeling the fishing fleet and completing the fisheries impact model and projections. Dr. Knapp assumed primary responsibility for analyzing market and processing effects and completing the fisheries impact model and projections.

Dr. Berman and Dr. Knapp were assisted in their work by numerous others. The staff at the University of Alaska Anchorage Institute of Social and Economic Research (ISER) mentioned below played a major role in the research. Linda Leask, ISER editor, helped write about the survey results and contributed a brief history of the halibut and sablefish fisheries (Berman and Leask, 1994). Dr. Jack Kruse helped design the survey of the longline fleet, and Virgene Hanna supervised the survey effort. Dan Hull collected and analyzed primary field data on changing business patterns in the halibut and sablefish fisheries. Dr. Hongjin Kim and Katheryn Eberhart programmed the fisheries impact model, and Ms. Eberhart processed and analyzed fisheries harvest data. Eric Larson programmed, documented, and helped design the community impact model.

The project benefited greatly from the assistance of a number of individuals and agencies outside ISER. Kurt Schelle and Ben Muse of the Alaska Commercial Fisheries Entry Commission (CFEC) consulted on survey methods, reviewed all aspects of the survey, and reviewed drafts of several preliminary studies. Craig Wiese of the University of Alaska Fairbanks Sea Grant Marine Advisory Program (MAP) reviewed the survey instrument, survey results, and provided valuable assistance on many aspects of the community impact modelling effort. CFEC and MAP provided the services of these staff members as an official in-kind contribution to the project.

In addition to the official non-federal in-kind support, the project could not have

been completed without the assistance generously provided by numerous agency staff at the North Pacific Fishery Management Council (NPFMC), the National Marine Fisheries Service (NMFS), and state of Alaska CFEC. The following individuals contributed particularly important and continued help: Darrell Brannon and Marcus Hartley, staff of NPFMC; Joe Terry and Jim Hastie of the NMFS Alaska Fisheries Science Center; and Elaine Dinneford, of CFEC.

VI. Findings

A. Actual accomplishments and findings

Four principal accomplishments of the study satisfy the main objectives of the project:

1. Discrete choice econometric models have been demonstrated as a successful way to model a fishing fleet and estimate cost and profit functions indirectly without having to obtain any direct information about fishing costs;

2. An optimization model was constructed for a large fishing fleet that uses changes in the management regime and geographic information to simulate changes in economic activity in individual ports and small regions;

3. A community impact model was constructed that translates changes in fishing activities into changes in direct economic activities for communities based on residence of harvesters, quota and boat owners, and location of landings; and

4. The fisheries impact model and the community impact model were simulated in an integrated manner to project long-run effects of ITQs under several scenarios.

The actual accomplishments of the project generated numerous findings. The various papers produced by the project detailed findings. The main findings may be summarized as follows.

1. The economic benefits of the pre-ITQ halibut and sablefish fisheries were very widely distributed. Small Alaska coastal communities played a big role in these fisheries (Berman and Leask, 1994), and the halibut and sablefish fisheries played a big role in the economies of small Alaska communities (Berman, 1997).

2. The study confirmed that markets are changing for halibut with increasing shares of fresh product. Halibut prices are higher as a result of the ITQ program. However, long-run price increases for the Alaska fishery due to ITQs are likely to be relatively modest, while Canadian prices are likely to be somewhat lower (Knapp, 1997a).

3. Business patterns and processing margins are changing in the processing industry with the shift from intense derby openings to an eight-month season and increase in fresh product, with corresponding changes in the pattern of economic activity in major ports where halibut and sablefish are landed (Knapp, 1997b).

4. Results of simulating the fisheries and community impact models show that some communities could see large long-term changes in participation in these fisheries and economic activity as a result of the ITQ program. Particular findings include projected increases in landings of halibut at Prince Rupert and Lower '48 ports, a shift of sablefish landings away from Southcentral Alaska ports and toward Southeast Alaska, and quota share from large boats tending to accumulate in Washington and Oregon ports (Berman and Knapp, 1997).

B. Discussion of problems

Two main problems interfered with timely completion of the project. In the early stages of the project, problems with acquisition of fishery management data from the National Marine Fisheries Service delayed work on the project for at least six months. Although investigators working on the project faced no legal barriers to access to confidential harvest data, obtaining necessary approval and actual copies of the data from the NMFS Alaska region proved extremely difficult. The barriers were only overcome with the intervention by staff of AFSC and NPFMC, who understood the nature of the project's data requirements and volunteered to help. Access to all the data needed did not come until over a year after the initial request.

Problems with the availability of staff to work on the project, and staff turnover over the delayed project schedule caused additional delays and inefficiencies after the harvest data had finally been acquired. The uncertainty about when data would actually be on hand to progress with the work on this study contributed to this second problem, since project staff had to commit to other funded projects. The large scope and complexity of the study, with its interlocking tasks and integrated models, made availability of staff time at critical moments essential to timely progress. The project team ultimately was able to complete the work; however, it took more time than anticipated.

C. Need for additional work

A large project such as this one generates a huge number of potential issues for future research. Three specific items stand out from this potentially long list as especially important.

First, the fisheries impact model shows that gains and losses in landings and income projected for various communities are highly sensitive to assumptions about prices processors can pay in each community. An important role exists for further research, therefore, on elaborating how fish processing and transportation patterns and costs are evolving along with the changing pattern of fish landings as the ITQ program matures.

A second area where additional work would be especially useful is in further developing the links between the fisheries impact model and the community impact model. The former model provides a great deal of information about fish harvesting patterns and costs that, because of their complexity, are not used by community impact model. In particular, the fisheries model projects distances traveled, travel costs, and travel times for components of the fleet, as this is one of the main factors driving model projections. However, in its current form, the community impact model is not able to use this information to adjust the spending patterns of the fleet. In addition, the fisheries model tracks the number of fishing trips made by vessels home ported in each community and the amount of ITQ fished in each community by vessel class. The detailed projection of these important items affecting local incomes is much greater that the accounting used in the community impact model.

The third area in which additional work would be highly beneficial is in monitoring the evolution of the geographic pattern of harvesting and processing activities in the ITQ fisheries, as well as geographic transfers of quota shares. This would allow researchers to test whether the insights gathered from the modeling exercise turn out to be valid.

VII. Evaluation

A. Attainment of goals and objectives

The two primary objectives of the study were (1) to build a fisheries impact model that could examine how and at what rate the composition of these fisheries will change in response to imposition of an ITQ system on the Alaska halibut and fixed-gear sablefish fishery; and (2) build a community impact model that can project how the evolving fishery will affect the economies of local coastal communities. A related objective was to use these two models to analyze potential longer term impacts on the fishing fleet and communities from ITQ management. The project successfully accomplished these two objectives, although with a number of important qualifications.

As originally envisioned, the community impact model would be able to project changes in total jobs and income for coastal communities. In its current form the model only projects direct effects -- changes in jobs and income directly derived from landings or spending by the halibut and sablefish harvesters and processors. As mentioned above, the community impact model also is not able to make use of all the cost information available from the fisheries impact model about spending patterns of the harvesting sector.

Also as originally envisioned, the fisheries impact model would have the capability to address the effects of varying limits on transferability and concentration of quota such as blocking restrictions, as well as address the time path of change to the long-run equilibrium configuration of the fleet. This analysis was to be based on examining historical changes in capitalization of the fleet in response to estimated changes in profitability over time. However, simulations of the fisheries impact model show that the current fleet is so overcapitalized in all ITQ vessel classes and management areas, that vessel investments are not likely to be a significant factor in determining the future pattern of landings. In addition, the cost structure estimated for the fisheries impact model does not estimate different costs for one boat from making 100 trips than for ten identical boats making ten trips. That is because all boats were assumed to be able to spread their fixed costs by participating in other fisheries such as salmon, crab, or groundfish -- as most halibut and sablefish boats actually do.

While these two important qualifications to the accomplishment of initial objectives weaken the usefulness of the study, the project team was able to strengthen the analysis in two other critical areas that more than offset the above losses. First, more attention was paid to the capability to address detailed geographic information relevant to reallocation of fishing and processing activity; the fisheries impact and community impact models address effects for 31 ports and small regions. Second, the investigators were able to mitigate to some extent the problems caused by delays in the project schedule by taking advantage of the availability of initial data on ITQ landings. This data was used to develop an analysis of how the shift to year-round fresh halibut will change halibut markets (Knapp, 1997a) and how it is changing business patterns in the processing sector (Knapp, 1997b).

B. Dissemination of project results

Research results funded by the grant are being disseminated in six papers or publications enumerated on the following page. Copies of these papers are attached. All are available to the public from the Institute of Social and Economic Research, and are or shortly will be included on the ISER publication list. Three of the papers -- Berman (1997), Knapp (1997b), and Berman and Knapp (1997) are currently under revision with plans to submit them for publication in professional journals. Berman (1997) was recently presented at the Western Regional Science Association annual meeting. In addition, Dr. Knapp plans to draw heavily on material in Knapp (1997a) and (1997b) to contribute an invited paper tentatively entitled, "Initial effects of the Halibut ITQ Program" for a forthcoming issue of *Marine Resource Economics*.

Many of the papers have been reviewed in draft form by professional staff of the North Pacific Fishery Management Council, the Alaska Sea Grant Marine Advisory Program, and the State of Alaska Commercial Fisheries Entry Commission. We are sending economists at all three agencies copies of all papers that they do not already have as a courtesy for assisting us with our research.

VIII. Papers and Publications Generated from the Project

Berman, Matthew D., and Gunnar Knapp. 1997. "Regional Impacts of the Alaska Halibut and Sablefish ITQ Program." Working paper, July.

Knapp, Gunnar P. 1997a. *Alaska Halibut Markets and the Alaska Halibut IFQ Program*, Institute of Social and Economic Research, January.

Knapp, Gunnar P. 1997b. *Modeling Community Economic Impacts of the Alaska Halibut IFQ Program*. Institute of Social and Economic Research, February.

Knapp, Gunnar P. 1996 "Thalassorama: Alaska Halibut Captains' Attitudes Towards IFQs," *Marine Resource Economics*, vol. 11, pp. 43-55, Spring.

Berman, Matthew D. 1997. "Limiting Fishing Rights in Small Coastal Communities: the Alaska Halibut and Sablefish Longline Fisheries." paper presented to the Western Regional Science Association annual meeting, Kamuela, Hawaii, February.

Berman, Matthew D., and Linda Leask. 1994. "On the Eve of IFQs: Fishing for Alaska's Halibut and Sablefish," *Alaska Review of Social and Economic Conditions*, 29(2), 1-20, November.